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G. B. He.	G. B. HECKEL. Secretary, American Paint and Varnish Manufacturers' Association. Editor of *Drugs, Oils and Paints*.	Interior Decoration (*in part*).
G. E.	REV. GEORGE EDMUNDSON, M.A., D.Litt., F.R.Hist.S. Formerly Fellow and Tutor of Brasenose College, Oxford.	Jacoba or Jacqueline.
G. F. K.	GEORGE FREDERICK KUNZ, A.M., Ph.D., Sc.D. Vice-President and Gem Expert, Tiffany and Co., New York, since 1879. Author of *Gems and Precious Stones of North America; The Curious Lore of Precious Stones*.	Jade and Other Hard Stone Carvings.
G. G. A.	MAJOR-GENERAL SIR GEORGE G. ASTON, K.C.B. Lecturer on Naval History, University College, London. Formerly Professor of Fortification at the Royal Naval College, Greenwich. Author of *Sea, Land and Air Strategy; Memories of a Marine; The Navy of To-day*. Editor of *The Study of War*.	'Iraq (*in part*); Ireland, Northern (*in part*); Irish Free State (*in part*).
G. G. Si.	GEORGE GAYLORD SIMPSON, Ph.D. Assistant Curator of Vertebrate Palaeontology, the American Museum of Natural History, New York. Author of *A Catalogue of the Mesozoic Mammalia in the Geological Department of the British Museum*.	Hyracoidea.
G. H. B.	REV. GEORGE HERBERT BOX, M.A., Hon.D.D. Rector of Sutton, Beds. Hon. Canon of St. Albans. Davidson Professor of Old Testament Studies in the University of London.	Isaiah.
G. Ma.	LIEUT.-GENERAL SIR GEORGE MACMUNN, K.C.B., K.C.S.I., D.S.O. Commander-in-Chief, Mesopotamia, April 1919 to January 1920; Q.M.G. in India, 1920–4. Author of *The Armies of India; A Free Lance in Kashmir*; etc.	Indian Mutiny, The; India (*in part*).
G. Mi.	REV. GEORGE MILLIGAN, D.D., D.C.L. Regius Professor of Divinity and Biblical Criticism in the University of Glasgow. Author of *The Theology of the Epistle to the Hebrews; Selections from the Greek Papyri*; etc.	James.
G. M. P.	GIUSEPPE MARIA PALLICCIA. Italian Advocate, Inner Temple, London.	Italian Codes.
G. O'B.	GEORGE O'BRIEN, D.Litt., F.R.Hist.S. Professor of National Economics of Ireland, University College, Dublin. Author of *Economic History of Ireland (1800–47)*.	Irish Free State (*in part*).
G. P. M.	GEORGE PERCIVAL MUDGE, A.R.C.S., F.Z.S. Professor and Head of the Department of Zoology, East London College, University of London.	Incubators (*in part*).
G. R. D.	G. R. DRIVER. Lecturer in Comparative Semitic Philology, University of Oxford.	Jehovah.
G. W. Co.	GRAHAM W. COLE, B.S. Director of Safety Service, Policy Holders Service Bureau, Metropolitan Life Insurance Company, New York. Member of American Engineering Council Committee preparing report on standardization of street signs, signals and markings.	Industrial Accidents, Prevention of (*in part*).
G. W. Ki.	GEORGE WASHINGTON KIRCHWEY, LL.D. Head of Department of Criminology, New York School of Social Work. Formerly Warden of Sing Sing Prison. Author of *Readings in the Law of Real Property*.	Imprisonment.

G. W. T.	Rev. Griffiths Wheeler Thatcher, M.A., B.D. Warden of Camden College, Sydney, N.S.W. Formerly Tutor in Hebrew and Old Testament History at Mansfield College, Oxford.	Ibn Faradī; Ibn Fārid; Jahiz.
H. A. R.	Horace Arthur Rose, I.C.S. Superintendent of Ethnography, District and Sessions Judge, Punjab, 1906-17.	India (*in part*).
H. B. B.	Henry Britten Brackenbury, M.R.C.S., L.R.C.P. Member of the Council of the British Medical Association. Chairman of the Insurance Acts Committee, London.	Insect Bites and Stings.
H. C. P.	The Rt. Hon. Sir Horace Curzon Plunkett, K.C.V.O., D.C.L., F.R.S. Senator, Irish Free State, 1922-3. Vice-President of the Department of Agriculture and Technical Instruction for Ireland, 1899-1907. Founder of the Irish Agricultural Organisation Society, 1894. Commissioner, Congested Districts Board, Ireland, 1891-1918. Chairman of the Irish Convention, 1917-8. Author of *Ireland in the New Century*; etc.	Ireland (*in part*).
H. C. S.	H. C. Stuart. Assistant Collector, United States Custom Service, New York.	Importing: In Practice (*in part*).
H. E. A.	Hugh E. Agnew, A.B., M.Pd. Chairman of the Department of Marketing, New York University School of Commerce, Accounts and Finance. Author of *Co-operative Advertising by Competitors.*	International Advertising Association, The.
H. E. C.	H. E. Cox, M.Sc., Ph.D., F.I.C. Public Analyst for the Metropolitan Borough of Hampstead, London.	Jams and Jellies (*in part*).
H. E. H.	Harrison E. Howe, M.S., Sc.D. Chemist and Editor, *Industrial and Engineering Chemistry*, Washington. Author of *The New Stone Age; Chemistry in the Home*; etc.	Industrial Chemistry.
H. H. L. B.	Hugh Hale Leigh Bellot, M.A., D.C.L. Late Associé de l'Institut de Droit International; Honorary Secretary, International Law Association and Grotius Society. Formerly Acting Professor of Constitutional Law, University of London, and Secretary, Branches of the Law of War Committee. Author of *Commerce in War; The Pharmacy Act; Permanent Court of International Justice.*	Inns of Court and Chancery (*in part*).
Hi. Br.	Henri Brenier. Director-General of the Chamber of Commerce, Marseilles. General Secretary to the National Colonial Exhibition at Marseilles, 1922, and to the Colonial Organisation Congress, 1922.	Indo-China, French.
H. L. He.	Harriet L. Hennesey, L.R.C.S.I., L.R.C.P.I., M.D.	Intestinal Obstruction.
H. M. D.	H. M. Dawson, Ph.D., D.Sc. Professor of Physical Chemistry, University of Leeds.	Ions, Catalytic Action of.
H. M. K.	Horace Meyer Kallen, A.B., Ph.D. Professor of Philosophy and Psychology, The New School of Social Research, New York. Author of *William James and Henri Bergson; The Philosophy of William James.*	James, William.
H. M. P.	Hugh McDowell Pollock, P.C., J.P., D.L. First Minister of Finance for Ulster. Member of Parliament for South Belfast.	Ireland, Northern (*in part*).
H. M. V.	Herbert M. Vaughan, M.A., F.S.A. Keble College, Oxford. Author of *The Last of the Royal Stuarts; The Last Stuart Queen*; etc.	James (The Pretender).
H. O.	Hermann Oelsner, M.A., Ph.D. Late Taylorian Professor of the Romance Languages in University of Oxford. Member of Council of the Philological Society. Author of *Frederic Mistral; A History of Provençal Literature*; etc.	Italian Literature (*in part*).
H. Pa.	Sir Harold Parlett, C.M.G. Japanese Councillor of H.M. Embassy in Tokyo since 1919. Formerly Assistant Japanese Secretary at H.M. Legation in Tokyo and Consul at Dairen. Joint-Compiler of *An English-Japanese Dictionary of the Spoken Language.*	Japanese Language.
H. St. J. B. P.	Harry St. John Bridger Philby, C.I.E., F.R.G.S., B.A., I.C.S.(retired). Explorer in Arabia. Author of *The Heart of Arabia; Arabian Mandates; The Truth about Arabia.*	Ibn Sa'ud.
H. W. C.	Harvey Wiley Corbett, F.R.I.B.A., F.A.I.A. Lecturer in Architecture, Columbia University, New York. Past President Architectural League of New York. Member, Fine Arts Commission, State of New York. Member of the firm of Helmle and Corbett, New York. Architect of Bush Terminal Office Building (N. Y.); Bush House (London); etc.	Industrial Architecture (*in part*).
H. W. P.	H. W. Parker, B.A. Assistant in the Department of Zoology, Natural History Museum, South Kensington, London.	Iguana.
I. A.	Israel Abrahams, M.A. Formerly Reader in Talmudic and Rabbinic Literature in the University of Cambridge and President, Jewish Historical Society of England. Author of *A Short History of Jewish Literature; Jewish Life in the Middle Ages; Judaism*; etc.	Jellinek, Adolf.
J. A. D.	James A. Dunnage, F.S.S., A.M.Inst.T. Author of *How to Import Goods; The Importer's Handbook; The Manual of Exporting.*	Importing: In Practice (*in part*).
J. A. S.	John Addington Symonds, LL.D. Author of *Renaissance in Italy*; etc. See the biographical article: Symonds, John Addington.	Italy (*in part*)
J. A. Si.	Judith Ann Silburn. Diplomée of Domestic Science, M.I.H. Formerly Trade Investigator, Ministry of Labour. Journalist and Domestic Science Consultant.	Invalid Cookery.

J. A. St.	JAMES ANDREW STRAHAN, LL.D. Barrister-at-Law. Emeritus Professor of Jurisprudence, University of Belfast. Reader of Equity, Inns of Court, London. Author of *The Bench and Bar of England.*	Intestacy (*in part*).
J. C. van D.	JOHN CHARLES VAN DYKE. Professor of The History of Art, Rutgers College, New Brunswick, N. J. Formerly Editor of the *Studio and Art Review.* Author of *Art for Art's Sake; History of Painting; Old English Masters.*	Inness, George.
J. C. We.	JAMES CLAUDE WEBSTER. Barrister-at-Law, Middle Temple.	Inns of Court and Chancery (*in part*).
J. D. B.	JAMES DAVID BOURCHIER, M.A., F.R.G.S. Late Correspondent of *The Times* in South Eastern Europe.	Ionian Islands (*in part*).
J. Dr.	JAMES DREVER, M.A., B.Sc., D.PHIL., F.R.S.E. Reader and Combe Lecturer in Psychology, University of Edinburgh. Assistant Editor, *British Journal of Psychology.* Associate Editor, *Journal of Abnormal and Social Psychology.* Author of *Instinct in Man; Psychology of Everyday Life;* etc.	Instinct in Man.
J. F. C. F.	COLONEL JOHN FREDERICK CHARLES FULLER, C.B.E., D.S.O. Military Assistant to the Chief of the Imperial General Staff. General Staff Officer, Tank Corps, 1917–8. Formerly Chief Instructor, Camberley. Author of *Tanks in the Great War; The Reformation of War; Sir John Moore's System of Training;* etc.	Ilerda, Campaign of; Issus, Battle of; Ivry, Battle of; Jemappes.
J. Fi.	JACK FILMAN. Hockey Department, Madison Square Garden, New York City. Author of *Madison Square Garden Official Hockey Program and Guide.*	Ice Hockey (*in part*).
J. G. D.	CAPTAIN J. G. DOLLMAN. Assistant Keeper, Department of Zoology, Natural History Museum, South Kensington.	Insectivora.
J. H.	JOHN HILTON. Director of Statistics, Ministry of Labour, London.	Industrial Councils; Industrial Court; Industrial Transference.
J. Har.	JIRO HARADA. Of the Imperial Household Museums, Japan. Formerly Professor in the Nagoya College of Technology, and in the 8th Higher School. Imperial Japanese Government Commissioner to the Panama-Pacific International Exposition at San Francisco, 1915. Author of *The Gardens of Japan.*	Interior Decoration (*in part*); Ivory Carving (*in part*); Japanese Architecture; Japanese Gardens; Japanese Music; Japanese Sculpture.
J. H. Ba.	JOAB H. BANTON. District Attorney, State of New York for County of New York.	Indictment (*in part*).
J. H. Be.	JOSEPH HENRY BEALE, LL.B., LL.D. Professor of Law, Harvard Law School. Author of *Cases on Criminal Law; Foreign Corporations; Cases on Taxation; Conflict of Laws.*	International Law, Private (*in part*).
J. H. Br.	JAMES HENRY BREASTED, A.M., PH.D., LL.D., D.LITT. Professor of Egyptology and Oriental History and Chairman of the Department of Oriental Languages, University of Chicago.	Ikhnaton.
J. H. Mu.	JOHN HENRY MUIRHEAD, M.A., LL.D. Emeritus Professor of Philosophy in the University of Birmingham. Author of *Elements of Ethics; Philosophy and Life;* etc. Editor of *Library of Philosophy.*	Idealism.
J. Ho.	JOSEF HOFFMANN. Professor at the School of Industrial Arts, Vienna. Art Director of the Wiener Werkstätte. Architect of many public and private buildings.	Interior Decoration (*in part*).
J. J. R. MacL.	J. J. R. MACLEOD, M.B., CH.B., D.Sc., LL.D., F.R.S. Regius Professor of Physiology, University of Aberdeen. Formerly Professor of Physiology, University of Toronto. Author of *Physiology and Biochemistry in Modern Medicine; Carbohydrate Metabolism and Insulin.*	Insulin.
J. L.	JULIEN LUCHAIRE. Director of the International Institute of Intellectual Co-operation, Paris. Hon. Professor of the University of Grenoble. Formerly Director of Education, Ministry of the Colonies and Inspector General of Public Instruction.	Intellectual Co-operation, International Institute of.
J. L. H.	JOHN LAWRENCE [LE BRETON] HAMMOND. Formerly Scholar of St. John's College, Oxford. Joint Author of *The Village Labourer, 1760–1832; The Town Labourer, 1760–1832; The Skilled Labourer, 1760–1832; Lord Shaftesbury; The Rise of Modern Industry.*	Industrial Revolution, The.
J. M. F. R.	J. M. F. ROMEIN. Member of Transit Section, League of Nations, Geneva.	Inland Water Transport.
J. M. La.	J. M. LANDIS, A.B., LL.B., S.J.D. Professor of Legislation, Harvard Law School. Author of *The Business of the Supreme Court of the United States.*	Injunction (*in part*); Intestacy (*in part*).
J. O'C.	SIR JAMES O'CONNOR, P.C., K.C. Attorney-General, Ireland, 1916–8. Lord Justice of Appeal, 1918–24. Author of *History of Ireland, 1798–1924.*	Ireland (*in part*).
J. P. Ea.	JOHN P. EARNEST, A.M., LL.M. Professor of Law, George Washington University, Washington. Member of the American Bar Association.	Inebriety, Law of (*in part*).
J. S.	SIR JOSIAH CHARLES STAMP, G.B.E., D.Sc., LL.D., F.B.A. Chairman and President of the Executive, London Midland and Scottish Railway. Director of the Bank of England. Member of the British Royal Commission on Income Tax, 1919; of the Committee on Taxation and National Debt, 1924. British Representative on the Reparation Commission's Committee on German Currency and Finance, 1924; and chief British representative on the Reparations Committee, Paris, 1929. Author of *Wealth and Income of the Chief Powers; Wealth and Taxable Capacity.*	Income: Economic Definition; Income Tax: Economic Aspect; Inheritance: Economic Aspect.

J. S. H.	JULIAN SORELL HUXLEY, M.A. Hon. Lecturer, King's College, London. Fullerian Professor of Physiology in the Royal Institution. Author of *Essays of a Biologist;* etc. Editor of the Biology and Zoology section, 14th Edition, *Encyclopædia Britannica.*	**Individuality.**
J. S. Ha.	COLONEL JOHN S. HAMMOND. President of the New York Rangers Professional Hockey Club, New York and Vice-President of the Madison Square Garden Corporation.	**Ice Hockey** (*in part*).
J. S. S.	JOHN STUART SCRIMGEOUR, O.B.E. Of the Middle Temple, Barrister-at-Law.	**Increment Value Duty.**
J. V.	JULES VIARD. Late Archivist of the National Archives, Paris.	**Jacquerie, The.**
J. Wa.	JAMES WALKER. Advocate of the Scottish Bar. Author of *Intestate Succession in Scotland.*	**Intestacy** (*in part*).
K. N. L.	KARL N. LLEWELLYN. Associate Professor of Law, Columbia University, New York.	**Instalment Purchase** (*in part*).
L.	SIR CHARLES STEWART HENRY VANE-TEMPEST-STEWART, 7th MARQUESS OF LONDONDERRY, K.G., P.C., M.V.O., LL.D. Minister of Education, Northern Ireland, 1921-6. Chancellor of Queen's University, Belfast.	**Ireland, Northern** (*in part*).
L. A. D.	LAWRENCE A. DOWNS, B.C.E. President, Illinois Central System, Chicago.	**Illinois Central System.**
L. Bi.	LAURENCE BINYON, HON.LL.D. Author and Deputy Keeper of Sub-department of Oriental Prints and Drawings, British Museum. Co-author of *Japanese Colour Prints.*	**Japanese Painting and Prints.**
L. C. M.	SIR LEO CHIOZZA MONEY, F.R.STAT.S., F.R.G.S., F.Z.S. Author and Journalist. Member of the War Trade Advisory Committee, 1915–8. Parliamentary Secretary to the Ministry of Shipping, 1916-8. Chairman of the Tonnage Priority Committee, 1917-8. Editor of the Economic, Engineering and Industry section of the 14th Edition of the *Encyclopædia Britannica.*	**Imperial Chemical Industries Limited; Imperial Tobacco Company Limited.**
L. D. S.	LAURENCE DUDLEY STAMP, B.A., D.Sc., F.G.S., M.I.T.P. Reader in Economic Geography in the University of London. Author of *An Introduction to Stratigraphy.*	**Irrawaddy.**
L. E. B.	REV. L. ELLIOTT BINNS, D.D. Vicar of Gedney, Lincolnshire.	**Jashar, Book of.**
L. Ga.	LEON GASTER. Hon. Secretary of the Illuminating Engineering Society, London.	**Illuminating Engineering.**
L. O. H.	LELAND OSSIAN HOWARD, PH.D., M.D., LL.D., Sc.D. Principal Entomologist, Bureau of Entomology, United States Department of Agriculture since 1878. Author of *The Insect Book; Mosquitoes, How They Live.*	**Japanese Beetle.**
L. V.	LUIGI VILLARI. Italian Vice-Consul in New Orleans, 1900; Philadelphia, 1907, and Acting-Consul at Boston, 1907-10. On the Secretariat of the League of Nations, 1920-3. Author of *Italian Life in Town and Country; The Awakening of Italy; The Fascist Experiment;* etc.	**Italian Front, in the World War, 1914-1918; Italy** (*in part*).
M. C.	MAX CARY, D.LITT. Reader in Ancient History in the University of London. Secretary to the Classical Association, 1911-4.	**Irene** (*in part*).
M. D. K.	CAPTAIN M. D. KENNEDY. Tokyo Correspondent, Reuters Limited.	**Japan** (*in part*).
Me.	JAMES SCORGIE MESTON, 1ST BARON MESTON, K.C.S.I., LL.D. Chancellor of Aberdeen University, 1928. Secretary to Finance Department, Government of India, 1906-12. Lieut.-Governor, United Provinces of Agra and Oudh, 1912-7. Representative of India, Imperial War Cabinet and Conference, 1917.	**India** (*in part*).
M. E. P.	MARLEN EDWIN PEW. Editor, *The Editor and Publisher,* New York.	**International News Service.**
M. H. G.	MOSES H. GROSSMAN. Judge and Honorary President, American Arbitration Association, New York.	**Industrial Relations** (*in part*).
M. H. L.	MISS M. H. LONGHURST. Assistant in the Department of Architecture and Sculpture, Victoria and Albert Museum, South Kensington.	**Ivory Carving** (*in part*).
M. M.	SIR MURDOCH MACDONALD, K.C.M.G., M.INST.C.E. Consulting Civil Engineer. Late Adviser and Under-Secretary of State for Public Works, Egypt. Civil Engineer, Assuan Dam Protective and Heightening Operations and Isna Barrage Construction.	**Irrigation** (*in part*).
M. M. G.	MARGARET M. GREEN, M.A. Assistant Editor of the International Section of the *Contemporary Review,* 1921; *The New Leader,* 1923-6; *Foreign Affairs,* 1926-8.	**Infant Schools.**
M. S. B.	M. S. BIRKETT, O.B.E. Secretary of the National Federation of Iron and Steel Manufacturers.	**Iron and Steel: World's Statistics.**
M. Sm.	MAY SMITH. Senior Investigator to the Industrial Fatigue Research Board, Medical Research Council, London.	**Industrial Psychology.**

M. S. R.	MERRYLE S. RUKEYSER, B.Litt., M.A. Member, Teaching Staff, School of Journalism, Columbia University, New York. Formerly Financial Editor, *New York Tribune* and *New York Evening Journal*. Author of *The Common Sense of Money and Investments*; etc.	**Investment** (*in part*); **Investment Trusts** (*in part*).
M. T. Bi.	MILLICENT TODD BINGHAM, M.A., Ph.D. Corresponding Member, Sociedad Geografica de Lima. Author of *Peru, Land of Contrasts; Geographical Controls in Peru*.	**Ica.**
N. E. C.	NORMAN E. CRUMP. Statistical Correspondent to the *Financial Times*, London. Member of the Council of the Royal Statistical Society. Joint Author of *Clare's A. B. C. of the Foreign Exchanges*.	**International Payments**; **Investment** (*in part*).
N. G.	NATHAN GREENE, A.B., LL.B., S.J.D. Practising Lawyer in Association with the firm of Cook, Nathan and Lehman, New York. Co-author of *The Labour Injunction*. Author of numerous legal articles.	**Injunction** (*in part*).
N. J. K.	N. J. KROM. Professor of History and Archaeology of the Dutch East Indies, University of Leyden.	**Java** (*in part*).
N. V. McC.	NANCY V. McCLELLAND, A.B. Author, Decorator and Lecturer on Interior Decoration. Author of *Historic Wall Papers*; etc.	**Interior Decoration** (*in part*).
O.	SYDNEY OLIVIER, 1st BARON OLIVIER OF RAMSDEN, P.C., K.C.M.G., C.B., LL.D. Secretary for India, 1924. Governor of Jamaica, 1907–13. Author of *White Capital and Coloured Labour; The Anatomy of African Misery; The Empire Builder*. See biographical article: OLIVIER, S.	**Jamaica.**
O. J. R. H.	OSBERT JOHN RADCLIFFE HOWARTH, M.A. Secretary of the British Association for the Advancement of Science. Geographical Scholar, Oxford, 1901. Geographical Assistant, 11th Edition, *Encyclopædia Britannica*.	**Ireland** (*in part*).
O. R. A.	OLIVIA ROSSETTI AGRESTI. Writer, Lecturer and Interpreter to the Assemblies of the League of Nations and the International Economic Conference. Connected with the founding of the International Institute of Agriculture in Rome. Lectured in the U. S. on Italian Economic Conditions, 1919, 1920, 1923. Author of *Giovanni Costa, His Life and Times*; on the editing staff of the *General Fascist Confederation in Industries*, Rome.	**International Institute of Agriculture**; **Italy** (*in part*).
P. Al.	PAUL DANIEL ALPHANDÉRY. Director of Studies, History of Dogma, École Pratique des Hautes Etudes, Sorbonne, Paris. Author of *Les Idées morales chez les hétérodoxes latines au début du XIIIe Siècle*.	**Inquisition, The** (*in part*).
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P. G. H. B.	P. G. H. BOSWELL, O.B.E., D.Sc. George Herdman Professor of Geology in the University of Liverpool.	**Itacolumite.**
P. Gi.	PETER GILES, M.A., LL.D., Litt.D., F.B.A. Master of Emmanuel College, Cambridge, and University Reader in Comparative Philology. Vice-Chancellor of the University, 1919–21. Author of *The Aryans* (Cambridge History of India).	**Indo-Europeans.**
P. G. K.	PAUL G. KONODY. Art Critic of *The Observer* and *The Daily Mail*, London. Author of *Velasquez, His Life and Work; The Brothers Van Eyck; Raphael; Fra Filippo Lippi*; etc.	**Impressionism.**
P. La.	PHILIP LAKE, M.A., F.G.S. Lecturer in Physical and Regional Geography in Cambridge University. Formerly of the Geological Survey of India. Author of *Monograph in British Cambrian Trilobites*. Translator and Editor of *Kayser's Comparative Geology*.	**India** (*in part*); **Japan** (*in part*).
P. Z. C.	MAJOR GENERAL SIR PERCY Z. COX, G.C.M.G., G.C.I.E., K.C.S.I. Acting British Minister to Persia, 1918–20. High Commissioner in Mesopotamia, 1920–3. Secretary, Foreign Department, Government of India, 1914. Consul and Political Agent, Muscat, Arabia, 1899–1904; etc.	**Iraq** (*in part*).
R. A. S. M.	ROBERT ALEXANDER STEWART MACALISTER, M.A., Litt.D., LL.D., F.S.A. Professor of Celtic Archaeology, University College, Dublin. Formerly Director of Excavations for the Palestine Exploration Fund. President of the Royal Irish Academy; President of the Royal Society of Antiquaries of Ireland, 1925–8. Author of *Ireland in Pre-Celtic Times; The Archaeology of Ireland*; etc.	**Idumaea** (*in part*); **Ireland** (*in part*).
R. C. J.	SIR RICHARD CLAVERHOUSE JEBB, O.M., LL.D., D.C.L. Public Orator, Cambridge University, 1869–75, and Professor of Greek, 1889–1905. Author of *Translations into Greek and Latin; The Growth and Influence of Classical Greek Poetry*. See the biographical article: JEBB, SIR RICHARD C.	**Isocrates** (*in part*).
R. D. Ca.	R. D. CARMICHAEL. Professor of Mathematics at University of Illinois, Urbana, Ill.	**Infinity.**
R. Ed.	RALPH EDWARDS, B.A. Member of Staff of *Country Life*. Assistant, Department of Woodwork, Victoria and Albert Museum. Joint-author of *The Dictionary of English Furniture*.	**Interior Decoration** (*in part*).
R. E. R.	R. ELLIS ROBERTS, B.A. Author of *A Roman Pilgrimage; Henrik Ibsen; The Other End; Reading for Pleasure*.	**Ibsen, Henrik Johan.**

R. G.	RICHARD GARNETT, C.B., LL.D. Librarian and Author. Late Superintendent of the Reading Room, British Museum, and Keeper of the Printed Books. Co-editor with Edmund Gosse of *English Literature*. Author of *Essays in Librarianship and Bibliophily; Emerson; Milton;* etc. *See* the biographical article: GARNETT, RICHARD.	**Irving, Washington.**
R. H. Ch.	ROBERT HENRY CHARLES, M.A., D.D., D.LITT. Archdeacon of Westminster. Formerly Grinfield Lecturer and Lecturer in Biblical Studies, Oxford. Fellow of the British Academy. Professor of Biblical Greek at Trinity College, Dublin, 1898–1906.	**Jeremy, Epistle of.**
R. H. G.	ROBERT, FREIHERR VON HEINE-GELDERN. Visiting Professor in Anthropology and Archaeology, University of Vienna.	**Indonesia** (*in part*).
R. J. S.	R. J. STOPFORD. Intelligence Department of the British Overseas Bank, London.	**Inter-Allied Debts.**
R. K. D.	SIR ROBERT KENNAWAY DOUGLAS. Author of *The Language and Literature of China; The Life of Jenghiz Khan;* etc.	**Jenghiz Khan.**
R. N. B.	ROBERT NISBET BAIN. Assistant Librarian, British Museum, 1883–1909. Author of *Scandinavia: The Political History of Denmark, Norway and Sweden, 1513–1900; The First Romanovs, 1613 to 1725; Slavonic Europe: The Political History of Poland and Russia from 1469 to 1796;* etc.	**Ivan IV.** (*in part*).
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R. Re.	RAYMOND RÉGAMEY. Artist and Designer. Author of *Gericault.*	**Iron in Art** (*in part*).
R. S. Co.	ROBERT SEYMOUR CONWAY, M.A., LITT.D. Professor of Latin and Indo-European Philology in the University of Manchester. Formerly Professor of Latin, University College, Cardiff, and Fellow of Gonville and Caius College, Cambridge.	**Iovilae.**
R. V. C.	RAYMOND V. CARPENTER, M.Sc. Actuary, Metropolitan Life Insurance Company, New York. Fellow, Actuarial Society of America. Co-author of *An Epoch in Life Insurance.*	**Industrial Insurance** (*in part*).
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HYDROZOA TO JEREMY. EPISTLE OF

HYDROZOA. The Hydrozoa (sometimes called Hydromedusae) are a class of animals, the vast majority of which are marine, and which belong to the still greater assemblage known as the Coelenterata (*q.v.*).

The Hydrozoa include not only polyps, but also medusae or jellyfish (these terms are defined in the article COELENTERATA). They are, in fact, that group of Coelenterata in which neither the one nor the other of these two forms of body predominates, and in this respect they contrast strongly with the other main classes (Scyphozoa and Anthozoa). Moreover, both polyp and medusa have a simpler plan of structure than in the other classes. The polyp itself is frequently (though not always) small. Its mouth leads directly into the internal cavity of its body (*coelenteron*), without the intermediary of a definite throat or gullet of any kind, and the ectoderm and endoderm (*see* COELENTERATA) meet at the lips. The coelenteron is a simple cavity lined by endoderm; it is not subdivided by partitions into lesser cavities, nor does it contain definite organs of any kind. With these limitations the actual form of the polyp varies very greatly. The medusa presents infinite variety of form, but it too lacks a throat, and although its coelenteron sends out radiating canals which run from the central cavity through the solid tissues of the bell, it is otherwise simple in that it contains no definite organs. The medusae of Hydrozoa are generally speaking smaller and more slightly-built creatures than the medusae belonging to the related class Scyphozoa, although in certain cases they attain a larger size than the average, which is a matter of millimetres. The Hydrozoa are also characterized by the fact that the sex-cells, when they ripen in the clusters known as *gonads*, typically lie in or under the ectoderm, although the site of their original formation may be in either ectoderm or endoderm.

It is among the Hydrozoa above all other Coelenterata that the phenomenon, briefly characterized elsewhere (article COELENTERATA), and known as *polymorphism*, attains its height. The details of this condition are described in parts of the present article and a summary of the question is given after the section on Siphonophora.

The infrequency of brackish or freshwater forms among the Coelenterata makes their occurrence of interest. The ordinary marine Hydrozoa are either pelagic (swimming or floating organisms) or sedentary, according to their nature, and many of either kind exist. The brackish and freshwater forms exhibit the same diversity, though few in number. One of the most interesting is a minute creature, *Protohydra*, the length of which is about 3mm. This organism inhabits the surface-layer of mud, rich in diatoms, which is to be found in the bottom of pools in certain tidal marshes; it also occurs in oyster-beds and similar places. It is carnivorous, and reproduces freely by transverse fission, but its sexual mode of reproduction is unknown. It possesses no tentacles, and is as simple in structure as any known Coelenterate.

The best known of the non-marine Hydrozoa, however, are the genera *Limnocodium*, *Limnocnida*, *Cordylophora* and *Hydra*. Of *Hydra* more details are given below, and the chief interest of *Cordylophora* lies in the fact that it may flourish in water of different degrees of salinity as well as in fresh water; it is otherwise ordinary. *Limnocodium ryderi* possesses a feebly developed polyp-generation (up to about 2mm. long) which produces small colonies containing about 2–7 individual polyps without tentacles. These colonies can produce buds of two kinds; some become separated from the parent, form polyps and produce new colonies, others develop into medusae, and these are liberated and swim away. The species of *Limnocodium* (with which is now included *Microhydra*) are not very clearly recognized; but representatives of the genus occur in lakes, mill-streams and similar places in the United States, Germany, China and Japan, and have appeared in water-lily tanks at various botanic gardens, and in other tanks and aquaria. The genus *Limnocnida* contains medusae which have been found in several river-systems in Africa and in some of the great lakes, as well as in India.

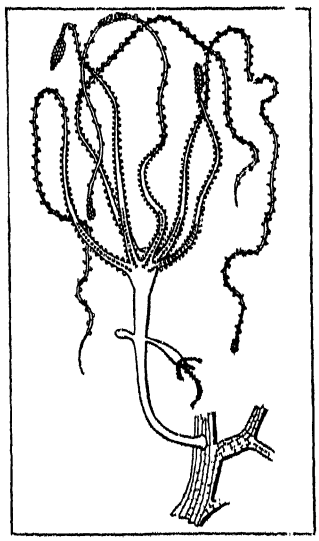
The Hydrozoa comprise three large orders which from this point onward will be treated separately.

ORDER I. HYDROIDA

The Hydroida are, roughly speaking, those Hydrozoa which possess a definite alternation of the polyp and the medusa in their life-history, and in which one generation (the polyp) is sedentary and usually constructs a fixed colony, the other being free-swimming when fully developed. There are various exceptions to this general statement, but they are not characteristic of the group as a whole. The variety of form and life-history exhibited, however, is so great, that it will need detailed treatment.

It is convenient to begin with the consideration of the common and well-known but quite untypical freshwater genus *Hydra* (fig.

1), which is the only thoroughly successful freshwater Coelenterate. *Hydra,* of one species or another, occurs in ponds and ditches and similar situations in many parts of the world. It consists of small isolated polyps, each with a pillar-like body and a limited number of tentacles. The length of the body is a matter of millimetres, and the tentacles in some species may be longer when stretched out than the body, although both they and the body can contract into rounded knobs. The *Hydra* attaches itself to stems and water-weeds, or floats beneath the surface film. It catches prey, often of a large size compared with its own bulk, in the manner characteristic of the Coelenterata (this is described in the article COELENTERATA) by stinging and then swallowing it. From the body of the *Hydra* there grow out buds, each of which acquires tentacles of its own and ultimately becomes separated from the parent; but no medusae whatever are produced, this being quite exceptional among the Hydroida. There are usually developed separately, on different parts of the body, ovaries and testes which give rise to the sex-cells. Whether this represents a degenerate condition, and there was once a medusa-stage in the life-cycle, or whether it is a primitively simple condition, cannot be determined.



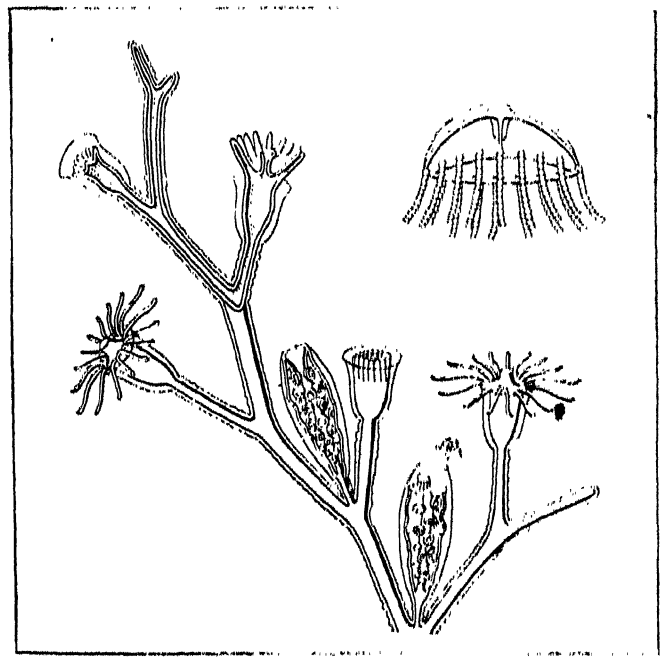
FROM DELAGE AND HEROUARD, "ZOOLOGIE CONCRÈTE" (REINWALD) (BONNAIRE)

FIG. 1.—FRESH-WATER POLYP HYDRA, ENLARGED

The specimen is shown attached to a plant-stem. Its tentacles are well extended and it bears two buds on its side, one of which has acquired tentacles of its own

The few other simple genera which are known, such as *Protohydra,* may be related to *Hydra,* or may be primitive or degenerate forms of separate origin. With the above preliminary, the characteristics of the group as a whole, without reference to these special forms, may be considered.

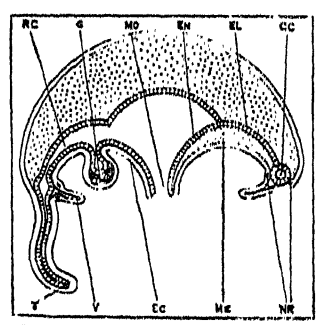
Structure.—The following is a description of the structure of a typical Hydroid, provided by the genus *Obelia* (fig. 2). *Obelia* begins its life, after the embryonic stages which succeed fertilization of the egg have transpired, as a single polyp, possessing a number of simple tentacles in a circlet around the base of its conical *peristome* or *manubrium.* The polyp sends out roots which attach it to the surface of a stone, the frond of a sea-weed, or other suitable support, and grows a stalk which raises it somewhat in the water. From this stem a bud arises from which, although it is at first a mere knob, a new polyp is gradually developed. This process of growth proceeds in a definite and regular manner, until a small tree-like colony, from less than an inch to several inches in height, is formed; the branches are definitely arranged, and all bear polyps. If one of the colonies be examined in detail, it will be found that each of the polyps possesses, outside its body, a little transparent cup of relatively stiff, horny material, into which it can withdraw when alarmed; and that not only are the polyps connected with each other by a stem composed of soft tissues, but the cups also are connected by a horny layer, outside the soft stem, which stiffens and supports the latter. The cups are known as *hydrothecae,* the soft stem as *coenosarc,* and the horny layer (including stem and cups) as the *perisarc.* The new polyps develop only from the tips of a branch of coenosarc, and not from one another; and in a well developed colony it will be seen that some additional branches have grown out, mostly in the lower part of the colony, each of them similar in structure to a developing polyp, and usually regarded as representing one. These branches (known as *blastostyles*) do not develop a mouth and tentacles; instead each produces a number of buds which gradually develop into small medusae, and which are known as *medusoid buds.* The blastostyle, like an ordinary polyp or *hydranth,* has a covering of perisarc known as a *gonotheca,* but this is at first imperforate. In due course it becomes open at the end, and the medusae separate off from the blastostyle and swim away into the sea, where, after a period of free life, they become hydroid polyps.



FROM (LARGE FIGURE) DELAGE AND HEROUARD "ZOOLOGIE CONCRÈTE" (REINWALD) (BONNAIRE); (SMALL FIGURE) PARKER AND HASWELL, "TEXT BOOK OF BOTANY" (MACMILLAN & CO.)

FIG. 2.—OBELIA (ENLARGED) SHOWING PART OF A COLONY OF THE POLYP GENERATION AND ALSO A MEDUSA. THE COLONY BEARS BOTH ORDINARY POLYPS AND BLASTOSTYLES, THE LATTER PRODUCING MEDUSOID BUDS

The structure of one of these fully developed medusae must now be considered in more detail (fig. 3). The body has the form of an umbrella, with a manubrium similar to that of a polyp hanging down inside it and bearing the mouth at its end. The manubrium is lined by endoderm, and contains a cavity, the main part of the coelenteron. The substance of the umbrella consists of mesogloea with ectoderm on both external surfaces; but the layer of mesogloea is penetrated by four narrow tubes or canals, lined by endoderm, which run out from the base of the manubrium like the four arms of a cross. Connecting these *radial canals* with each other is a flat sheet of endoderm like a web (*endoderm lamella*) and also a *circular canal* which runs round the edge of the umbrella close to the bases of the tentacles. The latter are solid, both in medusa and polyp. At the edge of the bell, on the inner side of the ring of tentacles, is a little circular shelf (the *velum*) which projects inwards and slightly narrows the opening of the bell. Round the margin of the bell, at the bases of certain of the tentacles, lie the sense organs, minute sacs, formed by the ectoderm, and each containing a calcareous particle (the *statolith*). They are known as *statocysts* (fig. 5), and are eight in number, two being definitely placed in each of the quadrants between the radial canals; they probably initiate and control the swimming-contractions of the bell. The sex-cells of the medusa ripen in the ectoderm of four gonads which occur on the course of the four canals, and which, when ripe, shed their products into the sea. The fertilized eggs develop into new polyps



FROM KUKENTHAL, "HANDBUCH DER ZOOLOGIE" (DE GRUYTER)

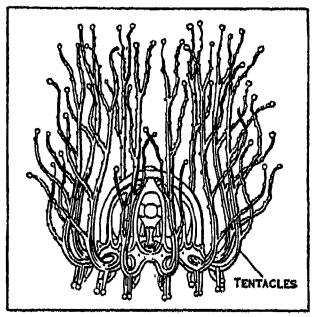
FIG. 3.—DIAGRAM OF A VERTICAL SECTION THROUGH A MEDUSA

EC, ectoderm; EN, endoderm; G, gonad; ME, mesogloea; MO, mouth; CC, circular canal; NR, inner and outer nerve rings; RC, radial canal; T, tentacle; V, velum

which initiate fresh colonies.

The story of *Obelia* is typical of the Hydroida, with modifications of one kind and another. In some cases the polyp-generation includes a single nutritive individual only, but usually it forms a colony. The form of the individual polyps and medusae, as also that of the colony, undergoes great modification however.

The polyps sometimes possess cups of perisarc as does *Obelia;* but often they are without these. Their tentacles are sometimes simple, sometimes knobbed at the tip or branched; sometimes arranged in one circlet, sometimes in two (one round the lip, one at the base of a conical manubrium), in other cases arranged irregularly over part or most of the surface of the polyp.

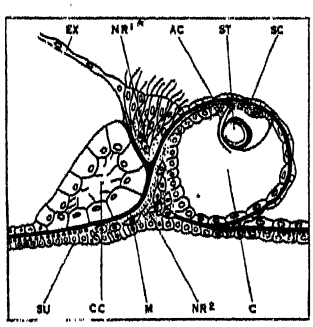


FROM ALLMAN, "GYMNOBLASTIC HYDROIDS" (COUNCIL OF THE RAY SOCIETY)

FIG. 4.—MEDUSA OF CLADONEMA (ENLARGED)

This is an example of a jellyfish with branched tentacles. The gonads here form swellings on the manubrium; and the medusa adheres to surfaces through knobs on the basal branches of its tentacles

The medusae vary even more than the polyps, both in shape and structure, and some idea of the diversity which occurs among them may be gained by reference to figs. 2–4 and 7–8. The shape of the bell may be shallow or almost flat, or on the other hand may be a high dome, and naturally varies with the movements of the animal. The number, arrangement and structure of the tentacles is widely various. The living medusae are some of the most beautiful of marine creatures. Their transparency, which is often touched with definite colour in given parts, and the regularity of their structure are responsible for this, and in some cases their movements also are extremely graceful. The sense organs vary from one kind of medusa to another. Statocysts are present in a number of cases, and these exhibit varying degrees of complexity of structure, with this in common to all of them—that the epithelium of the statolithic sac or pit (for the simplest of statocysts consist of an open pit) is derived from the ectoderm, and no endoderm takes part in its formation. Many medusae possess sense-organs of another nature, known as *ocelli,* and these are sensitive to light. In their simplest condition they consist of a clump of sensory cells mingled with pigment cells; but the more complicated ones possess a definite lens. These ocelli may be situated close to statocysts, but many medusae possess ocelli only, and others statocysts only. Another important variation in structure is, that in some medusae, as in *Obelia,* the gonads are situated on the radial canals; but in many others the sex-cells ripen instead on the manubrium.



FROM KUKENTHAL, "HANDBUCH DER ZOOLOGIE" (DE GRUYTER)

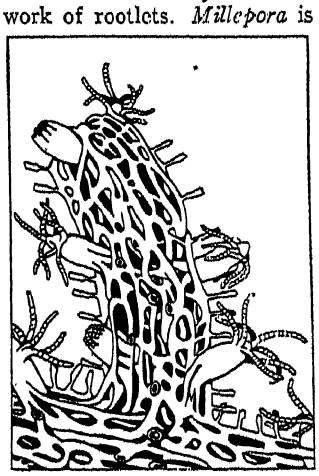
FIG. 5.—SECTION THROUGH A STATOCYST, MUCH ENLARGED

AC, sensory cell with sensory hair; C, statolithic sac; CC, circular canal; EX, ex-umbrella; M, mesoglœa; NR¹, outer nerve ring; NR², inner nerve ring; SC, statolithic cell; ST, statolith; SU, sub-umbrella

Colonies.—The next consideration must be that of the kinds of colonies which Hydroids construct. These colonies are frequently small and relatively soft, the horny perisarc giving a considerable amount of support, but not constituting a really rigid skeleton. Many such colonies are an inch or less in height, although colonies several inches long are common. Only rarely does the colony become actually large, but in a few cases it achieves a size and solidity which give it rank with the reef-forming corals; in these cases the skeleton is massive and calcareous, and is in fact "coral."

Hydroid colonies are roughly speaking of two kinds—mat-like and tree-like structures. The mat-like forms consist of a network of rootlets, attached to a stone, sea-weed or other support, from the upper surface of which arise the polyps. The network is sometimes straggling, sometimes compact, and may form a continuous sheet. The tree-like forms are mostly delicate feathery structures, resembling rather the fronds of a finely divided sea-weed than any animal. The general aspect of some of them is shown in the accompanying Plate. The size of the whole colony, the exact way in which it branches, and the way in which one polyp after another is added upon a branch, affect the general appearance of the ultimate result. Sometimes the branches themselves are thick and are composed of a dense network of branching rootlets (*Clathrozoon,* fig. 6), the polyps projecting at the surface. This condition, which is achieved in a manner different from that which produces the average tree-like colony, leads on to the state of affairs found in the massive, limy colonies.

These massive forms deserve special mention. They have been considered in time past as a separate group of Hydrozoa, the *Hydrocorallina;* but it has become evident that they are simply Hydroids with a more than usually solid skeleton, and that some of them are probably related to one series of Hydroid ancestors, others to a different series. A good example of these creatures is found in *Millepora* (*see* Plate). This animal constructs a colony containing innumerable minute individual polyps, which are connected with each other by a continuous surface-sheet of ectoderm and by a network of ramifying tubular rootlets. The colony secretes a massive, limy skeleton which may become a foot or more in height, and which is branched somewhat like the antlers of a stag, but in more compact fashion. The polyps inhabit little pits in the surface of the skeleton, and can retire into these completely when alarmed. The network of rootlets is lodged in a network of canals in the surface layers of the skeleton, the deeper parts consisting of coral only and containing no soft parts; this internal portion was secreted by the soft parts originally, but as growth proceeded and further skeleton was formed, these retired to the surface-layers. One can imagine that a similar state of affairs would be produced if a colony such as that of *Clathrozoon* were to secrete limy material into the meshes between its network of rootlets. *Millepora* is extraordinarily interesting in one respect. When the time comes for sexual medusae to be produced by the colony, these are not formed from buds as in *Obelia* and other Hydroids. Instead the sex-cells, which are migratory, move from the rootlets into one or other of the polyps. Each polyp so affected loses under their influence its characteristic structure, and becomes transformed by degrees into a medusa. The pit surrounding it enlarges and becomes closed in, so that it forms a cavity cut off from the outer world, and until the medusa is ready to escape it remains so; finally the cavity opens again and the medusa comes out. It is a weak swimmer and cannot feed; it swims a very little distance before shedding its ripe eggs or spermatozoa, the union of which gives rise to a polyp so that the life-cycle begins once more.



FROM KUKENTHAL, "HANDBUCH DER ZOOLOGIE" (DE GRUYTER)

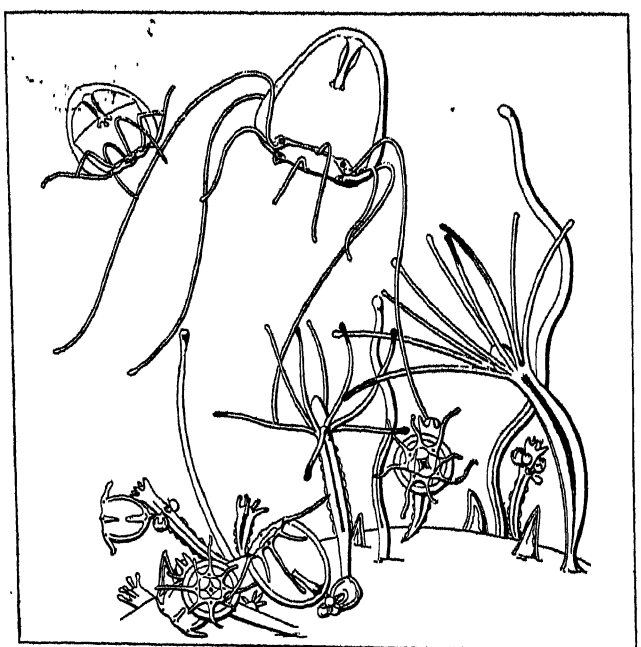
FIG. 6.—PART OF A COLONY OF CLATHROZOON

Diversities Exhibited by the Polyps and Medusae.—We may now pass on to some of the interesting diversities which the polyps and medusae exhibit. To begin with, in certain colonies, such as those of *Millepora* and *Hydractinia* (fig. 7), the hydranths are not all alike. Some of them (*gastrozooids*) possess mouths as well as tentacles, and inside these polyps digestion of food takes place. Other polyps on the contrary possess no mouths, but may have tentacles and are well provided with stinging capsules such as are described in the article COELENTERATA. These polyps themselves cannot feed, but they play a defensive part in the colony and assist the others in the capture and paralysing of food; they are known as *dactylozooids.* This is a simple example of the phenomenon of polymorphism, which

has been previously mentioned and which will be further discussed later. It is carried to greater lengths in *Hydractinia* than in *Millepora*, since in this case the colony produces also *blastostyles* similar in principle to those of *Obelia*. These may be regarded as modified polyps with a body but without mouth or tentacles, which produce sexual buds. Therefore a Hydractinia colony possesses four kinds of individuals—gastrozooids, dactylozooids, blastostyles and sexual buds.

To turn to the medusae, we find here a most curious state of affairs. To begin with, medusae may arise from blastostyles or direct from ordinary polyps; and the blastostyles may arise from the root or stem of a colony or from a polyp itself. Moreover, a medusa may itself bud off others from its manubrium, or from its tentacle-bases or other parts. The most remarkable fact connected with the medusae, however, is that despite the fact that a medusa is obviously an advantageous development, in that it can swim away and spread the eggs and spermatozoa over an area vastly wider than they could otherwise reach, there is yet a strong tendency among the Hydroida towards a condition in which the medusa not only remains permanently attached to the colony whence it sprang, but also becomes much reduced and simplified in structure. A series of medusae can be traced, in which at one end there is found the fully formed free-swimming jellyfish, at the other end a degenerate sac-like structure, devoid of any medusa-like features, and resembling the gonad of an active medusa, such as that of *Obelia*. This degenerate formation, which remains attached to the colony, is known as a *sporosac*, and consists of a layer of ectoderm containing or covering the sex-cells, and surrounding an endodermal core. Between these two extremes all intermediate stages may be found.

It has been considered by some authors that the sporosacs represent, not a reduced but a primitive condition, and that the other stages are to be regarded as developments leading up to

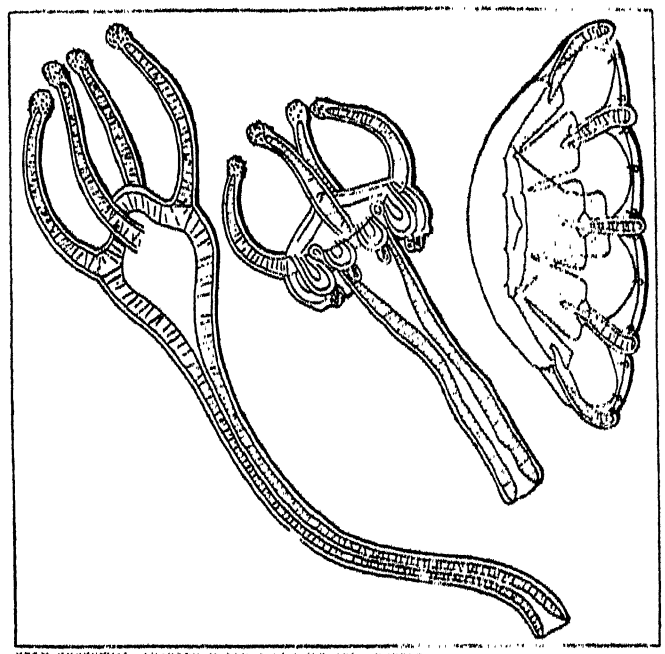


FROM KUKENTHAL, "HANDBUCH DER ZOOLOGIE" (DE GRUYTER)

FIG. 7.—PART OF A COLONY OF HYDRACTINIA (ENLARGED), SHOWING GASTROZOOIDS, DACTYLOZOOIDS, BLASTOSTYLES AND MEDUSOID BUDS, AS WELL AS FREE MEDUSAE

the fully formed medusa. This would seem reasonable from the point of view that the roving medusa is an obvious gain to a fixed colony; but the facts of the case do not seem to support it. From the structure and mode of occurrence of the various grades of medusae, and from the fact that in the development of certain of the reduced forms, medusoid features appear for a time and are subsequently lost, it is judged that they are not primitive but degenerate. The precocious development of the sex-cells may be the factor which leads to the reduction of the medusae; the gain being increased fertility.

The Coelenterata are singularly free from parasitic members. Of the few that are known, one is particularly interesting. This *Hydrichthys boycei*, a species referred to the Hydroida but which may be an unusual siphonophore. The colony is one of the mat-like kind, and the mat, instead of being affixed to a stone or weed, is attached to the fins or body of a fish. The underside of it sends



FROM KUKENTHAL, "HANDBUCH DER ZOOLOGIE" (DE GRUYTER)

FIG. 8.—STAGES IN THE DEVELOPMENT OF A TRACHYLINE (MUCH ENLARGED)

The figures show the direct transformation of a polyp-like larva, with a long proboscis, into a medusa

roots into the integuments of the fish, and under its growing edge are cells which are able to destroy the surface of the fish's skin and expose the vascular layer beneath. The polyps, which have no tentacles, bend down over the edge of the mat, apply their mouths to the wound made by the latter, and obtain blood from the vessels of the fish. Another parasite, better known than *Hydrichthys*, is *Polypodium*; this is parasitic at one stage of its life in the eggs of a sturgeon, which it destroys.

Classification.—The classification of the Hydroida is instructive, though as yet imperfect. The connection between medusae and polyps was at first not understood by naturalists, since it could not be deduced from observation of one of these types only, without a study of the whole life-history. Even now there are polyps and medusae which have not yet been linked on to their corresponding alternative form. Consequently a double classification has grown up, dealing with the two sets independently, and the two systems can be correlated with each other so far as the inter-connections are known.

The polyps are divided into:—

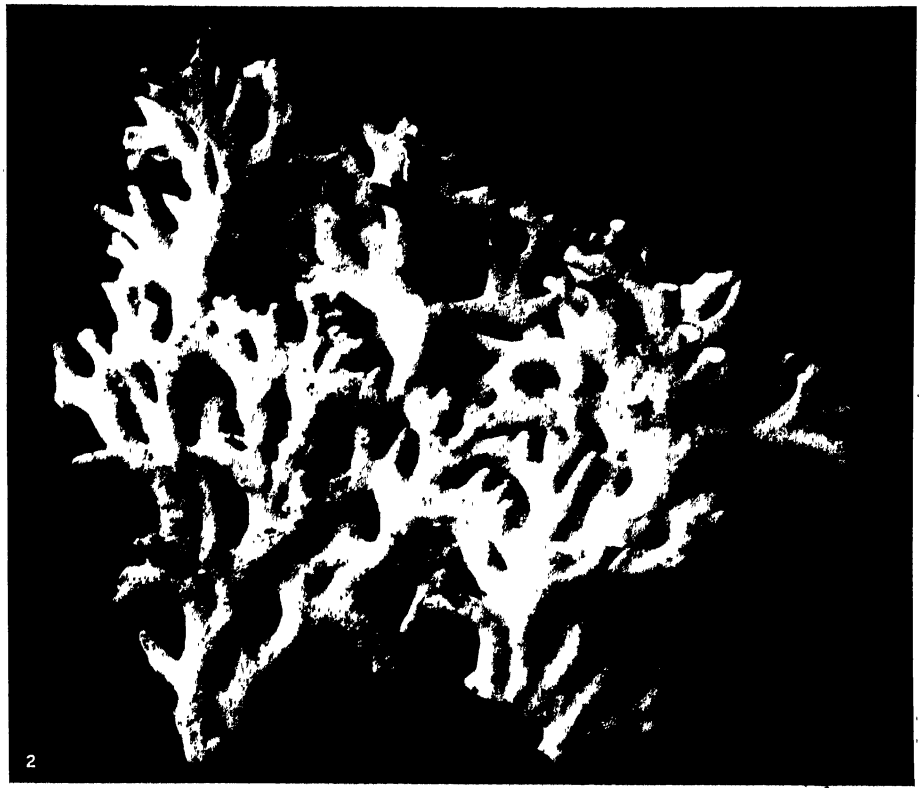
1. Gymnoblastea. Here the polyps are not enclosed in cups of perisarc (hydrothecae), nor are the blastostyles enclosed in gonothecae.
2. Calyptoblastea. Here the polyps possess hydrothecae and the blastostyles gonothecae.

The medusae are classified as follows:—

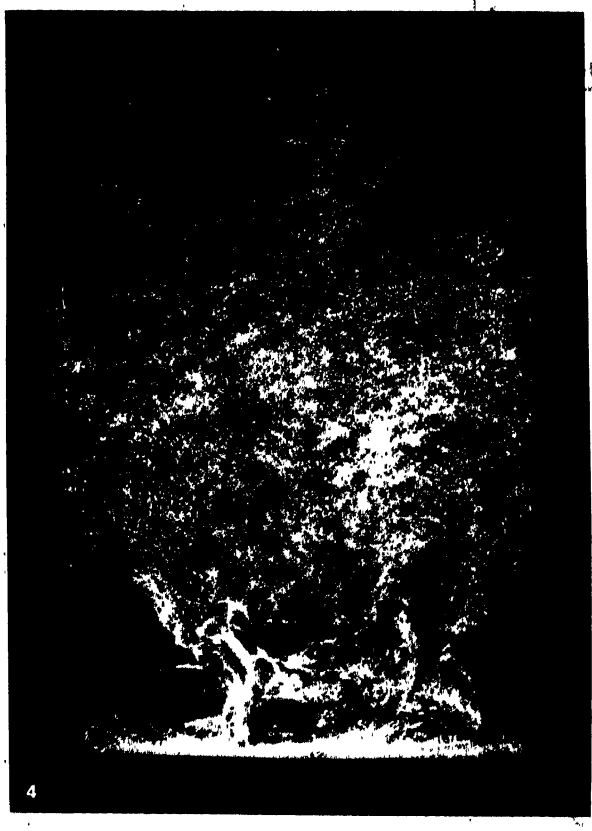
1. Anthomedusae. Medusae in which there are no statocysts (though there are usually ocelli) and in which the gonads develop on the manubrium. These are the medusae belonging to the Gymnoblastic polyp-generation.
2. Leptomedusae. Medusae in which there are typically statocysts and sometimes ocelli, and in which the gonads are arranged on the radial canals. These medusae belong to the Calyptoblastic polyp-generation.

In the above scheme *Hydra* and its relatives would be considered Gymnoblasts by some authors, by others they would be placed in an independent group, the *Hydrida*. The affinities of *Limnocodium* and *Limnocnida* are somewhat uncertain.









HYDROIDS AND HYDROID CORAL

1. Aglaophenia, showing featherlike form of the colonies which bear the minute polyps along the side branches
2. Millepora, a hydroid coral, bearing the polyps in minute tubular pits in the hard calcareous skeleton
3. Colonies of Pennaria, showing polyps borne on small lateral branches
4. Colonies of Obelia, showing complex tree like branching

ORDER II. TRACHYLINA

The Trachylina are an assemblage of Hydrozoa which differ sufficiently from any of the Hydroida or Siphonophora to warrant their inclusion in a separate group.

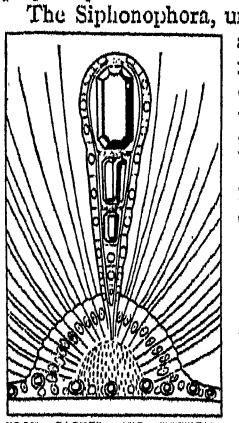
Among the Trachylina the medusa is the dominant form, and many reach a considerable size (*e.g.*, 10 x 3cm.). In accordance with this fact the Trachylina are mostly oceanic forms, pelagic throughout life; whilst the Hydroida are tethered, so far as their polyp-generation is concerned, to the bottom or to sea-weed, and include many characteristic shore-forms. The cleavage of the fertilized egg of the Trachylina typically produces a planula (*see* COELENTERATA), which develops into a more or less distinctly polyp-like larva; the latter is transformed directly into a medusa (fig. 8). In certain forms (Cuninidae) the polyp-larva is parasitic within medusae of its own or other kinds. In such cases it reproduces by budding, and both the parent and daughter polyps become transformed into medusae; or, the larva may form a stolon from which medusae are budded.

Beyond the facts thus outlined the Trachylina contribute little of general interest to the study of the Coelenterata, although their structure and life-histories are in themselves extremely interesting. For this reason they are dealt with very briefly here, and the only part of their structure calling for further mention is that of the sense organs. Ocelli (eye-spots) are rare amongst them, but all possess organs containing statoliths. These are of a different grade from those of the Hydroida, in that they exhibit the structure, not of ectodermal pits or sacs containing statoliths, but of small tentacles containing an endodermal core in which lie one or more statoliths, and covered by ectoderm. These modified tentacles are known as *tentaculocysts* (fig. 9), and they may, like tentacles, project freely at the surface, or may themselves become embedded in a pit or sac formed by the surrounding tissues.

ORDER III. SIPHONOPHORA

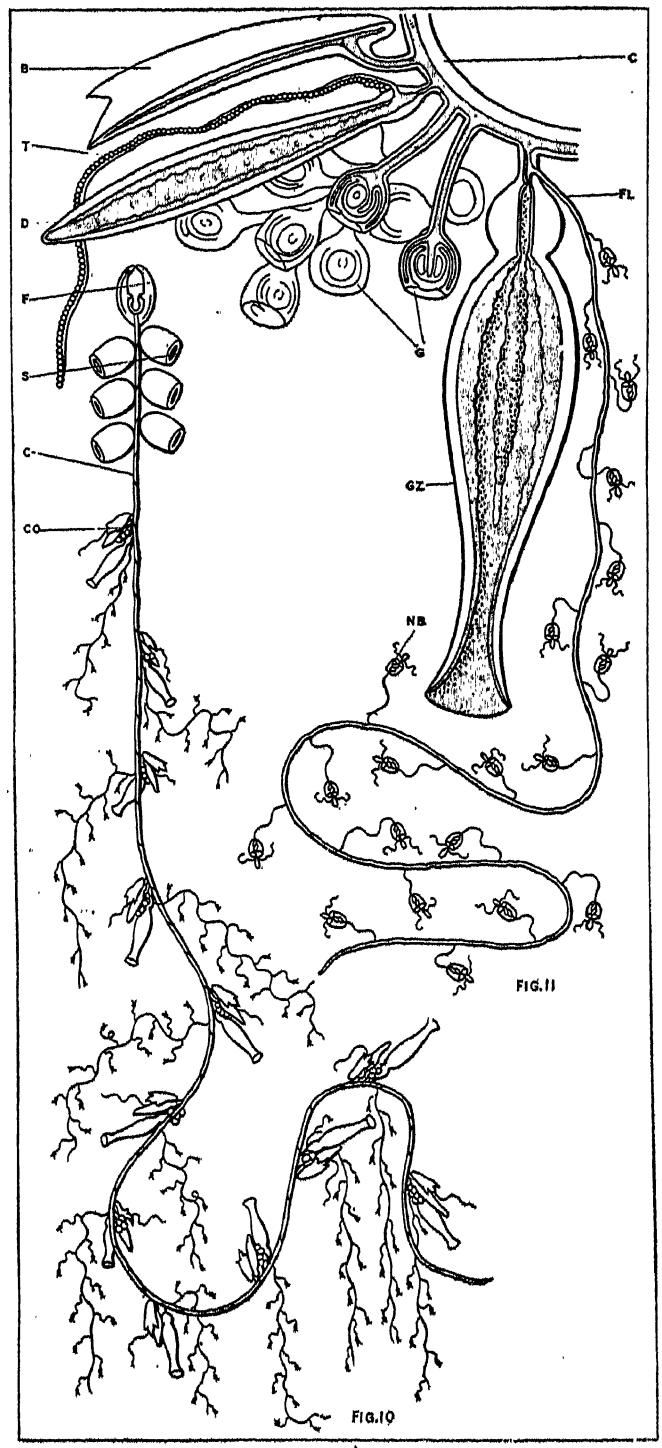
The Siphonophora constitute one of the most interesting groups of the animal kingdom, since they illustrate the lengths to which an organism may go in the direction of stringing together a number of different kinds of individuals in a single chain. In scientific terminology they exhibit at its height the phenomenon of polymorphism.

The Siphonophora, unlike the Hydroida, are essentially pelagic animals: they are exclusively marine, and most characteristic of warm seas. They one and all form colonies, but the colony is unattached and either floats or swims. It produces sexual medusae comparable to those of a hydroid, and these may or may not be set free from the colony; consequently there may be an alternation of generations, both pelagic, or the medusa-generation may never gain independent existence. There is however this difference from the state of affairs among the Hydroida, that a medusa which is set free as such is an exception, and that it has never the full structure of a Hydroid medusa, possessing no mouth or sense-organs. Most siphonophore medusae remain attached to the colony or to a segment of it, and many of them exhibit grades of reduction in structure. These are known as *gonophores*, but they are never as degenerate as a Hydroid sporosac. From the eggs produced by the medusae or gonophores a planula larva of a curious type develops, and this by budding produces a colony. The siphonophore contrasts with a trachyline in that it is here the colony, and not the sexual medusa, which is the dominant form; and in addition to this a new factor is introduced which is not found either in the Trachylina or in the Hydroida. This is the production by the colony not only of more than one kind of polyp (as in *Hydractinia*) but also of more than one kind of medusa. In addition to the sexual medusae corresponding to the sole medusa-form in the other groups, there are found here medusae of modified structure which neither feed nor produce gonads, but which act as swimming-bells for the whole colony; and other structures which are also probably modified medusae. Of these latter one is a medusa transformed into a gas-containing float.



FROM PARKER AND HASWELL, "TEXT-BOOK OF ZOOLOGY" (MACMILLAN & CO. LTD.)

FIG. 9.—ENLARGED VIEW OF A TENTACULOCYST
In the endodermal core of this organ statoliths are visible. The tentaculocyst is mounted on a prominence from which rise long sensory hairs



FROM DELAGE AND HEROUARD, "ZOOLOGIE CONCRÈTE" (REINWALD) (BONNAIRE)

FIG. 10.—THE STRUCTURE OF A STRING-LIKE SIPHONOPHORE COLONY.
FIG. 11.—TYPES OF INDIVIDUALS TO BE FOUND IN A TYPICAL SIPHONOPHORE CLUSTER

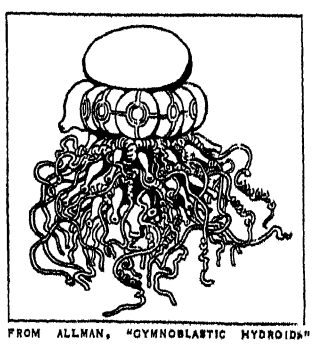
B, bract; C, coenosarc; CO, cormidium; D, dactylozooid; F, float; FL, tentacle of gastrozooid; G, bunch of gonophores; GZ, gastrozooid; NB, battery of sting cells; S, swimming-bell; T, tentacle of dactylozooid

Structure of Colonies.—It will be impossible to understand or to visualize the siphonophore organization, without first con-

sidering the structure of several typical colonies; these are so diverse in constitution that a general statement at the present stage would be unprofitable.

The first colony to be described will be that of *Halistemma* (figs. 10 and 11). At the upper end of this lies a small float, and depending from it a long thin string which is tubular and contractile. This is the *coenosarc* and corresponds to the stalk of an *Obelia*. Arranged on the string just below the float are a number of swimming-bells; each of these is a medusa attached to the coenosarc by a short stem arising from the outer side of its bell, and possessing radial canals and a velum but no manubrium or mouth. At intervals along the coenosarc are found little knots or clusters of individuals. These are not all alike, larger and smaller ones alternating regularly. Each cluster (*cormidium*) contains a certain number of individuals, but not the same selection in each case. The types of individuals comprised in the whole series are leaf-like protective structures, the *bracts*, together with digestive polyps (*gastrozooids*) each with a mouth and with a single tentacle which is attached to it at the base; other polyps (*dactylozooids*) with no mouths, each with a single tentacle at its base, which act as feelers and stingers; and lastly *blastostyles* upon which male and female gonophores are produced. The tentacles of the gastrozooids, which act as fishing-lines, are branched, the branches bearing terminal stinging-batteries; those of the dactylozooids are unbranched.

A type of colony similar in principle to that of *Halistemma* is formed by *Physophora*. Here we begin as before with a small float bearing a tubular string of coenosarc with swimming-bells. But below these bells, the rest of the coenosarc, instead of forming a long string, is short and compact, with the result that all the other individuals of the colony (which include dactylozooids, gastrozooids and blastostyles) are concentrated into a group with the dactylozooids forming a protective circlet round the outside. The same principle is further exemplified in a still more modified degree by *Stephalia* (fig. 12), in which the same essentials are present but the proportions and shapes of all the parts have changed. In this case the float is large and prominent and it opens to the exterior through a special spout-like structure (*aurophore*) at one side. The swimming-bells are restricted to a single circle below the float, instead of being strung out as in *Halistemma* and *Physophora*, and the coenosarc bearing the cormidia is neither the long string of the former nor the insignificant vesicle to which it is reduced in the latter, but is a bulky mass bearing in the middle of its lower surface a large terminal gastrozooid, and supporting the cormidia on its sides. This mass is penetrated by a number of tubes lined by endoderm, which run into each other and communicate with the digestive cavities of the gastrozooids.

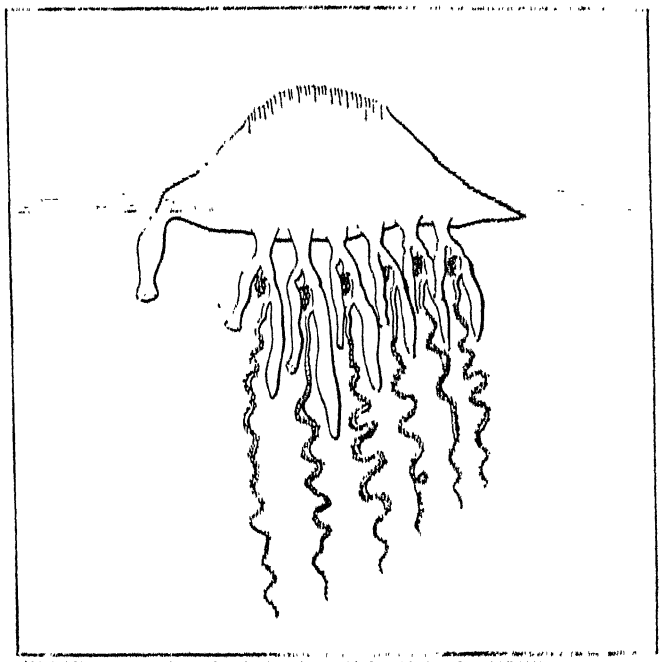


FROM ALLMAN, "GYMNOBLASTIC HYDROIDA" (COUNCIL OF THE RAY SOCIETY)

FIG. 12.—COLONY OF STEPHALIA
The swimming-bells are restricted to single circles and not strung out as in *Halistemma* and *Physophora*

From *Stephalia* to *Physalia* (fig. 13) is a natural transition. Here there are no longer any swimming-bells, but there is a large crested float opening to the outside by a pore, and bearing a gastrozooid at one end. In a young *Physalia* the underside of the float bears directly half a dozen cormidia, each containing a gastrozooid without a tentacle, a dactylozooid with a long unbranched fishing-line, and a branching blastostyle bearing small dactylozooids upon it, and also male and female gonophores. As the colony increases in size new individuals are added somewhat irregularly upon the stalks of the old, and the simple early arrangement is lost. The colours of *Physalia* (blue, orange, etc.) are of great brilliance, and it is a well-known denizen of the Atlantic, Pacific and Indian Oceans, often occurring in fleets, and commonly known as "Portuguese Man-of-War." One of its fishing-lines reaches a greater length than all the others, attaining more than a yard; and the stinging powers of these lines are extremely powerful, producing serious conditions after contact with them even in man. The colony is not bound to float at the surface; it can deflate the float and sink, reforming the gas within it and so rising once more, within a quarter of an hour.

A colony quite unlike any so far described is formed by *Velella*. Here the whole organism has the aspect at first sight of a single flat medusa bearing a sail on its upper side and tentacles round



FROM DELAGE AND HEROUARD, "ZOOLOGIE CONCRÈTE" (REINWALD) (HORNAIRE)

FIG. 13.—DIAGRAM OF A YOUNG COLONY OF PHYSALIA
From the crested float depend several Cormidia. At the left end of the colony is a single large gastrozooid

its margin (fig. 14). On closer examination it is found, however, that the apparent tentacles are really a circle of long dactylozooids, and that the underside of the disc-like colony is covered by a number of curious blastostyles which, unlike an average blastostyle, possess mouths. In the centre of these is a single large gastrozooid, the only one which the colony possesses. The disc-like portion of the animal to which all these polyps are attached is complex in structure. It is thick and contains below the skin-layers of its upper side an internal horny float, below which is a mass of soft tissue, a concentrated coenosarc. The float is itself flattened in shape, is subdivided into chambers, bears a vertical extension in the centre stiffening the "sail," and is prolonged into the soft tissues as fine *air-tubes*. The coenosarc contains a ramifying system of endodermal tubules, in communication with the cavities of the various polyps, which is probably both absorptive and excretory in function. The coenosarc also contains a massive concentration of nematocysts, doubtless a nursery whence they migrate when sufficiently developed into the parts where they can function. Very similar to *Velella* but without a sail, is *Porpita*. In these creatures we have reached a stage in which the colony has become so compact and the parts so markedly subordinated to the whole that their interrelation resembles rather that of organs than that of independent beings; but free medusae are liberated by the colony.

Finally it may be mentioned that there are a number of siphonophore colonies which differ from any so far mentioned in that they possess swimming-bells but no float.

We may now summarize the state of affairs in this very curious group of animals. In the course of the above descriptions mention has been made of a number of structures—gastrozooids, blastostyles, dactylozooids; swimming-bells, floats, bracts; and sexual medusae (fig. 11). It remains to comment on the status of these various entities. Continuing the view which is taken throughout the articles on Coelenterata in this Encyclopædia, most or all of these structures represent individuals, modifications

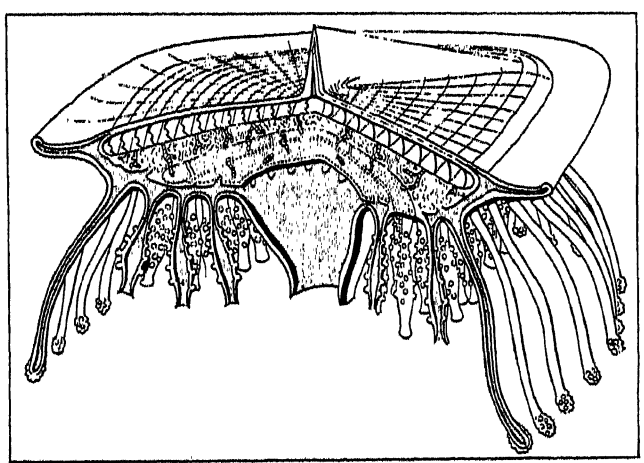
of either the polyp or the medusa form of body, or independently developed entities of equivalent standing. The gastrozooids and dactylozooids are varieties of polyp, the sexual medusae, the swimming-bells, and probably the bracts are modifications of medusae. The float is sometimes regarded as the invaginated upper end of the stem of coenosarc, and sometimes as a modification of a medusa. The status of the blastostyles is uncertain; they represent polyps in *Velella*, in other cases they are perhaps the present day substitute for bygone polyps.

It should be mentioned in conclusion that the Siphonophore is regarded by Moser not as a colony of individuals but as an individual animal with division of labour between organs and "on the way to alternation of generations and to colony-formation"; and that the medusae of *Velella* are regarded by this author as free-swimming gonophores leading up to true sexual medusae. The work of Moser has thrown considerable light on the morphology and the development of the Siphonophora, and has made clearer than formerly the homologies of parts throughout the group, especially that of the float, which may fairly be regarded as equivalent to the apical adult bell of the forms with no float. This work also forms a valuable contribution to the question of evolution within the Siphonophora, but in the view of the present writer it hardly establishes the claim that a siphonophore is an individual animal (*see* also the following section on Polymorphism).

POLYMORPHISM

In the articles COELENTERATA and ANTHOZOA, and in accounts of the groups of Hydrozoa already dealt with in the present article, references will be found to the phenomena known as *polymorphism* and *alternation of generations* (*metagenesis*). Since these phenomena are aspects of one and the same thing, and are of general interest and importance, a summary of the subject is indicated. In the following remarks it is taken for granted that the articles above mentioned are familiar to the reader.

Firstly it must be made clear that alternation of generations as found in *Obelia* is simply an example of polymorphism, which may be defined as the ability of a single species of animal to exist under more than one form—in this instance as polyp and medusa. In a clear-cut case of alternation of generations one of these forms is sexual and *succeeds* the alternative non-sexual form, the two co-existing on a single colony only for the period during which the medusae are developing from buds.



FROM DELAGE AND HEROUARD, "ZOOLOGIE CONCRÈTE" (REINWALD) (BONNAIRE)

FIG. 14.—DIAGRAM ILLUSTRATING THE STRUCTURE OF VELELLA
A sector of the disc-shaped coenosarc has been cut away so as to reveal the internal structure

The other type of polymorphism is that which is exhibited by such colonies as *Hydractinia* and in far higher degree by the Siphonophora, and in which there is not only the distinction of individuals into sexual and non-sexual forms, but the non-sexual polyps are themselves divided into kinds (gastrozooids, dactylozooids, etc.). This is exemplified even in *Obelia* by the distinction of the polyps into hydranths and blastostyles. In the Siphonophora there is the additional development that here there exist non-sexual as well as sexual medusae, and probably more than one kind of these (swimming-bells, bracts and float).

In other words there exists (*a*) a differentiation into sexual and non-sexual forms and (*b*) a division of labour between the non-sexual forms by virtue of which they become, for practical purposes, reduced to the condition of organs.

It must be noted however that the sexual forms tend to lose their independence; and the separate free-swimming generation so obvious in *Obelia* and similar forms becomes at the other end of the series a degenerate sporosac attached to the colony as permanently as any non-sexual individual. In fact it has become a sex-organ or gonad, and "alternation of generations" has been transformed into "division of labour."

Interesting divergences from the ordinary kinds of polymorphism typical of the Hydroida and Siphonophora are found among the Trachylina, Scyphozoa, and in forms such as *Millepora*. In *Millepora* a polyp, be it a gastrozooid or a dactylozooid, becomes directly transformed under the influence of the immigrating sex-cells into a medusa, instead of the medusa being formed from an independent bud. The polyp is a changeling. In the Trachylina the same process takes place, but in this case it is a pelagic or parasitic larval polyp which turns into a jellyfish, not an adult member of a colony. Among the Scyphozoa a unique condition exists; here the alternation of generations is very marked, and the medusa arises from the polyp direct; but in this case the polyp divides itself transversely into a series of superimposed saucer-like sections, which separate from it one by one, each becoming a medusa. A single polyp has therefore produced not one but several medusae. This is partly paralleled by a blastostyle, for if the latter be a polyp it produces by *budding*, several medusae; but the scyphozoan polyp achieves the same end quite differently.

The Anthozoa are the least interesting of the Coelenterata from the point of view of polymorphism. They possess no medusoid form and among their polyps little polymorphic variation in form occurs. In certain colonial forms ordinary polyps and siphonozooids co-exist, and there is also a distinction in some colonies between an original axial polyp and those subsequently formed. In the coral *Fungia* part of the life-cycle in some respects resembles the strobilization of the Scyphozoa.

Polymorphism is chiefly interesting as an example of the extraordinary ability of animals to produce an almost infinite number of variations upon a given theme. It has also been much employed as a subject for argument, however, and it should be mentioned here that the viewpoint regarding it which has been adopted in all the articles on Coelenterata in this Encyclopædia is not universally accepted. The argument here adopted has been that a siphonophore or a compound Hydroid is a *colony* and that its parts represent, morphologically speaking, *individuals* connected by a common intermediate tissue, the coenosarc. This view may appear to be far-fetched when one contemplates a sporosac, which is in effect a gonad, since it involves the claim that this structure represents not an organ but an animal. It is also true that in some cases, such as those of meandrine corals, it is difficult to decide whether a polyp with a dozen mouths represents one polyp or twelve. But taking the whole story, as presented to us throughout the Coelenterate series, as a unity, the interpretation of the systems encountered as colonies of individuals appears to be the soundest working hypothesis. The alternative view, that everything which results from the development of a single egg is an individual animal, however much it may subdivide asexually, and that gastrozooids, bracts, and the rest are nothing more than the organs of this animal, seems relatively satisfactory when applied to such a form as the adult *Velella*. But when one applies it to a free-swimming medusa it becomes reduced to an absurdity—is a jellyfish, an organism provided with mouth and stomach, canals, velum, tentacles and sense-organs, simply a moving *organ* and not an animal at all? Further, one may meet on many shores hosts of sea anemones, none of which have developed from eggs—each is an independent organism, not part of a colony, and each has been produced asexually by fission. Are these anemones then "organs"? To reduce the term "organ" to such a level is to remove its actual meaning. It is interesting to note that Moser

combines the two theories by regarding the Coelenterata other than Siphonophora as colonies of individuals, but the Siphonophora themselves as relatively primitive organisms, individuals comprising organs and the fore-runners of true colonies.

In this connection it should however be noted that in the above paragraphs the term "individual" has been used in a purely morphological sense—*i.e.*, the individuals of a Siphonophore represent morphological individuals which have suffered a loss of independence similar to that of the component cells of any multicellular animal, which latter may be regarded as having been derived originally from a colony of individual single-celled animals (protozoa). In a physiological sense on the other hand the Siphonophore colony is a unity and may be regarded as an individual system. The status of such a system in relation to the wide general question of individuality is further discussed in the article on that subject.

BIBLIOGRAPHY.—For general accounts *see* bibl. to article on COELENTERATA, and for recent lists of literature, Kükenthal's *Handbuch der Zoologie*, vol. i. (1923–25). *Freshwater forms.*—F. Payne, "A Study of the Freshwater Medusa, Craspedacusta Ryderi," *Journ. Morph.* (Boston, Mass., 1924), vol. xxxviii., p. 387. *Pictures of Siphonophora.*—E. Haechel, *"Challenger" Reports, Zool.*, vol. xxviii. (1888); *of Hydroida*, G. J. Allman, *Gymnoblastic or Tubularian Hydroids* (Ray Society, 1871). (T. A. S.)

HYENA, the name applied to members of the family *Hyaenidae*, a group of Carnivora (*q.v.*) distinguished by the four toes on each foot, the comparative length of the forelegs, the non-retractile claws, and the enormous strength of the jaws and teeth, enabling them to crush hard bones. Three species are known, belonging to the genus *Hyaena*.

The striped hyena (*H. striata*) has the widest distribution, being found in India, Persia, Asia Minor, North and East Africa. About the size of a wolf, the animal is greyish-brown in colour, marked with indistinct longitudinal stripes of a darker hue. There is a mane along the neck and back. The animal is nocturnal in habits and has an unearthly cry, aptly compared to demoniac laughter. It feeds mainly on carrion, but occasionally carries off sheep, goats and dogs. It is a solitary and cowardly animal.

The spotted form (*H. crocuta*) ranges from Abyssinia to the Cape, and is yellowish-brown, with darker spots. The brown hyena (*H. brunnea*) is South African, and about the size of the striped species. It is ashy brown in colour, with a lighter collar, chest and belly. Both spotted and striped hyenas have been found fossilized in the Pliocene of Europe.

HYÈRES, a town in the department of the Var in S.E. France, 11 m. by rail E. of Toulon. Pop. (1926) 11,697. The town of Hyères was founded in the 10th century, as a place of defence against pirates, and takes its name from the *aires* (*hierbo* in the Provençal dialect), or threshing-floors for corn, which then occupied its site. It passed from the possession of the viscounts of Marseille to Charles of Anjou, count of Provence. The château on the summit of the hill was dismantled by Henri IV., but the town resisted in 1707 an attack made by the duke of Savoy. Hyères is celebrated (as is also its fashionable suburb, Costebelle, nearer the seashore) as a winter health resort. The town is situated about 2½ m. from the seashore on the sheltered south-western slope of a steep hill (669 ft. of the Maurettes chain) but is exposed to the Mistral. To the south-west, across a narrow valley, is the suburb of Costebelle. The older portion of the town is surrounded, on the north and east, by remnants of its mediaeval walls, and has steep and dirty streets. The more modern quarter has broad boulevards and villas, with gardens, filled with semi-tropical plants. The parish church of St. Louis was built originally in the 13th century by Franciscan friars, and restored in the 19th century. The plain between the new town and the sea has large nurseries, an excellent *jardin d'acclimatation* and many market gardens, which supply Paris and London with early fruits and vegetables, especially artichokes and roses in winter.

HYGIEIA, in Greek mythology, the goddess of health. The oldest traces of her cult, so far as is known at present, are to be found at Titane in the territory of Sicyon, where she was worshipped together with Asclepius, to whom she appears completely assimilated, not an independent personality. Her cult was not introduced at Epidaurus till a late date, and therefore, when in 420 B.C. the worship of Asclepius was introduced at Athens coupled with that of Hygieia, it is not to be inferred that she accompanied him from Epidaurus, or that she is a Peloponnesian importation at all, but rather a new invention, an offshoot of the already existing worship of Athena Hygieia. At first no special relationship existed between Asclepius and Hygieia, but gradually she came to be regarded as his daughter, the place of his wife being already secured by Epione. Later Orphic hymns, however, and Herodas, iv. 1–6, make her the wife of Asclepius. The cult of Hygieia then spread concurrently with that of Asclepius, and was introduced at Rome from Epidaurus in 293, when she was gradually identified with Salus (*q.v.*). While in classical time Asclepius and Hygieia are simply the god and goddess of health, in the declining years of paganism they are protecting divinities.



VOTIVE RELIEF FOR AN AESCULAPIUM, OR TEMPLE OF ASCULAPIUS: GREEK SCHOOL, EARLY 4TH CENTURY, B.C.: ORIGINAL IN NATIONAL MUSEUM AT ATHENS

See H. Lechat in Daremberg and Saglio's *Dictionnaire des antiquités*, with full reference to authorities; and E. Thrämer in Roscher's *Lexikon der Mythologie*.

HYGIENE, the science of preserving health. The subject embraces all agencies affecting the physical and mental well-being of man, and requires acquaintance with physics, chemistry, geology, engineering, architecture, meteorology, epidemiology, bacteriology and statistics. On the personal side it involves consideration of food, water and other beverages; clothing; work, exercise and sleep; personal cleanliness, special habits, such as the use of tobacco, narcotics, etc.; and control of sexual and other passions. In its public aspect it deals with climate; soil; character, materials and arrangement of dwellings; heating and ventilation; removal of excreta and other waste matters; medical knowledge on incidence and prevention of disease; and disposal of the dead.

These topics will be found treated in such articles as ADULTERATION, BACTERIOLOGY, CREMATION, DIET AND DIETETICS, FOOD, FOOD-PRESERVATION, HEATING, HOUSING, INDUSTRIAL WELFARE AND MEDICINE, MENTAL HYGIENE, SOCIAL HYGIENE, SEWER CONSTRUCTION, VENTILATION, WATER, etc. For general principles governing the sanitary well-being of the community *see* PUBLIC HEALTH and PREVENTIVE MEDICINE.

HYGINUS (d. *c.* 140), eighth pope. It was during his pontificate (*c.* 137–140) that the gnostic heresies began to appear in Rome.

See *Liber Pontificalis* ed. Duchesne.

HYGINUS (surnamed GROMATICUS, from *gruma*, a surveyor's measuring-rod), Latin writer on land-surveying, flourished in the reign of Trajan (A.D. 98–117). Fragments of a work on legal boundaries attributed to him will be found in C. F. Lachmann, *Gromatici Veteres*, i. (1848).

A treatise on Castrametation (*De Munitionibus Castrorum*), also attributed to him, is probably of later date, about the 3rd century A.D. (ed. W. Gemoll, 1879; A. von Domaszewski, 1887).

HYGINUS, GAIUS IULIUS, Latin author, a native of Spain (or Alexandria), was a pupil of the famous Cornelius Alexander Polyhistor and a freedman of Augustus, by whom he was made superintendent of the Palatine library (Suetonius, *De Grammaticis*, 20). His numerous works included topographical and biographical treatises, commentaries on Helvius Cinna and the poems of Virgil, and disquisitions on agriculture and bee-keeping. All these are lost.

Under the name of Hyginus there are extant: (1) *Fabularum Liber*, some 300 mythological legends and celestial genealogies, valuable for the use made by the author of the works of Greek tragedians now lost; (2) *De Astronomia*, usually called *Poetica Astronomica*, containing an elementary treatise on astronomy and the myths connected with the stars, chiefly based on Eratosthenes. Both are abridgments and both are by the same hand; but the style and the elementary mistakes (especially in the rendering of the Greek originals) are held to prove that they cannot have been the work of so distinguished a scholar as Hyginus. It is suggested that they are an abridgment (made in the latter half of the 2nd century) of the *Genealogiae* of Hyginus by an unknown grammarian, who added a complete treatise on mythology.

EDITIONS:—*Fabulae*, by M. Schmidt (1872); *De Astronomia*, by B. Bunte (1875); *see* also Bunte, *De C. Julii Hygin, Augusti Liberti, Vita et Scriptis* (1820).

HYGROMETER, an instrument for determining the humidity of the atmosphere (Gr. ὑγρός, wet, μέτρον, a measure), an instrument which determines the humidity changes only is termed a "hygroscope." The earlier instruments generally depended for their action on the alterations in the length of substances when exposed to varying degrees of moisture; catgut, hair, twisted cords and wooden laths, all of which contract with an increase in the humidity, being the most frequently employed.

Many of the early forms are described in C. Hutton, *Math. and Phil. Dictionary* (1815). Modern instruments, which utilize other principles, are described in METEOROLOGY.

HYKSOS or **"SHEPHERD KINGS,"** the name of the earliest invaders of Egypt. Josephus (*c. Apion.* i. 14), who identifies the Hyksos with the Israelites, preserves an account of them from bk. ii. of Manetho. According to it, in the days of King Timaeus, Egypt was invaded from the east by a destructive band who elected a king named Salatis. He made all Egypt tributary and established garrisons and fortresses in various parts of the country. His successors Beon, Apachnas, Apophis, Jannas and Asses reigned *c.* 199 years, and all aimed at extirpating the Egyptians. Their race was named Hyksos, *i.e.*, "shepherd kings," and some say they were Arabs (another explanation found by Josephus is "captive shepherds"). When their successors had held Egypt for 511 years, a rebellion began at Thebes. Misphragmuthosis confined the "Shepherds" in Avaris; and his son Thutmosis, failing to capture the stronghold, allowed them to depart; whereupon they established themselves, 240,000 in number, in Judea and built Jerusalem.

In Manetho's list of kings, the six above named form the 15th dynasty, and are called "six foreign Phoenician kings." The 16th dynasty is made up of thirty-two "Hellenic shepherd kings," the 17th is of "shepherds and Theban kings" (reigning simultaneously). The lists vary greatly in different versions, but the above seems the most reasonable selection of readings. For "Hellenic" *see* below. In 1847 E. de Rougé proved from a papyrus of the British Museum, that Apopi was one of the latest of the Hyksos kings, corresponding to Aphobis; he was king of the "pest" and suppressed the worship of the Egyptian gods in favour of his god Setekh or Seti.

In 1850 a record of the capture of Hawari (Avaris) from the Hyksos by Ahmosi, founder of the 18th dynasty, was discovered by the same scholar. A large class of monuments was afterwards attributed to the Hyksos. Some statues, found in 1861 by Mariette at Tanis, had peculiar "un-Egyptian" features. One of these bore the name of Apopi engraved lightly on the shoulder, and on other grounds it was concluded that the features were those of the Hyksos. In 1893 Golenischeff produced an inferior example bearing its original name, which showed that it represented Amenemhe III. In consequence it is now generally believed that they all belong to the 12th dynasty. Meanwhile a headless statue of a king named Khyan, found at Bubastis, was attributed to the Hyksos, the soundest arguments being his foreign name and the boastful un-Egyptian epithet "beloved of his *ka*." His name was afterwards recognized on a lion found in Baghdad. Flinders Petrie then pointed out a group of kings named on scarabs of peculiar type, which, including Khyan, he attributed to the period between the Old Kingdom and the New, while others were in favour of assigning them all to the Hyksos, whose appellation seemed to be recognizable in the title Hek-khos, "ruler of the barbarians," borne by Khyan.

Besides the histories of Egypt, *see* J. H. Breasted, *Ancient Records of Egypt;* Historical Documents ii. 4, 125; G. Maspero, *Contes populaires*, 3me éd.; W. M. F. Petrie, *Hyksos and Israelite Cities.*

HYLAS, in Greek legend, son of Theiodamas, king of the Dryopians in Thessaly, the favourite of Hercules and his companion on the Argonautic expedition. Having gone ashore at Kios in Mysia to fetch water, he was carried off by the nymphs of the spring in which he dipped his pitcher. Hercules sought him in vain; and ever afterwards, in memory of the threat of Hercules to ravage the land if Hylas were not found, the inhabitants of Kios every year on a stated day roamed the mountains, shouting aloud for Hylas (so Apollonius Rhodius I. 1207 et seq., and later authors). But, although the legend is first told in Alexandrian times, the "cry of Hylas" occurs long before as the "Mysian cry" in Aeschylus (*Persae*, 1054); and in Aristophanes (*Plutus*, 1127) "to cry Hylas" is used proverbially of seeking something in vain.

HYLOZOISM, in philosophy, a term applied to any system which explains all life, whether physical or mental, as ultimately derived from matter ("cosmic matter," *Weltstoff*) (Gr. ὕλη matter, ζωή, life.) Such a view of existence has been common throughout the history of thought, and especially among physical scientists. Thus the Ionian school of philosophy, which began with Thales, sought for the beginning of all things in various material substances, water, air, fire (*see* IONIAN SCHOOL). These substances were regarded as being in some sense alive, and taking some active part in the development of being. This primitive hylozoism reappeared in modified forms in mediaeval and Renaissance thought, and in modern times the doctrine of materialistic monism is its representative.

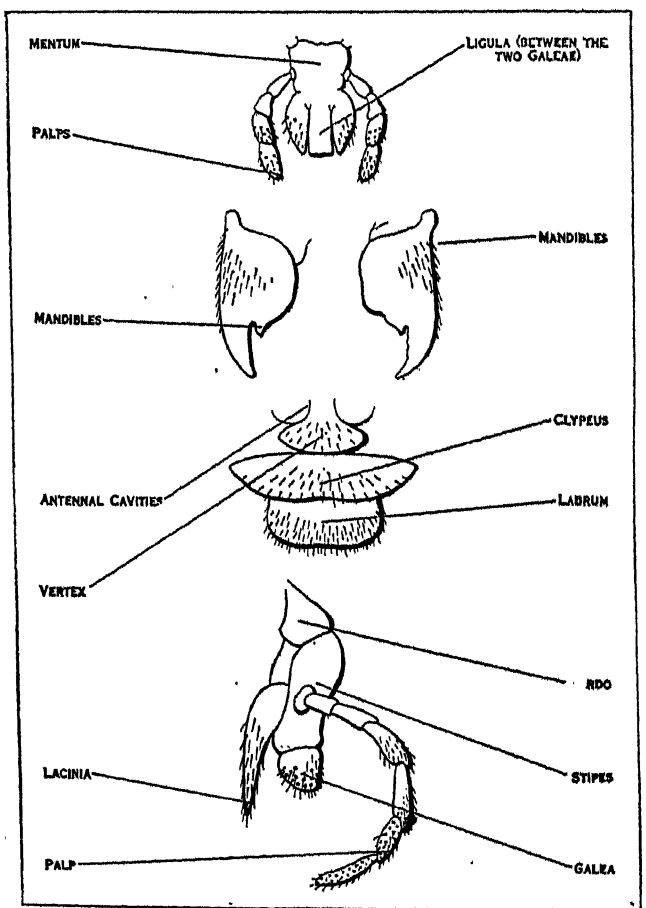
HYMANS, PAUL (1865–), Belgian statesman, was born at Ixelles, Brussels, on March 23, 1865. He became a barrister in 1885, and from 1898 to 1914 was professor of comparative parliamentary history at Brussels university. From 1900 he was deputy for Brussels and soon became the Liberal leader. After a mission to President Wilson in Aug. 1914 he was plenipotentiary in London, 1915–17, when he became head of the ministry of economic affairs. From 1918–20 and 1924–25 he was minister for foreign affairs. In Nov. 1918 he attended the inter-Allied Council at Versailles; he also represented Belgium at the Peace Conference in 1919 and on her behalf signed the peace treaty. In the same capacity he attended the conferences at San Remo, Boulogne, Brussels and Spa. He played a leading part in the settlement of the Ruhr question, the Dawes Plan, the Security Pact and the economic union of Luxembourg with Belgium. In Jan. 1920 he was appointed Belgian representative on the League of Nations, and in the same year was made president of the first Assembly at Geneva. On Nov. 29, 1927 he became minister of foreign affairs again after the reconstruction of the Jaspar cabinet. A member of the Académie Royale de Belgique, Hymans continued *L'histoire parlementaire de la Belgique* (1875, etc.) and wrote *Frère-Orban* (1905, etc.) and *Portraits, essais et*

discours (1914).

HYMEN or HYMENAEUS, originally the refrain of the song sung at marriages among the Greeks. As usual, the name gradually produced the idea of an actual person whose adventures gave rise to the custom of this song. He occurs often in association with Linus and Ialemus, who represent similar personifications, and is generally called a son of Apollo and a Muse. As the son of Dionysus and Aphrodite, he was regarded as a god of fruitfulness. In Attic legend he was a beautiful youth who, being in love with a girl, followed her in a procession to Eleusis disguised as a woman, and saved the whole band from pirates. As reward he obtained the girl in marriage, and his happy married life caused him ever afterwards to be invoked in marriage songs (Servius on Virgil, *Aen.* i. 651).

See J. A. Hild in Daremberg and Saglio's *Dictionnaire des antiquités*.

HYMENOPTERA, the term used in zoological classification for that order of insects comprising ants, bees, wasps, and their allies the saw-flies, gall-wasps and ichneumon flies. These insects all exhibit the following characters: (1) The presence of two pairs of stiff membranous wings often with the venation reduced



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FIG. 1.—HYMENOPTERA: MOUTH PARTS OF SAW-FLY (PACHYNEMATUS)
These are used principally for feeding, but in the bee the ligula is modified for sucking nectar

or almost absent: the hind-wings are smaller than the fore-pair and are interlocked with them by tiny hooklets. (2) The mouth-parts have biting jaws, but the labium is usually modified into a kind of tongue for lapping or sucking. (3) The abdomen is generally constricted at the base to form a waist and its first segment is joined up with the thorax: an ovipositor is present and used for sawing, piercing or stinging. (4) Metamorphosis is complete and the larvae are either caterpillars or more often vermiform: the pupae are usually in cocoons and their appendages are free.

Hymenoptera form one of the largest and most highly developed orders of insects and are of great interest, not only on account of the perfection of their structure but also with regard to the remarkable development of their instincts. In the latter respect they stand at the head of all invertebrate animals and their behaviour has been the subject of studies by many of the most famous naturalists. About 60,000 species are known but many thousands more still await discovery and even in the British Isles it is only the ants, bees and wasps that have been adequately collected and

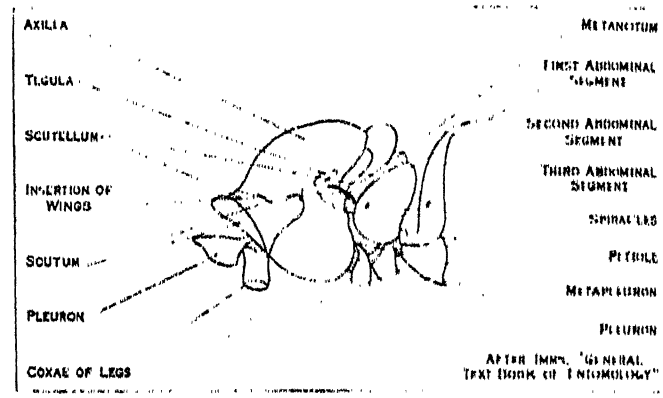
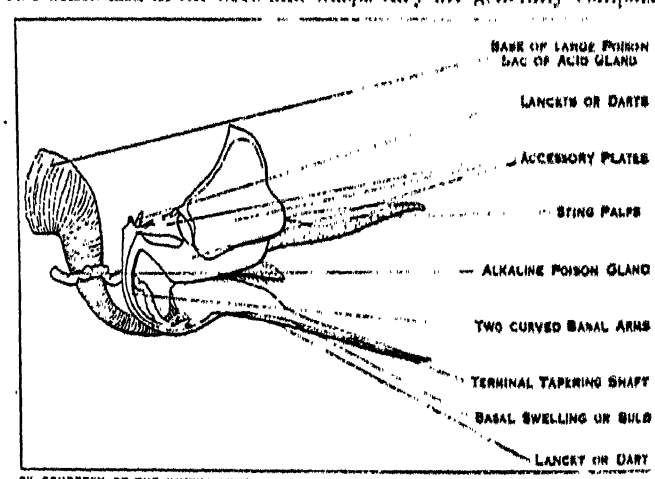


FIG. 2.—LATERAL VIEW OF THE THORAX AND BASE OF ABDOMEN OF HONEY BEE
The thorax is chiefly characterized by its fusion with the first segment of the abdomen. The parts of the pro- and metathorax are shaded; mesothorax and abdomen are plain

studied. Although the vast number of species are solitary like other insects, individuals of some species have acquired the habit of living together in great societies as is the case in ants, and certain bees and wasps: their social life and behaviour is fully discussed in the article SOCIAL INSECTS. Hymenoptera are also remarkable for the highly evolved condition parasitism has reached in the order: tens of thousands of species betray this habit, and although they confer immense benefit to man as agents destroying other forms of insect life, they have been relatively little collected, and in many parts of the world are quite unstudied.

General Structure.—Hymenoptera have acute vision, the compound eyes are consequently large and there are usually three ocelli or simple eyes. The antennae are often very different in the two sexes and in the bees and wasps they are generally composed



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FIG. 3.—SEMI-DIAGRAMMATIC VIEW OF LEFT SIDE OF STING OF WORKER HONEY BEE

of 13 joints in the males and 12 joints in the females. The mouth-parts exhibit their simplest form in saw-flies (fig. 1) where they depart but little from the generalized, biting type. In most other Hymenoptera the mandibles are used for what may be termed industrial purposes more than for feeding, and the ligula is modified into an organ for lapping or sucking nectar. In the higher types of bees this organ is elongated into a kind of tongue which, in some cases, exceeds in length that of the entire insect. In these instances the labial palpi and maxillae are also correspondingly lengthened and form with the ligula, a definite proboscis

(fig. 1). The thorax (fig. 2) is chiefly characterized by the fusion of its last segment with the *propodeum* or first segment of the abdomen. In the saw-flies this union is scarcely evident, but in all other Hymenoptera it is a pronounced feature and the second abdominal segment (or first apparent segment) is constricted to form a waist or *petiole*. The wings have departed very widely from the primitive type of venation and almost every transition can be found from the well developed condition seen in saw-flies to some of the parasitic forms where there is only a single vein to the fore-wings or even no veins at all. At the bases of the fore-wings are small scale-like plates or *tegulae*, which afford important characters used in classification. Most members of the order fly with the wings of a side interlocked by a row of hooklets. In the female the abdomen bears an elaborate ovipositor, typically composed of three pairs of valves. The first pair arises from the eighth segment and forms the lancets, while the other pairs arise from the ninth segment and form the lancet sheath and the so-called sting palps respectively (fig. 3). In addition to functioning as an egg-laying instrument the ovipositor is used in saw-flies for sawing niches in plants into which the eggs are lodged: in ichneumon flies and their allies it is often employed in stabbing their insect hosts preparatory to laying their eggs within the bodies of the latter: in bees, wasps and some ants it is used for stinging, a habit which is found in no other insects.

Classification.—Hymenoptera are grouped into two main sub-orders and these, along with their chief sub-divisions, are enumerated below.

SUB-ORDER I. SYMPHYTA

Abdomen with no definite basal constriction or waist: trochanters two-jointed. Larvae generally caterpillars with a variable number of legs.

Superfamily Tenthredinoidea (fig. 5). Included in this division are all the more primitive members of the order: they do not exhibit the specialized habits and instincts of the Apocrita and their larvae are almost entirely plant-feeders. The most important family is the *Tenthredinidae* or saw-flies (*q.v.*) which are distinguished by two large spines or spurs to each fore tibia. Their larvae are caterpillars which feed upon the leaves of plants, and those of a number of species are injurious to cultivated plants and forest trees. The ovipositor is usually elaborately toothed,

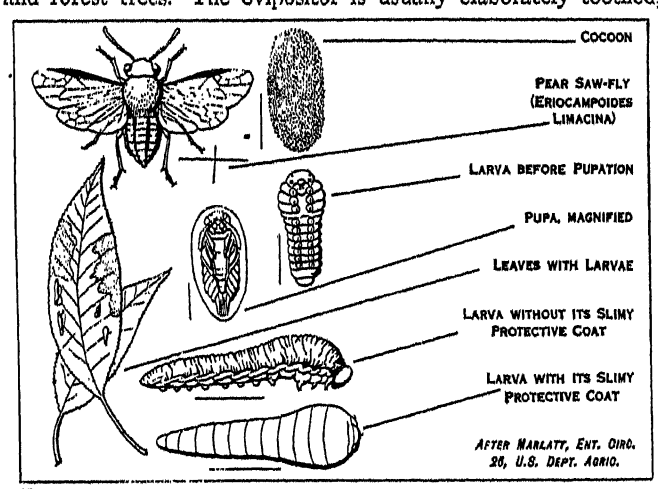


FIG. 4.—LIFE-HISTORY OF PEAR SAWFLY (ERIOCAMPOIDES LIMACINA)
The larvae are plant feeders, those feeding openly on leaves being caterpillars, often with six or more pairs of feet

and is used for sawing notches to enable the eggs to be laid in plant tissues. The *Cephidae* or stem saw-flies are a small group, whose larvae feed in the stems of various plants, while those of the *Siricidae* or wood-wasps bore into the wood of trees.

SUB-ORDER II. APOCRITA

Abdomen with a basal constriction or waist: trochanters 1- or 2-jointed. Larvae embryonic or vermiform without legs.

The great group is divisible into the *Parasitica* which generally have 2-jointed trochanters and the *Aculeata* or stinging forms in which the trochanters are single jointed. The *Parasitica* include the following super-families.

The Ichneumonoidea have the pronotum extending back to the tegulae, the antennae are not elbowed and the fore-wings have a dark mark or stigma (fig. 7). Without exception the larvae of all members of this group are parasites preying upon some stage in

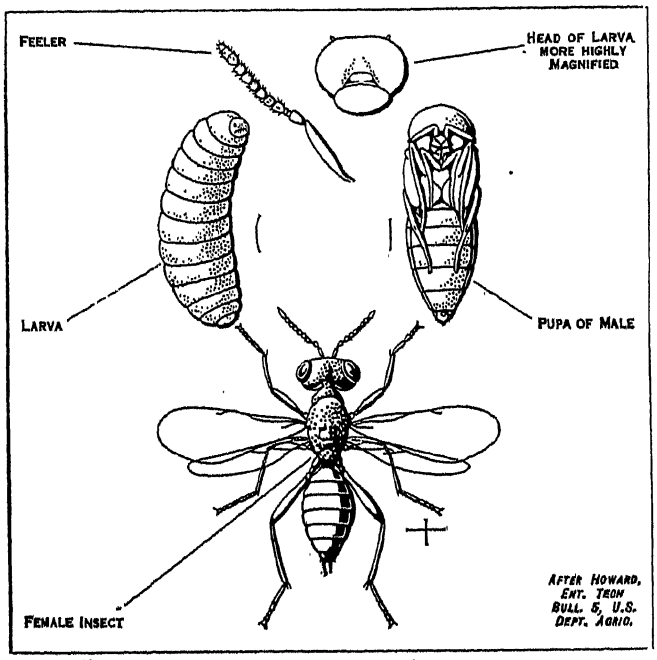


FIG. 5.—LIFE HISTORY OF CHALCID (DIBRACHYS CAVUS)
The sub-order Apocrita is chiefly characterized by the narrowly constricted waist of the adult and by the legless condition of the larvae

the life-cycle of other insects and are consequently of great economic importance. (*See* ICHNEUMON FLY.)

The Cynipoidea include the gall-wasps or gall-flies which differ from the ichneumons in the absence of a stigma to the fore-wings and in the trochanters being usually single-jointed, unlike other Parasitica. In the family *Cynipidae* many of the species lay their eggs in various plant-tissues which react in such a way that galls are produced wherein their development is completed. These galls are of characteristic form for each species, the oak apple and bedeguar of the rose being familiar examples. Other members of the family are inquilines, living within the galls and bearing a close resemblance to the true makers of the latter. The *Figitidae* are mostly parasites of fly larvae and of aphides.

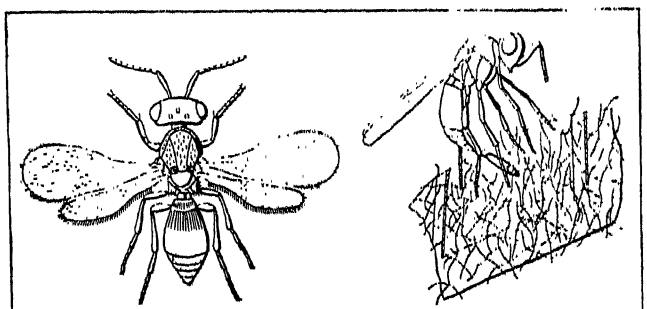
The Chalcidoidea or Chalcid-wasps are very small insects with elbowed antennae and with the pronotum not extending back to the tegulae. The group includes more than 16 families, most of the members of which are either parasites of the eggs, larvae or pupae of other insects or are hyperparasites. A small number are plant-feeders living in seeds, in figs, or form galls on cereals and grasses. The fig-insects are very numerous and certain of these are important agents in the pollination of the flowers, and have been introduced for economic purposes into lands where they were absent. The parasitic forms are of great practical value, in that they destroy vast numbers of injurious insects: certain of these exhibit the phenomenon of polyembryony, which is dealt with in the article INSECTS. Chalcids often exhibit beautiful metallic coloration, and can be recognized by the wing-veins being reduced to a single stem.

The Proctotrypoidea resemble the Aculeates in that the ovipositor issues from the apex of the abdomen, but the trochanters are 2-jointed. The first mentioned character, along with the fact that the pronotum reaches back to the tegulae, separates them from the Chalcids (fig. 5). They are all very small or minute insects with greatly reduced venation and many are wingless. They live as parasites or hyperparasites of other insects, frequently in the eggs which they destroy in large numbers. The largest of the eight chief families are the *Platygasteridae* which mainly para-

sitize gall midges, their larvae often living in the brain or stomach of their hosts. Like the Chalcids the Proctotrypids are beneficial.

The succeeding super-families form the series Aculeata or stinging Hymenoptera and in these the ovipositor issues from the apex of the abdomen, whereas in the Parasitica it issues some distance in front of the extremity.

The Formicoidea or ants form a very natural assemblage which



FROM SYLVESTRI, "PLATYGASTER DRYOMIAE" IN "BOLLETTINO DEL LABORATORIO DI ZOOLOGIA" (SCUOLA SUPERIORE D'AGRICOLTURA IN PORTICI)

FIG. 6.—A FEMALE PROCTOTRYPID (PLATYGASTER DRYOMIAE) On the right the female is seen in the act of oviposition in an egg (O), of a gall midge, on a leaf

are easily recognized by the greatly constricted "waist" and by the petiole being marked by one or two nodes: the pronotum extends back to the tegulae in the winged forms and the antennae are elbowed. The females are differentiated into winged "queens" and wingless workers of varied forms; each species of ant leads a complex social life which presents many phases of surpassing interest. (*See* ANT and SOCIAL INSECTS.)

The Sphecoidea or digging wasps (fig. 8) are not very sharply marked off from the Vespoidea, except by the fact that the pronotum does not reach back to the tegulae. For the most part they are to be regarded as beneficial insects from the fact that they are predators seizing other insects, which they carry off to their cells as food for their larvae. All are solitary insects which construct cells for their brood either below ground or in dry wood or stems. There are 12 families, the largest being the *Sphecidae*.

The Vespoidea include a large number of other digging wasps together with the social wasps. The pronotum generally reaches back to the tegulae but there are exceptions. Among the solitary species the *Mutillidae* are parasites in bumble-bees' nests and their females are wingless. Many of the *Pompilidae* provision their cells with spiders: they are often large insects with slender bodies and elongate hind-legs. The *Scoliidae* are robust, hairy wasps which often provision their cells with chafer larvae and chiefly inhabit warm countries. The *Chrysididae* or ruby-tailed wasps are beautiful metallic green or green and blue or ruby insects, which lay their eggs in the nests of bees and wasps where their larvae either prey upon those of their hosts or devour their food. In this family only three or four abdominal segments are visible, the remainder forming a retractile tube containing the ovipositor. The true wasps have their wings folded lengthwise in repose and the fore-legs are of normal build—not specialized for digging as in the fossorial groups. The *Vespidae* or social wasps have "queens" and "workers" as in ants, but both forms are winged, while the *Eumenidae* or solitary true wasps have no such differentiation into castes. (For the habits of these two families *see* WASP and SOCIAL INSECTS.)

The Apoidea include the solitary and social bees which agree with the Sphecoidea in the pronotum not extending back to the tegulae but differ from them in having the hind tarsi dilated, while the hairs of the head and thorax are feathery or plumose. The glossa or tongue is well developed and often exceedingly long and the food consists of nectar and pollen. The larvae are fed upon a similar diet, except that the nectar is regurgitated as honey before being served to them. These substances are stored in the cells and the latter are never provisioned with animal food. Most bees are solitary in habit, but those of the families *Bombidae* and *Apidae* are social insects resembling ants and wasps in the occurrence of a worker caste. (*See* BEE and SOCIAL INSECTS.)

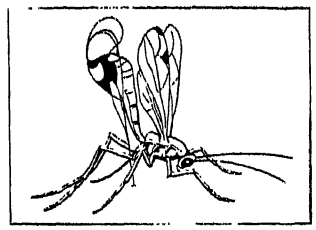
Reproduction and Development.—One of the most interesting facts with regard to reproduction in Hymenoptera, is the wide occurrence of parthenogenesis which obtains among members of all the great groups. The best known instance is in the honey-bee, in which the unfertilized eggs produce males (drones): in the gall-wasps or *Cynipidae* both sexes may be produced from unfertilized eggs and the generations which arise in this way alternate with those produced by the usual sexual method. In other of the gall wasps males are unknown: parthenogenesis is also very frequent in saw-flies and Chalcid wasps.

The larvae of the Symphyta are plant-feeders: those which feed openly on leaves are caterpillars, often with six or more pairs of abdominal feet (fig. 4), but in the stem- and wood-borers these appendages are absent and the thoracic limbs are reduced to mere tubercles. Among the Apocrita the larvae are usually hatched in immediate contact with an abundance of food: they are in consequence degenerate creatures devoid of limbs and of almost all traces of organs of special sense (fig. 5). In the parasitic groups hypermetamorphosis (*see* INSECTS) is very frequent, the larvae being hatched in forms very different from that assumed in the final instar. In a few cases the eggs are laid away from the hosts and the larvae upon hatching are active creatures of the type termed a planidium. The planidium seeks out its host and having found it, assumes the legless maggot-like form common to all Apocrita. Some of the parasitic species live externally on their hosts and feed by piercing the integument with their mouth-parts, but the largest number are endoparasites. In the latter case the female parent drives her ovipositor into the host and lays one or more eggs wherever the larvae will find abundant food. Many of the minute Chalcidoidea and Proctotrypoidea complete their development within the eggs of other insects: others parasitize the larvae or pupae or, more rarely, adult insects, and death of the host finally supervenes. The digging or fossorial wasps feed their brood with captured insects, which are stored away in cells along with a single egg: the wasp larva, upon hatching, thus finds its life's food-supply immediately at hand. The true wasps feed their brood with animal food including many insects, from time to time, very much as a bird does her fledglings, while bees entirely resort to honey and pollen. Thus, we find throughout the order a degree of care for the offspring, not attained in other insects, which has led to the development of social life in certain groups. When fully fed most Hymenoptera pupate in cocoons: silk is commonly used for their construction and among the ichneumon flies and their allies, these cocoons are often elaborate and beautiful objects.

Geographical Distribution.—Hymenoptera are found in all except the most inhospitable regions of the globe, but the order, as a whole, has not penetrated to such remote parts as have the Apterygota and Coleoptera. Bees, for example, are dependent upon the existence of flowering plants and are not found outside their range: some, such as the giant *Xylocopa* or carpenter bees are mainly tropical or sub-tropical, while bumble bees are essentially creatures of temperate climates and are generally confined to the mountains in the tropics; they are absent from almost the whole of Africa, the plains of India and none are indigenous to Australia or New Zealand. The honey-bee (*Apis mellifica*) has been introduced into most countries of the world, and some of the injurious saw-flies enjoy a very wide distribution, mainly through the agency of commerce. Among the Chalcid wasps the family *Agaonidae* or fig-insects occurs wherever trees of the fig kind flourish, but are not found outside that limit: certain other Chalcids (*Eucharidae*) are mainly tropical and are confined to where their particular ant hosts flourish. Perhaps the most interesting fact concerning the distribution of Hymenoptera is the great paucity of forms found in New Zealand, where they are represented by little more than 300 species, as compared with over 6,000 found in Australia.

Geological Distribution.—Forms ancestral to Hymenoptera are represented by the extinct order Protohymenoptera, whose remains occur in the Lower Permian of Kansas. The first true members of the order to appear in geological history are wood wasps of the genus *Pseudosirex* from the Upper Jurassic of Bavaria. In Tertiary times the order is represented by ants, bees and other forms which differ relatively little from those found living to-day.

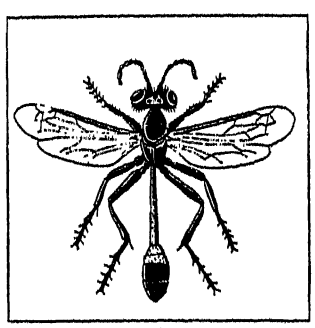
Natural History.—Hymenoptera are mostly of small or moderate size; only a few members of the order are very large insects, the giants being certain of the saw-flies and digging wasps of the family *Pompilidae*, some of the latter attaining a length of three inches. On the other hand, many of the parasitic forms are among the smallest of all insects, notably those which live as egg-parasites; certain Chalcid wasps of family *Mymaridae* or "fairy flies" measure only ·2 mm. in length.



BY COURTESY OF THE U.S. DEPT. OF AGRICULTURE

FIG. 7.—ICHNEUMON FLY (RHYSSA PERSUASORIA) OVIPOSITING

Hymenoptera are essentially terrestrial and aërial in habit. The only exceptions are those which parasitize the larvae or eggs of aquatic insects: the "fairy fly" *Polynema natans* swims readily beneath the water by means of its wings and seeks out the eggs of the water boatmen (*Notonecta*) as the host for its larvae. In a number of species the parasitic groups greatly exceed the remainder of the order. No order of terrestrial insects escapes their attacks, and even larvae deep in the soil or boring in the solid wood of trees are by no means immune. As a rule the length of the ovipositor is greatest in those parasites such as *Thalessa* and *Rhyssa* which have to force this organ through a depth of wood, in order to reach their hosts (fig. 7). One of the most remarkable cases of parasitism is found in a proctotrypid, *Riela manticida* which, according to L. Chopard, passes its development in the eggs of the praying mantis. The adult parasites, upon emergence, make their way to a mantis, upon whose body they settle down: in this situation they cast off their wings and live ectoparasitically. If the mantis be a female which has commenced egg-laying, the *Riela* migrates to the extremity of the body, in order to lay its eggs in the viscid mass of the mantis' egg-capsule as it is being formed. Parasites which settle upon male mantids are probably short-lived and perish. The digging wasps store their cells with other insects or spiders and as a rule they sting their prey first and reduce it to a condition of immobility without actually killing it: in other cases the prey is killed, but since it retains its fresh condition up to several weeks, it is presumed that the injected venom exercises an antiseptic influence. Fabre's observations upon the *Sphex* (*Ammophila*), which stings its caterpillar prey in successive segments of its body, have often been quoted. The French observer maintained that this insect (fig. 8) had a sort of intuitive knowledge of the inner anatomy of its victim, the stings being administered in the ganglionic nerve centres, thereby inducing paralysis, a conclusion which is scarcely warranted by the facts at his disposal. The number of times a prey is stung appears to vary from once up to about a dozen: in addition to being stung the victim is vigorously pinched by the jaws of the *Sphex* particularly when it has only been stung a few times and subsequent paralysis occurs in each case. The nature of the prey of digging wasps is often very constant for particular species. Thus *Philanthus triangulum* stores its nest with honey-bees, while species of *Bembex* prey upon large Diptera and the powerful *Pepsis fumoratus* stores its burrows with the great Tarantula spiders.



FROM IMMS, "TEXT-BOOK OF ENTOMOLOGY" (METHUEN & CO.)

FIG. 8.—FEMALE SPHEX (AMMOPHILA SABULOSA) (TWICE ACTUAL SIZE)

The genus sphex includes digging wasps, which store their cells with caterpillars and other insects. The prey is paralyzed by stinging and remains fresh during the time the sphex devours it

Among bees, wasps and some ants, the capacity for stinging is employed for defensive purposes and the usual glands which are found at the base of the ovipositor are especially large in these insects. Their secretions have irritating properties to which the sting is due, those of ants containing formic acid.

The nest-building habit is another feature of Hymenoptera. Digging wasps make simple burrows in the ground, and many burrowing bees make branched tunnels. Other bees excavate wood or make their brood-chambers in hollow stems, while the true wasps work up dry fragments of wood with their saliva to form a sort of paper with which they construct the cells of their nest. The social bees secrete wax from their own bodies with which they build up the combs of their nest. There are numerous Hymenoptera that are inquilines—insects which construct no nests of their own and utilize, instead, those of other species: in some cases their larvae consume the food provided by the rightful owners for their own brood, and in others, they devour the larvae of the host thus becoming true parasites.

The most interesting of all features associated with Hymenoptera is their social life, which forms the subject of a separate article. (*See* SOCIAL INSECTS.)

Economic Importance.—The chief injurious members of the order belong to the Symphyta and the larvae of a number of saw-flies are exceedingly destructive. Thus, the turnip saw-fly *Athalia spinarum* destroys the foliage of the turnip crop in Britain and many parts of Europe: the pear slug saw-fly (*Eriocampoides limacina*) skeletonizes the leaves of pears in Europe, North America, Australia and New Zealand and *Lygaeonematus erichsonii* is destructive to larch on both sides of the Atlantic. The gooseberry saw-fly (*Nematus ribesii*) is a well known pest of gooseberries in gardens in many parts of Europe, as well as in North America, and the larvae of various species of *Lophyrus* are destructive to pines. Wood-wasps (*Siricidae*) bore into timber in many parts of the world and the stem-borers (*Cephidae*), are especially injurious to cereals. The Apocrita are almost wholly beneficial insects, the honey-bee yields bees-wax and honey, while the important rôle played by the parasitic forms in destroying injurious insects, has already been dilated upon. The recent introduction of the Chalcid-wasp *Aphelinus mali* into New Zealand is an example of the practical utilization of parasitic Hymenoptera, and the species in question has now largely controlled the woolly aphis of the apple in that territory. Among other Chalcids certain fig-insects (*Blastophaga*) are employed in the pollination of the flowers of the fig, and have been previously mentioned. On the other hand, a small number of Chalcids are injurious, notably those whose larvae live in seeds such as species of *Megastigmus* which attack those of conifers, while larvae of *Harmolita* form stem galls on cereals and grasses.

BIBLIOGRAPHY.—In an order so extensive and diverse as Hymenoptera the reader will find very few comprehensive works, the literature mainly dealing with individual groups. The European species are monographed by E. and E. André, *Species des Hyménoptères d'Europe et d'Algérie* (1879–1913) and the world's species are catalogued by C. G. de Dalla Torre, *Catalogus Hymenopterorum* (Leipzig, 1802–1902). A useful guide to the North American forms is provided by H. L. Viereck and collaborators in *The Hymenoptera or Wasp-like Insects of Connecticut* (*Bull. 22 State Geol. and Nat. Hist. Survey:* Hartford, Conn., 1916) and for their classification consult W. H. Ashmead, *Proc. U.S. Nat. Mus.* xxiii., 1901. For the saw-flies and gall-flies the accounts given in C. Schröder's *Insekten Mitteleuropas*, vol. iii. (Stuttgart, 1914) are concise and well illustrated, while the British species are described by P. Cameron, *British Phytophagous Hymenoptera* (London, Roy. Soc., 1882–92), which is provided with accurate coloured plates. A useful popular account of the galls produced by Cynipidae is E. T. Connold, *British Plant Galls* (1909). For the North American galls *see* M. T. Cook, *Galls and Insects Producing them* (*Ohio Nat.*, vols. ii.–iv., 1902–04), and A. Cosens, *A Contribution to the Morphology and Biology of Insect Galls* (*Trans. Canad. Inst.* vol. ix., 1912). For parasitism and the forms exhibiting this habit the following works are important: W. H. Ashmead, *Classification of the Chalcid Flies* (*Mem. Carnegie Mus.* 1, 1904) and the same author's *Monograph of the North American Proctotrypidae* (Bull. 45, U.S. Nat. Mus. 1893); L. O. Howard, *The Biology of the Hymenopterous Insects of the family Chalcididae* (Proc. U.S. Nat. Mus., xiv., 1891); L. O. Howard and W. F. Fiske, *The Importation into the United States of the Parasites of the Gipsy Moth*, etc. (U.S. Dept. Agric., Entom. Bull. 91; 1911); other references are given in the article ICHNEUMON-FLY (*q.v.*).

The Aculeata have a very extensive literature and among the more important works are: E. Saunders, *Hymenoptera Aculeata of the British Islands* (1896); H. St. J. Donisthorpe, *British Ants* (1927); W. M. Wheeler, *Ants* (1910); P. and N. Rau, *Wasp Studies Afield* (Princeton, 1918); G. W. and E. G. Peckham, *Wasps, Social and*

Solitary (1905); for other references *see* SOCIAL INSECTS.

In addition to the foregoing numerous observations on the habits and behaviour of Hymenoptera are given in J. H. Fabre, *Souvenirs Entomologiques* (1879–1905), many of which are translated into English. (A. D. I.)

HYMETTUS, a mountain in Attica, bounding the Athenian plain on the south-east (3,370 ft.), has always been famous for its honey. The spring mentioned by Ovid (*Ars Amat.* iii. 687) is probably near the monastery of Syriani or Kaesariani on the western slope and identical with that known as Κόλλον Ἥρα said to be a remedy for childlessness. The marble of Hymettus, which often has a bluish tinge, was used for building in ancient Athens, and even for sculpture; although the white marble of Pentelicon was preferred for both purposes.

See E. Dodwell, *Classical and Topographical Tour* (1819), i. 483.

HYMNS. The word "hymn" (ὕμνος) was employed by the ancient Greeks to signify a song or poem composed in honour of gods, heroes or famous men, or to be recited on some joyful, mournful or solemn occasion. But hymns are actually much older than any Greece can show; the ancient Chinese "hymned" the Ruler of Heaven; Assyria, Egypt and India have all left us records of early hymns. The Athenian dramatists (Euripides most frequently) use the word and its cognate verbs of odes in praise of conquerors at the public games; they also describe by them metrical oracles and apophthegms, martial, festal and hymeneal songs, dirges and lamentations or incantations of woe.

Hellenic hymns, according to this conception of them, have come down to us, some from a very early and others from a late period of Greek classical literature.

The Romans did not adopt the word "hymn"; nor have we many Latin poems of the classical age to which it can properly be applied. There are, however, a few—such as the simple and graceful "Dianae sumus in fide" ("Dian's votaries are we") of Catullus, and "Dianam tenerae dicite virgines" ("Sing to Dian, gentle maidens") of Horace—which approach much more nearly than anything Hellenic to the form and character of modern hymnody.

Hebrew Hymnody.—For the origin and idea of Christian hymnody we must look, not to Gentile, but to Hebrew sources. St. Augustine's definition of a hymn, generally accepted by Christian antiquity, may be summed up in the words, "praise to God with song" ("cum cantico"); Bede understood the "canticum" as properly requiring metre; though he thought that what in its original language was a true hymn might retain that character in an unmetrical translation. Modern use has enlarged the definition; Roman Catholic writers extend it to the praises of saints; and the word now comprehends rhythmical prose as well as verse, and prayer and spiritual meditation as well as praise.

The modern distinction between psalms and hymns is arbitrary (*see* PSALMS).

In the New Testament we find our Lord and His apostles singing a hymn (ὑμνήσαντες ἐξῆλθον), after the institution of the Lord's Supper; St. Paul and Silas doing the same (ὕμνουν τὸν θεόν) in their prison at Philippi; St. James recommending psalm-singing (ψαλλέτω) and St. Paul "psalms and hymns and spiritual songs (ψαλμοῖς καὶ ὕμνοις καὶ ᾠδαῖς πνευματικαῖς) St. Paul also, in the 14th chapter of the first epistle to the Corinthians, speaks of singing (ψαλῶ) and of every man's psalm (ἕκαστος ὑμῶν ψαλμὸν ἔχει), in a context which plainly has reference to the assemblies of the Corinthian Christians for common worship. All the words thus used were applied by the LXX. to the Davidical psalms; it is therefore possible that these only may be intended, in the different places to which we have referred. But there are in St. Paul's epistles several passages (Eph. v. 14; 1 Tim. iii. 16; 1 Tim. vi. 15, 16; 2 Tim. ii. 11, 12) which have so much of the form and character of later Oriental hymnody as to have been supposed by Michaelis and others to be extracts from original hymns of the Apostolic age.

Eastern Church Hymnody.—The hymn of our Lord, the precepts of the apostles, the angelic song at the nativity, and "Benedicite omnia opera" are referred to in a curious metrical prologue to the hymnary of the Mozarabic Breviary as precedents for the practice of the Western Church. Philo describes the Therapeutae (*q.v.*) of the neighbourhood of Alexandria as composers of original hymns which were sung at their great religious festivals.

The practice, not only of singing hymns, but of singing them antiphonally, appears, from the well-known letter of Pliny to Trajan, to have been established in the Bithynian churches at the beginning of the 2nd century. This agrees well, in point of time, with the tradition recorded by the historian Socrates, that Ignatius (who suffered martyrdom about A.D. 107) was led by a vision or dream of angels singing hymns in that manner to the Holy Trinity to introduce antiphonal singing into the church of Antioch, from which it quickly spread to other churches.

The Greek hymnody contemporary with Ephraem followed, with some licence, classical models. One of its favourite metres was the Anacreontic; but it also made use of the short anapaestic, Ionic, iambic and other lyrical measures, as well as the hexameter and pentameter. Its principal authors were Methodius, bishop of Olympus, who died about A.D. 311, Synesius, who became bishop of Ptolemais in Cyrenaica in 410, and Gregory Nazianzen, for a short time (380–381) patriarch of Constantinople. They have found an able English translator in the Rev. Allen Chatfield (*Songs and Hymns of Earliest Greek Christian Poets*, 1876). Among the most striking of their works are μνήμων Χριστέ ("Lord Jesus, think of me"), by Synesius; σὲ τὸν ἄφθιτον μοναρχην ("O Thou, the One Supreme") and τί σοι θέλεις γενέσθαι ("O soul of mine, repining"), by Gregory; also ἄνοιγε παρθένε ("The Bridegroom cometh"), by Methodius. There continued to be Greek metrical hymn-writers, in a similar style, till a much later date. Sophronius, patriarch of Jerusalem in the 7th century, wrote seven Anacreontic hymns; and St. John Damascene, one of the most copious of the second school of "Melodists," was also the author of some long compositions in iambic trimeters.

Period of Arian Controversy.—An important development of hymnody at Constantinople arose out of the Arian controversy. Early in the 4th century Athanasius had rebuked, not only the doctrine of Arius, but the light character of certain hymns by which he endeavoured to make that doctrine popular. When, towards the close of that century (398), St. John Chrysostom was raised to the metropolitan see, the Arians, who were still numerous at Constantinople, had no places of worship within the walls; but they were in the habit of coming into the city at sunset on Saturdays, Sundays and the greater festivals, and congregating in the porticoes and other places of public resort, where they sang, all night through, antiphonal songs, with "acroteleutia" (closing strains, or refrains), expressive of Arian doctrine, often accompanied by taunts and insults to the orthodox. Chrysostom was apprehensive that this music might draw some of the simpler church people to the Arian side; he therefore organized, in opposition to it, under the patronage and at the cost of Eudoxia, the empress of Arcadius (then his friend), a system of nightly processional hymn-singing, with silver crosses, wax-lights and other circumstances of ceremonial pomp. Riots followed, with bloodshed on both sides. This led to the suppression, by an imperial edict, of all public Arian singing.

Melodists.—The controversies and persecutions of the 8th and succeeding centuries turned the thoughts of the "melodists" of the great monasteries of the Studium at Constantinople and St. Saba in Palestine and their followers, and those of the adherents of the Greek rite in Sicily and South Italy (who suffered much from the Saracens and the Normans), into a less picturesque but more strictly theological course; and the influence of those controversies, in which the final success of the cause of "Icons" was largely due to the hymns, as well as to the courage and sufferings, of these confessors, was probably the cause of their supplanting, as they did, the works of the older school.

Among the "melodists" of this latter Greek school there were many saints of the Greek church, several patriarchs and two emperors—Leo the Philosopher, and Constantine Porphyrogenitus, his son. Their greatest poets were Theodore and Joseph of the Studium, and Cosmas and John (called Damascene) of St. Saba. Neale translated into English verse several selected portions, or centoes, from the works of these and others, together with four

selections from earlier works by Anatolius. Some of his translations—particularly "The day is past and over," from Anatolius, and "Christian, dost thou see them," from Andrew of Crete—have been adopted into hymn-books used in many English churches; and the hymn "Art thou weary," which is rather founded upon than translated from one by Stephen the Sabaite, has obtained still more general popularity.

Western Church Hymnody.—It was not till the 4th century that Greek Hymnody was imitated in the West, where its introduction was due to two great lights of the Latin Church—St. Hilary of Poitiers and St. Ambrose of Milan.

Hilary was banished from his see of Poitiers in 356, and was absent from it for about four years, which he spent in Asia Minor, taking part during that time in one of the councils of the Eastern Church. He thus had full opportunity of becoming acquainted with the Greek church music of that day; and he wrote (as St. Jerome, who was thirty years old when Hilary died, and who was well acquainted with his acts and writings, and spent some time in or near his diocese, informs us) a "book of hymns," to one of which Jerome particularly refers, in the preface to the second book of his own commentary on the epistle to the Galatians. Isidore, archbishop of Seville, who presided over the fourth council of Toledo, in his book on the offices of the church, speaks of Hilary as the first Latin hymn-writer; that council itself, in its 13th canon, and the prologue to the Mozarabic hymnary (which is little more than a versification of the canon), associate his name, in this respect, with that of Ambrose.

Of the part taken by Ambrose, not long after Hilary's death, in bringing the use of hymns into the church of Milan, we have a contemporary account from his convert, St. Augustine. Justina, mother of the emperor Valentinian, favoured the Arians, and desired to remove Ambrose from his see. The "devout people," of whom Augustine's mother, Monica, was one, combined to protect him, and kept guard in the church. "Then," says Augustine, "it was first appointed that, after the manner of the Eastern churches, hymns and psalms should be sung, lest the people should grow weary and faint through sorrow; which custom has ever since been retained, and has been followed by almost all congregations in other parts of the world." He describes himself as moved to tears by the sweetness of these "hymns and canticles."

It is not, however, to be assumed that the hymnody thus introduced by Ambrose was from the first used according to the precise order and method of the later Western ritual. To bring it into (substantially) that order and method appears to have been the work of St. Benedict. Walafrid Strabo, the earliest ecclesiastical writer on this subject (who lived at the beginning of the 9th century), says that Benedict, on the constitution of the religious order known by his name (about 530), appointed the Ambrosian hymns to be regularly sung in his offices for the canonical hours. Hence, probably originated the practice of the Italian churches, and of others which followed their example, to sing certain hymns (Ambrosian, or by the early successors of the Ambrosian school) daily throughout the week, at "Vespers," "Lauds" and "Nocturns," and on some days at "Compline" also—varying them with the different ecclesiastical seasons and festivals, commemorations of saints and martyrs and other special offices. The national rituals were probably the "Ambrosian" and the "Mozarabic" (of Spain).

The hymns of which the use was thus established and authorized were those which entered into the daily and other offices of the church, afterwards collected in the "Breviaries"; in which the hymns "proper" for "the week," and for "the season," continued for many centuries, with very few exceptions, to be derived from the earliest epoch of Latin Church poetry—reckoning that epoch as extending from Hilary and Ambrose to the end of the pontificate of Gregory the Great. The "Ambrosian" music, to which those hymns were generally sung down to the time of Gregory, was more popular and congregational than the "Gregorian," which then came into use, and afterwards prevailed.

In the 5th and early in the 6th century the priest Sedulius, whose reputation perhaps exceeded his merit; Elpis, a noble Roman lady (considered, by an erroneous tradition, to have been the wife of the philosophic statesman Boetius); Pope Gelasius I.; and Ennodius, bishop of Pavia, were hymn-writers. Sedulius and Elpis wrote very little from which hymns could be extracted; but the small number taken from their compositions obtained wide popularity, and have since held their ground. Gelasius was of no great account as a hymn-writer; and the works of Ennodius appear to have been known only in Italy and Spain. The latter part of the 6th century produced Pope Gregory the Great and Venantius Fortunatus, an Italian poet, the friend of Gregory, and the favourite of Radegunda, queen of the Franks, who died (609) bishop of Poitiers. Eleven hymns of Gregory, and twelve or thirteen (mostly taken from longer poems) by Fortunatus, came into general use in the Italian, Gallican and British churches. Eleven metrical hymns are attributed to Bede and there are also in one of Bede's works (*Collectanea et flores*) two rhythmical hymns of considerable length on the Day of Judgment, with the refrains "In tremendo die" and "Attende homo," both irregularly rhymed, and, in parts, not unworthy of comparison with the "Dies Irae." Paulinus, patriarch of Aquileia, contemporary with Paul, wrote rhythmical trimeter iambics in a manner peculiar to himself. Theodulph, bishop of Orleans (793–835), author of the famous processional hymn for Palm Sunday in hexameters and pentameters, "Gloria, laus, et honor tibi sit, Rex Christe Redemptor" ("Glory and honour and praise be to Thee, King Christ the Redeemer"), and Hrabanus Maurus, archbishop of Mainz, the pupil of Alcuin, and the most learned theologian of his day, enriched the church with some excellent works.

Sequences.—The invention of "sequences" by Notker (d. 912), may be regarded as the beginning of the later mediaeval epoch of Latin hymnody. In the eucharistic service, in which (as has been stated) hymns were not generally used, it had been the practice, except at certain seasons, to sing "laud," or "Alleluia," between the epistle and the gospel, and to fill up what would otherwise have been a long pause, by extending the cadence upon the two final vowels of the "Alleluia" into a protracted strain of music. It occurred to Notker that, while preserving the spirit of that part of the service, the monotony of the interval might be relieved by introducing at that point a chant of praise specially composed for the purpose. With that view he produced the peculiar species of rhythmical composition which obtained the name of "sequentia" (probably from following after the close of the "Alleluia"), and also that of "prosa," because its structure was originally irregular and unmetrical, resembling in this respect the Greek "troparia," and the "Te Deum," "Benedicite" and canticles. That it was in some measure suggested by the forms of the later Greek hymnody seems probable, both from the intercourse (at that time frequent) between the Eastern and Western churches, and from the application by Ekkehard, in his biography and elsewhere (*e.g.*, in Lyndwood's *Provinciale*), of some technical terms, borrowed from the Greek terminology, to works of Notker and his school and to books containing them.

The "Golden Sequence," "Veni, sancte Spiritus" ("Holy Spirit, Lord of Light"), is an early example of the transition of sequences from a simply rhythmical to a metrical form. Archbishop Trench, who esteemed it "the loveliest of all the hymns in the whole circle of Latin sacred poetry," inclined to give credit to a tradition which ascribes its authorship to Robert II., king of France, son of Hugh Capet. Others have assigned to it a later date—some attributing it to Pope Innocent III., and some to Stephen Langton, archbishop of Canterbury.

Dies Irae and Stabat Mater.—But the two most widely celebrated of all this class of compositions—works which have exercised the talents of the greatest musical composers, and of innumerable translators in almost all languages—are the *Dies Irae* ("That day of wrath, that dreadful day"), by Thomas of Celano, the companion and biographer of St. Francis of Assisi, and the *Stabat Mater dolorosa* ("By the cross sad vigil keeping") of Jacopone, or Jacobus de Benedictus, a Franciscan humorist and reformer, who was persecuted by Pope Boniface VIII. for his satires on the prelacy of the time, and died in 1306. Besides these, the 13th century produced the famous sequence *Lauda Sion salvatorem* ("Sion lift thy voice and sing"), and the four other

well-known sacramental hymns of St. Thomas Aquinas, viz. *Pange lingua gloriosi corporis mysterium* ("Sing, my tongue, the Saviour's glory"), *Verbum supernum prodiens* ("The Word, descending from above"—not to be confounded with the Ambrosian hymn from which it borrowed the first line), *Sacris solemniis juncta sint gaudia* ("Let us with hearts renewed our grateful homage pay"), and *Adoro Te devote, latens Deitas* ("O Godhead hid, devoutly I adore Thee")—a group of remarkable compositions, written by him for the then new festival of Corpus Christi, of which he induced Pope Urban IV. (1261–1265) to decree the observance.

Before the time of the Reformation, the multiplication of sequences (often as unedifying in matter as unpoetical in style) had done much to degrade the common conception of hymnody. In some parts of France, Portugal, Sardinia and Bohemia, their use in the vernacular language had been allowed. In Germany also there were vernacular sequences as early as the 12th century, specimens of which may be seen in the third chapter of C. Winkworth's *Christian Singers of Germany*. Scoffing parodies upon sequences are said to have been among the means used in Scotland to discredit the old church services. After the 15th century they were discouraged at Rome. They retained for a time some of their old popularity among German Protestants, and were only gradually relinquished in France. A new "prose," in honour of St. Maxentia, is among the compositions of Jean Baptiste Santeul; and Dr. Daniel's second volume closes with one written in 1855 upon the dogma of the Immaculate Conception.

German Hymnody.—Luther was a proficient in and a lover of music. He desired (as he says in the preface to his hymn-book of 1545) that this "beautiful ornament" might "in a right manner serve the great Creator and His Christian people." The persecuted Bohemian or Hussite Church, then settled on the borders of Moravia under the name of "United Brethren," had sent to him, on a mission in 1522, Michael Weiss, who not long afterwards published a number of German translations from old Bohemian hymns (known as those of the "Bohemian Brethren"), with some of his own. These Luther highly approved and recommended. He himself, in 1522, published a small volume of eight hymns, which was enlarged to 63 in 1527, and to 125 in 1545. He had formed what he called a "house choir" of musical friends, to select such old and popular tunes (whether secular or ecclesiastical) as might be found suitable, and to compose new melodies, for church use. His fellow labourers in this field (besides Weiss) were Justus Jonas, his own especial colleague; Paul Eber, the disciple and friend of Melanchthon; John Walther, choirmaster successively to several German princes, and professor of arts, etc., at Wittenberg; Nicholas Decius, who from a monk became a Protestant teacher in Brunswick, and translated the *Gloria in Excelsis*, etc.; and Paul Speratus, chaplain to Duke Albert of Prussia in 1525. Some of their works are still popular in Germany. Weiss's "Funeral Hymn," *Nun lasst uns den Leib begraben* ("Now lay we calmly in the grave"); Eber's *Herr Jesu Christ, wahr Mensch und Gott* ("Lord Jesus Christ, true Man and God"), and *Wenn wir in höchsten Nöthen sein* ("When in the hour of utmost need"); Walther's "New Heavens and new Earth" ("Now fain my joyous heart would sing"); Decius's "To God on high be thanks and praise"; and Speratus's "Salvation now has come for all," are among those which at the time produced the greatest effect, and are still best remembered.

Followers of Luther.—The principal hymn-writers of the Lutheran school, in the latter part of the 16th century, were Nikolaus Selnecker, Herman and Hans Sachs, the shoemaker of Nuremberg, also known in other branches of literature. They were succeeded by men of another sort, to whom F. A. Cunz gives the name of "master-singers," as having raised both the poetical and the musical standard of German hymnody:—Bartholomäus Ringwaldt, Ludwig Helmbold, Johannes Pappus, Martin Schalling, Rutilius and Sigismund Weingartner. The well-known English hymn, "Great God, what do I see and hear," is founded upon one by Ringwaldt. Of a quite different character were two of great beauty and universal popularity, composed by Philip Nicolai, a Westphalian pastor, during a pestilence in 1597, and published by him, with fine chorales, two years afterwards. One of these (the "Sleepers wake! a voice is calling," of Mendelssohn's oratorio, *St. Paul*) belongs to the family of Advent or New Jerusalem hymns. The other, a "Song of the believing soul concerning the Heavenly Bridegroom" (*Wie schön leucht't uns der Morgenstern*—"O morning Star, how fair and bright"), became the favourite marriage hymn of Germany.

The hymns produced during the Thirty Years' War are characteristic of that unhappy time. In point of refinement and graces of style, the hymn-writers of this period excelled their predecessors. Their taste was chiefly formed by the influence of Martin Opitz, the founder of what has been called the "first Silesian school" of German poetry, who died comparatively young in 1639, and who, though not of any great original genius, exercised much power as a critic. Some of the best of these works were by men who wrote little. In the famous battle-song of Gustavus Adolphus, published (1631) after the victory of Breitenfeld, for the use of his army, *Verzage nicht du Häuflein klein* ("Fear not, O little flock, the foe"), we have almost certainly a composition of the hero-king himself, the versification corrected by his chaplain Jakob Fabricius (1593–1654) and the music composed by Michael Altenburg, whose name has been given to the hymn. This, with Luther's paraphrase of the 67th Psalm, was sung by Gustavus and his soldiers before the battle of Lützen in 1632. Two very fine hymns, one of prayer for deliverance and peace, the other of trust in God under calamities, were written about the same time by Matthäus Löwenstern, a saddler's son, poet, musician and statesman, who was ennobled after the peace by the emperor Ferdinand III. Martin Rinckhart, in 1636, wrote the "Chorus of God's faithful children" (*Nun danket alle Gott*—"Now thank we all our God"), introduced by Mendelssohn in his *Lobgesang*, which has been called the *Te Deum* of Germany, being usually sung on occasions of public thanksgiving. Weissel, in 1635, composed a beautiful Advent hymn ("Lift up your heads, ye mighty gates"), and J. M. Meyfart, professor of theology at Erfurt, in 1642, a fine adaptation of the ancient *Urbs beata Hierusalem*.

The most copious, and in their day most esteemed, hymn-writers of the first half of the 17th century, were Johann Heermann and Johann Rist. Heermann, a pastor in Silesia, the theatre (in a peculiar degree) of war and persecution, experienced in his own person a very large share of the miseries of the time, and several times narrowly escaped a violent death. His *Devoti musica cordis*, published in 1630, reflects the feelings natural under such circumstances. Next to Heermann and Rist in fertility of production, and above them in poetical genius, was Simon Dach, professor of poetry at Königsberg, who died in 1659.

Gerhardt.—The fame of all these writers was eclipsed in the latter part of the same century by three of the greatest hymnographers whom Germany has produced—Paul Gerhardt (1604–1676), Johann Franck (1618–1677) and Johann Scheffler (1624–1677), the founder of the "second Silesian school," who assumed the name of "Angelus Silesius." Gerhardt is by universal consent the prince of Lutheran poets. One of his hymns is well known and highly appreciated in English through Wesley's translation, "Commit thou all thy ways"; and the evening and spring-tide hymns ("Now all the woods are sleeping" and "Go forth, my heart, and seek delight") show an exquisite feeling for nature; while nothing can be more tender and pathetic than *Du bist zwar mein und bleibest mein* ("Thou'rt mine, yes, still thou art mine own"), on the death of his son. Franck, who was burgomaster of Guben in Lusatia, has been considered by some second only to Gerhardt. It was after his conversion to Roman Catholicism that Scheffler adopted the name of "Angelus Silesius," and published in 1657 his hymns, under a fantastic title, and with a still more fantastic preface.

The Pietists.—Towards the end of the 17th century, a new religious school arose, to which the name of "Pietists" was given, and of which Philipp Jakob Spener was esteemed the founder. He and his pupils and successors, August Hermann Francke and Anastasius Freylinghausen, all wrote hymns. Spener's hymns are not remarkable, and Francke's are not numerous.

Joachim Neander, a schoolmaster at Düsseldorf, and a friend

of Spener and Schütz (who died before the full development of the "Pietistic" school), was the first man of eminence in the "Reformed" or Calvinistic Church who imitated Lutheran hymnody. The Summer Hymn ("O Thou true God alone") and that on the glory of God in creation ("Lo, heaven and earth and sea and air") are instances of his best style.

With the "Pietists" may be classed Benjamin Schmolke and Dessler, representatives of the "Orthodox" division of Spener's school; Philipp Friedrich Hiller, their leading poet in South Germany; Gottfried Arnold and Gerhard Tersteegen, who were practically independent of ecclesiastical organization, though connected, one with the "Orthodox" and the other with the "Reformed" churches; and Nikolaus Ludwig, Graf von Zinzendorf. Schmolke, a pastor in Silesia, called the Silesian Rist (1672–1737), was perhaps the most voluminous of all German hymn-writers. He wrote 1,188 religious poems and hymns, a large proportion of which do not rise above mediocrity.

Gellert and Klopstock.—The transition from Tersteegen and Zinzendorf to Gellert and Klopstock marks strongly the reaction against Pietism which took place towards the middle of the 18th century. The *Geistlichen Oden und Lieder* of Christian F. Gellert were published in 1757, and are said to have been received with an enthusiasm almost like that which "greeted Luther's hymns on their first appearance." It is a proof of the moderation both of the author and of his times that they were largely used, not only by Protestant congregations, but in those German Roman Catholic churches in which vernacular services had been established through the influence of the emperor Joseph II. They became the model which was followed by most succeeding hymn-writers, and exceeded all others in popularity till the close of the century, when a new wave of thought was generated by the movement which produced the French Revolution. Klopstock, the author of the *Messiah*, cannot be considered great as a hymn-writer, though his "Sabbath Hymn" (of which there is a version in *Hymns from the Land of Luther*) is simple and good. Generally his hymns (ten of which are translated in Sheppard's *Foreign Sacred Lyre*) are artificial and much too elaborate.

The "Romantic" School.—Of the "romantic" school, which came in with the French Revolution, the two leading writers are Friedrich Leopold von Hardenberg, called "Novalis," and Friedrich de la Motte Fouqué, the celebrated author of *Undine* and *Sintram*—both romance-writers, as well as poets. The genius of Novalis was early lost to the world; he died in 1801, not thirty years old. Some of his hymns are very beautiful; but even in such works as "Though all to Thee were faithless," and "If only He is mine," there is a feeling of insulation and of despondency as to good in the actual world, which was perhaps inseparable from his ecclesiastical idealism. Fouqué survived till 1843.

The later German hymn-writers of the 19th century belong, generally, to the revived "Pietistic" school. Some of the best, Johann Baptist von Albertini, Friedrich Adolf Krummacher, and especially Karl Johann Philipp Spitta (1801–59) have produced works not unworthy of the fame of their nation.

British Hymnody.—After the Reformation, the development of hymnody was retarded, in both parts of Great Britain, by the example and influence of Geneva. Archbishop Cranmer appears at one time to have been disposed to follow Luther's course, and to present to the people, in an English dress, some at least of the hymns of the ancient church. In a letter to King Henry VIII. (Oct. 7, 1544), among some new "processions" which he had himself translated into English, he mentions the Easter hymn, *Salve, festa dies, toto memorabilis aevo* ("Hail, glad day, to be joyfully kept through all generations"), of Fortunatus. In the "Primer" of 1535 (by Marshall) and the one of 1539 (by Bishop Hilsey of Rochester, published by order of the vicar-general Cromwell) there had been several rude English hymns, none of them taken from ancient sources. King Henry's "Primer" of 1545 (commanded by his injunction of May 6, 1545 to be used throughout his dominions) was formed on the model of the daily offices of the Breviary; and it contains English metrical translations from some of the best-known Ambrosian and other early hymns. But in the succeeding reign different views prevailed. A new direction had been given to the taste of the "Reformed" congregations in France and Switzerland by the French metrical translation of the Old Testament Psalms, which appeared about 1540. This was the joint work of Clément Marot, valet or groom of the chamber to Francis I., and Theodore Beza, then a mere youth, fresh from his studies at Orleans.

The translation commonly known as the "Old Version" of the Psalms, was begun by Thomas Sternhold, whose position in the household of Henry VIII., and afterwards of Edward VI., was similar to that of Marot with Francis I., and whose services to the former of those kings were rewarded by a substantial legacy under his will. Sternhold published versions of nineteen Psalms, with a dedication to King Edward, and died soon afterwards. A second edition appeared in 1551, with eighteen more Psalms added, of Sternhold's translating and seven others by John Hopkins, a Suffolk clergyman. The work was continued during Queen Mary's reign by British refugees at Geneva, the chief of whom were William Whittingham, afterwards dean of Durham, who succeeded John Knox as minister of the English congregation there, and William Kethe or Keith, said by Strype to have been a Scotsman. They published at Geneva in 1556 a service-book, containing fifty-one English metrical psalms, which number was increased, in later editions, to eighty-seven. On the accession of Queen Elizabeth, this Genevan Psalmody was at once brought into use in England—first (according to a letter of Bishop Jewell to Peter Martyr, dated 5th March 1560) in one London church, from which it quickly spread to others both in London and in other cities. The first edition of the completed "Old Version" appeared in 1562.

In this book, as published in 1562, and for many years afterwards, there were (besides the versified Psalms) eleven metrical versions of the *Te Deum*, canticles, Lord's Prayer (the best of which is that of the *Benedicite*); and also *Da pacem, Domine*, a hymn suitable to the times, rendered into English from Luther; two original hymns of praise, to be sung before morning and evening prayer; two penitential hymns (one of them the "humble lamentation of a sinner"); and a hymn of faith, beginning, "Lord, in Thee is all my trust." In these respects, and also in the tunes which accompanied the words (stated by Dr. Charles Burney, in his *History of Music*, to be German, and not French), there was a departure from the Genevan platform.

Scottish Psalms.—In Scotland, the General Assembly of the kirk caused to be printed at Edinburgh in 1564, and enjoined the use of, a book entitled *The Form of Prayers and Ministry of the Sacraments used in the English Church at Geneva, approved and received by the Church of Scotland; whereto, besides that was in the former books, are also added sundry other prayers, with the whole Psalms of David in English metre.* This contained, from the "Old Version," translations of forty Psalms by Sternhold, fifteen by Whittingham, twenty-six by Kethe and thirty-five by Hopkins. Of the remainder two were by John Pulleyn (one of the Genevan refugees, who became archdeacon of Colchester); six by Robert Pont, Knox's son-in-law, who was a minister of the kirk, and also a lord of session; and fourteen signed with the initials I.C., supposed to be John Craig; one was anonymous, eight were attributed to N., two to M. and one to T. N. respectively.

So matters continued in both churches until the Civil War. During the interval, King James I. conceived the project of himself making a new version of the Psalms, and appears to have translated thirty-one of them—the correction of which, together with the translation of the rest, he entrusted to Sir William Alexander, afterwards earl of Stirling. Sir William having completed his task, King Charles I. had it examined and approved by several archbishops and bishops of England, Scotland and Ireland, and caused it to be printed in 1631 at the Oxford University Press, as the work of King James; and, by an order under the royal sign manual, recommended its use in all churches of his dominions. In 1634 he enjoined the Privy Council of Scotland not to suffer any other psalms, "of any edition whatever," to be printed in or imported into that kingdom. In 1636 it was republished, and was attached to the famous Scottish service-book, with which the troubles began in 1637. When the Long Parliament

undertook in 1642, the task of choosing between the rival translations of the Psalms by Rouse and Barton, Rouse's version was chosen and was received in Scotland with great favour, which it has ever since retained. The "New Version" of the Psalms, by Dr. Nicholas Brady and the poet-laureate Nahum Tate (both Irishmen), appeared in 1696, under the sanction of an order in council of William III. The relative merits of the "Old" and "New" versions have been very variously estimated. Competent judges have given the old the praise, which certainly cannot be accorded to the new, of fidelity to the Hebrew.

Wither, Cosin, Milton and Taylor.—Conspicuous among the sacred poets of the first two Stuart reigns in England was George Wither. His *Hymnes and Songs of the Church* appeared in 1622–1623, under a patent of King James I., by which they were declared "worthy and profitable to be inserted, in convenient manner and due place, into every English Psalm-book to metre." His *Hallelujah* (in which some of the former *Hymnes and Songs* were repeated) followed in 1641. John Cosin, afterwards bishop of Durham, published in 1627 a volume of "Private Devotions," for the canonical hours and other occasions. The hymns of Milton (on the Nativity, Passion, Circumcision and "at a Solemn Music"), written about 1629, in his early manhood, were probably not intended for singing. During the Commonwealth, in 1654, Jeremy Taylor published at the end of his *Golden Grove*, twenty-one hymns.

Restoration Period.—The epoch of the Restoration produced in 1664 Samuel Crossman's *Young Man's Calling*, with a few "Divine Meditations" in verse attached to it; in 1668 John Austin's *Devotions in the ancient way of offices, with psalms, hymns and prayers for every day in the week and every holyday in the year;* and in 1681 Richard Baxter's *Poetical Fragments*. In these books there are altogether seven or eight hymns, the whole or parts of which are extremely good.

Dryden, Ken, Patrick and Addison.—Dryden's translation of "Veni Creator" a cold and laboured performance, is to be met with in many hymn-books. Abridgments of Ken's morning and evening hymns are in all. These, with the midnight hymn, which is not inferior to them, first appeared in 1697, appended to the third edition of the author's *Manual of Prayers for Winchester Scholars*. Bishop Patrick's hymns were chiefly translations from the Latin, most of them from Prudentius. The best is a version of *Alleluia dulce carmen*.

Of the five attributed to Addison, not more than three are adapted to public singing; one ("The spacious firmament on high") is a perfect and finished composition, taking rank among the best hymns in the English language.

From the preface to Simon Browne's hymns, published in 1720, we learn that down to the time of Dr. Watts the only hymns known to be "in common use, either in private families or in Christian assemblies," were those of Barton, Mason and Shepherd, together with "an attempt to turn some of George Herbert's poems into common metre," and a few sacramental hymns by authors now forgotten, named Joseph Boyse (1660–1728) and Joseph Stennett. Of the 1,410 authors of original British hymns enumerated in Daniel Sedgwick's catalogue, published in 1863, 1,213 are of later date than 1707; and, if any correct enumeration could be made of the total number of hymns of all kinds published in Great Britain before and after that date, the proportion subsequent to 1707 would be very much larger.

The English Independents, as represented by Dr. Isaac Watts, have a just claim to be considered the real founders of modern English hymnody. Watts was the first to understand the nature of the want, and, by the publication of his *Hymns* in 1707–1709, and *Psalms* (not translations, but hymns founded on psalms) in 1709, he led the way in providing for it. His immediate followers were Simon Browne and Philip Doddridge. Later in the 18th century, Joseph Hart, Thomas Gibbons, Miss Anne Steele, Samuel Medley, Samuel Stennett, John Ryland, Benjamin Beddome and Joseph Swain succeeded to them.

Isaac Watts.—Among these writers, most of whom produced some hymns of merit, and several are extremely voluminous, Isaac Watts and Philip Doddridge are pre-eminent.

Of the other followers in the school of Watts, Miss Anne Steele (1717–1778) is the most popular and perhaps the best. The influence of Watts was felt in Scotland, and among the first whom it reached there was Ralph Erskine. This seems to have been after the publication of Erskine's *Gospel Sonnets* which appeared in 1732, five years before he joined his brother Ebenezer in the Secession Church. The *Gospel Sonnets* became as some have said, a "people's classic"; but there is in them very little which belongs to the category of hymnody.

Scottish Paraphrases and Methodist Hymns.—Of the contributions to the authorized "Paraphrases" (with the settlement of which committees of the General Assembly of the Church of Scotland were occupied from 1745, or earlier, till 1781), the most noteworthy, besides the two already mentioned, were those of John Morrison and those claimed for Michael Bruce. The obligations of these "Paraphrases" to English hymnody, already traced in some instances (to which may be added the adoption from Addison of three out of the five "hymns" appended to them), are perceptible in the vividness and force with which these writers, while adhering with a severe simplicity to the sense of the passages of Scripture which they undertook to render, fulfilled the conception of a good original hymn. The "Methodist" movement, which began about 1738, afterwards became divided, between those who esteemed Arminian, under John Wesley, those who adhered to the Moravians, when the original alliance between that body and the founders of Methodism was dissolved, and the Calvinists, of whom Whitfield was the leader, and Selina, countess of Huntingdon, the patroness. Each of these sections had its own hymn-writers, some of whom did, and others did not, secede from the Church of England. The Wesleyans had Charles Wesley, Robert Seagrave and Thomas Olivers; the Moravians, John Cennick, with whom, perhaps, may be classed John Byrom, who imbibed the mystical ideas of some of the German schools; the Calvinists, Augustus Montague Toplady, John Berridge, William Williams, Martin Madan, Thomas Haweis, Rowland Hill, John Newton and William Cowper.

Among all these writers, the palm undoubtedly belongs to Charles Wesley. In the first volume of hymns published by the two brothers are several good translations from the German, believed to be by John Wesley, who, although he translated and adapted, is not supposed to have written any original hymns; and the influence of German hymnody, particularly of the works of Paul Gerhardt, Scheffler, Tersteegen and Zinzendorf, may be traced in a large proportion of Charles Wesley's works.

The Moravian Methodists produced few hymns now available for general use. The best are Cennick's "Children of the heavenly King" and Hammond's "Awake and sing the song of Moses and the Lamb," the former of which (abridged), and the latter as varied by Madan, are found in many hymn-books, and are deservedly esteemed. John Byrom, whose name we have thought it convenient to connect with these, was the author of a Christmas hymn ("Christians awake, salute the happy morn") which enjoys great popularity.

The contributions of the Calvinistic Methodists to English hymnody are of greater extent and value. Few writers of hymns had higher gifts than Toplady, author of "Rock of ages," by some esteemed the finest in the English language.

Berridge, William Williams (1717–1791) and Rowland Hill, all men remarkable for eccentricity, activity and the devotion of their lives to the special work of missionary preaching, though not the authors of many good hymns, composed, or adapted from earlier compositions, some of great merit.

Cowper and Newton.—If, however, the number as well as the quality of good hymns available for general use is to be regarded, the authors of the *Olney Hymns* are entitled to be placed at the head of all the writers of this Calvinistic school. The greater number of the *Olney Hymns* are, no doubt, homely and didactic; but to the best of them, and they are no inconsiderable proportion, the tenderness of Cowper and the manliness of John Newton (1725–1807) give the interest of contrast, as well as that of sustained reality. *The Remains of Henry Kirke White*, published by Southey in 1807, contained a series of hymns, some of which are

still in use; and a few of Bishop Heber's hymns and those of Sir Robert Grant, which, though offending rather too much against John Newton's canon, are well known and popular, appeared between 1811 and 1816, in the *Christian Observer*. In John Bowdler's *Remains*, published soon after his death in 1815, there are a few more of the same, perhaps too scholarlike, character. But the chief hymn-writers of that period were two clergymen of the Established Church—one in Ireland, Thomas Kelly, and the other in England, William Hurn—who both became Nonconformists, and the Moravian poet, James Montgomery (1771–1854), a native of Scotland.

Collections of Hymns.—During this period, the collections of miscellaneous hymns for congregational use, of which the example was set by the Wesleys, Whitfield, Toplady and Lady Huntingdon, had greatly multiplied; and with them the practice (for which, indeed, too many precedents existed in the history of Latin and German hymnody) of every collector altering the compositions of other men without scruple, to suit his own doctrine or taste; with the effect, too generally, of patching and disfiguring, spoiling and emasculating the works so altered, substituting neutral tints for natural colouring, and a dead for a living sense. In the Church of England the use of these collections had become frequent in churches and chapels, principally in cities and towns, where the sentiments of the clergy approximated to those of the Nonconformists.

Two publications, which appeared almost simultaneously in 1827—Bishop Heber's *Hymns*, with a few added by Dean Milman, and John Keble's *Christian Year* (not a hymn-book, but one from which several admirable hymns have been taken, and the well-spring of many streams of thought and feeling by which good hymns have since been produced)—introduced a new epoch, breaking down the barrier as to hymnody which had till then existed between the different theological schools of the Church of England. In this movement Richard Mant, bishop of Down, was also one of the first to co-operate. It soon received a great additional impulse from the increased attention which, about the same time, began to be paid to ancient hymnody, and from the publication in 1833 of Bunsen's *Gesangbuch*. Among its earliest fruits was the *Lyra apostolica*, containing hymns, sonnets and other devotional poems, most of them originally contributed by some of the leading authors of the *Tracts for the Times* to the *British Magazine;* the finest of which is the pathetic "Lead, kindly light, amid th' encircling gloom," by Cardinal Newman—well known, and universally admired. From that time hymns and hymn-writers rapidly multiplied in the Church of England, and in Scotland also. Nearly 600 authors whose publications were later than 1827 are enumerated in Sedgwick's catalogue of 1863, and about half a million hymns are now in existence. Works, critical and historical, upon the subject of hymns, have also multiplied; and collections for church use have become innumerable—several of the various religious denominations, and many of the leading ecclesiastical and religious societies, having issued hymn-books of their own, in addition to those compiled for particular dioceses, churches and chapels, and to books (like *Hymns Ancient and Modern*, published 1861, supplemented 1889, revised edition, 1905) which have become popular without any sanction from authority. Among the best known American hymn-writers are John Greenleaf Whittier, Bishop Doane, Dr. W. A. Muhlenberg and Thomas Hastings; and it is difficult to praise too highly such works as the Christmas hymn, "It came upon the midnight clear," by Edmund H. Sears; the Ascension hymn, "Thou, who didst stoop below," by Mrs. S. E. Miles; two by Dr. Ray Palmer, "My faith looks up to Thee, Thou Lamb of Calvary," and "Jesus, Thou joy of loving hearts," the latter of which is the best among several good English versions of *Jesu, dulcedo, cordium;* and "Lord of all being, throned afar," by Oliver Wendell Holmes.

The more modern "Moody and Sankey" hymns (*see* MOODY, D. L.) popularized a new Evangelical type, and the Salvation Army has carried this still farther.

The object aimed at in this article has been to trace the general history of the principal schools of ancient and modern hymnody, and especially the history of its use in the Christian church. For this purpose it has not been thought necessary to give any account of the hymns of Racine, Madame Guyon and others, who can hardly be classed with any school, nor of the works of Caesar Malan of Geneva (1787–1864) and other quite modern hymn-writers of the Reformed churches in Switzerland and France.

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HYNDMAN, HENRY MAYERS (1842–1921), founder of British Socialism, was born in London on March 7, the son of a wealthy man. He was educated at Trinity college, Cambridge and travelled extensively. He was deeply influenced by the Paris Commune and in 1881 joined with several extreme Radicals in forming the London Democratic Federation which advocated views which were practically Socialist. For its first conference (June 1881) he wrote *England for All*, the first Socialist book published in England since the collapse of Owenism. In this he expounded the views of Karl Marx, which he now finally adopted. But as he omitted to make what Marx felt was the necessary acknowledgment of his indebtedness, Marx was offended and Engels who disliked Hyndman deliberately widened the breach. The chief, and indeed only exponent of Marxism in the country where Marx lived was thus not on speaking terms with his leader. This, however, did not stop the spread of Marxist Socialism. The Democratic Federation in 1884 became the Social Democratic Federation and nearly all the prominent Socialists of the new generation, except J. Keir Hardie, were moulded by Hyndman. William Morris, John Burns, Tom Mann, H. H. Champion, George Lansbury and Harry Quelch were among his colleagues and pupils. But it was significant of Hyndman's failings that of these named above only one succeeded in working with him for any long space of time. Hyndman remained always an aristocrat among the Socialists. He was proud and dominant in his manners, intellectually intolerant, and resentful of criticism or disagreement. Even when distributing leaflets announcing meetings he always wore a top hat and frock-coat, and he frequently in Trafalgar square or elsewhere, taunted his ragged audiences with being such fools as to provide the money on which such as he could dress so well. But the qualities of his defects were also present—his indomitable energy which enabled him to create a Socialist movement almost from the void, his self sacrifice and patience, and his uprightness and hatred of compromise and of loose thinking. In the late '80s the Socialist and unemployed movement blew suddenly up to an enormous size; the riots in Trafalgar square were succeeded by the famous dock strike (1889); and for a short while public opinion, hostile or friendly, magnified the importance of the S.D.F. and its leader, whom it credited with the control and inspiration of these occurrences.

With the return of better trade in the '90s the explosive period of Hyndman's career ended, though he incurred plenty of hostility by his denunciation of the Boer War. He was severely critical of the policy of both the Independent Labour Party and the Labour Party, and till 1914 was the acknowledged chief of a small, but hard working and influential party of doctrinaire revolutionaries. But on the outbreak of the World War, to the surprise of his followers, he became a strong nationalist, and later on equally vehement anti-Bolshevik. For the first time he was unable to carry his party with him: in 1915 the British Socialist Party (as it had become) ousted him and his sympathizers from control. They formed a small group known as the "National Socialist Party." He expounded his new views in *The Evolution of Revolution* (1920). He died on November 22, 1921.

See his own *Record of an Adventurous Life* (1911) and *Further Reminiscences* (1912); Mrs. R. T. Hyndman, *The Last Years of H. M. Hyndman* (1923); and F. J. Gould, *Hyndman, Prophet of Socialism* (1928).

HYOGO, a town and district of Japan in the province of Settsu, on the western shore of the bay of Osaka, adjoining the foreign settlement of Kobe, 21 m. W. of Osaka by rail. The growth of its prosperity has been very remarkable. Its population, including that of Kobe, is nearly 1,000,000. Silk and cotton-fabrics and matches are the chief industries.

Hyogo has several temples of interest, one of which has near it a huge bronze statue of Buddha, while by the Minatogawa, which flows into the sea between Hyogo and Kobe, a temple commemorates the spot where Kusunoki Masashige, the mirror of Japanese loyalty, met his death in battle in 1336. The temple of Ikuta was erected on the site of the ancient fane built by Jingo on her return from Korea in the 3rd century.

Hyogo was originally known as Bako and as early as the 12th century was of some maritime importance. (*See* KOBE.)

HYOSCINE is the chief of the alkaloids (*q.v.*) of *Datura metel*, and is colourless syrup, soluble in most ordinary solvents, and yielding crystalline salts. (Its formula is $C_{17}H_{21}(C_4N.)$ Of these the hydrobromide, $C_{17}H_{21}O_4N$, $HBr.3H_2O$, is that generally used in medicine. It forms colourless rhombs, which melt at 193–194°C. Hyoscine is optically active (*see* STEREOCHEMISTRY), the natural base being laevo-rotatory ($[\alpha]_D$ −18° to −20.8°). It is also known as scopolamine and atroscine.

Laevo-hyoscine is easily racemized to *atroscine* (compare atropine) which can be crystallized and yields crystalline salts, usually melting 10–14°C below the corresponding salts of the natural *laevo*-base. Hyoscine is a mydriatic, like atropine, but is principally used as a sedative in acute mania, and with morphine to produce the so-called "twilight sleep" in maternity cases. Chemically, hyoscine is closely related to atropine.

HYOSCYAMINE, one of the alkaloids (*q.v.*) of belladonna (*q.v.*). It is the chief source of atropine (*q.v.*), to which it stands in the relation of laevo-rotatory optical isomer, being converted to atropine by racemization (*see* STEREOCHEMISTRY). It crystallizes, like atropine, in colourless prisms, has a melting point 108.5° C, a specific rotation $[\alpha]_D$ −22°, and the chemical formula $C_{17}H_{23}O_3N$. The sulphate forms needles from alcohol, has a melting point 206° C, and is the salt generally used in medicine.

HYPAETHRUS, an architectural term used by Vitruvius for an opening in the roof to admit light. Alternative forms are hypaethros and hypaethrum. Many students of Greek temples, especially James Fergusson and T. J. Hittorff, basing their conclusions upon the Vitruvian reference to such an hypaethrus in the temple of Zeus Olympius at Athens, and upon coping tiles found in the temple at Aegina, have concluded that all Greek temples had some such method of admitting light. Moreover, late Greek tombs at Cyrene and Delos show raised copings in the centre of the roof as though for such an opening. And according to Strabo (*c.* 50 B.C.), the temple of Apollo Didymaeus at Miletus (second half of 4th century B.C.) had its entire vast cella open to the sky and planted with groves of laurel. Pausanias, however, states that this temple was never completed; if this is so a roof may have been planned originally.

The consensus of modern opinion is counter to the idea that the hypaethrus was a common feature. No arrangements for drainage have been found in connection with Greek temples, and the very reference of Vitruvius on which the speculations of Fergusson, Hittorff and others are based seems to point to the arrangement as exceptional enough to warrant mention, and used only in the largest buildings. Thus the ordinary temple would be lighted only by the enormous doorway; certainly light thus obtained would furnish a more beautiful and impressive illumination than any direct glare from above. (T. F. H.)

HYPATIA (A.D. 370?–415), Neoplatonic philosopher, born in Alexandria, was the daughter of Theon, author of a scholia on Euclid and a commentary on the *Almagest*, in which it is suggested that he was assisted by Hypatia. Lecturing in her native city, Hypatia ultimately became the recognized head of the Neoplatonic school there (*c.* 400). Her remarkable intellectual gifts, eloquence and modesty, combined with her beauty, attracted many pupils. Among these was Synesius, afterwards (*c.* 410) bishop of Ptolemaïs, several of whose letters to her, full of admiration and reverence, are extant. Shortly after the accession of Cyril to the patriarchate of Alexandria in 412, owing to her intimacy with Orestes, the pagan prefect of the city, Hypatia was barbarously murdered (Mar. 415) by a fanatical Christian mob. Socrates (*Hist. Eccl.* vii. 15) has related how she was torn from her chariot, dragged to the Caesareum (then a Christian church), stripped naked, done to death with oyster-shells and finally burnt.

Hypatia, according to Suidas, wrote commentaries on the *Arithmetica* of Diophantus of Alexandria, on the *Conics* of Apollonius of Perga and on the astronomical canon (of Ptolemy), which are now lost. Little is known of her philosophical opinions, but she appears to have embraced the intellectual rather than the mystical side of Neoplatonism, and to have been a follower of Plotinus rather than of Porphyry and Iamblichus.

See Fabricius, *Bibliotheca Graeca* (ed. Harles), ix. 187; John Toland,

Tetradymus (1720); R. Hoche in *Philologus* (1860), xv. 435; monographs by Stephan Wolf (Czernowitz, 1879), H. Ligier (Dijon, 1880) and W. A. Meyer (Heidelberg, 1885), who devotes attention to the relation of Hypatia to the chief representatives of Neoplatonism. The story of Hypatia forms the basis of the historical romance by Charles Kingsley (1853).

HYPERBOLA, a geometrical curve; as first conceived, probably by Menaechmus (*c.* 350 B.C.), a section of an obtuse-angled circular cone made by a plane orthogonal to a cone-element. About 220 B.C. Apollonius generalized the notion into that of a section of any circular cone, made by a plane cutting one element and diverging from the opposite at an angle greater than the vertical, so as to cut also the other nappe of the cone, the double section extending indefinitely both ways without meeting the opposite cone-edge. This is of course indicated in the central rectangular equation of the hyperbola

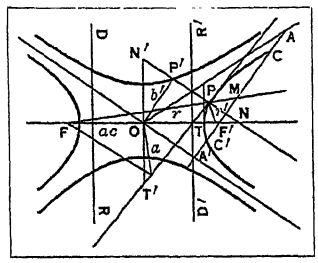


DIAGRAM OF HYPERBOLA

$$x^2/a^2-y^2/b^2=1,$$

in which, for x (or y) real and infinite (∞), y (or x) is also real and ∞; *i.e.*, the curve has two real points at ∞. This equation of the hyperbola is seen to differ from that of the ellipse only in the sign of b^2, and accordingly the hyperbola is the counterpart of the ellipse, reflecting its properties, *mutatis mutandis*, although we must suppose the branches continuous through ∞ to detect any likeness in form. Thus (*see* fig.) the ratio of the distances of any point of the hyperbola from either focus (F. F') and the corresponding directrix (DR), the polar of the pole F, is a constant, the *eccentricity* $e=\sqrt{(a^2+b^2/a)}$, but the changed sign of b^2 makes $e>1$. Similarly, the difference (not the sum, as in the ellipse) of the focal distances FP, $F'P$ of any point P (x y) of the hyperbola is a constant, the *transverse axis* is $2a$;

$$F'P-FP=r'-r=2a.$$

Either of these properties may be taken as a definition of the hyperbola. Again, it is the changed sign of b^2 that marks the two points at ∞ (imaginary in the ellipse) as real in the hyperbola. The tangent and normal still bisect the angles between the focal radii, r, r', to any point of the hyperbola, but they exchange positions, the tangent lying within, between F and F', the normal without. Thus, an ellipse and a hyperbola that are confocal intersect orthogonally, a property that extends to confocal conicoids, making possible important orthogonal co-ordinate systems of such surfaces. The ends ($\pm a$, o) of the transverse axis, AA', are real, but these (o, $\pm ib$) of its conjugate, BB', are imaginary in the hyperbola—a relation exactly reversed in the *conjugate* hyperbola

$$x^2/a^2-y^2/b^2=1.$$

In the ellipse, the asymptotes, or tangents at ∞, are imaginary,

$$x^2/a^2+y^2/b^2=0,\ x/a=\pm i\ y/b;$$

but in the hyperbola both are real,

$$x^2/a^2-y^2/b^2=0,\ x/a=\pm y/b,$$

plainly common to the hyperbola and its conjugate and forming the most striking feature of the curve. The analogue to the circle $x^2+y^2=a^2$ in relation to the ellipse, $x^2/a^2+y^2/b^2=1$, is the *rectangular* (equilateral, equiaxial) hyperbola

$$x^2-y^2=a^2$$

in relation to $x^2/a^2-y^2/b^2=1$ (both obtained by putting $b=a$). Every other hyperbola is obtained from this, as every ellipse from the circle, by vertical compression (or expansion) in the ratio b/a. On taking the asymptotes, $ay\pm bx=0$, as coordinate axes, the equation of the hyperbola becomes

$$xy=k^2=(a^2+b^2)/4,$$

a simple areal relation that makes the hyperbola the geometric depiction of various physical phenomena in which two magnitudes vary inversely, their product being a constant, as in $xy=k^2$. By the general law, the equation of the tangent at any point (x', y') is

$$xy'+x'y=2k^2;$$

hence, for $y=0$, $x=2k^2/y'$ and for $x=0$, $y=2k^2/x'$; *i.e.*, the tangent-intercept between the asymptotes is bisected at the tangent-point. Hence the triangle of asymptotes and tangents is constant in area. This tangent-intercept equals the parallel diameter conjugate to the diameter through the tangent-point (P). Obviously the two intercepts (CA, $C'A'$) of any chord (being parallel to a tangent), between the hyperbola and its asymptotes, are equal (*see* fig.).

HYPERBOLE, a figure of rhetoric whereby the speaker expresses more than the truth, in order to produce a vivid impression; hence, an exaggeration.

HYPERBOLIC FUNCTIONS: *see* TRIGONOMETRY.

HYPERBOLOID, in geometry, either of two open centric surfaces of the second degree (conicoids, quadrics). The general equation of such centrics takes the form

$$Ax^2+By^2+Cz^2=1,$$

where A, B, C, may have four orders of signs: + + + (ellipsoid), and − − − (a *nowhere* ellipsoid, with no real points); the other two, + + − and + − −, yield hyperboloids of one nappe or two nappes. The central rectangular equations may be written

$$x^2/a^2+y^2/b^2-z^2/c^2=1$$

and

$$x^2/a^2-y^2/b^2-z^2/c^2=1$$

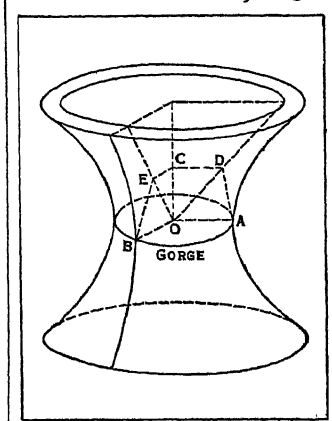


FIG. 1

Planes parallel to XY cut the hyperboloid in similar ellipses, $x^2/a^2+y^2/b^2=z^2/c^2+1$, and the hyperboloid of two nappes in similar hyperbolas

$$x^2/a^2-y^2/b^2=z^2/c^2+1;$$

likewise for sections parallel to the other coordinate planes. It is simplest to consider the limiting cases, when $a=b=c$. Then hyperboloid

$$x^2+y^2-z^2=a^2$$

is plainly the "revolute" of the rectangular hyperbola $x^2-z^2=a^2$ rotated round the Z-axis, each point (x, z) tracing a circle $x^2+y^2=a^2+z^2$. For $z=0$, $x^2+y^2=a^2$ becomes minimal circle. The general surface (fig. 1) is found, as in the *ellipsoid* (*q.v.*), by compression (or expansion) of all y's and z's in the ratios b/a and c/a respectively, which yields $x^2/a^2+y^2/b^2-z^2/c^2=1$. The "revolute" has as tangent at ∞ the central cone $x^2+y^2-z^2=0$, which remains tangential in the form $x^2/a^2+y^2/b^2-z^2/c^2=0$, after the affine transformation. Rotating the same hyperbola $x^2-z^2=a^2$ round X yields the *conoid* $x^2-y^2-z^2=a^2$, whose asymptotic cone is $x^2-y^2-z^2=0$. On compression (or expansion) parallel to Y or Z in the ratio b/a, c/a respectively, there results the general hyperboloid of two *nappes* $x^2/a^2-y^2/b^2-z^2/c^2=1$, with its asymptotic cone $x^2/a^2-y^2/b^2-z^2/c^2=0$ (fig. 2).

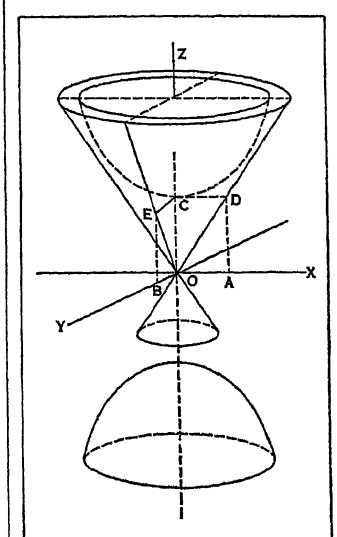


FIG. 2

Surfaces of second degree are all *ruled*, *i.e.*, traceable by a right line moving in a definite way. For, combining the two equations of a line and the one of such a surface, we may eliminate two

coordinates and obtain a resultant equation in one coordinate, and this equation, which is of the second degree, vanishes identically when its three coefficients reduce each to 0; and since the equations of the line have four parameters, this reduction is possible in an ∞ of ways; hence there are ∞ many lines lying on a conicoid, like line-elements forming a cone. In the ellipsoid and the hyperboloid of two nappes these lines are imaginary, but in the hyperboloid of one nappe they are real, forming two systems, each line of each system meeting all lines of the other system but none of its own (fig. 3). *See* MATHEMATICAL MODELS.

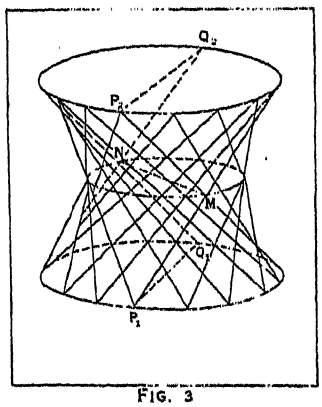


FIG. 3

HYPERBOREANS, a mythical people intimately connected with the worship of Apollo, especially but not exclusively that at Delos (Ὑπερβόρεοι, Ὑπερβόρειοι). Their names do not occur in Homer, but Herodotus (iv. 32) states that they were mentioned in Hesiod and in the *Epigoni*, an epic of the Theban cycle. According to Herodotus, two maidens, Opis and Arge, and later two others, Hyperoche and Laodice, escorted by five men, called by the Delians Perpherees, were sent by the Hyperboreans with certain offerings to Delos. Finding that their messengers did not return, the Hyperboreans adopted the plan of wrapping the offerings in wheat-straw and requested their neighbours to hand them on to the next nation, and so on until they finally reached Delos. The likeliest explanation of their name is still that of H. L. Ahrens. They are "those who carry over" (*βορ-* = *φορ-* in Macedonian and other Northern speeches, and may be thus connected with *φέρω*). The name then refers to the bringing of the offerings; *ὑπερβόρεοι* and *περφερέες* are probably the same. It is, of course, likely enough that an Apollo-worshipping people or clan really lived in the north; the offerings must have come from somewhere.

Under the influence of a derivation from *βορέας*, the home of the Hyperboreans was placed in a paradisiacal region beyond the north wind. The duration of their life was 1,000 years, but if any desired to shorten it, he decked himself with garlands and threw himself from a rock into the sea. The close connection of the Hyperboreans with the cult of Apollo may be seen by comparing the Hyperborean myths, the characters of which by their names mostly recall Apollo or Artemis (Agyieus, Opis, Hecaergos, Loxo), with the ceremonial of the Apolline worship.

See O. Crusius in Roscher's *Lexikon*, O. Schröder in *Archiv für Religionswissenschaft* (1904), viii. 69; W. Mannhardt, *Wald-und Feldkulte* (1905); L. R. Farnell, *Cults of the Greek States* (1907), iv. 100.

HYPEREIDES (*c.* 390–322 B.C.), one of the ten Attic orators, was the son of Glaucippus, of the deme of Collytus. Having studied under Isocrates, in 360 he prosecuted Autocles, a general charged with treason in Thrace (frags. 55–65, Blass). At the time of the Social War (358–355) he accused Aristophon, then one of the most influential men at Athens, of malpractices (frags. 40–44, Blass), and impeached Philocrates (343) for high treason. From the peace of 346 to 324 Hypereides supported Demosthenes in the struggle against Macedon; but in the affair of Harpalus he was one of the ten public prosecutors of Demosthenes, and on the exile of Demosthenes he became the head of the patriotic party (324). He was the chief promoter of the Lamian war against Antipater and Craterus, and after the defeat at Crannon (322), Hypereides and the other orators, whose surrender was demanded by Antipater, were condemned to death. Hypereides fled to Aegina, but Antipater's emissaries dragged him from the temple of Aeacus, where he had taken refuge, and put him to death; according to others, he was taken before Antipater at Athens or Cleonae. His body was afterwards removed to Athens.

Hypereides was an ardent pursuer of "the beautiful"; his temper was easy-going and humorous. In his development of the periodic sentence he followed Isocrates, but the essential tendencies of his style are those of Lysias, whom he surpassed, however, in the richness of his vocabulary and in the variety of his powers. His diction was plain and forcible, and his composition simple. Jebb sums up the criticism of pseudo-Longinus (*De sublimitate*, 34) in the phrase—"Hypereides was the Sheridan of Athens."

Most of what we possess of Hypereides's speeches was discovered in the second half of the 19th century, and edited by Sir Frederick Kenyon (1893).

On Hypereides generally *see* pseudo-Plutarch, *Decem oratorum vitae*; F. Blass, *Attische Beredsamkeit*, iii.; R. C. Jebb, *Attic Orators*, ii. 381. A full list of editions and articles is given in F. Blass, *Hyperidis orationes sex cum ceterarum fragmentis* (1894, Teubner series), to which may be added I. Bassi, *Le Quattro Orazioni di Iperide* (introduction and notes, 1888), and J. E. Sandys in *Classical Review* (Jan. 1895) (a review of the editions of Kenyon and Blass). For the discourse against Athenogenes *see* H. Weil, *Études sur l'antiquité grecque* (1900).

HYPERGAMY. The custom of hypergamy forbids a woman of a particular group to marry a man of a group lower than her own in social standing. When, as in India, severe social penalties support this rule, it produces serious effects upon the social order. It allows men to marry women of groups below them and therefore favours the men. It reinforces social distinctions and flourishes in societies where these are numerous, permanent and of the essence of the social order. It restricts the field of marriage in the case of the women of the highest section. It is found in its extreme development in India within castes which are divided into sections based on differences of religious purity, social eminence, political authority or economic superiority. To it are traced female infanticide (q.v.), the purchase of husbands, and wholesale polygamy.

The same principle is at work in the cases where, as in Africa, a community has been formed by the dominance of a group of alien origin of different physique imbued with a strong sense of superiority. Women from the inferior conquered subordinate classes are accepted as mates by the ruling class, which does not allow its women to mate with males of the subject people. King Cophetua may wed the beggar-maid, but the princess makes a misalliance.

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HYPERION, in Greek mythology, one of the Titans, son of Uranus and Gē, and father of Helios, the sun-god (Hesiod, *Theog.*, 134, 371). The name is often used as an epithet of Helios, who is himself sometimes called simply Hyperion. Its meaning may be "son of Hyperos"; *i.e.*, of him who is above (heaven).

HYPERSTHENE, a rock-forming mineral belonging to the group of orthorhombic pyroxenes. It differs from the other members (enstatite and bronzite) of this group in containing a considerable amount of iron replacing magnesium; the chemical formula is $(Mg,Fe)SiO_3$. Distinctly developed crystals are rare, the mineral being usually found as foliated masses embedded in those igneous rocks—norite, hypersthene-andesite, etc.—of which it forms an essential constituent. The coarsely grained labradorite-hypersthene-rock (norite) of St. Paul island, Labrador, has furnished the most typical material. The colour is brownish-black, and the pleochroism strong; the hardness is 6 and specific gravity 3·4–3·5.

HYPERTROPHY, a term in medicine implying increase in size of an organ or component tissue of the body, where such enlargement involves the natural elements of the part and is not the result of the presence of some extraneous morbid material. Thus, a lung in pneumonia, a liver full of cancer, is enlarged but not hypertrophied. Further, the word implies life, an uncut nail or excessive length of hair is not hypertrophy. The enlargement may consist in the presence of a normal number of elements each of excessive size (true hypertrophy) or an excessive number of elements, each of normal size (hyperplasia). Frequently both conditions are present.

Hypertrophy may be physiological or pathological. Physiological hypertrophy is due either to work (*e.g.*, the muscles of an athlete), or is compensatory (*e.g.*, when one of paired organs is absent or removed). For hypertrophy to occur the functional

activity demanded must be well within its powers, otherwise atrophy occurs. Pathological hypertrophy is seen in leucocythaemia, where the spleen is enormously enlarged; lymphadenoma, where lymphatic glands are enlarged; acromegaly, where bone is affected, etc. Physiological hypertrophy occurs under pathological conditions. The hypertrophy of the left ventricle in aortic obstruction, of the bladder in stricture of the urethra, of the stomach in pyloric obstruction are examples of work hypertrophy.

The causes of hypertrophy are largely the converse of those causing atrophy (*q.v.*), but as is shown by acromegaly, endocrine activity plays a part not observed in atrophy, and the growth of tissues in dermoid cysts or in monsters without brain or spinal cord (*see* MONSTERS) is clearly independent of the nervous system. As hypertrophy is essentially growth carried beyond normal limits the conditions underlying it are those underlying growth. These are (1) an inherent power of growth on the part of the cell; (2) an excessive supply of nutriment; (3) a stimulus.

A spurious hypertrophy is observed in the rare disease *pseudo-hypertrophic muscular paralysis,* in which the calves, buttocks and muscles of the back are greatly enlarged but excessively feeble. The enlargement is due to interpolation of fatty connective tissue between the muscular bundles which themselves are greatly atrophied. (W. S. L.–B.)

HYPNOTISM, a term involving all that appertains to that condition of artificial sleep known as hypnosis which is allied to normal sleep and can be induced in many normal persons. At all times individuals have fallen into an abnormal state of mind resembling the hypnotic state, such a condition being deliberately induced by others, through their own efforts, or spontaneously arising, generally under the influence of some special emotional excitement. Hypnotic phenomena were known thousands of years ago to the Persian magi and the Indian yogis and fakirs but scientific and medical interest in the subject was first universally aroused during the latter part of the 18th century by the work of Mesmer, a Viennese physician, who claimed to be able to cure many diseases by means of "animal magnetism." He enunciated the doctrine of a vital magnetic fluid which became stored up in living bodies, and by its instrumentality one individual could act on another. This method of mesmerism, notwithstanding much remedial success, was adversely reported on by several scientific commissions so that it fell into disuse until a generation later, when interest in it as a form of medical treatment was revived, but unfortunately mingled with much charlatanism.

In the middle of the 19th century Braid, a Manchester surgeon, recognized its validity but denied any magnetic element. He became convinced that there was no mysterious fluid passing from operator to subject, that the phenomena elicited were really subjective in origin, and it was he who first used the term "hypnotism" in place of mesmerism and laid the foundations for its modern study. Before many years the method was practised by physicians in all European countries. Liébault and Bernheim, at Nancy, laid the foundation of the school of hypnotic suggestion which has since held sway. In the hands of such investigators as Pierre Janet much light has been thrown by hypnotic experimental work on the constitution of the mind.

Methods of Induction.—The usual modern procedure is to place the subject in an arm-chair or on a couch where there shall be absolute muscular relaxation and passivity of mind. The environment should be conducive to sleep. The physician, standing at the side, holds up the index and middle fingers of one hand, a little above and away from the patient's eyes. The gaze is fixed on these and verbal suggestions are made to the effect that the eyelids are getting heavy, drowsiness is being felt, the eyes are closing, and sleep approaches. Light sensory stimulation by stroking the forehead gently or making downward passes over the face may also be carried out. In many subjects the eyelids gradually flicker more and more and then close as some stage of sleep supervenes. Self-induction of hypnosis may be possible by fixation of gaze in some people who have previously been hypnotized by another. Repeated hypnotic sitting commonly renders the advent of sleep easier. In specially susceptible patients complete hypnosis may supervene at once on the command to sleep either made orally or in writing. Terminating hypnosis is easily brought about by suggesting the idea of wakefulness, but if left to themselves patients, after a variable time, would spontaneously resume the normal state.

Different stages of hypnosis have been described by different authorities, many of them being very artificial, but it will suffice if we speak of three only. In very light hypnosis there is complete passivity and relaxation with an inability to open the eyes or resist some simple commands concerning the voluntary muscles. The individual is quite conscious of all that goes on. In a further stage, further phenomena can be produced, but still there is recollection of the hypnotic period. The most susceptible subjects may pass into a deep sleep known as artificial somnambulism. Here they respond to all or most suggestions made by the operator, and on awakening are oblivious to all they have heard, said, or done while in that state.

Hypnosis in some stages can be induced in a large percentage of normal people provided that they willingly submit to the process. Soldiers from active service during the World War were almost universally found easy subjects. For definite psychological reasons the insane are usually impervious to its influence.

Signs and Symptoms Seen in Hypnosis.—A peculiar relationship exists between patient and operator in the deep stages. They are said to be "en rapport"; only suggestions from the latter are accepted. Suggestibility is much increased though there are limitations to what suggestions will be acted upon. As already stated, the memory of the sleep period in deep hypnosis is lost, but this so-called amnesia can be much modified by suggestions. During hypnosis there is a great widening of the memory so that impressions long since forgotten can be revived. Much use of this phenomenon is made in treatment of various abnormalities. Suggestions made during hypnosis may be carried out subsequently to waking, and at a definitely named hour. This post-hypnotic suggestion is highly important in that it demonstrates the unconscious calculation of time and also shows that actions may be carried out without awareness of the source of the impulse. Through suggestion under hypnotism the voluntary muscles may be paralysed or put in a state of tonic contraction, and also the action of involuntary muscular fibre modified so that arterial blood flow and bowel movement can be to some extent controlled. The special senses tend to be rendered more acute, feeling and pain can often be abolished, and positive and negative hallucinations brought about. After repeated hypnosis many of these phenomena can be elicited even in the waking state by suggestion.

Possible Dangers.—The possible dangers of hypnotism have been much exaggerated, and in the hands of an expert physician no fear need be felt. Repeated hypnosis in certain types will tend to increase a mental dissociation which already exists, and there is apt to arise a far too great dependency on the operator. Whether criminal action can be suggested is a debatable point, but it may be stated that there is good reason for believing that no hypnotized subject will follow a suggestion which is contrary to his fundamental personal character.

The practice of hypnotism as a method of medical treatment has now largely been relinquished and superseded by other forms of psychotherapy. It is a blind method of procedure in that the origin of any disorder is not thereby usually traced, and attacking the cause of illness and not its surface manifestation should always be our scientific aim. Its use has been mainly applied to the treatment of the so-called functional nervous diseases, and in these states of mental disharmony modern knowledge has placed physicians in a position to unravel the causation links by some analytical means. Nevertheless, hypnotic suggestion in appropriate cases has its distinct sphere of usefulness. It may also be employed for the amelioration of pain, insomnia, stammering, seasickness, etc.

Theories Regarding Hypnosis.—Various theories of hypnosis have been propounded, and it may be viewed from both a physiological and psychological aspect. The factor of any magnetic or other power on the part of the operator has been long discarded, and that the phenomenon is subjective and due to suggestion is now more or less universally held. Charcot regarded

it as a form of artificial hysteria, and there are undoubted links between the two conditions. Modern authorities would explain it in terms of mental dissociation. In ordinary sleep it is presumed that the different nerve cells in the higher parts of the brain are dissociated from each other, and it may be that in hypnosis there is the same relative dissociation but that through the presence of the operator and the special link which exists between him and the subject one part of the nervous system is kept active and awake. Because the rest of the brain is quiescent, no contrary ideas are aroused to prevent the acceptance of suggestions which are therefore acted upon immediately. The psychoanalytic school would base the explanation of this artificial sleep and suggestibility on the idea that the operator symbolically represents the parent in the mind of the subject and that there is therefore an unconscious attitude of blind belief and obedience to the suggestions that may be made. The special rapport existing between the two would be thus interpreted.

It must not be forgotten that experimental work in hypnotism has been highly fruitful in adding to our knowledge of normal and abnormal psychology. Through its phenomena we are enabled better than in any other way to demonstrate the process of unconscious motivation, and to see in the mind the probability of a series of levels at which different mental processes take place. (C. S. R.)

See Moll, *Hypnotism* (trans. New York, 1893); Janet, *L'Automatisme psychologique* (1889); McDougall, *Abnormal Psychology*.

HYPOCAUST, in architecture, an open space below a floor to allow the passage of hot air and smoke, in order to heat the room above. This type of heating was developed to a high degree by the Romans who used it, not only in the warm and hot rooms of the baths (*q.v.*), but also almost universally in private houses in the northern provinces. Many examples of such hypocausts exist in villa and house foundations in Roman centres in Germany and England. Although the usual custom was to lead the smoke from a hypocaust into a single vertical flue through which it escaped into the open air, where greater warmth was desired, several flues would lead up from the hypocaust in the side walls of the room; at times, these wall flues consisted of hollow oblong tiles, set close together, entirely around the room. The usual construction of a hypocaust consisted of a layer of tiles, 2 ft. square, laid continuously in a bed of concrete for the bottom surface, piers approximately 8 in. square and about 2 ft. apart as the supports, and a floor above of concrete or of large square tiles supporting a bed of concrete, on which the finished floor of marble, tesserae or mosaic was laid.

HYPOCHONDRIASIS, a medical term, given by the ancients and early physicians to derangements of the abdominal viscera. It is not now used to refer to any actual disease but to a morbid mental symptom which consists in an undue pre-occupation in one's own state of health with a tendency to find evidence of disease from insignificant signs. There may arise a settled conviction that disease exists even in their absence. The idea of ill-health, however, relates essentially to the internal organs and predominantly to the functioning of the heart, intestinal canal, or genital structures. Such a symptom may occur in many forms of mental illness. It is not infrequently noted in hysterical anxiety and neurasthenic neuroses; in melancholic states, especially those of later years; in dementia praecox; and in the initial stages of such organic psychoses as arterio-sclerotic dementia and general paresis.

In some cases hypochondriasis seems to present itself without any other symptom, and though examination reveals no physical abnormality, the assurance of that fact has usually only a temporary effect on the false belief which may lead to self-centredness, depression and insomnia.

It is probable that the hypochondriacal type has a greater sensitivity to sensations emanating from the internal organs, is therefore more easily aware of any change that may occur therein, and so more affected by any possible alteration in their functioning.

Any treatment naturally depends on the associated disease. In its more pure manifestation some form of psychotherapy is indicated, but results are often disappointing. (C. S. R.)

HYPOSTYLE, in architecture, a term applied to halls with flat ceilings supported by columns, especially in Egyptian work. A hypostyle hall formed the largest room in every Egyptian temple. It was usually placed immediately behind the main court and in front of the small rooms that formed the sanctuary. Such halls were either lit by openings between the front range of columns, above the low screen wall built between them, as in the Ptolemaic temple at Edfu (237 to 57 B.C.), or by having the central ranges of columns taller than those at the side so that a clerestorey of pierced stone screens was possible above the roof of the side portions.

HYPOSULPHITE OF SODA, the name originally given to the salt, still in general use by photographers as a fixing agent, known in chemistry as sodium thiosulphate, $Na_2S_2O_3$. One molecule of the salt crystallizes with five molecules of water. In systematic chemistry sodium hyposulphite is a salt of hyposulphurous acid, to which Schutzenberger gave the formula H_2SO_2, but which Bernthsen showed to be $H_2S_2O_4$. (*See* SULPHUR; and HYDROSULPHITE OF SODA.)

HYPOTHEC, in Roman law, the most advanced form of the contract of pledge. A specific thing may be transferred to the possession of a creditor on the condition that it is to be given back when the debt is paid; or the property in the thing may be assigned to the creditor while the debtor is allowed to remain in possession, the creditor as owner being able to take possession if his debt is not discharged. Here we have the kind of security known as pledge and mortgage respectively. In the hypothec the property does not pass to the creditor, nor does he get possession, but he acquires a preferential right to have his debt paid out of the hypothecated property; that is, he can sell it and pay himself out of the proceeds, or in default of a purchaser he can become the owner himself. The name and the principle have passed into the law of Scotland, but the number of instances in which movable property may be hypothecated is restricted to a few cases under the heads of (1) landlord and tenant (*q.v.*), (2) agent and client, (3) maritime hypothec, and (4) privileged debts. A law agent has a hypothec for his amount of expenses incurred in an action over his client's right contained in a furnishing of expenses due to the client from his opponent, which failing, over any principal sum declared for in the client's favour. In maritime hypothecs the ship may be hypothecated for (a) bottomry loans, (b) repairs executed abroad, (c) seamen's wages, and (d) collisions and salvage. A debtor's personal estate also is subject to hypothecs (a) in favour of the claim for unpaid taxes, (b) in favour of domestic and farm servants for their current wages and (c) where the debtor has died, in favour of his medical attendant for death-bed and funeral expenses, in favour of his widow for mournings, and in favour of his landlord for the current rent of his dwelling house.

HYPOTHESIS, in ordinary language, a tentative explanation supposition or assumption (from Gr. *ὑποτίθεναι*, to put under; Lat. *suppositio*, from *sub-ponere*). Both in ordinary life and in the acquisition of scientific knowledge hypothesis is all important. A detective's work consists largely in forming and testing hypotheses. If an astronomer is confronted by some phenomenon which has no obvious explanation he may suppose some set of conditions which might give rise to the phenomenon in question; he then tests his hypothesis until he discovers whether it does or does not conflict with the facts. An example of this process is that of the discovery of the planet Neptune: certain perturbations of the orbit of Uranus had been observed, and it was seen that these could be explained on the hypothesis of the existence of a then unknown planet, and this hypothesis was verified by actual observation. The progress of inductive knowledge is by the formation of successive hypotheses, and it frequently happens that the demolition of one or even many hypotheses is the direct road to an accurate hypothesis, *i.e.*, to knowledge.

The recognition of the importance of hypotheses has led to various attempts at drawing up exact rules for their formation, but logicians are generally agreed that only very elementary principles can be laid down. Thus a hypothesis must contain

nothing which is at variance with known facts or principles: it should not postulate conditions which cannot be verified empirically. J. S. Mill (*Logic*, III. xiv. 4) laid down the principle that a hypothesis is not "genuinely scientific" if it is "destined always to remain a hypothesis": it must "be of such a nature as to be either proved or disproved by comparison with observed facts." Mill's principle, though sound in the abstract, has, except in a few cases, little practical value in determining the admissibility of hypotheses, and in practice any rule which tends to discourage hypothesis is undesirable. The most satisfactory check on hypothesis is expert knowledge in the particular field of research by which rigorous tests may be applied. This test is roughly of two kinds, first by the ultimate principles or presuppositions on which a particular branch of knowledge rests, and second by the comparison of correlative facts. Useful light is shed on this distinction by Lotze, who contrasts (*Logic*, § 273) *postulates* ("absolutely necessary assumptions without which the content of the observation with which we are dealing would contradict the laws of our thought") with *hypotheses*, which he defines as conjectures, which seek "to fill up the postulate thus abstractly stated by specifying the concrete causes, forces or processes, out of which the given phenomenon really arose in this particular case, while in other cases maybe the same postulate is to be satisfied by utterly different though equivalent combinations of forces or active elements." Thus a hypothesis may be ruled out by principles or postulates without any reference to the concrete facts which belong to that division of the subject to explain which the hypothesis is formulated. A true hypothesis, therefore, seeks not merely to connect or colligate two separate facts, but to do this in the light of certain fundamental principles.

(*See* LOGIC; SCIENTIFIC METHOD; SYLLOGISM.)

See Naville, *La Logique de l'hypothèse* (1880); A. Wolf, *Essentials of Scientific Method* (1928).

HYPOTRACHELIUM, in architecture, the space which lies between the annulets or little rings at the bottom of the echinus or convex portion of the Greek Doric capital, and the topmost stone of the column shaft proper. It is thus the lowest portion of the stone from which the capital is carved, and contains the tops of the column flutes. It is frequently decorated at the bottom by a groove or grooves circling the circumference, which may have inserted mouldings of bronze. The word is also sometimes applied in the Roman Doric order to the neeking, or space between the bottom of the capital and the astragal, or convex moulding, with fillet below which marks the top of the shaft proper (*see* ORDER).

HYPOTROCHOID: *see* CURVES, SPECIAL.

HYPSOMETER, an instrument for measuring heights (Gr. ὕψος, height, μέτρον, a measure), which employs the principles that the boiling-point of a liquid is lowered by diminishing the pressure (*see* HEAT) and that the barometric pressure varies with the height of the point of observation. (*See* METEOROLOGY.) The instrument consists of a cylindrical vessel in which the liquid, usually water, is boiled, surmounted by a jacketed column, in the outer partitions of which the vapour circulates, while in the central one a thermometer is placed.

HYRACOIDEA, a group of small hoofed mammals, including the biblical cony. The name cony or coney originally referred to the rabbit but has also come to be used for the related pikas, and for the present quite distinct animals. There is no unambiguous popular term for members of the Hyracoidea. They are usually called hyraxes (or hyraces). "Rock rabbits," also sometimes used, is objectionable because they are not rabbits and many of them have nothing to do with rocks. In appearance the living hyraxes, with their plump, pointed heads, short necks, relatively short, slender legs, and squat, almost tailless bodies, look much more like rodents than ungulates. Nevertheless their anatomy clearly shows they are related to the hoofed mammals.

Living hyraxes are confined to Africa south and east of the Sahara and extreme southwestern Asia. They may be divided into two groups. One, the genus *Procavia*, includes the ground-living forms, especially characteristic of deserts, hills and mountains up to about 10,000 feet, living in holes and fissures among the rocks. The other group is similar but is best separated as *Dendrohyrax*. These forms, confined to Africa, are almost entirely tree-dwelling, the only true arboreal hoofed mammals. They live in holes in trees and move readily along the trunks and branches. Both types climb easily, clinging even to almost vertical surfaces by the pads on their feet.

The hyraxes have numerous structural peculiarities which separate them sharply from any other mammals. The normal adult dental formula is $I\frac{1}{2}\ C\frac{0}{0}\ P\frac{4}{4}\ M\frac{3}{3}$. The upper incisors are large, curved in a semicircle longitudinally, and grow continuously throughout life like those of rodents. Canines are absent. The premolars and molars are in pattern surprisingly like those of some of the typical ungulates, especially the rhinoceros. The dorsal and lumbar vertebrae are unusually numerous (up to 30 in *Procavia*). On both front and hind feet the three middle toes are well-developed. In the forefeet the other two toes are also present, although the first is much reduced; in the hind feet the first toe is absent, the fifth vestigial. The hoof of the inner (second) toe of the hind foot is claw-like, but on all the other toes the hooves are normal, although small. The wrist-bones are arranged serially, the individual bones generally coming in contact with only one bone of the opposite row—an arrangement typical of the most primitive extinct ungulates but lost in the more specialized modern forms. The alimentary canal is unique in having a pair of large coeca opening into the large intestine some distance below the usual one at the junction of large and small intestines. There is a gland on the back.

The relationships of the hyraxes are doubtful. There is no question that the numerous resemblances to the rodents are all superficial and that the fundamental characters indicate affinities with the ungulates, but these affinities must be distant so far as any living forms are concerned. In addition to their many very primitive characters, the hyraxes show some special resemblance to primitive or extinct members of several groups, particularly the Proboscidea, Perissodactyla, some Condylarthra (*Meniscotherium*), and the peculiar South American fossil ungulates. This confusing series of resemblances suggests that the group is an ancient and unprogressive offshoot derived from the ungulate stem at a time when the modern groups of ungulates were not well differentiated.

Fossil Hyracoidea.—Numerous extinct hyracoids are known and they indicate that the group was formerly much more diversified than at present. Ten extinct genera are recognized, chiefly from the Oligocene of Egypt (Faiyum), Miocene of east and southwest Africa, and Pliocene of Greece (Pikermi and Samos). The earliest forms are characterized generally by having a full complement of teeth, $I\frac{3}{3}\ C\frac{1}{1}\ P\frac{4}{4}\ M\frac{3}{3}$, with the last molars relatively larger than in recent forms. In some cases, for instance *Geniohyus* from Faiyum, the skull was strikingly elongated. Most of these extinct forms were larger than the recent hyraxes and some, such as species of *Megalohyrax* or *Titanohyrax* from Faiyum or *Pliohyrax* from Greece, were relatively gigantic. The largest must have been as big as a horse. (*See* UNGULATA.)

(G. G. SI.)

HYRAX, the name given to animals of the order Hyracoidea, small, plump, almost tail-less beasts, having a hoof on each toe, superficially resembling rodents but forming an order of their own of doubtful affinities. Here belongs the "cony" of the Bible. There are two genera, *Procavia*, which comprises the ground-living forms (including the "cony"), and *Dendrohyrax*, the species of which are arboreal. *Procavia* is distributed over Africa, south and east of the Sahara, and south-western Asia; *Dendrohyrax* is confined to Africa. All hyraxes climb well. *Procavia* is found in deserts and mountainous country, living in holes among rocks.

HYRCANIA. (1) An ancient district of Asia, south of the Caspian Sea, and bounded on the east by the river Oxus, called *Virkana*, or "Wolf's Land," in Old Persian. It was a wide and indefinite tract. Its chief city is called Tape by Strabo, Zadracarta by Arrian. The latter is evidently the same as Carta, mentioned by Strabo as an important city. Little is known of the history of

the country. Xenophon says it was subdued by the Assyrians; Curtius that 6,000 Hyrcanians were in the army of Darius III. (2) Two towns named Hyrcania are mentioned, one in Hyrcania, the other in Lydia. The latter is said to have derived its name from a colony of Hyrcanians, transported thither by the Persians.

HYRCANUS (Ὑρκανός), a Greek surname, of unknown origin, borne by several Jews of the Maccabaean period.

JOHN HYRCANUS I., high priest of the Jews from 135 to 105 B.C., was the youngest son of Simon Maccabaeus. In 137 B.C. he, with his brother Judas, commanded the force which repelled the invasion of Judaea led by Cendebeus, the general of Antiochus VII. *Sidetes*. On the assassination of his father and two elder brothers by Ptolemy, governor of Jericho, his brother-in-law, in 135, he succeeded to the high priesthood and the supreme authority in Judaea. While still engaged in the struggle with Ptolemy, he was attacked by Antiochus with a large army (134), and compelled to shut himself up in Jerusalem. Peace was secured at last on condition of a Jewish disarmament, and the payment of an indemnity and an annual tribute. He confirmed the alliance which his father had made with Rome, and at the same time availed himself of the weakened state of the Syrian monarchy under Demetrius II. to overrun Samaria, and also to invade Idumaea, which he completely subdued. About 109 B.C. his sons took Samaria, and by his orders razed it to the ground. He died in 105, and was succeeded by Aristobulus, the eldest of his five sons. The external policy of Hyrcanus was marked by considerable energy and tact, and, aided by favouring circumstances, was so successful as to leave the Jewish nation in a position of great independence and influence.

JOHN HYRCANUS II., high priest from 78 to 40 B.C., was the eldest son of Alexander Jannaeus by his wife Alexandra, and was thus a grandson of the preceding. When his father died in 78, he was appointed high priest, and on his mother's death in 69 he claimed the succession to the supreme civil authority. After a troubled reign of three months, he was compelled to abdicate both dignities in favour of his more ambitious younger brother Aristobulus II. In 63 Pompey restored him to the high priesthood, with some semblance of supreme command. He was soon again deprived of his office by the arrangement of the pro-consul Gabinius, according to which Palestine was in 57 B.C. divided into five separate circles. For services to Caesar after the battle of Pharsalia, he was again rewarded with the sovereignty in 47 B.C., Antipater of Idumaea, however, being at the same time made procurator of Judaea. In 41 B.C. he was practically superseded by Antony's appointment of Herod and Phasael to be tetrarchs of Judaea; and in the following year he was taken prisoner by the Parthians, deprived of his ears that he might be permanently disqualified for priestly office, and carried to Babylon. He was permitted in 33 B.C. to return to Jerusalem, where on a charge of treasonable correspondence with Malchus, king of Arabia, he was put to death in 30 B.C.

See Josephus (*Ant.* xiii. 8–10, xiv. 5–13; *Bell. Jud.* i. 2, i. 8–13). Also MACCABEES, *History*.

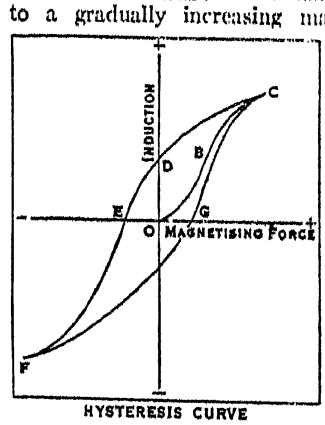
HYSSOP (*Hyssopus officinalis*), a garden herb belonging to the family Labiatae, formerly cultivated for use in domestic medicine. It is a small perennial plant about 2 ft. high, with slender, quadrangular, woody stems; narrowly elliptical, pointed, entire, dotted leaves, about 1 in. long and ¼ in. wide, growing in pairs on the stem; and long terminal, erect, half-whorled, leafy spikes of small violet-blue flowers, which are in blossom from June to September. Varieties of the plant occur in gardens with red and white flowers, also one having variegated leaves. The leaves have a warm, aromatic, bitter taste, and are believed to owe their properties to a volatile oil which is present in the proportion of ½ to ½%. Hyssop is a native of the south of Europe, its range extending eastward to central Asia, and has become naturalized in North America from Maine to Ontario and southward and also on the Pacific coast. A strong tea made of the leaves, and sweetened with honey, was formerly used in pulmonary and catarrhal affections, and externally as an application to bruises and indolent swellings.

The hedge hyssop (*Gratiola officinalis*) belongs to the family Scrophulariaceae, and is a native of marshy lands in the south of Europe, whence it was introduced into Great Britain more than 300 years ago. Like *Hyssopus officinalis*, it has smooth, opposite, entire leaves, but the stems are cylindrical, the leaves twice the size, and the flowers solitary in the axils of the leaves and having a yellowish-red veined tube and bluish-white limb, while the capsules are oval and many-seeded. The herb has a bitter, nauseous taste, but is almost odourless. In small quantities it acts as a purgative, diuretic and emetic when taken internally. It is said to have formed the basis of a celebrated nostrum for gout, called *Eau médicinale*, and in former times was called *Gratia Dei*. When growing in abundance, as it does in some damp pastures in Switzerland, it becomes dangerous to cattle. *G. peruviana* is known to possess similar properties.

The hyssop (*'ezob*) of Scripture (Exod. xii. 22; Lev. xiv. 4, 6; Num. xix. 6, 18; 1 Kings v. 13 [iv. 33]; Ps. li. 9 [7]; John xix. 29), a wall-growing plant adapted for sprinkling purposes, has long been the subject of learned disputation, the only point on which all have agreed being that it is not to be identified with the *Hyssopus officinalis*, which is not a native of Palestine. No fewer than eighteen plants have been supposed by various authors to answer the conditions. The most probable opinion would seem to be that found in Maimonides and many later writers, according to which the Hebrew *'ezob* is to be identified with the Arabic *sa'atar*, now understood to be *Satureia Thymus*, a plant of very frequent occurrence in Syria and Palestine, with which *Thymus Serpyllum*, or wild thyme, and *Satureia Thymbra* are closely allied. Its smell, taste and medicinal properties are similar to those of *H. officinalis*.

HYSTASPES (the Greek form of the Persian *Vishtaspa*). (1) A semi-legendary king (*kava*), praised by Zoroaster as his protector and a true believer, son of Aurvataspa (Lohrasp). The later tradition and the *Shahname* of Firdousi make him (in the modern form Kai Gushtāsp) king of Iran. As Zoroaster probably preached his religion in eastern Iran, Vishtāspa must have been a dynast in Bactria or Sogdiana. The Zoroastrian religion was already dominant in Media in the time of the Assyrian king Sargon (*c.* 715 B.C.), and had been propagated probably in much earlier times (*cf.* PERSIA); the time of Zoroaster and Vishtāspa therefore may be put at *c.* 1000 B.C. (2) A Persian, father of Darius I., under whose reign he was governor of Parthia, as Darius himself mentions in the Behistun inscription (*c.* 05). By Ammianus Marcellinus, xxiii. 6. 32, and by many modern authors he has been identified with the protector of Zoroaster, which is impossible for chronological and historical reasons, and from the evidence of the development of Zoroastrianism itself (*see* PERSIA: *Ancient History*).

HYSTERESIS. If an unmagnetized iron bar be subjected to a gradually increasing magnetizing force, and the corresponding values of the magnetic induction (flux density) in the iron be determined, then on plotting the magnetizing force against the induction a curve OBC is obtained. If now the magnetizing force is gradually decreased to zero and the values of the magnetic induction determined, it will be found that the curve obtained does not coincide with OBC but takes the form CD. If now the direction of the magnetizing force is reversed, DEF is obtained, and decreasing the magnetizing force again to zero, reversing, and increasing will give the curve FGC. It will be seen from a study of the complete curve that the magnetic induction (flux density) *lags behind* the magnetizing force. It was to this property of magnetic materials that Ewing gave the name *Hysteresis*. (*See* MAGNETISM, ELECTROMAGNET, ELECTRIC GENERATOR, ETC.).



HYSTERESIS CURVE

HYSTERIA, a term applied to a mental affection which occurs usually in individuals of neurotic and unstable constitu-

tions. It is manifested by an undue susceptibility to external impressions, emotional episodes, and marked sensory, psychic and motor disturbance. Though classed among so-called "nervous" diseases, it is functional in origin, and no organic change in the nervous system is known to exist. Physicians of the past supposed that hysteria occurred only in women and resulted from a wandering of the uterus or womb; hence its name; but after the experiences of the World War it has been more and more clearly realized that men may be as much affected as women.

Though heredity has a definite influence, modern knowledge has shown that environmental factors in early life and faulty education are of main importance.

The modern period in the history of hysteria may be said to have begun with Charcot; since, many physiological and psychological theories have been put forward. The most fruitful work was done by Pierre Janet, who regarded it as a purely mental malady. He believed that the disorder lay in a poor synthesis of the personality so that certain ideas became split off from the main portion of the personality, and in a subconscious region of the mind independently produced these results. Various other theories of such mental dissociation have been formulated and the most important and interpretative is that of Sigmund Freud of Vienna. According to this worker, the hysterical symptom is the result of a conflict between the personality and some "wish" which is out of harmony with the personal ego, and is therefore repressed. (*See* PSYCHO-ANALYSIS.) The repression, however, is not entirely successful, and the wish in the unconscious mind, being dynamic, forces its way into consciousness in a symbolic and disguised form. The symptom is thus a compromise between the two urges at play. Much of the "wish" material which is repressed Freud believes to be related intimately to the sexual instinct.

The symptoms of hysteria are manifold and complex and may appear in many combinations. They may be physical or mental. Among the former we may note paralysis of limbs, spasms of muscles, tremors, loss of voice or speech, loss of sensation in the skin, blindness, vomiting, etc. The hysterical fit is a convulsive attack which is well known and liable to be confused with epilepsy. There are, however, points of differentiation which careful investigation will usually reveal. The mental symptoms can all be looked upon as the result of the independent functioning of a dissociated part of the content of the mind. The chief are memory gaps, sleepwalking, fugues (wandering attacks of which there is no subsequent recollection), trances, hallucinations, deliria, and dream states. Double personality would be explained on a similar basis. In such a condition the split-off mental functions are so extensive that a second complete personality is formed. Freud classifies hysteria into two forms—conversion hysteria, when the psychic excitation is converted into some bodily innervation, and anxiety hysteria, when the symptoms are purely mental. In the latter category are included those cases evidencing anxiety, depression and morbid fears. In the minor form of hysteria the individual tends to be nervous and excitable, show exaggerated emotion, lack of control, with a liability to phantasy, egoism, and craving for attention and sympathy. Hysteria may be so severe as to constitute insanity. In many of its manifestations its diagnosis is by no means easy and its physical symptoms are not infrequently taken as evidence of bodily disease. Treatment involves the use of some form of psychotherapy. Drug administration is not in the main scientifically admissible. What method of psychotherapy should be applied will vary according to the type of case and other circumstances. Suggestion, hypnotism, and persuasion are of value in properly selected patients. If possible, the psychic cause should be discovered. This may be sought through some form of psychological analysis or through the Freudian technique of psycho-analysis. An education in mental hygiene will generally be indicated.

See McDougall, *Abnormal Psychology*. (C. S. R.)

HYTHE, a market town and watering-place, one of the Cinque Ports, and a municipal borough of Kent, England, 67 m. S.E. by E. of London on a branch of the S.R. Pop. (1921) 7,767. It is situated near the eastern extremity of Romney marsh, about half a mile from the sea, and consists principally of one long street running parallel with the shore. On the slope of the hill above the town stands the church of St. Leonard, partly Late Norman, with an Early English chancel. The tower was rebuilt about 1750. In a vault under the chancel there is a collection of human skulls and bones supposed to be the remains of men killed in a battle near Hythe in 456. Lionel Lukin (1742–1834), inventor of the life-boat, is buried in the churchyard. Hythe possesses a guildhall founded in 1794 and two hospitals, that of St. Bartholomew founded by Haimo, bishop of Rochester in 1336, and that of St. John (rebuilt in 1802), still older, founded originally for the reception of lepers.

Lympne, now 3 m. inland, is thought to have been the original harbour which gave Hythe a place among the Cinque Ports. The sea-sand lying on the surface shows the course of the ancient estuary. Here are remains of a Roman fortress, and of the *Portus Lemanis*. Large portions of the fortress walls are standing. At the south-west corner is one of the circular towers which occurred along the line of wall. The site is now occupied by the old castellated mansion of Studfall castle, formerly a residence of the archdeacons of Canterbury. The church at Lympne is Early English, and has a Norman tower built by Archbishop Lanfranc, with some Roman material in the walls. A short distance east is Shipway or Shepway Cross, where some of the great assemblies relating to the Cinque Ports were held. A mile north from Hythe is Saltwood castle, of ancient origin, but rebuilt in the time of Richard II. The castle was granted to the see of Canterbury in 1026, and here the murder of Thomas à Becket is said to have been concerted. It remained a residence of the archbishops until the time of Henry VIII. It was restored as a residence in 1882. About 2 m. N.W. of Saltwood are remains of the fortified 14th century manor-house of Westenhanger, quadrangular and surrounded by a moat, with three of the nine towers (alternately square and round) by which the walls were defended remaining.

Hythe (Heda, Heya, Hethe, Hithe, *i.e.*, landing-place), a port in Saxon times, was granted by a Saxon thegn to Christ Church, Canterbury. In the Domesday Survey the borough is entered among the archbishop's lands as appurtenant to his manor of Saltwood, and the bailiff of the town was appointed by the archbishop. Hythe was evidently a Cinque Port before the Conquest, as King John in 1205 confirmed the liberties which the townsmen had under Edward the Confessor. The liberties of the Cinque Ports were confirmed in Magna Carta and later by Edward I. in a general charter, which was confirmed, often with additions, by subsequent kings down to James II. John's charter to Hythe was confirmed by the Lancastrian kings. These charters were granted to the Cinque Ports in return for the 57 ships which they supplied for the royal service, of which five were contributed by Hythe. The ports were first represented in the parliament of 1365, to which they each sent four members.

Hythe was governed by 12 jurats until 1574, when it was incorporated by Elizabeth under the title of the mayor, jurats and commonalty of Hythe; a fair for the sale of fish, etc., was also granted, to be held on the feast of St. Peter and St. Paul. With the silting up of the harbour Hythe lost its old importance.

HYTHE, CONFERENCE OF, a meeting (May 15 to 17 1920) between the British and French prime ministers, together with the chancellor of the exchequer and the French minister of finance, in preparation for the Conference of Spa (*see* SPA, CONFERENCE OF). A French proposal that France should be granted priority in reparation payments seems to have been put forward but not pressed, and the linking up of the reparation problem with the question of inter-Allied debts was proposed publicly for the first time in the official communiqué.

I This letter corresponds to Semitic ☿ (*yod*) and Greek Ι (*iota*). Early Greek forms from the island of Thera were ⥢ and S, which obviously more closely resemble the Semitic than the later single vertical stroke. In Attic inscriptions also the form ⥢ appears, while in early Corinthian inscriptions the forms ⦃, ⦃, ⦃ are found. The Chalcidic alphabet had the form Ι and this was the form in all the Italic alphabets including the Etruscan. The Lydian alphabet besides the form Ι also shows a form ⦅ (written from right to left).

NAME OF FORM	APPROXIMATE DATE	FORM OF LETTER
PHOENICIAN	B.C. 1,200	☿
CRETAN	1,100-900	⦃ ⦃
THERAEAN	700-600	⦃ ⦃
ARCHAIC LATIN	700-500	(Ι)
ATTIC	600	⦃ Ι
CORINTHIAN	600	⦃
CHALCIDIAN	600	Ι
IONIC	403	Ι
ROMAN COLONIAL	PRE-CLASSICAL AND CLASSICAL TIMES	Ι
URBAN ROMAN		Ι
FALISCAN		Ι
OSCAN		Ι
UMBRIAN		Ι
CLASSICAL LATIN AND ONWARDS		I

THE DEVELOPMENT OF THE LETTER "I" FROM THE PHOENICIAN THROUGH THE CLASSICAL LATIN TO THE PRESENT FORM

The minuscule letter is merely a shortened form of the majuscule. The dot first appears in mss. of about the 11th century and was used to distinguish the letter and assist reading in words in which it was in close proximity to letters such as *n* or *m* (*inimicis*, for example). The dot frequently took the form of a dash, *e.g.*, ī. It became the custom in mediaeval mss. to distinguish an initial or otherwise prominent *i* by continuing it below the line, and it was from this habit that the differentiation of the letters *i* and *j* arose. The initial letter, nearly always lengthened, had most frequently a consonantal force, and this led to *j* representing the consonant, *i* the vowel. The two letters were not considered as separate until the 17th century.

In Semitic the letter represented a spirant akin to the sound of English consonantal *y*. In Greek, Latin and the Romance languages it has represented a high front vowel similar to English long *e*. In Latin short *i* represented a considerably more open sound than long *i*, as is evidenced by the fact that in late Latin it ran together with long *e*. In modern English the sound of short *i* is almost identical with what it was in Latin (*e.g.*, in the word *pit*). Long *i* has become a diphthong (*aɪ*, *ɑɪ*, *e.g.*, in the words *ice, hire*), the sound formerly represented by long *e* (*i.e.*, that heard in French *tête*) having shifted forwards and upwards till it has become that formerly represented by long *i*.

In words such as *fir* the letter represents the neutral vowel, while in certain foreign words it retains its continental sound, identical with that it represented in Middle English and previously (*e.g.*, in the words *pique, emir*). (B. F. C. A.)

IACANDONES, an Indian tribe belonging to the Maya-Quiché stock. They occupy the tributary streams west of the Usumacintla river in Chiapas, Mexico. Their tongue is closely related to the Maya of Yucatan. Living in scattered family groups, their total number to-day is only a few hundred. Formerly, however, they were numerous and opposed the Spaniards so resolutely, especially during the 17th century, that they were never completely subdued. Their culture at present is primitive but they show survivals of higher phases inherited from pre-Columbian times.

See A. M. Tozzer, *A Comparative Study of the Mayas and Lacandones* (1907).

IAMBIC, a verse or succession of verses composed wholly or principally of the foot called an iambus (⏑–). It is generally described by a compound name consisting of a Greek numeral and the word *metron*, signifying a group of two iambi; as, iambic dimeter, a line consisting of two *metra* or four iambi: "perūnxĭt hŏc Iasonem," or "John Gil|pin was | a cit|izen." The commonest form, and one of the most popular of Greek metres, especially in drama, is the trimeter (three *metra*, or six iambi). When "pure," *i.e.*, containing no other feet, this runs "suīs ĕt ipsa Roma vĭrĭbŭs ruit." But as a substitute for each of the first five iambi, under various restrictions more or less severe according to subject and language, the ancients allowed a spondee (– –), a tribrach (⏑ ⏑ ⏑), a dactyl (– ⏑ ⏑), an anapaest (⏑ ⏑ –), sometimes a proceleusmatic (⏑ ⏑ ⏑ ⏑). Other common lines are the tetrameter catalectic ("părātŭs ōmnĕ Caesaris periculum subīre") and acatalectic ("bĕātŭs ille qui procul negotiis, ut prisca gens"), with similar substitutions allowed. These last two are common in English, as "In good | King Charles|'s gol|den days, | when loy|alty | no harm | meant," and "But come, | thou god|dess fair | and free, | in heaven | yclept | Euphro|syne," but the trimeter is almost unknown; Spenser's "Unhappy verse | the witness of | my unhappy state" is an example; the Alexandrine, as "And hope to merit Heaven | by

making earth a hell," has a different rhythm. Its place in our literature is taken by the five-foot line, in couplets or "blank," as "A lit|tle on|ward lend | thy gui|ding hand."

IAMBLICHUS (d. *c.* A.D. 330), the chief representative of Syrian Neoplatonism, was born at Chalcis in Coele-Syria of an illustrious family. He studied under Porphyry in Rome, and later taught in Syria. Although his commentaries on Plato and Aristotle, and works on the Chaldaean theology and on the soul, are lost, fragments of them have been preserved by Stobaeus and others. Proclus mentions his five extant books, which are parts of a great work on Pythagorean philosophy, and ascribes to him the celebrated book *On the Egyptian Mysteries,* which probably only emanated from his school. As a philosopher, Iamblichus had little originality. His contemporaries, like his admirers of the 15th and 16th centuries, looked upon him with extravagant veneration, but Eunapius, his biographer, merely says that he was inferior to Porphyry only in style. The modifications of Neoplatonism introduced by Iamblichus were the elaboration of its formal divisions, the more systematic application of the Pythagorean number-symbolism, and chiefly, under the influence of Oriental systems, a mystical colouring. Immediately after the absolute one of Plotinus (*see* NEOPLATONISM), Iamblichus introduced a second superexistent unity as the producer of intellect, and modified the three succeeding moments of the emanation (intellect, soul and nature). He speaks of them as intellectual, supramundane and mundane gods. The first of these is again distinguished into spheres of intelligible gods and of intellectual gods, each subdivided into triads, the latter sphere being the place of ideas, the former of the archetypes of these ideas. He identifies the Demiurge, Zeus, or world-creating potency with the perfected *νοῦς* (intellect), the intellectual triad being increased to a hebdomad, probably (as Zeller supposes) through the subdivision of its first two members. As in Plotinus *νοῦς* produced nature by mediation of *ψυχή* (soul), so here the intelligible gods are followed by a triad of psychic gods. The first of these is incommunicable and supramundane, while the other two seem to be mundane though rational. In the third class, or mundane gods, there is a great variety of gods, angels, demons and heroes. The world is thus peopled by a crowd of superhuman beings influencing natural events, possessing and communicating knowledge of the future, and not inaccessible to prayers and offerings. Nature is bound by the indissoluble chains of necessity, but being the result of higher powers becoming corporeal, a continual stream of elevating influence flows from them, interfering with the necessary laws and turning to good the imperfect and evil which is said to have been generated accidentally.

Iamblichus retains for the soul of men the middle place between intellect and nature which it occupies in the universal order. It descends by a necessary law (not solely for trial or punishment) into the body, and, passing perhaps from one human body to another, returns again to the supersensible by its virtuous activities. To the political, purifying, theoretical and paradigmatic virtues of Porphyry, Iamblichus adds the priestly virtues in which the divinest part of the soul raises itself by insight above intellect to absolute being. His tendency, however, was not so much to raise man to God as to bring the gods down to men. His ethical theory is strongly practical.

The works of Iamblichus are: (1) *On the Pythagorean Life* ed. T. Kiessling (1815), A. Nauck (St. Petersburg, 1884), Eng. trans. by T. Taylor (1818). (2) The *Exhortation to Philosophy,* ed. T. Kiessling (1813); H. Piselli (1888). (3) The treatise *On the General Science of Mathematics,* ed. J. G. Friis (Copenhagen, 1790), N. Festa (Leipzig, 1891). (4) The book *On the Arithmetic of Nicomachus* with fragments on fate and prayer, ed. S. Tennulius (1688), the *Arithmetic* by H. Pistelli (1894). (5) The *Theological Principles of Arithmetic* by F. Ast (Leipzig, 1817). The *Letters to Iamblicus the Philosopher* bearing the name of the emperor Julian are now considered spurious. The *Liber de mysteriis* (ascribed to Iamblichus but most probably by a pupil) was edited with Latin translation and notes, by T. Gale (Oxford, 1678), and by G. Parthey (Berlin, 1857); Eng. trans. by T. Taylor (1821). *See* G. E. Hebenstreit, *De Iamblichi, philosophi Syri, doctrina* (Leipzig, 1764); Harless, *Das Buch v. d. ägypt. Myst.* (Munich, 1858); T. Whittaker, *The Neo-Platonists* (Cambridge, 2nd ed., 1918); Eunapius, *Vitae Philosophorum;* Zeller, *Phil. d. Griechen;* E. Vacherot, *Hist. de l'école d' Alexandrie* (1846); Überweg, *Grund. der Gesch. der Phil.* Pt. I. (1926) with full bibliography. *See* NEO-PLATONISM.

IAMBLICHUS, of Syria, the earliest of the Greek romance writers, flourished in the 2nd century A.D. He was the author of *βυλωνιακά,* Βα the loves of Rhodanes and Sinonis, of which an epitome is preserved in Photius (cod. 94). Only a few fragments have been preserved. According to Suidas Iamblichus is said to have been a freedman.

IAPETUS, in Greek mythology, son of Uranus and Ge, one of the Titans, father of Atlas, Prometheus, Epimetheus, and Menoetius (Hesiod, *Theog.* 507). As a punishment for having revolted against Zeus, he was imprisoned in Tartarus (Homer, *Iliad,* viii. 479) or underneath the island of Inarime off the coast of Campania (Silius Italicus xii. 148). Hyginus makes him the son of Tartarus and Ge, and one of the giants. The etymology of the name is doubtful, but it certainly has nothing to do with the Hebrew Japhet.

See Preller-Robert, i. p. 47.

IAPYDES (ī-ahp′-ü-dās) or **IAPODES,** one of the three chief peoples of Roman Illyria. They occupied the interior of the country on the north between the Arsia and Tedanius, which separated them from the Liburnians. Their territory formed part of the modern Croatia. A mixed race of Celts and Illyrians, who used Celtic weapons and tattooed themselves, they were warlike and addicted to plundering expeditions. In 129 B.C. C. Sempronius Tuditanus celebrated a triumph over them, and in 34 B.C. they were finally crushed by Augustus.

See Strabo iv. 207, vii. 313–315; Dio Cassius xlix. 35; Appian, *Illyrica,* 10, 14, 16; Livy, *Epit.* lix. 131; Tibullus iv. 1. 108; Cicero, *Pro Balbo,* 14.

IATROCHEMISTRY (coined from Gr. *ἰατρός,* a physician, and "chemistry"), a stage in the history of chemistry, during which the object of this science was held to be "not to make gold but to prepare medicines." This doctrine dominated chemical thought during the 16th century, its foremost supporters being Paracelsus, J. B. van Helmont, and F. de la Boë Sylvius. But it gave way to the new definition formulated by Boyle, viz., that the proper domain of chemistry was "to determine the composition of substances." (*See* ALCHEMY; CHEMISTRY.)

IAZYGES (ī-ahz′-ü-gās), Sarmatian tribe on the Maeotis, allies of Mithridates the Great (q.v.). Moving westward across Scythia, they were on the lower Danube by the time of Ovid, and about A.D. 50 occupied the plains east of the Theiss. Here, under the general name of Sarmatae, they were a perpetual trouble to Dacia (q.v.) the Roman province. They were divided into freemen and serfs, the latter of whom were probably an older settled population enslaved by nomad masters. They rose against them in A.D. 344, but were repressed. Nothing is heard of Iazyges or Sarmatae after the Hunnish invasions.

IBADAN, a town of British West Africa, in Yorubaland, Southern Nigeria, 123 m. by rail north-east of Lagos, and about 50 m. north-east of Abeokuta. Ibadan is the largest negro city in Africa, having an urban population of over 175,000, and with its farm suburbs, 238,000 inhabitants. It occupies the slope of a hill, and stretches into the valley through which the river Ona flows. It is enclosed by mud walls, which have a circuit of 18 m., and is encompassed by cultivated land 5 or 6 m. in breadth. The native houses are low, thatched structures, enclosing a square court, the only break in the mud wall being the door. There are numerous mosques, *orishas* (idol-houses) and open spaces shaded with trees. There are also buildings in the European style. Most of the inhabitants are engaged in agriculture; but a great variety of handicrafts is also carried on. The administration is in the hands of two chiefs, a civil and a military, the *bali* and the *balogun.* There is also an *iyaloda* or mother of the town, to whom are submitted the disputes of the women. The town is in the province of Oyo and is subject to the authority of the *alafin* (ruler) of Oyo, who is guided by the advice of a British resident. For many years the Ibadans had shown a tendency to flout the authority of the *alafin* and set up a separate rule under their own *bali.* This tendency to the disintegration of Yorubaland was checked, and misrule replaced by good government through reforms instituted by Sir F. D. (Lord) Lugard in 1914–18. (*See* also YORUBA.)

(F. R. C.)

IBAGUE, or SAN BONIFACIO DE IBAGUÉ, a city of Colombia and capital of the department of Tolima, about 60m. W. of Bogota and 18m. N.W. of the Nevado de Tolima. Pop. (1900) est. 13,000, (1918) 30,255. Ibague is built on a beautiful plain between the Chipalo and Combeima, small affluents of the Cuello, a western tributary of the Magdalena. Its elevation, 4,300ft. above the sea, gives it a mild, subtropical climate. The plain and the neighbouring valleys produce cacao, tobacco, rice and sugar-cane. It is an important commercial centre, being on the road which crosses the Quindio pass, or *paramo,* into the Cauca valley. Ibague was founded in 1550 and was the capital of the republic for a short time in 1854.

IBÁÑEZ, VICENTE BLASCO (1867–1928), Spanish novelist and politician, was born at Valencia. He became an impassioned political agitator and suffered exile, hard labour and frequent imprisonment for his opinions, although he was returned to parliament on eight occasions by his native city. His early novels, such as *Arroz y Tartana, La Barraca* and *Cañas y Barro,* deal with life in Valencia and are remarkable for their vivid descriptions. Although a republican, Ibáñez held strong anti-feminist opinions. He travelled extensively and achieved world-wide success as a writer for the cinematograph. Among his best-known novels are *La Catedral* (1903; Eng. trans., *The Shadow of the Cathedral,* 1909); *Sangre y Arena* (1908; Eng. trans., *Blood and Sand,* 1913); *Los cuatro Jinetes del Apocalipsis* (1916; Eng. trans., *The Four Horsemen of the Apocalypse,* 1918) and *Mare Nostrum* (1918; Eng. trans., *Our Sea,* 1920). He was unpopular in Spain, where his writings were ignored by the majority, and he eventually settled in Paris, becoming the centre of a group of politicians with anti-monarchical views. A journey to America led to the production of such novels as *Los Argonautas* and *La Tierra de Todos,* but in these, as in other works, Ibáñez failed to recapture the charm and realism of his regional novels.

IBANS (SEA DAYAKS). Mostly in the south-west of Borneo, but scattered, on account of their migratory habits, over various parts, usually not far from the coast, are the Ibans, who may be described as a butterfly people. The word Iban, or Ivan, meaning "wanderer," was applied to them by the Kayans and has only been adopted by the Ibans themselves within the last half century. Their skin is darker than that of the other tribes and their hair longer; their mouths are often shapeless and their teeth are filed and discoloured by the chewing of betel-nut. They are, however, a most likeable people and are the tribe best known and best liked by Europeans. They are cheerful, talkative, and sociable, but very ready to quarrel and addicted to litigation. Individually they are vain and self-indulgent, and given to boasting and exaggeration. These faults often lead collectively to a want of discipline, their individualistic bent and their camaraderie being responsible for follies, and even excesses, in which every man follows his neighbour. For this reason the chief in an Iban long house or village has less power and influence than is the case among Kayans or Kenyahs. On the other hand, when an Iban is given some special work by a European his vanity impels him to do it well, and, coupled with a natural adaptability, makes him a more loyal adherent of a settled government.

As Ibans rarely remain in one village for more than three years at a stretch, they are not great builders, but in smaller material and in detail they are such skilled artists that their houses, though unsubstantial, are full of conveniences and amenities. Though they are spoken of as sea dyaks, they are not really a sea-faring people; they are often content with makeshift arrangements as to boats, most of their canoes consisting simply of the hollowed out trunks of big trees. In many sorts of decorative work, such as bead or shell-work, and various patterned articles of clothing, they excel. In general, their faults and their virtues alike leap to the eye; but their geniality and willingness, their versatility and humour, make for attractiveness. *See* BORNEO.

See C. Hose and W. McDougall, *The Pagan Tribes of Borneo* (1912).

IBARRA, a city of Ecuador and capital of the province of Imbabura, is situated about 50 m. N.N.E. of Quito in lat. 25′ N. and long. 78° 10′ W., on a small fertile plain at the northern foot of Imbabura volcano, 7,340 ft. above sea-level. Pop. (1926 estimate) 10,000. It stands on the left bank of the Tahuando, a small stream whose waters flow north and west to the Pacific through the Mira, and is separated from the higher plateau of Quito by an elevated transverse ridge of which the Imbabura and Mojanda volcanoes form a part. Ibarra itself has a mild, humid climate, and is set in the midst of orchards and gardens. It is the see of a bishop and has a large number of churches and convents, and many substantial residences. Ibarra has manufactures of cotton and woollen fabrics, hats, sandals (*alpargates*), sacks and rope from *cabulla* fibre, laces, sugar and various kinds of distilled spirits and cordials made from the sugar-cane grown in the vicinity. The city was founded in 1597 by Alvaro de Ibarra, president of Quito. It has suffered from the eruptions of Imbabura, and more severely from earthquakes, that of 1859 causing great damage to its public buildings, and the greater one of Aug. 16, 1868, almost completely destroyed the town and killed a large number of its inhabitants. The village of Carranqui, 1½ m. from Ibarra, is the birthplace of Atahualpa, the Inca sovereign executed by Pizarro, and close by is the small lake called Yaguarcocha where the army of Huaynacapac, the father of Atahualpa, inflicted a bloody defeat on the Carranquis. Another aboriginal battle-field is that of Hatuntaqui, near Ibarra, where Huaynacapac won a decisive victory and added the greater part of Ecuador to his realm.

IBERIANS, an ancient people inhabiting parts of the Spanish peninsula. The name was applied by the earlier Greek navigators to the peoples who inhabited the eastern coast of Spain; originally those who dwelt by the river Iberus (mod. *Ebro*). The river's name itself may represent the Basque phrase *ibay erri,* "the country of the river." In older Greek usage the term Iberia embraced the country as far east as the Rhone and by the time of Strabo it was the common Greek name for the Spanish peninsula. Iberians thus meant sometimes the population of the peninsula in general and sometimes one element in that population. In Spain, when this element first became known to the Greeks and Romans, there existed many separate and variously civilized tribes connected by at least apparent identity of race, and by similarity (but not identity) of language, and sufficiently distinguished by their general characteristics from Phoenicians, Romans and Celts.

1. **Numismatic.**—Knowledge of ancient Iberian language and history is mainly derived from a variety of coins, found widely distributed in the peninsula, and also in the neighbourhood of Narbonne. (For the prehistoric civilization of the peninsula as a whole *see* SPAIN.) They are inscribed in an alphabet which has many points of similarity with the western Greek alphabets, and some with the Punic alphabet, but retains a few characters from an older script. The same Iberian alphabet is found also rarely in inscriptions. The coinage began before the Roman conquest was completed; the monetary system resembles that of the Roman republic, with values analogous to *denarii* and *quinarii.* The coin inscriptions usually give only the name of the town; *e.g., Ilplis* (Bilbilis), *Klaqriqs* (Calagurris), *Seqbrics* (Segobriga), *Tmaniare* (Dumania). The types show late Greek and perhaps also late Punic influence, but approximate later to Roman models. The commonest reverse type, a charging horseman, reappears on the Roman coins of Bilbilis, Osca, Segobriga and other places. Another common type is one man leading two horses or brandishing a sword or a bow. The obverse has usually a male head, sometimes inscribed with what appears to be a native name.

2. **Linguistic.**—The survival of the Basque language (*q.v.*) around the west Pyrenees suggested the attempt to interpret by its means a large class of similar-sounding place names of ancient Spain, some of which are authenticated by their occurrence on the inscribed coins, and to link it with other traces of non-Aryan speech round the shores of the western Mediterranean and on the Atlantic seaboard of Europe. K. W. von Humboldt contended that there existed once a single great Iberian people, speaking a distinct language of their own; that an essentially "Iberian" population was to be found in Sicily, Sardinia and Corsica, in southern France, and even in the British Isles; and that the Basques of the present day were remnants of this race, which had elsewhere been expelled or absorbed. He adduced explanations

of a vast number of the ancient topographical names of Spain, and of other asserted Iberian districts, by the forms and significations of Basque.

3. **Anthropological.**—This "Iberian theory" depended partly on the widespread similarity of physical type among the population of south-western Europe. Anthropological researches have proved the existence in Europe, from Neolithic times, of a race, small of stature, with long or oval skulls, who buried their dead in tombs. Their remains have been found in Belgium and France, in Britain, Germany and Denmark, as well as in Spain; and they bear a close resemblance to a type common among the Basques and all over the Iberian peninsula. This Neolithic race has consequently been nicknamed "Iberians," and the racial characteristics of "Iberians," have been identified in the "small swarthy Welshman," the "small dark Highlander," and the "Black Celts to the west of the Shannon," as well as in the typical inhabitants of Aquitania and Brittany. Thus a race with fairly uniform characteristics was at one time in possession of the south of France (or at least of Aquitania), the whole of Spain from the Pyrenees to the straits, the Canary Islands (the Guanches) a part of northern Africa and Corsica. Whether this type is more conveniently designated by the word *Iberian*, or by some other name ("Eur-African," "Mediterranean," etc.) is a matter of comparative indifference, provided that there is no misunderstanding as to the steps by which the term *Iberian* attained its meaning in modern anthropology.

IBERVILLE, PIERRE LE MOYNE, SIEUR D' (1661–1706), French-Canadian soldier and colonizer of Louisiana, was born in Montreal, Canada, on July 16, 1661. He was one of eleven sons of Charles Le Moyne, all of whom performed distinguished service in the extension of the French empire in America. The elder son, Charles Le Moyne, Baron de Longueuil, later became governor of Canada. A younger son, Jean Baptiste Sieur d'Bienville, became Iberville's lieutenant in founding the Louisiana colony, and later first governor of that province. At the age of 14 d'Iberville was appointed midshipman in the French navy and sent to France. After four years service on French ships he returned to Canada. In 1886 he led a detachment on the overland expedition under De Troyes against the English forts on Hudson bay and aided in the reduction of forts Monsipi, Rupert and Kitchichouame (later Fort Albany), also with the aid of his brothers capturing two English vessels. He was left in command of the forts, 1886–89, and in 1888 succeeded in taking two more English ships. In 1890 he was a leader of the French expedition against Schenectady, but before the end of the year returned to Hudson bay to recapture Fort Albany which had relapsed into English control. In 1694 he led a land expedition which captured Ft. Nelson, on Hudson bay. During the winter of 1896–97 he captured Fort Pemaquid and ravaged the English settlements on the coast of Newfoundland. In 1897, in command of a frigate, he again entered Hudson bay and defeated three superior English vessels in a desperate engagement. Afterwards he again took Fort Nelson which the English had recaptured. After the Peace of Ryswick d'Iberville was called to France and commissioned by the marine minister, Pontchartrain, to found a settlement at the mouth of the Mississippi. He left Brest in Oct. 1698 with four vessels and 200 colonists and reached Mobile bay in Jan. 1699. Here the colonists were left while d'Iberville and a number of men searched the coast for the Mississippi, which was entered at the delta and ascended probably to the mouth of the Red river. No favourable site for a colony was found along the river, and, it being late, d'Iberville built Ft. Maurepas on the present site of Biloxi, Miss., and there left his colonists. This was the first permanent French settlement on the Gulf coast.

Returning the next year, d'Iberville built a post on the Mississippi river near New Orleans and explored much of the lower valleys of the Red and Mississippi rivers. Returning a third time in 1701, he found his colony badly reduced by disease and transferred most of the colonists to Mobile. He returned for additional colonists, but France was again at war, and d'Iberville was retained for naval service. He was given command of the West Indian fleet, and in 1706 invaded the islands of Nevis and St. Christopher forcing them to surrender and capturing 30 ships and 1750 men. While outfitting at Havana for an expedition against the Carolinas, he fell ill with fever and died July 9, 1706.

D'Iberville's journal is found in B. F. French, *Historical Collections of Louisiana and Florida*, 2nd series (1875). *See* also H. Gravier, *L'Oeuvre de d'Iberville à la Louisiane* (1899); C. B. Reed, *The First Great Canadian* (1910).

IBEX, the Alpine wild goat, *Capra ibex*. Formerly common in the Alps, the ibex is now confined to the Gran Paradiso range in the neighbourhood of Cogne, and to the Swiss National Park in the Engadine. It measures about 4½ ft. in length and stands about 40in. at the shoulder. In summer the short fur is ashy grey, but in winter this is concealed by long yellowish-brown hairs. The horns are long, curved backwards and ridged on the front surface. The forelegs are somewhat shorter than the hind-limbs. The agility of the ibex on its native mountains is astounding. It inhabits the line of perpetual snow, descending at night to graze in the highest woods. The ibex is gregarious, living in small herds, but the old males are usually solitary. The female, after a period of gestation of 90 days, produces a single young one, which is at once able to follow her. The flesh resembles mutton, but with a flavour of game.



BY COURTESY OF THE NEW YORK ZOOLOGICAL SOCIETY

THE IBEX OR ALPINE WILD GOAT

The name "ibex" has been extended to include allied species of which the Asiatic ibex (*C. sibirica*), ranging over Central Asia, is the finest and may possess horns 60in. long. Other species, differing in the thickness of and ridges on the horns, occur in Arabia, Abyssinia, the Caucasus and the Pyrenees, and the name is also applied to the short-horned Indian *Hemitragus hylocruis* from the Nilgiris.

IBIS, one of the sacred birds of ancient Egypt, *Ibis aethiopica*. The myth of the Ibis is explained by Renouf in his *Hibbert Lectures*. The ibis inhabits the Nile basin from Dongola southward, as well as Kordofan and Sennar. It arrives in Egypt in summer, disappearing again as the Nile subsides. It is somewhat larger than a curlew, with a much stouter beak and legs. The plumage is black and white, the bare head and neck being black. The bill and feet are black. The birds nest in colonies in trees or bushes; two to four white eggs spotted with reddish-brown are laid. The young are hatched in August.



BY COURTESY OF THE AMERICAN MUSEUM OF NATURAL HISTORY

THE WHITE-FACED IBIS OF EGYPT

Numerous other species occur in the tropics and subtropics throughout the world. These include *Eudocimus ruber*, the scarlet ibis of America (usually substituted for *I. aethiopica* by artists); and the glossy ibis (*Plegadis falcinellus*) with an enormous range, including all five continents. The *Ibididae* are related to the spoonbills (*Plataleidae*) and storks (*Ciconiidae*).

IBLĪS, in Muslim mythology the counterpart of the Christian and Jewish devil. He figures oftener in the Qur'ān under the name Shayṭān, Iblīs being mentioned 11 times, whereas Shayṭān appears in 87 passages. Iblīs rebelled against Allāh and was expelled from Paradise but was afterwards respited till the Judgment day (Qur'ān vii. 13). The Qur'ānic story is that his fall was a punishment for his refusal to worship Adam.

See Iblīs (in *Encyclopaedia of Islam*, bibl.); L. Massignon, *Al-Hallaj*, p. 869 *sqq.* (1922).

IBN 'ABD RABBIHI (Abū 'Umar Aḥmad ibn Mohammed ibn 'Abd Rabbihi) (860–940), Arabian poet, was born in Cordova. He enjoyed a great reputation for learning and eloquence. No diwan of his is extant, but many selections from his poems are given in the *Yatīmat ud-Dahr*, i. 412–436 (Damascus, 1887). His great anthology, the *'Iqd ul-Farīd* ("The Precious Necklace"), is an *adab* book (*see* ARABIA: *Literature*, section "Belles Lettres") resembling Ibn Qutaiba's *'Uyūn ul-Akhbār*, from which it borrows largely. It has been printed several times in Cairo (1876, 1886).

IBN 'ARABĪ [Muḥyiuddīn Abū 'Abdallāh ibn ul-'Arabī] (1165–1240), Muslim theologian and mystic, was born in Murcia and educated in Seville. When thirty-eight he travelled in Egypt, Arabia, Baghdad, Mosul and Asia Minor, after which he lived in Damascus for the rest of his life. In law he was a Zahirite, in theology a mystic of the extreme order, though professing orthodox Ash'arite theology and combating in many points the Indo-Persian mysticism (pantheism). He claims to have had conversations with all the prophets past and future, and reports conversations with God himself. Of his numerous works about 150 still exist. The most extensive is the twelve-volume *Futuḥāt ul-Makkīyāt* ("Meccan Revelations"), a general encyclopaedia of Sufic beliefs and doctrines.

Of some 289 works said to have been written by Ibn 'Arabī 150 are mentioned in C. Brockelmann's *Gesch. der arabischen Litteratur*, vol. i. (Weimar, 1898), pp. 441–448. *See* also R. A. Nicholson, *A Literary History of the Arabs*, pp. 399–404 (1907).

IBN ATHĪR, the family name of three brothers, all famous in Arabian literature, born at Jazīrat ibn 'Umar in Kurdistan. The eldest brother, MAJD UD-DĪN (1149–1210), was long in the service of the amir of Mosul. His dictionary of traditions (*Kitāb un-Nihāya*) was published at Cairo (1893), and his dictionary of family names (*Kitāb ul-Murassa'*) has been edited by Seybold (Weimar, 1896). The youngest brother, DIYĀ UD-DĪN (1163–1239), served Saladin from 1191 on, then his son, al-Malik ul-Afdal, and was afterwards in Egypt, Samosata, Aleppo, Mosul and Baghdad. He was one of the most famous aesthetic and stylistic critics in Arabian literature. His *Kitāb ul-Mathal*, published in Bulāq in 1865 (cf. *Journal of the German Oriental Society*, xxxv., and Goldziher's *Abhandlungen*, i.), contains some very independent criticism. Some of his letters have been published by D. S. Margoliouth "On the Royal Correspondence of Diya ed-Din el-Jazari" in the *Actes du dixième congrès international des orientalistes*, sect. 3.

The brother best known by the simple name of Ibn Athīr was ABU-L-ḤASAN 'IZZUDDĪN MAHOMMED IBN UL-ATHĪR (1160–1234), who devoted himself to history. At the age of twenty-one he settled in Mosul. In the service of the amir for many years, he visited Baghdad and Jerusalem and later Aleppo and Damascus. His great history, the *Kāmil*, which extends to 1231, was edited by C. J. Tornberg, *Ibn al-Athiri Chronicon quod perfectissimum inscribitur* (14 vols., Leiden, 1851–76), and has been published in 12 vols. in Cairo (1873 and 1886). The first part of this work up to A.H. 310 (A.D. 923) is an abbreviation of the work of Ṭabarī (*q.v.*) with additions. Ibn Athīr also wrote a history of the Atabegs of Mosul, published in the *Recueil des historiens des croisades* (vol. ii., Paris); a work (*Usd ul-Ghāba*), giving an account of 7,500 companions of Mohammed (5 vols., Cairo, 1863), and a compendium (the *Lubāb*) of Sam'ānī's *Kitāb ul-Anṣab*. (*Cf.* F. Wüstenfeld's *Specimen el-Lobabi*, Göttingen, 1835.)

IBN BATUTA, *i.e.*, Abu Abdullah Mohammed, surnamed Ibn Batuta (1304–1378), the greatest of Moslem travellers, was born at Tangier in 1304. He entered on his travels in 1325 and closed them in 1355. He began by traversing the Mediterranean coast from Tangier to Alexandria, marrying twice on the road. After some stay at Cairo, and an unsuccessful attempt to reach Mecca from Aidhab on the west coast of the Red Sea, he visited Palestine, Aleppo and Damascus. He then made the pilgrimage to Mecca and Medina, and visited the shrine of Ali at Nejef (Mashhad-Ali), travelling to Basra, and across the mountains of Khuzistan to Isfahan, thence to Shiraz and back to Kufa and Baghdad. After an excursion to Mosul and Diarbekr, he made the *haj* a second time, staying at Mecca three years. He next sailed down the Red Sea to Aden (then a place of great trade), the singular position of which he describes, noticing its dependence for water-supply upon the great cisterns restored in modern times. He continued his voyage down the African coast, visiting, among other places, Mombasa and Quiloa (Kilwa). Returning north he passed by the chief cities of Oman to New Ormuz (Hurmuz), which about 1315 had been transferred to its famous island-site from the mainland (Old Ormuz). After visiting other parts of the gulf he crossed Arabia to Mecca, making the *haj* for the third time. Crossing the Red Sea, he made a journey to Aswan (Syene) and along the Nile to Cairo. After this, travelling through Syria, he made a circuit among the petty Turkish states. He now crossed the Black Sea to Kaffa, then mainly occupied by the Genoese, and apparently the first Christian city he had seen, for he was much perturbed by the bell-ringing. He next travelled into Kipchak (the Mongol khanate of Russia), and joined the camp of the reigning khan Mohammed Uzbeg, from whom the *Uzbeg* race is perhaps named. Among other places in this empire he travelled to Bolghar (54° 54′ N.) in order to witness the shortness of the summer night, and desired to continue his travels north into the "Land of Darkness" (in the extreme north of Russia), but was obliged to forego this.

Returning to the khan's camp he joined the cortège of one of the Khatuns, who was a Greek princess and in her train travelled to Constantinople, where he had an interview with the emperor Andronikos III. the Younger (1328–1341). He tells how, as he passed the city gates, he heard the guards muttering *Sarakinu*. Returning to the court of Uzbeg, at Sarai on the Volga, he crossed the steppes to Khwarizm and Bokhara; thence through Khorasan and Kabul, and over the Hindu Kush (to which he gives that name, its first occurrence). He reached the Indus in 1333.

Sojourn in the East.—From Sind, which he traversed to the sea and back again, he went to Multan, and eventually, on the invitation of Mahommed Tughlak, the reigning sovereign, to Delhi. He appointed the traveller to be kazi of Delhi. In the sultan's service Ibn Batuta remained eight years; but his good fortune stimulated his natural extravagance, and his debts soon amounted to four or five times his salary. He fell into disfavour and retired from court, only to be summoned again to accompany an embassy to the emperor of China, last of the Mongol dynasty. The party travelled through central India to Cambay and thence sailed to Calicut, classed by the traveller with the neighbouring Kaulam (Quilon), Alexandria, Sudak in the Crimea, and Zayton (Amoy harbour) in China, as one of the greatest trading havens in the world. The party was to embark in Chinese junks (the word used) and smaller vessels, but that carrying the other envoys and the presents, which started before Ibn Batuta was ready, was totally wrecked; the vessel that he had engaged went off with his property, and he was left at Calicut. Not daring to return to Delhi, he remained about Honore and other cities of the western coast, taking part in various adventures, among others the capture of Sindabur (Goa), and visiting the Maldive islands, where he became kazi, and married four wives. In 1344 he left the Maldives for Ceylon; here he made the pilgrimage to the "Footmark of our Father Adam." Thence he went to Malabar (the Coromandel coast), where he joined a Mussulman adventurer of Madura. After again visiting Malabar, Canara and the Maldives, he left for Bengal, a voyage of 43 days, landing at Sadkawan (Chittagong). In Bengal he visited the Moslem saint Shaykh Jalaluddin, whose shrine (Shah Jalal at Silhet) is still maintained. Returning to the delta, he took a junk at Sunarganw (near Dacca) bound for Java (*i.e.*, Java Minor of Marco Polo, or Sumatra). He reached Sumatra in 40 days, and was provided with a junk for China by Malik al Dhahir, disciple of Islam. Calling (apparently) at Cambodia on his way, Ibn Batuta reached China at Zayton (Amoy harbour), famous from Marco Polo; he also visited Sin Kalan or Canton, and professes to have been in Khansa (Kinsay of Marco Polo, *i.e.*, Hangchau), and Khanbalik (Cambaluc or Peking).

The Return Journey.—On his way home he saw the great bird *Rukh* (evidently, from his description, an island lifted by refraction); revisited Sumatra, Malabar, Oman, Persia, Baghdad,

and crossed the great desert to Palmyra and Damascus, where he got his first news of home, and heard of his father's death 15 years before. Diverging to Hamath and Aleppo, on his return to Damascus, he found the Black Death raging. Revisiting Jerusalem and Cairo he made the *haj* a fourth time, and finally reappeared at Fez (visiting Sardinia *en route*) on Nov. 8, 1349, after 24 years' absence. Morocco, he felt, was, after all, the best of countries. "The *dirhems* of the West are but little; but then you get more for them." After going home to Tangier, Ibn Batuta crossed into Spain and toured Andalusia, including Gibraltar, following a siege from the "Roman tyrant Adfunus" (Alphonso XI. of Castile, 1312–1350). In 1352 he started for Central Africa, passing by the oases of the Sahara (where the houses were built of rock-salt, as Herodotus tells, and roofed with camel skins), to Timbuktu and Gogo on the Niger, a river which he called the Nile, believing it to flow down into Egypt. Being then recalled by his own king, he returned to Fez (early in 1354) via Takadda, Haggar and Tuat. Thus ended his 28 years' wanderings which easily exceeded 75,000 miles. By royal order he dictated his narrative to Mohammed Ibn Juzai, who concluded the work (1355), with the declaration: "This Shaykh is the traveller of our age; and he who should call him the traveller of the whole body of Islam would not exceed the truth." Ibn Batuta died in 1378, aged 73.

Ibn Batuta's travels have only been known in Europe during the 19th century; at first merely by Arabic abridgments in the Gotha and Cambridge libraries. Notices or extracts had been published by Seetzen (*c.* 1808), Kosegarten (1818), Apetz (1819) and Burckhardt (1819), when in 1829 Dr. S. Lee published for the Oriental Translation Fund a version from the abridged mss. at Cambridge, which attracted interest. The French capture of Constantina (Spain, 40 m. N. of Seville) afforded mss. of the complete work, one of them the autograph of Ibn Juzai. And from these, after versions of fragments by various French scholars, was derived at last (1858–59) the standard edition and translation of the whole by M. Défrémery and Dr. Sanguinetti, in 4 vols. *See* also Sir Henry Yule, *Cathay*, ii. 397–526; C. Raymond Beazley, *Dawn of Modern Geography*, iii. 535–538; and a volume of *Selections* (Broadway Travellers series, 1927).

IBN DURAID (Abū Bakr Mohammed ibn ul-Hasan ibn Duraid ul-Azdī) (837–934), Arabian poet and philologist, was born at Baṣra of south Arabian stock, but fled in 871 to Oman at the time Baṣra was attacked by the negroes, known as the Zanj, under Muhallabī. In 883 he went to Persia, where he remained until 920 when he settled in Baghdad.

The poem *Maqṣūra* was edited by A. Haitsma (1773), E. Scheidius (1786) and N. Boyesen (1828). The *Kitāb ul-Ishtiqāq* ("Book of Etymology"), ed. F. Wüstenfeld (Göttingen, 1854), was written in opposition to the anti-Arabian party to show the etymological connection of the Arabian tribal names. The *Jamhara fi-l-Lugha*, a large dictionary in Persian, is not printed. *See* Brockelmann, *Gesch. der arab. Lit.* i. (Weimar, 1898).

IBN EZRA, ABRAHAM BEN MEIR: *see* ABENEZRA.

IBN FARADĪ (Abū-l-Walīd ʿAbdallāh ibn ul-Faradi) (962–1012), Arabian historian, was born at Cordova and studied law and tradition. In 992 he made the pilgrimage and proceeded to Egypt and Kairawān. After his return in 1009 he became cadi in Valencia, and was killed at Cordova when the Berbers took the city.

His chief work is the *History of the Learned Men of Andalusia*, edited by F. Codera (Madrid, 1891–92). He wrote also a history of the poets of Andalusia. (G. W. T.)

IBN FĀRID (Abū-l-Qāsim ʿUmar ibn ul-Fārid) (1181–1235), Arabian poet, was born in Cairo, lived for some time in Mecca and died in Cairo. His poetry is entirely Sufic, and he was esteemed the greatest mystic poet of the Arabs. His diwan was published with commentary at Beirūt, 1887, etc.; with the commentaries of Burīnī (d. 1615) and ʿAbdul-Ghānī (d. 1730) at Marseilles, 1853, and at Cairo; and with the commentary of Rushayyid Ghālib (19th century) at Cairo, 1893. One of the separate poems was edited by J. von Hammer Purgstall as *Das arabische hohe Lied der Lieve* (Vienna, 1854).

See R. A. Nicholson, *A Literary History of the Arabs* (1907). (G. W. T.)

IBN GABIROL (SOLOMON BEN JUDAH, or AVICEBRON and AVENCEBROL to the Schoolmen) (*c.* 1021–*c.* 1058–1070), Jewish poet and philosopher, was born at Malaga. His early years were spent at Saragossa, where he came under the protection of Samuel ha-Nagid, the well known patron of learning. At the age of 16 he is supposed to have written poems including the *ʿAnaq*, a poem on grammar, partially extant. He first popularized the use of Arabic metres in Hebrew, and it is as a poet that he has been remembered by the Jews. To the liturgy he contributed many fine lyrical compositions, the best known being the philosophical *Kether Malkūth* (for the Day of Atonement) and the *Azharōth*, on the 613 precepts (for *Shebhuʿōth*).

Ibn Gabirol's chief philosophical work, which was translated from Arabic into Latin by Johannes Hispalensis and Gundisalvi under the title, *Fons Vitae*, exercised a wide influence on the Schoolmen, though Jewish thinkers practically ignored it because of its non-religious attitude and its neo-Platonic inspiration. In it, Ibn Gabirol speaks of God as unknowable and transcendental, but he tries to save Him from being impersonal by making His wisdom the ground of all being and by admitting the activity of His will in the production of the universe. His views on the Will are peculiar, for he regards it as an hypostasis identifiable in itself with the Divine nature, but distinguishable inasmuch as it is active. Elsewhere he says it is to the world as soul to body, holding it together and penetrating it as a principle of movement. From the Will emanate the intelligences which, as creatures, must possess two factors, namely, universal matter and universal form. The former, which is the source of the potentiality and finite nature in spiritual beings, sustains the universal form which confers the perfecting properties. The intelligences produce the corporeal world in which universal matter is differentiated into materia universalis corporalis, materia universalis caelestis, materia universalis naturalis and materia particularis naturalis. To these types of matter there are corresponding forms.

BIBLIOGRAPHY.—Besides the above mentioned works, Ibn Gabirol wrote *Islāh al-akhlāq*, a popular ethical work (Arabic text and Eng. trans. by S. S. Wise, New York, 1901) and a collection of moral maxims (Eng. trans. New York, 1925, Hebrew and English edit. by Ascher, 1859); Texts of the liturgical poems are to be found in the prayer-books; others in Dukes and Edelmann, *Treasures of Oxford* (Oxford, 1850); Dukes, *Shīrē Shelomoh* (Hanover, 1858); S. Sachs, *Shīṣ ha-shīrīm asher li-Shelomoh* (Paris, 1868, incomplete); Brody; *Die weltlichen Gedichte des . . . Gabirol* (Berlin, 1897, etc.). The Latin text of the *Fons Vitae* was published by C. Baeumker (Münster, 1892). *See* S. Munk, *Mélanges de Philos. juive et arabe* (1859); Wittmann, *Die Stellung des hl. T. von Aquin zu Avencebrol* (Münster, 1900) and *Zur Stellung Avencebrol's im Entwicklungsgang der arabischen Philosophie* (Münster, 1905); D. Neumark, *Gesch. d. jud. Philos. im Mittelalt.* I. (1907) and I. Husik, *Hist. of Mediaeval Jewish Philosophy* (1916); J. Guttmann, *Die Philosophie des ibn Gabirol* (Göttingen, 1889); D. Kaufmann, *Studien über Sal. ibn Gabirol* (Budapest, 1899).

IBN HAUḲAL, strictly Ibn Hauqal, a 10th century Arabian geographer. Nothing is known of his life. His work on geography, written in 977, is only a revision and extension of the *Masālik ul-Mamālik* of al-Iṣṭakhrī who wrote in 951. This itself was a revised edition of the *Kitāb ul-Ashkāl* or *Ṣuwar ul-Aqālim* of Abū Zaid ul-Balkhī, who wrote about 921. Ibn Hauḳal's work was published by M. J. de Goeje (Leiden, 1873). An anonymous epitome of the book was written in 1233.

See M. J. de Goeje, "Die Iṣtahrī-Balhī Frage," in the *Zeitschrift der deutschen Morgenländischen Gesellschaft*, xxv. 42 *sqq.*

IBN ḤAZM (Abū Mohammed ʿAlī ibn Aḥmad ibn Ḥazm) (994–1064), Moslem theologian, was born in a suburb of Cordova. He studied history, law and theology, and became a vizier as his father had been before him, but was deposed for heresy, and spent the rest of his life quietly in the country. In legal matters he belonged first to the Shāfiʿite school, but came to adopt the views of the Zāhirites, who admitted only the external sense of the Koran and tradition, disallowing the use of analogy (*Qiyās*) and *Taqlīd* (appeal to the authority of an imām), and objecting altogether to the use of individual opinion (*Raʾy*). Ibn Ḥazm extended the application of these principles from the study of law to that of dogmatic theology. His chief work is the *Kitāb ul-Milal wan-Niḥal*, or "Book of Sects" (published in Cairo, 1899).

For his teaching *cf.* I. Goldziher, *Die Zahiriten*, pp. 116–172 (Leipzig,

1884), and M. Schreiner in the *Journal of the German Oriental Society*, lii. 404–486. For a list of his other works *see* C. Brockelmann's *Geschichte der arabischen Literatur*, vol. i. (Weimar, 1898), p. 400.

IBN HISHĀM (Abū Mohammed 'Abdulmalik ibn Hishām ibn Ayyūb ul-Himyari) (d. 834), Arabian biographer, studied in Kufa but lived afterwards in Fostāt (old Cairo), where he gained a name as a grammarian and student of language and history. His chief work is his edition of Ibn Isḥāq's (*q.v.*) *Life of the Apostle of God*, ed. by F. Wüstenfeld (Göttingen, 1858–1860).

IBN ISḤĀQ (Mohammed ibn Isḥāq Abū 'Abdallāh) (d. 768), Arabic historian, lived in Medina, where he interested himself to such an extent in the details of the Prophet's life that he was accused of rationalism. He consequently left Medina in 733, and went to Alexandria, then to Kufa and Hira, and finally to Baghdad, where he wrote the *Life of the Apostle of God*, which is now lost and is known to us only in the recension of Ibn Hishām (*q.v.*). The work has been attacked by Arabian writers (as in the *Fihrist*) as untrustworthy, and it seems clear that he introduced forged verses (cf. *Journal of the German Oriental Society*, xiv.). It remains, however, one of the most important works of the age.

IBN JUBAIR [Abū-l Ḥusain Maḥommed ibn Aḥmad ibn Jubair] (1145–1217), Arabian geographer, was born in Valencia. At Granada he studied the Koran, tradition, law and literature, and later became secretary to the Mohad governor of that city. During this time he composed many poems. In 1183 he left the court and travelled to Alexandria, Jerusalem, Medina, Mecca, Damascus, Mosul and Baghdad, returning in 1185 by way of Sicily.

The *Travels of Ibn Jubair* were edited by W. Wright (Leiden, 1852); and a new edition of this text, revised by M. J. de Goeje, was published by the Gibb Trustees (London, 1907). The part relating to Sicily was published, with French translation and notes, by M. Amari in the *Journal asiatique* (1845–46) and a French translation alone of the same part by G. Crolla in *Museon*, vi. 123–132.

IBN KHALDŪN (Abū Zaid ibn Mohammed ibn Mohammed ibn Khaldūn) (1332–1406), Arabic historian, was born at Tunis. In 1352 he entered the service of the Marīnid sultan Abū Inān (Faris I.) at Fez, but in 1356, his integrity having been suspected, he was imprisoned for two years. Later, having offended the prime minister, he emigrated to Granada, where he was received with great cordiality by Ibn al Ahmar. This excited the jealousy of the vizier, and he was driven back to Africa (1364), where he entered the service of the sultan of Tlemçen. A few years later he was taken prisoner by Abdalaziz ('Abd ul 'Azīz), who had seized the throne. He then entered a monastic establishment, until 1370 when the new sultan recalled him to Tlemçen. In 1378 he entered the service of the sultan of his native town of Tunis, where he devoted himself to his studies and wrote his history of the Berbers. While on a pilgrimage to Mecca, he visited Cairo, where he was presented to the sultan, al-Malik udh-Dhahir Barkuk, who insisted on his remaining there, and in 1384 made him grand cadi of the Malikite rite for Cairo. Later he made the pilgrimage to Mecca, and on his return lived in retirement in the Fayum until 1399, when he was called to resume his functions as cadi. He was removed and reinstated in the office no fewer than five times.

In 1400 he was sent to Damascus, in connection with the expedition intended to oppose Timur or Tamerlane. When Timur had become master of the situation he permitted Ibn Khaldūn to return to Egypt. Ibn Khaldūn died on March 16, 1406.

His chief work, the "Universal History," deals more particularly with the history of the Arabs of Spain and Africa, and includes a short autobiography. An edition of the Arabic text was printed at Būlāq (7 vols., 1867) and a part of the work has been translated by de Slane under the title of *Histoire des Berbères* (Algiers, 1852–56). Vol. i., the *Muqaddama* (preface), was published by M. Quatremère (3 vols., Paris, 1858), often republished in the East, French translation by de Slane (3 vols., Paris, 1862–68). The parts of the history referring to the expeditions of the Franks into Moslem lands were edited by C. J. Tornberg (Upsala, 1849), and the parts treating of the Banu-l Aḥmar kings of Granada were translated into French by M. Gaudefroy-Demombynes in the *Journal asiatique*, ser. 9, vol. xiii. The *Autobiography* was translated into French by de Slane in the *Journal asiatique*, ser. 4, vol. iii. *See* R. Flint, *History of the Philosophy of History* (Edinburgh, 1893).

IBN KHALLIKĀN [Abū-l 'Abbās Aḥmad ibn Khallikan] (1211–1282), Arabian biographer, was born at Arbela. When eighteen he went to Aleppo, where he studied for six years, then to Damascus, and in 1238 to Alexandria and Cairo. In 1261 he became chief cadi of Syria in Damascus, from 1271 to 1278, he was professor in Cairo, and from 1281 to his death, professor in Damascus.

His great work, the *Kitab Wafayāt ul-A'yān*, contains in alphabetical order the lives of the most celebrated persons of Muslim history and literature, except those of Mahomet, the four caliphs and the companions of Mahomet and their followers (the *Tabuat*). It was published by F. Wüstenfeld (Göttingen, 1835–43), in part by McG. de Slane (Paris, 1838–42), and also in Cairo (1859 and 1882). An English translation by McG. de Slane was published in 4 vols. (London, 1842–71). Thirteen extra biographies from an Amsterdam ms. were published by Pijnappel (Amsterdam, 1845). The best known supplement to the book is that of Maḥommed ibn Shākir (d. 1362), published in Cairo 1882. A collection of poems by Ibn Khallikān is also extant. *See* E. V. Lucas, *A Boswell of Baghdad* (I.K.) (1917).

IBN QUTAIBA or **KOTAIBA** [Abū Mohammed ibn Muslim ibn Qutaiba] (828–889), Arabian writer, was born at Baghdad or Kufa, and was of Iranian descent. He became cadi in Dinawar and afterwards teacher in Baghdad, where he died. He was the first representative of the eclectic school of Baghdad philologists that succeeded the schools of Kufa and Baṣra. (*See* ARABIA: *Literature*, section "Grammar.") Although engaged also in theological polemic (*cf.* I. Goldziher, *Muhammedanische Studien*, ii. 136, Halle, 1890), his chief works were directed to the training of the ideal secretary. Of these five form a series. The *Adab ul-Katib* ("Training of the Secretary") contains instruction in writing and is a compendium of Arabic style. It has been edited by Max Grünert (Leyden, 1900). The *Kitāb ush-Sharab* is still in ms. The *Kitab ul-Ma'arif* has been edited by F. Wüstenfeld as the *Handbuch der Geschichte* (Göttingen, 1850, summary in E. G. Browne, *A Literary History of Persia*, 1902); the *Kitab ush-Shi'r wash-Shu'arāi* ("Book of Poetry and Poets") edited by M. J. de Goeje (Leyden, 1904). The fifth and most important is the *'Uyūn ul-Akhbār*, which deals with lordship, war, nobility, character, science and eloquence, asceticism, friendship, requests, foods and women, with many illustrations from history, poetry and proverb (ed. C. Brockelmann, Leyden, 1900 *sqq.*).

For other works *see* C. Brockelmann, *Gesch. der arabischen Literatur*, vol. i. (Weimar, 1898).

IBN SA'D [Abū 'Abdallāh Mohammed ibn Ṣa'd ibn Mani' uz-Zuhrī, often called Katib ul-Waqidī ("secretary of Waqidī") of Baṣra] (d. 845), Arabian biographer, lived chiefly in Baghdad. His *Kitāb ul-Ṭabaqāt ul-Kabīr* (15 vols.) contains the lives of Mahomet, his Companions and Helpers and of the following generation.

It has been edited under the superintendence of E. Sachau (Leiden, 1904 *sqq.*); *cf.* O. Loth, *Das Classenbuch des Ibn Sa'd* (Leipzig, 1869).

IBN SA'UD or **'ABDUL 'AZIZ IBN 'ABDULRAHMAN IBN FAISAL IBN SA'UD,** was born at Riyadh, capital of Nejd, about 1880. His father, 'AbdulRahman (d. 1928), was the youngest of the four sons of the Amir Faisal, Sultan of Nejd from 1834 to 1867. The latter's death had plunged Central Arabia into a state of anarchy and civil war owing to the contest of his two elder sons, 'Abdullah and Sa'ud, for the throne he had vacated. In 1875 the Turks occupied Hasa, while the rival dynasty of Ibn Rashid in northern Nejd gradually extended southwards until in 1891 the great Amir Muhammad put an end to the Wahhabi state by the occupation of Riyadh itself. 'Abdul 'Aziz went into exile with his family and, after a period of residence at Bahrain, arrived at Kuwait. Here he was influenced by Shaikh Mubarak ibn Sawah and to this Ibn Sa'ud owed much of his future greatness and his friendship for Great Britain. From his father he inherited steady purposefulness.

Though 'AbdulRahman was the cadet of the Wahhabi dynasty, it was he who made the first effort to recover his father's throne in 1900. His defeat at Sarif was followed by the formal abdication of his rights and obligations in favour of his eldest son, 'Abdul 'Aziz, who in 1901 launched out into the desert with a force of only 200 men. At some distance from the capital he selected 15 of these, including his cousin 'Abdullah ibn Jiluwi

(afterwards governor of Hasa), for the final venture; entering Riyadh by night with his following he forced an entry into a house opposite the great fort where the Rashidian governor was lodged. A desperate struggle left Ibn Sa'ud the master of Riyadh, where he was at once proclaimed ruler of Nejd.

During the next few years Ibn Sa'ud consolidated the outlying provinces and resisted the Turks in their support of Ibn Rashid. A Wahhabi victory at Bukairiya (1904) was followed by Ibn Rashid's death (1906) and left Ibn Sa'ud master in the house of his ancestors with no danger of interference from the north.

Free now to show his capacity for administration Ibn Sa'ud proceeded to lay the foundations of his future greatness in a scheme remarkable both for boldness and ingenuity. He boldly seized upon the latent fanaticism of his countrymen as an instrument for the creation of a non-tribal or pan-tribal element out of tribal material to leaven the mass into the semblance of a homogeneous nation. The first *Ikhwan* colony in 1912 was the first step of a deliberate programme aiming at the abrogation of the patriarchal system in Arabia in favour of nationalism. At the time such an ambition was beyond the bounds of practical politics, but circumstances combined to bring it within the focus of Ibn Sa'ud's clear vision.

'Artawiya, now a flourishing town of 10,000 inhabitants, rapidly became the prototype of a hundred colonies which sprang up in various parts of Nejd during the next 15 years. Agriculture displaced pastoral activities as the binding force of the new organization, while the *Shar'* or religious law took the place of the customary law of Badawin society. Each colony constituted a contingent of the new Wahhabi standing army, for which circumstances have provided ample work at home and abroad. It was first put to the test in 1913 when Ibn Sa'ud turned his attention to the Turks who had been in Hasa since 1875. With a mere handful of men he suddenly appeared before Hufuf, whose astonished garrison surrendered without a blow. The garrisons at 'Uqair and Qatif followed suit and the Turks left Eastern Arabia.

At the end of 1914 Captain W. H. I. Shakespear was deputed by Sir Percy Cox to visit Ibn Sa'ud with a view to enlisting his active assistance against the Turks, with whom his dynastic rival, Ibn Rashid, had thrown in his lot. Ibn Sa'ud immediately undertook military operations and in January, 1915, a battle took place at Jarrab. The result was indecisive but Captain Shakespear was killed and the British authorities were discouraged from further activity in Arabia. In December Ibn Sa'ud concluded a treaty of friendship with Great Britain but remained quiescent though he grew increasingly anxious as he watched King Husain in the Hejaz building up a strong position for himself with the help of Lawrence. In 1917 the Philby Mission visited him at Riyadh to take stock of the situation and in the autumn of 1918 Ibn Sa'ud resumed activities against Ibn Rashid. He reached the walls of Hail without being able to press home the attack, and the sudden termination of the Great War found him still within the same frontiers as at its outbreak and with two powerful enemies to reckon with, Ibn Rashid and King Husain. Relations with the latter were already strained to breaking point. In March, 1919, Lord Curzon on behalf of the British Government decided in favour of King Husain and authorised him to occupy Khurma which Ibn Sa'ud was warned to relinquish. The latter disregarded the warning and two months later the Wahhabi army surprised and annihilated the Hashimite forces at Turaba. Having vindicated his rights by might Ibn Sa'ud retired to Riyadh. In 1920 a Wahhabi expedition added the highland districts of 'Asir to Ibn Sa'ud's dominions, and in August of the following year the capture of Hail placed all central Arabia under a single rule. Meanwhile Bisha and Tathlith in the south were occupied, as also Khaibar and Taima northwards, while in 1922 Jauf came within the Wahhabi sphere.

The British Government made a belated effort to mediate at the Conference of Kuwait, convened in Nov. 1923. The discussions ended without result in April, 1924, and in September the Wahhabi invasion of the Hejaz began with the sudden capture of Taif and a massacre of its inhabitants. King Husain was forced to abdicate in favour of his eldest son, 'Ali, who evacuated Mecca which was quietly occupied by the Wahhabis in October. The outlying districts of the Hejaz were rapidly occupied and only Jedda and Medina remained in the hands of the Hashimites, both being subjected to a desultory siege by Ibn Sa'ud who entered Mecca for the first time in December, 1924. During the following November Sir Gilbert Clayton concluded the treaties of Bahra and Hadda with him, by which certain questions relating to 'Iraq and Trans-Jordan were satisfactorily disposed of. The following month Medina surrendered, while Jedda followed suit a fortnight later. On January 8, 1926, Ibn Sa'ud was proclaimed King of the Hejaz in the great mosque of Mecca; and a year later his title of Sultan of Nejd and its Dependencies was converted to King.

Security has been established where it was never known before; motor-transport has added enormously to the comfort of pilgrims; the state revenues have increased substantially; corruption in the public service has been greatly reduced if not entirely eliminated. Relations with Great Britain were placed on a new and friendly footing by the Treaty of Jedda negotiated with Sir Gilbert Clayton in May, 1927. Unfortunately these relations were marred by a regrettable incident in November 1927. The 'Iraq government in contravention of the provisions of a protocol signed at 'Uqair (1922), had built a fort at the desert wells of Busaiya near the frontier. A party of *Ikhwan*, visiting the spot, resented the innovation and slew the builders. And the spring months of 1928 were spent in a series of futile and unnecessary raids and counter-raids, to which an end was at length put by the agreement of Ibn Sa'ud and the British Government to meet in conference. In May Sir Gilbert Clayton, since nominated to the High Commissionership of 'Iraq, again visited Jidda and the discussions, interrupted by the pilgrimage, ended in August in failure to achieve agreement on the points at issue. Ibn Sa'ud maintained unswervingly his contention that the 'Iraq Government had been at fault in building the forts in the frontier district, while the British representative was unable to agree to their demolition.

Ibn Sa'ud has now ruled 28 years in Nejd and three years over the Hejaz. His eldest surviving son and heir to the throne of his dual monarchy is Sa'ud now about 25 years old, who occupies the position of Viceroy of Nejd. The second son Faisal, who has twice visited Europe on his father's behalf, is Viceroy of Mecca. Besides these two Ibn Sa'ud has 11 other sons ranging from the age of 17 down to two. For political and other reasons the Wahhabi king has always taken the fullest advantage of Islamic laxity in the matter of marriage and divorce, and he is reputed to have been married about 150 times in the course of his career. His father, who died in June 1928, lived to see him achieve a position, perhaps unparalleled in the annals of Arabian history since the immediate successors of Mohammed himself.

(H. St. J. B. P.)

IBN TIBBON, a family of Jewish translators, who flourished in Provence in the 12th and 13th centuries. They rendered into Hebrew the chief Arabic writings of the Jews in the middle ages. These Hebrew translations were, in their turn, rendered into Latin (by Buxtorf and others) and in this way were circulated in Europe. The chief members of the Ibn Tibbon family were (1) JUDAH BEN SAUL (1120–90), who was born in Spain but settled in Lunel. He translated the works of Baḥya, Halevi, Saadiah, the grammatical treatises of Janah and an ethical treatise by Gabirol. (2) His son, SAMUEL (1150–1230), translated, among other things, the *Guide of the Perplexed* by Maimonides, his friend, and wrote a philosophical treatise, *Ma'amar Yikkawu ha-Mayim* (pr. Pressburg, 1837). (3) Son of Samuel, MOSES (died 1283). He translated into Hebrew a large number of Arabic books (including the Arabic version of Euclid).

See I. Husik, *Hist. of Mediaeval Jewish Philosophy* (1916).

IBN ṬUFAIL or **TOFAIL** [Abū Bakr Moḥammed ibn ʿAbd-ul-Malik ibn Ṭufail ul-Qaisī (or to the Schoolmen, Abubacer)] (d. 1185), Moslem philosopher, was born at Guadix near Granada. He was skilled in philosophy, mathematics and medicine, and was a friend of Averroes. He became secretary to the governor of Granada, and later physician and vizier to the Mohad caliph, Abu Yaʿqūb Yūsuf. He died at Morocco. His chief work,

Risālat Ḥayy ibn Yaqẓān, is a philosophical romance describing the awakening of philosophical knowledge in the intellect of a child removed from society.

See S. Munk, *Mélanges* (1859); T. J. de Boer, *Gesch. der Philosophie im Islam* (Stuttgart, 1901); L. Gauthier, *Ibn Thofail, sa vie, ses oeuvres* (1909); Carra de Vaux, *Les Penseurs de l'Islam* (1923).

IBN USAIBI'A (Muwaffaquddīn Abū-l-'Abbās Aḥmad ibn ul-Qāsim ibn Abī Usaibi'a) (1203–1270), Arabian physician, was born at Damascus, the son of an oculist, and studied medicine at Damascus and Cairo. In 1236 he was appointed by Saladin physician to a new hospital in Cairo, but resigned in 1237 to serve the amir of Damascus in Salkhad. There he lived and died. He wrote "*'Uyun ul-Anba 'fi Ṭabaqāt ul-Aṭibba*" or "Lives of the Physicians."

Edition by A. Müller (Königsberg, 1884).

IBO. A Southern Nigerian tribe comprising 33 sub-tribes, inhabiting the provinces of Benin, Ogoja, Onitsha, Owerri and Warri, whose language is related to Ibibio. The Ibo on the west of the Niger were long subject to the Edo: the rest lived in independent towns or villages under a paramount chief and a chief for each quarter. The extended family groups lived together in the same quarter. Marriage rules vary: marriage is usually prohibited between members of the same extended family and between near relations. Marriage by exchange is frequent. Descent is patrilineal. Age classes and secret societies flourish.

Bibliography.—P. Amaury Talbot, *Life in Southern Nigeria: The Magic, Beliefs and Customs of the Ibibio Tribe* (1923); *The Peoples of Southern Nigeria* (1926).

IBRAHIM (d. 1536), grand vizier of Turkey, was the son of a sailor at Parga, was sold into slavery, and was bought by the sultan, Solyman II., who made him his grand vizier and married him to his own sister. Ibrahim, says a Venetian record, was "the heart and breath of the Padishah, who does nothing without consulting him; he is learned, fond of reading, and knows his law well." He was made commander-in-chief of the army for the invasion of Hungary, and in 1526 took Peterwardein. But his main functions were diplomatic. With the Venetian Gritti he conducted the negotiations for peace between the sultan and the emperor Ferdinand in 1533. In the autumn of that year he took command in Asia against the Persians. He occupied Tabriz on July 13; he was then joined by Solyman, and marched against Baghdad. In both cases he prevented plunder. They returned to Constantinople on Jan. 8, 1536. He had for 14 years been the sultan's constant companion, even sharing his sleeping apartments. They retired as usual on March 30, and in the morning Ibrahim was found strangled by the sultan's orders.

IBRAHĪM AL-MAUṢILĪ (742–804), Arabian singer, was born of Persian parents settled in Kufa. In his early years his parents died and he was trained by an uncle. Singing, not study, attracted him, and at the age of twenty-three he fled to Mosul, where he joined a band of wild youths. After a year he went to Rai (Rei, Rhagae), where he met an ambassador of the caliph Manṣūr, who enabled him to come to Baṣra and take singing lessons. His fame as a singer spread, and the caliph Mahdī brought him to the court. There he remained a favourite under Hādī, while Harūn al-Rashīd kept him always with him until his death, when he ordered his son (Ma'mūn) to say the prayer over his corpse. His powers of song were far beyond anything else known at the time.

See the Preface to W. Ahlwardt's *Abu Nowas* (Greifswald, 1861), pp. 13–18, and the many stories of his life in the *Kitāb ul-Aghāni*, v. 2–49.

IBRAHIM PASHA (1789–1848), Egyptian general, son, or adopted son of Mohammed Ali, pasha of Egypt, was born at Kavala in Thrace. During his father's struggle to establish himself in Egypt, Ibrahim, then sixteen years of age, was sent as a hostage to the Ottoman capitan pasha (admiral), but when Mohammed Ali was recognized as pasha, he was allowed to return to Egypt. When Mohammed Ali went to Arabia to fight against the Wahhabis in 1813, Ibrahim was left in command in Upper Egypt. He continued the war with the broken power of the Mamelukes, whom he suppressed. In 1816 he succeeded his brother Tusun in command of the Egyptian forces in Arabia. Mohammed Ali had already begun to introduce European discipline into his army, and Ibrahim had probably received some training, but his first campaign was conducted more in the old Asiatic style than his later operations. The campaign lasted two years, and the political power of the Wahhabis was destroyed. Ibrahim landed at Yenbo, the port of Medina, on Sept. 30, 1816. The holy cities had been recovered from the Wahhabis, and Ibrahim's task was to follow them into the desert of Nejd and destroy their fortresses. Such training as the Egyptian troops had received, and their artillery, gave them a marked superiority in the open field. But the difficulty of crossing the desert to the Wahhabi stronghold of Deraiya, some 400 m. east of Medina, and the courage of their opponents, made the conquest a very arduous one. Ibrahim displayed great energy and tenacity, sharing all the hardships of his army, and never allowing himself to be discouraged by failure. By the end of September 1818 he had forced the Wahhabi leader to surrender, and had taken Deraiya, which he ruined. On Dec. 11, 1819, he made a triumphal entry into Cairo. After his return he supported the Frenchman, Colonel Sève (Suleiman Pasha), who was employed to drill the army on the European model. Ibrahim set an example by submitting to be drilled as a recruit.

When in 1824 Mohammed Ali was appointed governor of the Morea by the sultan, who desired his help against the insurgent Greeks, he sent Ibrahim with a squadron and an army of 17,000 men. The expedition sailed on July 10, 1824, but Ibrahim was not able to land at Modon until Feb. 20, 1825. Ibrahim easily defeated the Greeks in the open field, and though the siege of Missolonghi proved costly he captured the place on April 24, 1826. The Greek guerrilla bands harassed his army, and in revenge he desolated the country and sent thousands of the inhabitants into slavery in Egypt. These measures led first to the intervention of the English, French and Russian squadrons (see Navarino, Battle of), and then to the landing of a French expeditionary force. By the terms of the capitulation of Oct. 1, 1828, Ibrahim evacuated the country. English officers who saw him at Navarino describe him as short, grossly fat and deeply marked with smallpox. In 1831 Ibrahim was sent to conquer Syria. He took Acre after a severe siege on May 27, 1832, occupied Damascus, defeated a Turkish army at Homs on July 8, defeated another Turkish army at Beilan on July 29, invaded Asia Minor, and finally routed the grand vizier at Konia on Dec. 21. The convention of Kutaiah on May 6 left Syria for a time in the hands of Mohammed Ali.

After the campaign of 1832 and 1833 Ibrahim remained as governor in Syria. The exactions he was compelled to enforce by his father soon provoked revolts. In 1838 the Porte felt strong enough to renew the struggle, and war broke out once more. Ibrahim won his last victory for his father at Nezib on June 24, 1839. But Great Britain and Austria intervened to preserve the integrity of Turkey. Their squadrons cut his communications by sea with Egypt, a general revolt isolated him in Syria, and he was finally compelled to evacuate the country in February 1841. In 1846 Ibrahim paid a visit to western Europe. When his father became imbecile in 1848, he held the regency till his own death on Nov. 10, 1848.

See Edouard Gouin, *L'Égypte au XIXe siècle* (Paris, 1847); Aimé Vingtrinier, *Soliman Pasha (Colonel Sève)* (Paris, 1880). A great deal of unpublished material of the highest interest with regard to Ibrahim's personality and his system in Syria is preserved in the British Foreign Office archives; for references to these see *Cambridge Mod. Hist.*, v. 882, bibliography to chap. xvii.

IBSEN, Henrik Johan (1828–1906) Norwegian poet and dramatist, was born at Skien on March 20, 1828. His father, Knud Henriksen Ibsen, a merchant, was of mixed Danish, German and Scotch blood; his mother, Maria Cornelia Altenburg was a Norwegian, of German descent. When Ibsen was eight years old, his father failed in business, and recollections of the penury which followed can be found in *Peer Gynt*.

Early Life and Works.—At the age of 15 Ibsen was apprenticed to an apothecary in Grimstad, a small town of eight hundred inhabitants; it was a business he detested, and he began to express himself and relieve his misery by writing poetry in 1847.

He read widely and deeply, especially in poetry and theology, and in 1850 he went to Christiania as a student; this year also saw the publication of his first play, a blank-verse tragedy, *Cataline,* which was followed, not many months after, by *The Viking's Barrow,* which was performed at the Christiania theatre, but not published. For a few months he co-operated in the production of a weekly satirical newspaper; but in November 1851, when in September the paper's brief life of nine months had ended, he was appointed as "theatre-poet" to the new theatre at Bergen, established for the encouragement of Norwegian drama, by the violinist Ole Bull. This position Ibsen held until the summer of 1857, and this intimate connection with the theatre—he combined the duties of producer, manager, adviser and designer with that of a poet—confirmed him in his nascent desire to be a dramatist. The plays which he wrote for this theatre were *St. John's Night* (1853), *Lady Inger of Ostrat* (1855), *The Feast of Solhaug* (1856) *and Olaf Liljekrans* (1857). He left Bergen for Christiania in 1857; and his next two plays reflect the influence of his engagement and marriage to Susanna Thoresen; *The Vikings of Helgeland* (1858) and *Love's Comedy* (1862) are the first plays—earlier signs may be found in the lyric poems—in which the unmistakable voice of Ibsen is heard clearly. Both plays were misunderstood; and the fierce anti-romantic, idealistic satire of *Love's Comedy* caused a storm of indignation in Denmark and Norway: it is Ibsen's earliest protest on behalf of the inalienable rights of the individual, his first stroke in the life-long battle against the stupidity, the weight of the majority. There is in it not a little of the spirit which we find in the satiric poetry of Arthur Hugh Clough whose lines "O let me love my love unto myself alone And know my knowledge to the world unknown," might well have been Henrik Ibsen's motto. He had accepted the position of manager of a new theatre in Christiania; but he could not get *The Vikings* produced there, and it was not acted until 1861. The next year his theatre failed, and Ibsen became adviser in aesthetics at the opposition house. In spite of his disappointment and the disgust he felt at the reception of *Love's Comedy* he wrote for this theatre *The Pretenders* (1864), the best drama of his saga period. It was a popular success; but the managers of the Christiania theatre were shy of its strangeness, and it was not until Ibsen's reputation was secure—after the publication of *Brand* and *Peer Gynt*—that it took its place as one of the masterpieces of the new theatre.

Ibsen had applied to the Storthing for a poet's pension, which had been recently given to Björnson; but it was refused and in indignation he went into exile; for his departure to Italy in 1864 was not an ordinary tour to the sun and the south. It was undertaken with a deep sense of injustice, which was partly responsible for the two magnificent poetic dramas—*Brand* (1866) and *Peer Gynt* (1867). After the issue of *Brand* he was granted a poet's pension and Ibsen had no longer to fear actual penury.

Plays.—In 1869 he wrote the earliest of his modern prose dramas *The League of Youth,* a political satire that roused as much animosity as did *Love's Comedy;* he was now settled in Dresden, but he returned to Norway for a short time after the publication of one of the most ambitious dramas ever composed—the huge double play *Emperor and Galilean* (1873), an elaborate historical study of the character of Julian the Apostate, which shows wide reading and a remarkable power of re-creating familiar figures of history. It is of great interest as one of the first attempts to free the study of Greek history from that smooth, neo-classical veneer by which it was falsified; it is far nearer in spirit to the Greece of Gilbert Murray and Jane Harrison than the Hellas of Winckelmann or Shelley. These years also mark the end of Ibsen's work as a poet; his collected lyrics were published in 1871, and the occasionally exalted prose of *Emperor and Galilean* does not again reappear in his work, except in brief snatches in some of the later prose dramas. His deep interest in politics was made intenser by the growing power of Germany, and when the days of the Commune came in Paris he felt strong in him something of the hopes that had awakened in 1848, when there was promise of revolution in Europe. His only persistent political principle, to be found in every play from *The Pretenders* to *When We Dead Awaken,* was the necessity of a society which should give the amplest possible opportunity for the free growth of the individual, and he was naturally and inevitably disappointed with all movements of reform—liberal, radical, socialist—as conducted. He found that they all tended in time to subordinate the individual to the state—and to Ibsen the state, the great compact majority, was always the enemy. In 1877 he published *The Pillars of Society*—a title which might be taken to cover all the social dramas which succeeded that play.

Later Life.—Ibsen's life presents few points of interest except the steady production of his plays; he never had the inclination nor the necessary social exuberance for such public and political appearances as were enjoyed by his rival and contemporary Björnson. From 1868 to 1891 his permanent home was Germany, first in Dresden, later in Munich; in 1891 he settled in Christiania where he lived till his death on May 28th, 1906; for the four years previously he had suffered from an almost complete physical and mental collapse, and was unaware of the world without. Of his marriage (1858) there was one son, Sigurd, to whose education Ibsen devoted no little care and thought. When he left his home in 1850, he ceased to communicate with any of his family except his sister Hedvig; and although he had friends in journalism and in the theatre there is little evidence that any one had any real or permanent influence on the development of his character and his genius; he was grateful to Björnson, he was grateful to Brandes, for the support each gave him at different periods of his career, but he never showed the slightest inclination to accommodate his own thought to their ideas. No other dramatist of so immensely creative a genius has ever been so lonely: he did not need long or continuous intercourse with society. A chance word, a chance meeting, a sudden memory were enough to fertilize that powerful imagination which then, feeding on itself and nourishing the germ, gave birth, every two years, to a play which brought into the world entirely new characters, owing only an infinitesimal part of their life to any power outside the mind and spirit of the dramatist. Ibsen was first and last a great poet, and a great mystic—one of the greatest poets and the greatest mystics who ever devoted himself to the drama; the "lyrical Pegasus" may as Brandes said, "have been killed under him," but his poetic inspiration burned all the more fiercely because of the severe limits which Ibsen forced on its expression, limits which are unfortunately very much exaggerated in the best-known English versions of his social dramas. His interest in his characters, real as they are, intense as it is, is always dependent on his poetic vision of life; his vision of life is never dependent, as was Björnson's, Strindberg's or even Goethe's, on circumstances either of his own choosing or of chance. Ibsen was never afraid that facts, however obstinate, or persons, however powerful, could detract from the truth and his grasp of it. In this he showed signs of affinity to the theological outlook on the world. He knew, mystically, that his conception of life and of mankind could explain and express all the facts with which he came in contact; and if ever he met apparent contradictions, he was ready to dismiss them as irrelevant or worthless. His consummate skill as a dramatist, his influence in the making of a new European theatre must not allow us to forget that he was never of the movement which he caused, and of which he was acclaimed the leader. He was always in advance and always detached.

Main Ideas.—There are two main ideas in Ibsen's work, implicit even in the early dramas, and explicit, in different degrees of emphasis, in his theatre from *Brand* to *When We Dead Awaken.* Of this continuity in his work he was himself fully conscious, and resented the tendency to separate his work into periods, and find any contradiction—except a purely formal one—between the laughing, rapid poetry of *Peer Gynt* and the close, compact prose of the social dramas. The two ideas are these. First, the supreme importance of individual character, of personality: in the development and enrichment of the individual he saw the only hope of a really cultured and enlightened society. Second, comes the belief that the only tragedy that can be suffered, the only final wrong that can be committed, is the

denial of love. The former idea was easily grasped, and was proclaimed by most Ibsenites—Brandes, Archer, and Shaw as the key to Ibsen's drama; the latter idea was excused in the poetic plays as a relic from an imaginary romantic phase of Ibsen's life, and ignored when it appeared again in the social dramas, especially the later ones. Archer indeed was so disturbed at its very evident intrusion in *When We Dead Awaken*, that he suggested that the dramatist's mind was already failing; while he followed Shaw in his description of the climax of *Peer Gynt* as a "crowningly unreal self-realization." The reason for this obtuseness—shared by nearly all early critics of Ibsen except Sir Arthur Quiller-Couch—is to be found in the fact that it was the lot of Ibsen, a Christian mystic with no definite allegiance to any religious body, to be interpreted to the world by men who were mostly sentimental rationalists, who noticed, what was fully obvious, that the dramatist waged an unceasing war against conventional Christianity, but failed to observe that he did so, not under the banner of rationalism, but in the name of an intenser Christianity.

The same mistake was made, and is still made occasionally, by interpreters of William Blake, in whose thought may be found not a little which would have won Ibsen's sympathy and understanding. In *Brand* Ibsen preached his first and most defiant proclamation of the need of whole-heartedness in the personality; the prophet-priest of the play with his cry of "All or nothing," is a projection of Ibsen's own character, with its stern refusal to be diverted from his work. Balancing that play is *Peer Gynt*, the richest, the most imaginative and fantastic of Ibsen's works: as Brand stands for singleness of purpose, *Peer Gynt* is the embodiment of distraction and dreaming—a parody in some sense of Ibsen's own gospel that facts do not matter, anticipating the bitterer parody of *The Wild Duck*.

In *A Doll's House* (1879) we have the first emphatic statement of Ibsen's individualistic creed. It is not a feminist play. Ibsen was at the moment pre-occupied with the struggle between society and the individual, and he chose a woman as his protagonist because he knew that, on the whole, women were more likely to take a personal view of life than men. There are two dramas in the play—one consists in Nora's discovery that she has lived for years with a strange man; but this depends on the more essential drama that for Torvald a crime against society is more important than a sin against love. The same motive inspired, in a more terrible form, *Ghosts* (1881); and when *Ghosts* roused fury throughout Europe, Ibsen retorted on his critics with *An Enemy of the People* (1882) in which he attacks the stupid majority who prefer disease to the confession of their disgrace. One of the loveliest of his plays, one in which the poet breaks out again, is *The Wild Duck* (1884). It has a tenderness and a lyrical beauty which stand out all the more strongly beside the fierce satire against those who have misinterpreted him. This play, with its quiet charm, its ironic humour and its devastating satire, is the record of Ibsen's discovery that it takes two people to tell the truth, one to speak and one to understand what is spoken—the last lesson to be learned by all prophets.

Later Works.—*Rosmersholm* (1886) written after a journey to Norway is a powerful study in ineffective idealism—and in the contrast of Rebecca West and Rosmer Ibsen reached his greatest heights in pure tragedy. *The Lady from the Sea* (1888) is the happiest of the prose dramas; it is rather weak in construction, but its characterization has a cheerful, relenting quality, and Dr. Wangel is one of the few men who can be put on a level with Ibsen's women. Of all modern plays Ibsen's come nearest, in form and sense of necessity, to the theatre of Athens; and of all his plays *Hedda Gabler* (1890) is, with the possible exception of *Ghosts*, the nearest to the Greek. If Hedda had been called Medea, her egotistic ferocity would not perhaps have so distressed those critics who pitifully complained that Ibsen's women were not womanly. *The Master Builder* (1892) is a return to the poetic, symbolic manner; and the conflict between two generations, Solness and Hilda, has become a classic statement of an age-long problem. *Little Eyolf* (1894) and *John Gabriel Borkman* (1896) are variations on his old theme, the conflict between love and the claims of other desirable things. In *Little Eyolf* love is threatened by the lust of the woman and by the vanity and incompetence of the man; the solution comes only through disaster; in *John Gabriel Borkman* love has been killed by ambition, and with love dead, there is nothing else; and the end of the play is the dramatist's consummate disclosure of the truth that Borkman, Ella and Gunhild were dead before the play opened, and that none of the other characters, except the old clerk Foldal (one of Ibsen's most exquisite minor characters) has ever been alive. Yet there is hope *When We Dead Awaken* (1900). This great final statement of the poet's invincible creed has disappointed those who had misunderstood his earlier plays, and attached too much importance to the incidental social teaching that can be extracted from them, and to their amazing stagecraft. Its form is less perfect, its external action fantastic; but in the reunion of Rubek and Irene Ibsen writes out of his very soul, repeating once more his persistent cry that, whether the world be well lost for love or no, at least that which a man thinks to gain by the sacrifice of love is not held at all.

The intense reality of Ibsen's characters, while evident at a first reading or a first hearing of any play, can only be properly appreciated by continuous study of his complete theatre. It was his habit to make more or less complete histories of the lives of his people up to the moment of the opening of the first act; and in the drafts and first version of many plays (available in the volume called *Ibsen's Workshop*) can be seen the care with which he worked, the fierceness with which he sacrificed anything, however entertaining, that was not essential, and his amazing power of getting the utmost out of a character or a situation. He made his people work for him; and there is no dramatist in whose work it would be so hard to find a single speech out of character. He could not bear either to discuss, or to disclose, the idea of a new play until it was completed. He retired into his own world with his own people, and agonized until they became and did exactly what he knew was right. When, as in *The Lady from the Sea*, he relaxes a little, the change in atmosphere is startling. This severity might be lamented as a defect did we not know from *Peer Gynt* that it was a deliberate sacrifice. The author of that supremely diverting and supremely mobile play cannot be accused of any incapacity for exuberance.

Ibsen's later abstinence from humour, from divagations and those extravagances which charm us in *Peer Gynt* was the abstinence not of impotence but a deliberately self-imposed control. It may be that he sometimes regretted his choice, for in 1900 he wrote to Count Prozor (after the publication of *When We Dead Awaken*) that, if he comes back to the old battlefields, "it will be with new weapons and in new armour"; there was, however, to be no reappearance, and it would indeed be ungracious for the world to complain of any lack of variety in the drama of the man who left us *Brand*, *Peer Gynt*, *Emperor and Galilean*, *A Doll's House*, *The Wild Duck*, *The Master Builder* and *When We Dead Awaken*.

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(R. E. R.)

IBYCUS, of Rhegium in Italy, Greek lyric poet, contemporary of Anacreon, flourished in the 6th century B.C. He lived a wandering life, and spent a considerable time at the court of Polycrates, tyrant of Samos. Plutarch (*De Garrulitate*, xiv.) preserves the legend of his death. Attacked by robbers, he called on a flock of cranes to avenge him. Later, one of the robbers, in the theatre at Corinth, saw the cranes, and said "Behold the avengers of Ibycus," thus betraying himself. The "cranes of Ibycus" became proverbial. Ibycus wrote seven books of lyrics, partly mythical, but mainly erotic (Cicero, *Tusc. Disp.* iv. 33).

The best editions of the fragments are by F. W. Schneidewin (1833) and Bergk, *Poëtae lyrici Graeci*.

ICA, a coast department of southern Peru, bounded on the north by the department of Lima, east by Huancavelica and Ayacucho, south by Arequipa, west by the Pacific. It includes the western slopes of the cordillera and desert coast zone, a barren waste except for fertile, irrigated valleys of the Chincha, Pisco, Ica and Grande rivers. Pop. (estimate 1920), 90,962; area, 9,799 sq.m.

In the Chincha valley, of which Chincha Alta (pop. 6,000) is the chief town, 35,000 ac. are under cultivation—the cotton yield second only to Piura—25,000 in the Pisco valley, and 12,000 in valleys tributary to the Rio Grande. The Pisco valley is the home of Señor Fermín Tangüis, originator of the cotton which bears his name, a variety which is gradually replacing the cultivation of others in Peru. The Nazca valley, tributary to the Grande, has a pre-Hispanic irrigating system and is famous for its archaeological remains. A system of roads including the coast trunk-line, 25–35 m. inland, is finished, though sometimes sand-covered, throughout its length, 214 m. Several branches run up the valleys to agricultural centres, a total of 404 miles of finished roads (1927). A railway 46 m. long connects Ica, the capital, with its port, Pisco. The only other port is Tambo de Mora, 16 m. north of Pisco, connected with Chincha Alta by rail (7½ m.). Chief products of the department are cotton, grapes, wines, spirits, honey, tropical fruits and vegetables. Lake Huacachina, near Ica, is a famous health resort.

Ica, a city, capital of the department of the same name, is 46 m. by rail south-east of its port, Pisco. Pop. (estimate 1927), 13,000, altitude 1,300 feet. It lies in an irrigated valley filled with vineyards and cotton fields (total producing area about 50,000 ac.). Much of the brandy known as "Pisco" is produced in the Ica valley. The original town (founded 1563), has been twice destroyed by earthquake and looted by a Chilean army in 1882. In spite of repeated disaster, it has typical Spanish charm and considerable commercial and industrial activity. Imports are controlled by wholesale houses, and several Lima banks have agencies here. The largest industry is a cotton factory including gin, oil-mill and other departments. (M. T. Bl.)

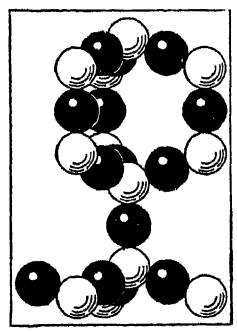
ICE is the solid formed when water freezes. It is a colourless substance crystallizing in the hexagonal system (*vide infra*); the crystals display a marked tendency to "twinning," and this is what gives rise to the flower-like patterns so frequently noticed on windows. Hoar-frost, snow and hail result from the freezing of atmospheric moisture.

The temperature of melting ice is adopted as a standard in thermometric scales, being zero for both the Réaumur and Centigrade scales, and 32° for the Fahrenheit.

In the act of freezing, water undergoes a remarkable expansion although its temperature remains unchanged; consequently, ice at 0°C. has a density only 0·9175 of that of water at the same temperature, and therefore floats on cold water. If the ice were denser than the water, it would sink and ponds would then freeze from the bottom upwards, thus becoming solid much more rapidly than they do; this low density of ice is thus of great significance to pond life and therefore indirectly to all life.

The process of freezing in a pond presents features of interest. If the air is at or below 0°C. and the temperature of the water is, say, 10°C., the upper layers of water become colder and sink into the main bulk, since the cold water is denser than the rest; this process continues until the whole of the water is chilled to 4°C., but at this temperature it attains its maximum density (*see* Water), and thereafter the surface layers, having a lower temperature than 4°C., are relatively lighter, remain on the surface and begin to freeze. The freezing is facilitated by the stillness of the water, resulting from the cessation of convection currents below 4°C. Sea water does not freeze until it is cooled to about −2°C., even in the most favourable circumstances, and the resulting ice is found to be practically free from the salt present in the water.

On being cooled, ice behaves like most other solids and contracts; its specific heat is about half that of water. In order to melt ice at 0°C. into water at the same temperature, it is necessary to supply a definite quantity of heat, viz., 80 calories per gram; this is called the "latent heat of fusion," since its absorption causes no rise of temperature. Conversely, the same amount of heat has to be dissipated during the freezing of water. In 1849 James Thomson showed that, since water expands on freezing, according to the laws of thermodynamics its freezing point must be lowered by increase of pressure, and he calculated this lowering to be 0·0075° per atmosphere, an estimate subsequently verified by his brother, Lord Kelvin. When two blocks of ice at 0°C. are pressed together, the ice melts at the point of contact, the flow of resulting water relieves the pressure, and the water freezes again; these processes continue until the blocks are firmly united. A similar explanation accounts for the movements of a glacier past restrictions in its course—the pressure causes local melting and flowing, and the ice gradually adjusts itself to the constriction and refreezes on the farther side.



Structure of ice
White spheres represent the effective volume of oxygen atoms; black spheres, hydrogen atoms

In India water is made to freeze on cold clear nights by leaving it in a porous vessel (*Chatti*), the evaporation from the pores absorbing sufficient heat from it.

Ordinary block-ice is rendered opaque by minute bubbles of air which are produced in any but very slowly cooled water, owing to the decreased solubility of the air.

By subjecting ice to enormous pressures, P. W. Bridgman and G. Tammann have produced four other forms of ice (five according to the latter) differing in crystalline form and in density, all being denser than water. Thus, ordinary ice (Ice-I) at −10°C. is converted under 4,400 atmos. to Ice-V, and at 6,300 atmos. to Ice-VI; similarly, at −30°C. 2,200 atmos. pressure converts Ice-I to Ice-III, and 3,000 atmos. converts it to Ice-II, and higher pressures then produce Ice-V and Ice-VI.

The crystal structure of ice has been investigated by several workers. That deduced by Sir W. H. Bragg (*Proc. Physical Soc.*, 1922, 34, p. 98) is shown in the annexed diagram, from which it will be seen that, when the structure is extended indefinitely in all directions, each oxygen atom is situated at the centre of gravity of four equidistant oxygen atoms, from each of which it is separated by a hydrogen atom. Thus, each hydrogen atom touches two oxygen atoms and each oxygen touches four hydrogens. The whole structure agrees with the hexagonal habit characteristic of the crystals, and its open nature accounts for the low density of ice, which is exactly that calculated from the dimensions given. (For the manufacture of ice, *see* Refrigeration.) (A. D. M.)

ICE AGE: *see* Glacial Period and Pleistocene.

ICEBERG, a floating mass of ice broken from the end of a glacier or a polar ice-sheet. Icebergs drift according to the direction of the sea currents, frequently from the polar regions to navigable waters, and they are therefore occasionally encountered far beyond the polar regions. When a glacier descends to the sea and is pushed outwards into water of greater depth than the thickness of the ice, the ends are broken off and the detached masses float away as icebergs. Only one-ninth of the mass of ice is seen above water. Many bergs are overturned, or at least tilted, as they set sail, as the result of the wave-cutting and melting which disturb their equilibrium. The disintegration of an Arctic ice-sheet is a simpler matter, as the ice is already floating. The ice-sheet cracks at the end, and masses break off, owing to the upward pressure of the water upon the lighter ice. This is accomplished with considerable violence. Icebergs, especially those of glacier origin, carry a load of débris which they gradually strew upon the sea floor; glacial material found in dredgings shows that icebergs occasionally transport their load for a considerable distance.

ICE-CREAM. A name applied to a great variety of frozen compounds, ranging from a cheap mixture of custard powder, water or milk, sugar, flavouring and colouring matter, to real

cream compounds, soufflés and parfaits, water ices and "sorbets," ice-cream blocks, etc. Ice-cream making is an important branch of the confectionery and because of its excellent food value has taken an important place in the diet of some people. The necessary utensils for a small trade, or for household use, are pewter freezers in wooden tubs or any good ice-machine (there are many on the market), pewter spatulas, ice pick, ice caves for storing or sending out ices, and pewter moulds, which are made in many shapes and sizes, for ice puddings or for small ices to serve to one person. The common American freezers are made with metal cans which revolve in a wooden tub and have a paddle which revolves inside the can.

The most usual freezing mixture employed is of coarse freezing salt and ice, about one-third of salt to two-thirds of ice; more salt may be used if a very sharp frost is needed, but too much salt melts the ice. The ice is broken with the ice pick into pieces not smaller than a large walnut. The freezing mixture is used in layers in a tub. Care must always be taken that no salt gets into the mixture. The paddle or spatula is used for mixing and to maintain a smooth creamy mixture.

Varieties of Ice-cream.—(1). Cream ices may be flavoured with vanilla, chocolate, caramel, coffee, strawberry, raspberry, orange, or in fact any fruit. They are made from cream, fruit purée or flavouring which gives the name to the ice, with sugar and colouring. Half cream and half custard may be used, or for a very economical ice, custard without cream. *Standard proportions:* ½ pint fruit purée, ½ pint cream (or ¼ pint custard and ¼ pint cream). Before serving moulded ices, the mould should be passed under cold water, so that the ice will slip out of the mould when it is unfastened.

(2). *Soufflés, Mousses, Parfaits.*—These are not frozen in ice-machines. For soufflés the mixture is put into large or small soufflé cases, for mousses into bombe moulds, and placed in an ice cave to become cold. When packed with the freezing mixture the cave should be covered with coarse house-flannel or blanket. Parfaits are flavoured with liqueurs and fruit purées.

(3). *Water Ices, Sorbets.*—There are many varieties, viz., lemon, orange, jam, pineapple, strawberry, or indeed any fruit, and tea. Sorbets are flavoured with liqueur and frozen rough. *Standard proportions:* ½ lb. loaf sugar and 1 pint of water boiled for syrup, 1 gill fruit juice and the white of two eggs.

Factory Ice-cream.—Both in the United States and Great Britain ice-cream is made in great volume for popular consumption. Ice-cream, sold in large quantities, is made from a standard mixture of milk, cream and sugar, to which flavourings and colouring-matters are added. Eggs and custards are also used in some of the factory sorts.

The mixture is first sterilized in enormous vats. By means of large pipes this is passed through a cooling chamber into vats holding 100 gal. each and is kept moving until cold. It then rests for 24 hours, when the creamy mass is again passed through large pipes into vessels, whence it is easily poured as needed into large cylindrical pans, which are taken on trolleys into freezing rooms. Machinery is so arranged that hands never touch the ices.

(E. G. C.)

In America the mixture is first standardized in a tank and packed into pasteurizers where it is held for a period of time at about 148° in order to kill harmful bacteria. The mixture then passes through a machine known as the "homogenizer" or "viscolizer," which breaks up the globules of fat and makes for a smoother product. The mixture is still hot and must be cooled and in order to do this quickly it is dropped over the outer surface of a series of pipes containing cold brine. These pipes are arranged one above the other so that there is a fall of about 8 ft., during which the temperature is lowered about 100°. It next passes into tanks, holding usually about 1,000 gal. each, in which a revolving coil operates to keep the mix in motion until ready to be frozen. From these holding tanks, or "agitators," the mix passes to the room where the ice-cream freezers are placed. The sugar is placed in the mix in the standardizing room and the flavour is added to the mix at the freezer. The freezers or containers are placed in a hardening room, constructed of concrete and lined with cork. The temperature, controlled by a brine refrigerating system, ranges from 10 to 20 degrees below zero. The cans and moulds from the freezer rooms, placed in the hardening room, are shipped directly out to the retailer. There are two generally accepted grades of ice-cream; Philadelphia, which is cream, sugar and flavour; and French, which is practically the same formula but to which has been added a heavy custard.

ICE HOCKEY, a game dating probably from the 18th century. In the mid-Victorian age the players, four or five a side, used curved hockey sticks and a bung.

From stick and bung the game evolved to "bandy" or hockey-stick and ball, usually the lacrosse ball of solid rubber, mainly through the agency of the Bury Fen team and the brothers Tebbutt, rivals of the famous Virginia Water club founded in 1873 by H. Blackett. In 1891 the Bandy Association was formed and the game fairly established as a national pastime. International matches, 11 a side, were also started with the Dutch in 1891, a Bury Fen team captained by C. G. Tebbutt defeating Haarlem by 14 goals to 1, while in 1893 the latter turned the tables by defeating the English 7 1. The Tebbutts introduced the game into Scandinavia, visiting Norway, Sweden and Denmark. Meanwhile Switzerland was the scene of annual matches among the fast increasing British visitors, especially at the two oldest centres, Davos and St. Moritz.

Such games were played on large grounds up to 200 x 100yd. with any number from 7 to 11 players. Meanwhile the combined influence of the Niagara club in Westminster, of Prince's club at Prince's skating rink, Knightsbridge, and the Oxford Canadians the fickleness of the British climate, making regular bandy almost impossible except at the favoured Swiss resorts with the consequent multiplication of indoor rinks—and finally the immense development of the game in Canada and America (see below) in preference to bandy were causing a rapid revolution in favour of the more popular form of the game known as ice hockey.

The essential difference is that this game is played with a "puck" or flat solid circular disk of vulcanized rubber, 3in. (7·6cm.) in diameter by 1in. (2·54cm.) thick, weighing about 5 6oz. (141·5-170gr.), and with no more than six players a side. Further, the "field of play" is enclosed by wooden barriers, often 40in. high from the ice, the "goal-cage" enclosed with netting 4ft. (1·22 metres) in height with posts 6ft. (1·83 metres) apart being placed 1½–4½ metres from the end of the ice so that it is possible to skate round behind the goals. The result is that in contradistinction to other ball games the puck is very seldom out of play, and this added to the lightning speed at which the game is played has given rise to the claim that ice hockey is the fastest of all games, as well as the most strenuous and exhausting. The limits of the arena are fixed at a maximum of 80 x 40 metres, usually 60 x 25 metres, a convenient size for most indoor rinks. That of the new Ice club in London, for instance, is 170 by 90 ft., enclosed by netting to protect spectators, while the Richmond Ice Rink club, opened in 1928, with its surface of 280 x 85ft., is even larger.

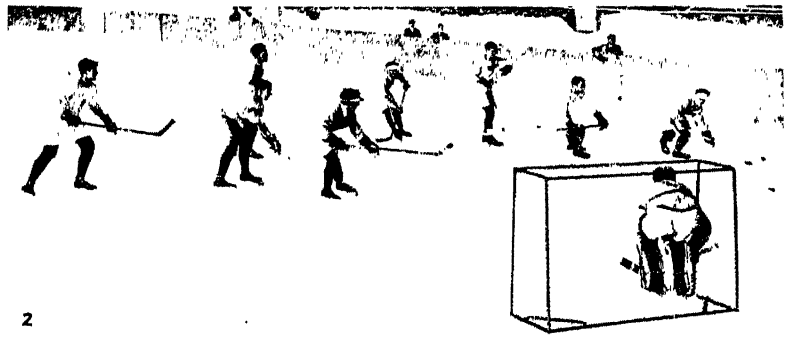
The rules of play emanated from Canada and have been drawn up by an International Ice Hockey League, to which the following 16 nations belong: Great Britain, Canada, United States, Belgium, France, Germany, Austria, Italy, Switzerland, Finland, Poland, Hungary, Rumania, Sweden, Spain and Czechoslovakia.

In 1927 the championship of Europe was won by Austria in Vienna, and the double championship of Switzerland by Davos, but the outstanding feature of the season was the victorious tour of the Victoria Ice Hockey club of Montreal, representing Canada. Their victories included Stockholm, Viborg, Djurgarden (champions of Sweden), Soedertaelja, Berlin, Czechoslovakia, Vienna, Wiener Eislauf-Verein, Milan, Switzerland, Davos and St. Moritz, Cortina d'Ampezzo, without a single defeat, their goal total being 171–10, while they concluded with a 14–1 victory in London over an England side drawn from the London Lions, the universities, Prince's and Manchester clubs—a remarkable record.

In Feb. 1928 ice hockey matches were played in the Olympic Games at St. Moritz, with the following final placings: 1—Canada; 2—Sweden; 3—Switzerland; 4—Great Britain. Eleven nations entered, Canada, the winners of the previous



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DETAILS OF PLAY IN ICE HOCKEY

1. Ice hockey match, showing action at cage. Player in striped uniform is attempting a shot at goal (left). Player in dark uniform is making a sweep check to break up the play. Goal keeper, standing in front of cage, is trying to prevent the scoring of a goal. Man behind cage is the goal umpire
2. Practicing ice hockey at St. Moritz, Switzerland. Player at extreme right is driving the puck or rubber disc, attempting to score a goal, and is about to shoot the puck. Goal keeper is in defensive position. Sideboards of rink and construction of goal are clearly shown
3. Goal keeper wearing full equipment for hockey match. Layer stick shown is wider than that used by other players on the team. The protective leg pads prevent injury from the puck, which is driven toward the goal with great force by players of the opposing team. Pneumatic or padded chest protector is used to protect the body
4. Player illustrating left-handed pose, in position for shot at goal. The puck is shown at blade of stick. Leg and knee pads are worn, as well as padded gloves and trunks, and chest and shoulder padding
5. Player in left-handed position to block or check opponent
6. Player in right-handed position to play the stick and puck from right side of the body
7. Player in position to pass puck to teammate on combination play

Olympic matches at Chamonix in 1924, being required to play only the winners of the three groups. The Canadians who played magnificently, beat Sweden 11–0, Switzerland 13–0 and Great Britain 14–0. They subsequently on tour beat Davos 6–1, Paris 6–0 and England 11–4.

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THE UNITED STATES AND CANADA

Every tiny hamlet throughout the Dominion of Canada has its hockey rink laid out in the open air during the winter months, but the larger cities are equipped with substantial buildings in which the game may be played before large gatherings of spectators. Despite the fact that frost is almost continuous in the winter months in most parts of Canada, east of the Rocky mountains, many of the city rinks are equipped with artificial ice plants which guarantee an ice surface before the winter really sets in and after the spring has begun.

There are six players to a team, the positions being goal, left defence, right defence, centre, left wing and right wing (forwards). The centre of the rink is marked and the teams take positions on either side of this centre point, nearest the goal they are defending. The goal-keeper takes a position directly between the posts of the goal net. The defence men take positions to the right and left of the goal net about 25 ft. towards the centre of the ice from the net. The forwards take positions on a line close to the centre of the ice. The game is started by a referee dropping the puck between the opposing centres in centre ice. This puts the puck in play, and the opposing teams must keep "onside," or behind the puck, when pushing or passing it from one player to another in combination play. The passing between members of the same teams may be intercepted at any time by an opponent.

There is some difference between the professional and amateur rules, but the usual play is for three 20 min. periods with 10 min. intermissions between periods. Substitutes may enter the play at any time, but no substitution may be made unless the player being replaced leaves the ice. A goal is scored by the puck being driven fairly into the net or across the goal line by a stick. The team scoring the most goals in the three periods of play is declared the winner. In the event of a tie when the regulation number of periods is completed, overtime sessions are played. The present professional rules call for two "sudden death" periods of 5 min. each. If either team scores in these overtime sessions, the game is immediately over, but if neither team is able to score, the contest is declared a draw. Penalties are imposed by the referee for tripping a player, slashing with the stick, checking a player bodily with undue roughness, or by unfair use of the stick. The player penalized is sent to the sidelines, and takes no part in the game for such time as the referee sees fit to penalize him. A minor penalty is 2 min., a major penalty is 5 minutes. The penalized player's team continues to play short of his services until the expiration of the time of his penalty.

The National Hockey League is the major professional league. The teams comprising this circuit represent the following cities: two from New York, two from Montreal and one each from Toronto, Ottawa, Boston, Chicago, Detroit and Pittsburgh. The amount paid for admissions for the season 1927–28 at National Hockey League games was $1,304,683. Players are purchased by the teams, prices ranging from $5,000 to over $30,000. The average salary of a major league player is approximately $4,500 per season.

There are five minor professional leagues, each circuit having five or more teams which represent smaller cities in the United States and Canada. All of the Canadian universities and colleges, and the more important of these institutions in the United States have organized hockey teams, and in many of them hockey is ranked as a major sport.

In Canada there are over 1,200 organized amateur teams. During the past few years hockey has spread rapidly into the northern sections of the United States. This has become possible through the more extensive use of ice in rinks prepared by artificial means in the larger arenas and auditoriums. The game being played at night in the winter, it is not dependent upon weather conditions. Furthermore, it is played at a season of the year when the great outdoor sports are not engaging the attention of sport lovers. (J. S. HA.; F. CR.)

TECHNIQUE OF THE GAME

Ordinary pleasure-skating, figure-skating and speed-skating count for little in ice hockey. The recruit must practise hours, days and months to master the "stop-turn-and-start." Ice-hockey is played in a series of short dashes,—dodging, shifting, side-stepping and even hurdling being parts of the puck-chaser's routine. The game of tag on the ice is good practice, and intensive training may be obtained in skating rounds of 10 or 20 yd. dashes, swinging the body into sharp left or right turns or even making a complete about-face at the end of the dash. The next point is to confine the skating-stride to as narrow a path of ice as possible. The professional player rushes a puck in a path as narrow as 3 ft., using a foot-over-foot stride and offering his opponents little in the way of legs, feet, stick and body to reach for. The close, choppy stride is the proper skating form to carry a player and his puck safely through an opposing team.

Many mediocre skaters have held positions in good teams through their knowledge of handling a hockey stick,—pushing the rubber puck along the ice with the 4 ft. hickory war-club, forward, sideways left to right; holding it steady with a sudden stopping or "feinting" motion and varying the whole routine with such tricky manipulations of the feet and body as completely to baffle opponents who attempt to steal the puck and thereby check the play. Years of constant practise are necessary to crown the efforts of the expert stick-handler. Professional players in the big leagues "stick-handle" the 3 in. rubber puck in a manner that is uncanny,—pushing and tossing the small rubber pellet about the ice between a maze of sticks and skates with a speed and accuracy too bewildering for the human eye to follow.

Methods of rushing, or "carrying," a puck along the ice vary. Some push the disc ahead at stick's length when the play is open; others play the puck from side to side and close to their feet at all times. Some flip the rubber against the sideboards, depending on the rebound for recovery of the disc, while others attempt to poke the puck between the opponents' feet and skate their man to regain possession of the disc while the opponents are off balance or too befuddled to hamper the play effectively. Stick-checking calls for quick thinking and clever action on the part of the checker. The poke, sweep and hook checks are effective means of stopping opposing forwards in their rush toward the goal. The body-check in hockey is the same exhibition of brute strength, superior weight and sheer roughness that is used in football and other sports.

With skating and stick-handling perfected to a point where they are combined into one mechanical operation, the player can direct his whole attention to playing the game. A good hockey player never looks at his feet, stick or puck during the progress of the play. His eyes must be focused on his opponents at all times. Once he comes into possession of the puck he has three forwards, two defence-men and a goal-tender to beat before he can register a score by shooting the rubber disc into the 4 by 6 ft. goal-net guarded by the opposing team.

Left wing, centre and right wing, commonly known as "the forward line," should practise passing the puck from one to the other across the ice, while skating at top speed, until their combination-play is perfected to a point which enables them to beat the opposing forwards, swoop in on the opposing defence, and leave the odd man in position for a shot at the net. Individual rushes by self-styled stars seldom result in tallies being marked on the scoreboard. Left and right wing players should at all times play their positions in their respective alleys and leave the centre alley or mid-ice section to the centre player. Members of the forward-line are supposed to score goals when the opportunity is presented and never at the cost of allowing the opposing forwards to break away for a two- or three-man combination

attack on the home team's net.

Defence-men, working within a 20-yd. radius of the goal-net, should never leave their goal-tender unguarded. The good defence player must hold, at all times, a position between his goal-tender and the opposing forwards who attempt to carry the puck close enough to the net for a shot that may mean a score. Defence players adopt various forms of checking the forward line attack. Some use a stick or body check or a combination of the two; others crowd the incoming forwards to the sideboards or sandwich their man between their bodies for what is known as a "hoist"—anything to spoil the forwards' shots, keep them out of shooting range of the goal-net or force them to shoot from impossible angles.

A goal-tender has 4 by 6 ft. of open net to protect and must study the shots from all angles and positions on the ice. He must cover as much of his net as possible with his body and shift his position between the posts continuously to hamper the vision of the opposing sharp-shooters. If an opposing left-winger or right-winger gets through the defence for a shot the net-guardian crowds the corner of the goal nearest to the winger, who is delivering the shot from the left-wing or right-wing "alley." When a forward skates through the defence and looms up directly in front of the net for a shot, there is little the goal-tender can do but attempt to anticipate the direction of his opponent's shot, as good forwards always shoot for the top or lower corners of the net.

(J. Fr.)

ICELAND, an island in the North Atlantic ocean (Dan. *Island*). Its extreme northerly point is touched by the Arctic Circle; it lies between 13° 22′ and 24° 35′ W., and between 63° 12′ and 66° 33′ N., and has an area of 40,437 sq. miles. Its length is 298 m. and its breadth 194 m., the shape being a rough oval, broken at the north-west, where a peninsula, diversified by a great number of fjords, projects from the main portion of the island. The total length of the coast-line is about 3,730 m., of which approximately one-third belongs to the north-western peninsula. Iceland is a plateau or tableland, built up of volcanic rocks of older and younger formation, and pierced on all sides by fjords and valleys. Compared with the tableland, the lowlands have a relatively small area, namely, one-fourteenth of the whole; but these lowlands are almost the only parts of the island which are inhabited. In consequence of the rigour of its climate, the central tableland is absolutely uninhabitable. At the outside, not more than one-fourth of the area of Iceland is inhabited; the rest consists of elevated deserts, lava streams and glaciers. The north-west peninsula is separated from the main mass of the island by the bays Hunaflói and Breiðifjörðr, so that there are really two tablelands, a larger and a smaller. The isthmus which connects the two is only 4¼ m. across, but has an altitude of 748 feet. The mean elevation of the north-west peninsula is 2,000 feet. The fjords and glens which cut into it are shut in by precipitous walls of basalt, which plainly shows that they have been formed by erosion through the mass of the plateau. The surface of this tableland is bare and desolate, being covered with gravel and fragments of rock. Here and there are large straggling snowfields, the largest being Glámu and Drangajökull, on the culminating points of the plateau. The only inhabited districts are the shores of the fjords, where grass grows capable of supporting sheep; but most of the population gain their livelihood by fishing.

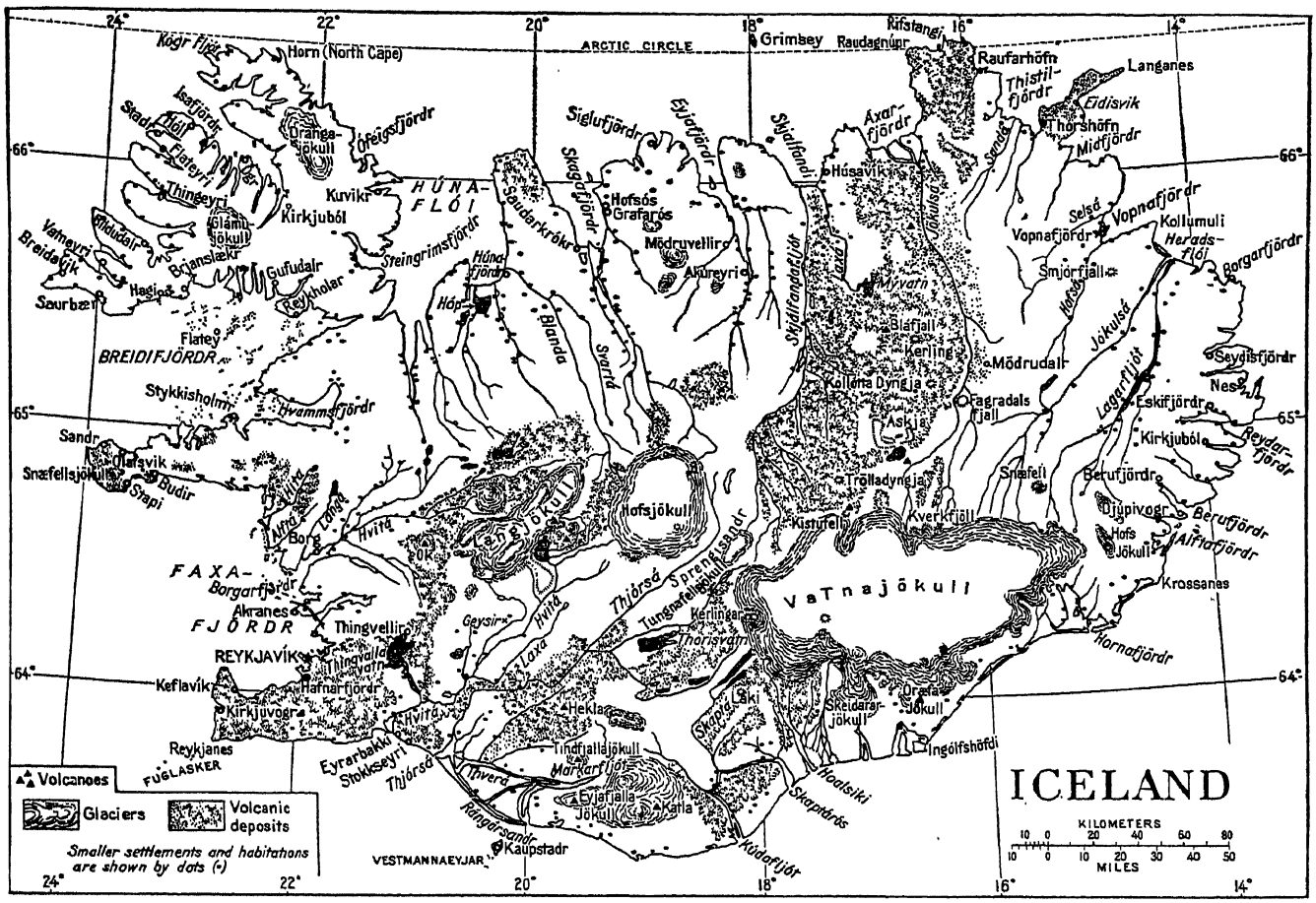
The other and larger tableland, which constitutes the substantial part of Iceland, reaches its culminating point in the south-east, in the gigantic snowfield of Vatnajökull, which covers 3,300 sq. miles. The axis of highest elevation of Iceland stretches from north-west to south-east, from the head of Hvammsfjörðr to Hornafjörðr, and from this water-parting the rivers descend on both sides. The crest of the water-parting is crowned by a chain of snow-capped mountains, separated by broad patches of lower ground. They are really a chain of minor plateaux, which rise 4,500 to 6,250 ft. above sea-level and 2,000 to 3,000 ft. above the tableland itself. In the extreme east is Vatnajökull, which is separated from Tungnafellsjökull by Vonarskard (3,300 ft.). Between Tungnafellsjökull and Hofsjökull lies the broad depression of Sprengisandr (2,130 ft.). Continuing north-west, between Hofsjökull and the next snow-capped mountain, Langjökull, lies Kjölur (2,000 ft.); and between Langjökull and Eiriksjökull, Flosaskard (2,630 ft.). To the north of the *jöklar* last mentioned there are a number of lakes, all well stocked with fish. Numerous valleys or glens penetrate into the tableland, especially on the north and east, and between them long mountain spurs, sections of the tableland which have resisted the action of erosion, thrust themselves towards the sea. Of these the most considerable is the mass crowned by Mýrdalsjökull, which stretches towards the south. The interior of the tableland consists for the most part of barren, grassless deserts, the surface being covered by gravel, loose fragments of rock, lava, driftsand, volcanic ashes and glacial detritus.

Save the lower parts of the larger glens, there are no lowlands on the north and east. The south coast is flat next the sea; but immediately underneath Vatnajökull there is a strip of gravel and sand, brought down and deposited by the glacial streams. The largest low-lying plain of Iceland, lying between Mýrdalsjökull and Reykjanes, has an area of about 1,550 sq. miles. In its lowest parts this plain barely keeps above sea-level, but it rises gradually towards the interior, terminating in a ramification of valleys. Its maximum altitude is attained at 381 ft. near Geysir. On the west of Mount Hekla this plain connects by a regular slope directly with the tableland, to the great injury of its inhabited districts, which are thus exposed to the clouds of pumice dust and drift-sand that cover large areas of the interior. Nevertheless the greater part of this lowland plain produces good grass, and is relatively well inhabited. The plain is drained by three rivers—Markarfljót, Thjórsá and Oelfusá—all of large volume, and numerous smaller streams. Towards the west there exist a number of warm springs. There is another lowland plain around the head of Faxaflói, nearly 400 sq.m. in extent. As a rule the surface of this second plain is very marshy. Several dales or glens penetrate the central tableland; the eastern part of this lowland is called Borgarfjörðr, the western part Mýrar.

The great bays on the west of the island (Faxaflói and Breiði fjörðr), as well as the many bays on the north, which are separated from one another by rocky promontories, appear to owe their origin to subsidences of the surface; whereas the fjords of the north-west peninsula, which make excellent harbours, and those of the east coast seem to be the result chiefly of erosion.

Glaciers.—An area of 5,170 sq.m. or a little more than 13% of the total area is covered with snowfields and glaciers. This extraordinary development of ice and snow is due to the raw, moist climate, the large rainfall and the low summer temperature. The snow-line varies greatly in different parts of the island, its range being from 1,300 to 4,250 feet. It is highest on the tableland, on the north side of Vatnajökull, and lowest on the north-west peninsula, to the south of North Cape. Without exception the great *névés* of Iceland belong to the interior tableland. They consist of slightly rounded domes or billowy snowfields of vast thickness. In external appearance they bear a closer resemblance to the glaciers of the Polar regions than to those of the Alps. The largest snowfields are Vatnajökull (3,280 sq.m.), Hofsjökull (520), Langjökull (500) and Mýrdalsjökull (390). The glaciers which stream off from these snowfields are often of vast extent, *e.g.*, the largest glacier of Vatnajökull has an area of 150 to 200 sq.m., but the greater number are small. Altogether, more than 120 glaciers are known in Iceland. It is on the south side of Vatnajökull that they descend lowest; the lower end of Breidamerkurjökull was in the year 1894 only 30 ft. above sea-level. The glaciers of the north-west peninsula also descend nearly to sea-level. The great number of streams of large volume is due to the moist climate and the abundance of glaciers, and the milky white or yellowish-brown colour of their waters (whence the common name Hvitá, white) is due to the glacial clays. The majority of them change their courses very often, and vary greatly in volume; frequently they are impetuous torrents, forming numerous waterfalls.

Iceland also possesses a great number of lakes, the largest being Thingvallavatn and Thorisvatn, each about 27 sq.m. in area. Mývatn, in the north, is well known from the natural beauty of



its surroundings. Above its surface tower a great number of volcanoes and several craters, and its waters are alive with waterfowl, a multitude of ducks of various species breeding on its islands. Mývatn fills a depression between lava streams, and has a depth of not more than 8½ feet. The group of lakes called Fiskivötn (or Veidivötn), which lie in a desolate region to the west of Vatnajökull, consist for the most part of crater lakes. The groups of lakes which lie north-west from Langjökull occupy basins formed between ridges of glacial gravel; and in the valleys numerous lakes are found at the backs of the old moraines.

Volcanoes.—Iceland is one of the most volcanic regions of the earth; volcanic activity has gone on continuously from the formation of the island in the Tertiary period down to the present time. So far as is known, there have in historic times been eruptions from 25 volcanic vents. Altogether 107 volcanoes are known to exist in Iceland, with thousands of craters, great and small. The lava-streams which have flowed from them since the Glacial epoch now cover an area of 4,650 sq. miles. They are grouped in dense masses round the volcanoes from which they have flowed, the bulk of the lava dating from outbreaks which occurred in prehistoric times. The largest volume of lava which has issued at one outflow within historic times is the stream which came from the craters of Laki at Skaptá. This belongs to the year 1783, and covers an area of 218 sq.m., and amounts to a volume represented by a cube each of whose sides measures 7½ miles. The largest unbroken lava-field in Iceland is Oda∂ahraun (Lava of Evil Deeds), upon the tableland north from Vatnajökull (2,000 to 4,000 ft. above sea-level). It is the accretion of countless eruptions from over 20 volcanoes, and covers an area of 1,300 sq.m. (or, including all its ramifications and minor detached streams, 1,700 sq.m.), and its volume would fill a cube measuring 13·4 m. in every direction.

As regards their superficies, the lava-streams differ greatly. Sometimes they are very uneven and jagged (*apalhraun*), consisting of blocks of lava loosely flung together in the utmost confusion. The great lava-fields, however, are composed of vast sheets of lava, ruptured and riven in divers ways (*helluhraun*). The smooth surface of the viscous billowy lava is further diversified by long twisted "ropes," curving backwards and forwards up and down the undulations. Moreover, there are gigantic fissures, running for several miles, caused by subsidences of the underlying sections. The best-known fissure of this character is Almannagjá at Thingvellir. On the occasion of outbreaks the fine ashes are scattered over a large portion of the island, and sometimes carried far across the Atlantic. After the eruption of Katla in 1625 the ashes were blown as far as Bergen in Norway, and when Askja was in eruption in 1875 a rain of ashes fell on the west coast of Norway 11 hours 40 minutes, and at Stockholm 15 hours, afterwards. The volcanic ash frequently proves extremely harmful, destroying the pastures so that the sheep and cattle die of hunger and disease. The outbreak of Laki in 1783 occasioned the loss of 11,500 cattle, 28,000 horses and 190,500 sheep—that is to say, 53% of the cattle in the island, 77% of the horses and 82% of the sheep. After that the island was visited by a famine, which destroyed 9,500 people, or one-fifth of the total population.

The Icelandic volcanoes may be divided into three classes: (1) cone-shaped, like Vesuvius, built up of alternate layers of ashes, scoriae and lava; (2) cupola-shaped, with an easy slope and a vast crater opening at the top—these shield-shaped cupolas are composed entirely of layers of lava, and their inclination is seldom steeper than 7°–8°; (3) chains of craters running close alongside a fissure in the ground. For the most part the individual craters are low, generally not exceeding 300 to 500 feet. These crater chains are very common and often very long. The chain of Laki, which was formed in 1783, extends 20 m., and embraces about 100 separate craters. Sometimes, however, the lava-streams are vomited straight out of gigantic fissures in the earth without any crater being formed. Many of the Icelandic volcanoes during their periods of quiescence are covered with snow and ice. Then when an outbreak occurs the snow and ice melt, and in that way they sometimes give rise to serious catastrophes (*jökulhlaup*), through large areas being suddenly inundated by great floods of

water, which bear masses of ice floating on the surface. Katla caused very serious destruction in this way by converting several cultivated districts into barren wastes. In the same way in the year 1362 Oraefajökull, the loftiest mountain in Iceland (6,424 ft.), swept 40 farms, together with their inhabitants and live stock, bodily into the ocean. The best-known volcano is Hekla (5,108 ft.), which was in eruption 18 times within the historic period down to 1845. Katla during the same period was active 13 times down to 1860. The largest volcano is Askja, situated in the middle of the lava-field of Odaðahraun. Its crater measures 3½ sq.m. in area. At Mývatn there are several volcanoes, which were particularly active in the years 1724–30. On several occasions there have been volcanic outbreaks under the sea outside the peninsula of Reykjanes, islands appearing and afterwards disappearing again. The crater chain of Laki has only been in eruption once in historic times, namely, the violent and disastrous outbreak of 1783. Iceland, however, possesses no constantly active volcano. There are often long intervals between the successive outbreaks, and many of the volcanoes (and this is especially true of the chains of craters) have only vented themselves in a solitary outburst.

Earthquakes are frequent, especially in the districts which are peculiarly volcanic. Historical evidence goes to show that they are closely associated with three naturally defined regions: (1) the region between Skjálfandi and Axarfjörðr in the north, where violent earth tremblings are extremely common; (2) at Faxaflói, where minor vibrations are frequent; (3) the southern lowlands, between Reykjanes and Mýrdalsjökull, have frequently been devastated by violent earthquake shocks, with great loss of property and life, *e.g.*, on Aug. 14–16, 1784, when 92 farmsteads were totally destroyed, and 372 farmsteads and 11 churches were seriously damaged; and again in Aug. and Sept. 1896, when another terrible earthquake destroyed 161 farmsteads and damaged 155 others. Hot springs are found in every part of Iceland, both singly and in groups; they are particularly numerous in the western portion of the southern lowlands, where amongst others is the famous Geyser (*q.v.*). Sulphur springs and boiling mud lakes are also general in the volcanic districts; and in places there are carbonic acid springs, these more especially on the peninsula of Snaefellsnes, north of Faxaflói.

Geology.—Iceland is built up almost entirely of volcanic rocks, none of them older, however, than the middle of the Tertiary period. The earlier flows were probably contemporaneous with those of Greenland, the Faeroes, the western islands of Scotland and the north-east of Ireland. The principal varieties are basalt and palagonitic breccias, the former covering two-thirds of the entire area, the latter the remaining one-third. Compared with these two systems, all other formations have an insignificant development. The palagonitic breccias, which stretch in an irregular belt across the island, are younger than the basalt. In the north-west, north and east the coasts are formed of basalt, and rise in steep, gloomy walls of rock to altitudes of 3,000 ft. and more above sea-level. Deposits of clay, with remains of plants of the Tertiary period, lignite and tree-trunks pressed flat, which the Icelanders call *surtarbrandur*, occur in places in the heart of the basalt formation. These fossiliferous strata are developed in greatest thickness in the north-west peninsula. Indeed, in some few places well-marked impressions of leaves and fruit have been discovered, proving that in Tertiary times Iceland possessed extensive forests, and its annual mean temperature must have been at least 48° F, whereas the present mean is 35·6°. The palagonitic breccias, which attain their greatest development in the south of the island and on the tableland, consist of reddish, brown or yellowish rocks, tuffs and breccias, belonging to several different groups or divisions, the youngest of which seems to be of a date subsequent to the Glacial epoch.

All over Iceland, in both the basalt and breccia formations, there occur small intrusive beds and dikes of liparite, and as this rock is of a lighter colour than the basalt, it is visible from a distance. In the south-east of the island, in the parish of Lón, there exist a few mountains of gabbro, a rock which does not occur in any other part of Iceland. Near Húsavik in the north there have been found marine deposits containing a number of marine shells; they belong to the Red Crag division of the Pliocene. In the middle of Iceland, where the geological foundation is tuff and breccias, large areas are buried under ancient outflows of lava, which bear evidences of glacial scratching. These lava streams, which are of a doleritic character, flowed before the Glacial age, or during its continuance, out of lava cones with gigantic crater openings, such as may be seen at the present day. During the Glacial epoch the whole of Iceland was covered by a vast sheet of inland ice, except for a few small isolated peaks rising along its outer margins. This ice-cap had on the tableland a thickness of 2,300 to 2,600 feet. Rocks scored by glacial ice and showing plain indications of striation, together with thousands of erratic blocks, are found scattered all over Iceland. Signs of elevation subsequent to the Glacial epoch are common all round the island, especially on the north-west peninsula. There are found strikingly developed marine terraces of gravel, shore lines and surf beaches marked on the solid rock. In several places there are traces of shells; and sometimes skeletal remains of whales and walruses, as well as ancient driftwood, have been discovered at distances from the present coast. The ancient shore lines occur at two different altitudes. Along the higher, 250 to 600 ft. above the existing sea-level, shells have been found which are characteristic of high Arctic latitudes and no longer exist in Iceland, whereas on the lower shore-line, 100 to 130 ft., the shells belong to species which occur amongst the coast fauna of the present day.

The geysers and other hot springs are due to the same causes as the active volcanoes, and the earthquakes are probably manifestations of the same forces. A feature of special interest to geologists in the present conditions of the island is the great power of the wind both as a transporting and denuding agent. The rock sculpture is often very similar to that of a tropical desert. (See Th. Thoroddsen, "Explorations in Iceland during the years 1851–1898," *Geographical Journal*, vol. xiii. [1899], pp. 481–271, 459–513, with map.)

Climate.—Considering its high latitude and situation, Iceland has a relatively mild climate. The meteorological conditions vary greatly, however, in different parts of the island. In the south and east the weather is generally changeable, stormy and moist; whilst on the north the rainfall is less. The climate of the interior tableland approximates to the Continental type and is often extremely cold. The mean annual temperature is 37·2° F in Stykkishólmr. The range is great not only from year to year, but also from month to month. For instance, at Stykkishólmr the highest annual mean for March was 39·7°, and the lowest 8°, during a period of 38 years. Iceland lies contiguous to that part of the north Atlantic in which the shifting areas of low pressure prevail, so that storms are frequent and the barometer is seldom firm. The barometric pressure at sea-level in the south west of Iceland during the period 1878–1900 varied between 30·8 and 27·1 inches.

The climate of the coasts is relatively mild in summer, but cold in winter. The winter means of the north and east coasts average 31·7° and 31·3° F respectively; the summer means, 42·8° and 44·6°; and the means of the year, 33·1° and 35·6°. The winter means of the south and west coasts average 32° and 31·7° respectively; the summer means, 48·2° and 50°; the annual means, 37·4° and 39·2°. The rainfall on the south and east coasts is considerable, *e.g.*, at Vestmannaeyjar, 49·4 in. in the year. On the west coast it is less, *e.g.*, 24·3 in. at Stykkishólmr; but least of all on the north coast, being only 14·6 in. on the island of Grimsey, which lies off that coast. Mist is commonly prevalent on the east coast; at Berufjörðr there is mist on no fewer than 212 days in the year. The south and west coasts are washed by the Gulf stream, and the north coast by an Arctic current, which frequently brings with it a quantity of drift-ice, and thus exercises a considerable effect upon the climate of the island; sometimes it blocks the north coast in the summer months. On the whole, during the 19th century, the north coast was free from ice on an average of one year in every four or five. The clearness of the atmosphere has been frequently remarked. Thunderstorms occur mostly in winter.

Flora.—The vegetation presents the characteristics of an Arctic European type, and is tolerably uniform throughout the island, the differences even on the tableland being slight. At present 435 species of phanerogams and vascular cryptogams are known; the lower orders have been little investigated. The grasses are of the greatest importance to the inhabitants, for upon them they are dependent for the keep of their live stock. Heather covers large tracts, and also affords pasture for sheep. The development of forest trees is insignificant. Birch woods exist in a good many places, especially in the warmer valleys; but the trees are very short, scarcely attaining more than 3 to 10 ft. in height. In a few places, however, they reach 13 to 20 ft. and occasionally more. A few mountain ash or rowan trees (*Sorbus aucuparia*) are found singly here and there, and attain to 30 ft. in height. Willows are also pretty general, the highest in growth being *Salix phyllicifolia*, 7 to 10 feet. The wild flora of Iceland is small and delicate, with bright bloom, the heaths being especially admired. Wild crowberries and bilberries are the only fruit found in the island.

Fauna.—The Icelandic fauna is of a sub-Arctic type. But while the species are few, the individuals are often numerous. The land mammals are very poorly represented; and it is doubtful whether any species is indigenous. The polar bear is an occasional visitant, being brought to the coast by the Greenland drift-ice. Foxes are common, both the white and the blue occurring; mice and the brown rat have been introduced, though one variety of mouse is possibly indigenous. Reindeer were introduced in 1770, and without the aid of these strong, heavily built animals, many portions of the country could scarcely be permanently inhabited; these reindeer can maintain a speed of nine to ten miles an hour for long periods at a time, and draw a weight of over 200 lbs.

The marine mammalia are numerous. The walrus is now seldom seen, although in prehistoric times it was common. There are numerous species of seals; and the seas abound in whales. Of birds there are over 100 species, more than one-half being aquatic. In the interior the whistling swan is common, and numerous varieties of ducks are found in the lakes. The eider duck, which breeds on the islands of Breidifjörðr, is a source of livelihood to the inhabitants, as are also the many kinds of sea-fowl which breed on the sea-cliffs. Iceland possesses neither reptiles nor batrachians. The fish fauna is abundant in individuals, some 68 species being found off the coasts. The cod fisheries are amongst the most important in the world. Large quantities of herring, plaice and halibut are also taken. Many of the rivers abound in salmon, and trout are plentiful in the lakes and streams.

Population and Towns.—With a population of about 100,000 (in 1925) Iceland is the most sparsely populated country in Europe. Remembering that almost four-fifths of the island are uninhabited and almost uninhabitable, the distribution of population gives an average of something less than one per square kilometre. In the earlier days of its settlement Iceland suffered from disasters and visitation of plagues, which greatly decreased the number of its population. The Black Death, which ravaged the country from 1402–04, is supposed to have killed off no less than two-thirds of the inhabitants. The increase of population during the 19th century was counterbalanced by the number of Icelanders who emigrated to America, chiefly to Manitoba and Saskatchewan. The highest figures of emigration were reached in 1887 when about 2,000 persons emigrated. In the present century an average of about 200 per year emigrated until 1915, when emigration practically stopped. The population of Iceland consists almost exclusively of Icelanders. The census of 1920 shows only 0·7% were born out of Iceland. The largest town is Reykjavik, on the Faxaflói, with about 22,000 inhabitants, the capital of the island and the seat of Government. Here also are the Icelandic university and many of the principal schools of the country, together with the cathedral, whose marble font was made by Albert Thorvaldsen, whose father was an Icelander. Other towns include, Akureyi (pop. 2,906), Vestmannaeyjar (pop. 2,841), Hafnarfjörður (2,692), Isafjördur (2,158).

Industries.—The classification of the population according to occupations is shown in the following summary based upon the census of 1920:

Public service, art and science	3,417	3·6%
Farming	40,614	42·9%
Fisheries	17,947	18·9%
Handicraft and industry	10,697	11·3%
Commerce and communications	11,539	12·2%
Servants	6,436	6·8%
Pensioners and "retired" men.	1,866	2·0%
Receiving poor relief	1,482	1·6%
Profession not stated	692	0·7%
	94,690	100·00%

Though farming is still the chief occupation of the population yet formerly it was so in a much higher degree. In 1880 73·2% were engaged in farming compared with 42·9% in 1920, while there has been a material rise in the numbers engaged in fisheries, industry, handicraft, communications and commerce. Farmers are largely occupied with cattle-breeding, and more particularly sheep-breeding. Grain is not cultivated in Iceland, all breadstuffs being imported. An attempt to grow barley proved to be an economic failure. Considerable progress has been made in modern times in the cultivation of turnips and potatoes. While fruit trees do not thrive, black and red currants and rhubarb grow excellently. In nearly every district a small agricultural association is found; there are also four agricultural schools and one agricultural society in Iceland.

Fisheries now furnish employment to about one-fifth of the population. There has been a marked development of the fishing fleet during the last 25 years, due solely to the increased employment of trawlers and large and small motor boats. In 1922 the trawler fleet consisted of 31 ships, with an average measurement of some 300 gross reg. tons each, while the whole motor ship fleet had a total of 3,938 tons (gross reg.).

This development of the fisheries has greatly influenced the distribution of the population, and has been the cause of the migration of people from rural to coastal districts. Practically the whole fishing fleet is employed in fishing cod and cod-like species, and the winter fishing season (the first four to five months of the year) off the south coast of Iceland yields about three-fifths of the total catch of the year. In summer the waters are visited by a great number of fishing-boats from French ports, the Faeroes and Norway, and by steam-trawlers from Britain. Inspection of fishing grounds is at present carried out by Danish patrol boats, and the maritime jurisdiction of Iceland, as far as the fisheries are concerned, is fixed by a treaty made between Denmark and Great Britain on March 28, 1903. Many public measures have been taken for the encouragement of salt-water fisheries, the chief being an annual grant from the budget, the Fishing Fund, which grants loans for the purchase of vessels and fishing gear and which derives its increased capital from the fines for illegal fishing and the sale of forfeited gear, and the Sea-territorial Fund, which derives its capital from the same source and is concerned with the provision of protective patrol boats. The Icelandic Association for the Promotion of the Fishing Trade was established in 1911, has 41 local branches and a membership of 1,500 in 1924; it issues a monthly and gives short courses in navigation and in motor repairs. On the initiative of the State there is now a marine mutual insurance company and two special schools for sailors and fishermen, one for marine engineers and one in navigation. The total export of fish in 1923 was 59,464 tons, to the value of 37·2 million kroner.

Commerce.—In 1902 imports were valued at £596,193 and exports at £511,083. In 1923 imports were valued at £2,794,151 and exports at £3,194,283. Trade is almost entirely with Denmark, the United Kingdom, and Norway and Sweden, in this order according to value. The principal native products exported are live sheep, horses, salt meat, wool and hides, to which must be added the fish products—cod, train-oil, herring and salmon—eiderdown and woollen wares. The spinning, weaving and knitting of wool is a widespread industry, and the native tweed (*vaðmal*) is the principal material for the clothing of the inhabitants. The imports consist principally of cereals and flour, coffee, sugar, ale, wines and spirits, tobacco, manufactured wares, iron and metal wares, timber, salt, coal, etc. The money, weights

and measures in use are the same as in Denmark. The Islands Bank in Reykjavik (1904) is authorized to issue bank-notes up to £133,900 in total value. This was greatly increased during the World War, and a special committee has now been appointed to make proposals regarding the definite fixing of the note issue.

Communications.—All land journeys are made on horseback, and in the remoter parts all goods have to be transported by the same means. Throughout the greater part of the island there exist no proper roads, even in the inhabited districts, but only bridle-paths, and in the uninhabited districts not even these. Nevertheless, under the Roads Act, much has been done to improve such paths as there are, and several miles of driving roads have been made, more particularly in the south. Since 1888 many bridges have been built; previous to that year there were none. The larger rivers have been spanned by iron swing-bridges, and the Blanda is crossed by a fixed iron bridge. Postal connection is maintained with Denmark by steamers, which sail from Copenhagen and call at Leith. Besides, steamers go round the island, touching at nearly every port. Since motor cars were introduced in 1913 their number has increased until, in 1925, 400 had been registered. No railways exist, but a preliminary survey has been made for a line from Reykjavik to the southern lowlands. A wireless telegraph station was opened in 1917. Iceland controls its own steamship company with six mail steamers.

Religion.—The Icelanders are Lutherans. The island forms one bishopric, with its see at Reykjavik, and there are two vice-bishops, one for each of the two dioceses into which the island was formerly divided. There are 20 deaneries, each with a district council, and 142 parishes administered by a parish council. Candidates for the priesthood must now, as a rule, have taken a theological degree at the University of Iceland, and clergymen are chosen by a secret voting on the part of such of the parishioners who are of full age (21 years) and of blameless reputation.

The Icelandic Church has always been liberal in her views, and many adherents to the new theology and the doctrines of spiritualism are found among the younger clergy.

Health.—In 1923 the birth rate was 26·5 per 1,000, and the death rate was 12·5 per 1,000, the latter showing a marked improvement on pre-war figures. This improvement is due to greater cleanliness, better housing and nourishment, and the increase in the number of doctors. There is a modern asylum for leprosy near Reykjavik, and the building of a large State hospital at Reykjavik was commenced in 1925. There is also a mental hospital and a sanatorium, as well as a number of minor infirmaries. The chief surgeon (national physician), who resides at Reykjavik, is in charge of the general sanitary affairs of the island, and has superintendence over the doctors and the medical school.

Government.—According to the Constitution granted to Iceland in 1874, and amended by the Icelandic Parliament Act of 1903 and 1918, the king of Denmark shares the legislative power with the Althing, an assembly of 42 popularly elected members, 36 of whom are elected by the constituencies for a period of four years. Six members are chosen by the whole electorate, according to proportional representation, for a period of eight years. These last six form the upper house and the remainder the lower house, but upon occasions the two houses work together in a united Althing.

The Althing meets every other year, and as it has the right to vote its own supplies, the budget is passed for two years at once.

Iceland has its own prime minister, who must be an Icelander and reside in Reykjavik. He is responsible to the king and to the Althing, and is aided in the work of administration by a secretary of State and three chiefs of departmental bureaus. For convenience he has a sub-office in Copenhagen, for the purpose of laying the measures approved by the Althing before the king, for his sanction and signature.

The island is divided into 16 districts (sýslur) each of which is administered by a district magistrate (sýslumenn), and seven towns administered by town magistrates. These magistrates act as tax-gatherers, notaries public and judges of first instance. The counties are divided into 169 hreppur (rapes) poor-law districts, and in each hreppur the magistrate has an assistant, called hreppstjori.

From the magistrates' courts appeals lie to the superior court at Reykjavik, consisting of three judges, and appeals may further be taken in all criminal and in most civil cases to the supreme court at Copenhagen.

In Feb. 1918 the Althing agreed that it was desirable to cancel the present treaty of personal unity with Denmark, thereby obtaining complete independence.

Education.—There is compulsory elementary education between the ages of 10 and 14 years. In towns, trading stations and some rural districts children receive instruction at "stationary" schools for six months of the year; where this is impossible, "movable" schools have been provided, in which each child receives instruction for at least two months of the year. In various parts of the country there are "schools for youths" providing courses of instruction of secondary school nature. In Reykjavik there is a "Mentaskóli" (State school) and the final examination here entitles those who pass it to matriculation at the university. There are also a number of technical schools, most of which provide a general, as well as a professional education, such as training college for elementary teachers, theological school, nautical school, agricultural schools, schools for marine engineers, and evening technical schools for apprentices, in various towns. There is a national library at the capital containing some 110,000 printed volumes and 7,500 mss., and almost every district has a public library.

There is a daily newspaper, several weeklies and a number of periodical publications (monthlies and quarterlies). Among the learned societies are the Icelandic Literary Society, the Society of the Friends of the People and the Archaeological Society of Reykjavik.

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HISTORY

The discovery of Iceland by the Scandinavians, *c.* 850 (it had long been inhabited by a small colony of Irish Culdees), led in sixty years, to the establishment of some 4,000 homesteads. In this immigration three distinct streams can be traced. (1) About 870–890 four great noblemen from Norway, settled with their dependants in the south-west. (2) In 890–900 there came from the Western islands Queen Aud, widow of Olaf the White, king of Dublin, preceded and followed by a number of her kinsmen and relations (many like herself being Christians), who settled the best land in the west, north-west and north, and founded families who long swayed its destinies. There also came from the Western islands a fellowship of vikings seeking a free home in the north. They had fled from Harald Haarfager's rule and colonized the west in the viking times. (3) In 900–930 a few more incomers direct from Norway completed the settlement of the south, north-east and south-east. Among the immigrants there was no small proportion of Irish blood. In 1100 there were 4,500 franklins,

i.e., about 50,000 souls.

The unit of Icelandic politics was the homestead with its franklin-owner (*buendi*), its primal organization the hundred-moot (*thing*), its tie the goðorð (godar) or chieftainship. The chief who had led a band of kinsmen and dependants to the new land, naturally became their leader, presiding as priest at the feasts and sacrifices, acting as speaker of their moot, and as their representative towards the neighbouring chiefs. He was not a feudal lord, for any franklin could change his goðorð when he would, and the rights of "judgment by peers" were in full use; moreover, the office could be bequeathed, sold, divided or pledged by the possessor; still the goði had considerable power as long as the commonwealth lasted.

Disputes and uncertainty about the law, brought about the *Constitution of Ulfliot* (*c.* 930), which appointed a central moot for the whole island, the Althing; the *Reforms of Thord Gellir* (964), settling a fixed number of moots and chieftaincies, dividing the island into four quarters, to each of which a head-court, the "quarter-court," was assigned; and the *Innovations of Skapti* (ascribed in the saga to Nial) *the Law-Speaker* (d. 1030), who set up a "fifth court" as the ultimate tribunal in criminal matters. But here constitutional growth ceased: the law-making body made few and unimportant modifications of custom; the courts were too weak for the chiefs, who defied them; the speaker's power was not sufficiently supported; even the ecclesiastical innovations, while they secured peace for a time, provoked in the end the struggles which put an end to the commonwealth.

Union with Norway.—Christianity was introduced *c.* 1000 from Norway. Tithes were established in 1096, and an ecclesiastical code made *c.* 1125. The first disputes about the jurisdiction of the clergy were moved by Gudmund in the 13th century, bringing on a civil war, while the questions of patronage and rights over glebe and mortmainland occupied Bishop Arni and his adversaries fifty years afterwards, when the land was under Norwegian viceroys and Norwegian law. For the civil wars broke down the great houses who had monopolized the chieftaincies; and after violent struggles the submission of the island to Norway quarter after quarter took place in 1262–64, under Gizur's auspices, and the old Common Law was replaced by the New Norse Code "Ironside" in 1271.

The political life and law of the old days is abundantly illustrated in the sagas (especially Eyrbyggia, Hensa-Thori, Reykdaela, Hrafnkell and Niala), the two collections of law-scrolls (*Codex Regius, c.* 1235, and *Stadarhol's Book, c.* 1271), the Libellus, the Liberfragments and the Landnamabok of Ari and the Diplomatarium. (*See* K. Maurer *Beiträge zur Rechtsgeschichte des Germanischen Nordens* [Munich 1852]; *Island von seiner ersten Entdeckung bis zum Untergang des Freistaats* [Munich 1874].)

The mediaeval Icelandic church had two bishoprics, Skalholt (1056) and Holar (1106), and about 175 parishes. They belonged to the metropolitan see of Bremen, then to Lund, lastly to Nidaros, 1237. There were several religious foundations, Benedictine and Augustinian, dating from the 12th to 15th centuries. The bishops, elected by the people at the Althing till 1237, enjoyed considerable power; two, Thorlak of Skalholt and John of Holar, were publicly voted saints at the Althing. For ecclesiastical history *see* "Biskupasögur" in *Origines Islandicae* Bk. 1 (ed. and trans. G. Vigfusson and F. York Powell 1905).

Iceland was pastoral, depending upon herds for subsistence, for, though rye and other grain would grow in favoured localities, the hay, self-sown, was the only regular crop. In some districts the fisheries and fowling were also of importance. Outdoor occupations—fishing, shepherding, fowling, hay-making and fuel-gathering—occupied the summer; while indoor business—weaving, tool-making, etc.—filled up the long winter. The year was broken by the spring feasts and moots, the great Althing meeting at midsummer, the marriage and arval gatherings after the summer, and the long yule feasts at midwinter. There were but two degrees of men, free and unfree, though only the franklins had any political power; and, from the nature of the life, social intercourse was unrestrained; goði and thrall lived the same lives, ate the same food, spoke the same tongue, and differed little in clothing or habits. The thrall had a house of his own and was rather villein or serf than slave, having rights and a legal price by law. During the heathen days many great chiefs passed part of their lives in Norway at the king's court, but after the establishment of Christianity in Iceland they kept more at home, visiting the continent, however, for purposes of state, suits with clergy, etc. Trade was from the first almost entirely in foreign (Norse) hands.

Life in the commonwealth was turbulent and anarchic, but free and varied; it produced men of mark, and fostered bravery, adventure and progress. But on the union with Norway all this ceased, and there was left but a low dead level of poor peasant proprietors careless of all save how to live by as little labour as possible, and pay as few taxes as they could to their foreign rulers. The island received a foreign governor (*Earl, Hirdstjori* or *Stiptamtsmadr* as he was successively called), and was parcelled out into counties (*sýslur*), administered by sheriffs (*sýslumadr*) appointed by the king. A royal court took the place of the Althing courts; the local business was carried out by the (*hreppstjori*) bailiff, a subordinate of the sheriff; and the goðorð things, quarter-courts, trial by jury, etc., were swept away by these innovations. The power of the crown was increased by the confiscation of the great Sturlung estates, which were underleased to farmers, while the early falling off of the Norse trade threatened to deprive the island of the means of existence; for the great epidemics and eruptions of the 14th century had gravely attacked its pastoral wealth and ruined much of its pasture and fishery.

Union with Denmark.—The union of the Three Crowns transferred the practical rule of Iceland to Denmark in 1280, and the old Treaty of Union, by which the island had reserved its essential rights, was disregarded by the absolute Danish monarchs. During the whole of the 15th century their trade with England, exporting sulphur, eiderdown, wool and salt stock-fish, and importing as before wood, iron, honey, wine, grain and flax goods, was their only link with the outer world. This period of Iceland's existence is eventless: she had got peace but with few of its blessings; even shepherding and agriculture sank to a lower stage; wagons, ploughs and carts went out of use; architecture in timber became a lost art, and the fine carved and painted halls of the heathen days were replaced by turfwalled barns half sunk in the earth; the large decked luggers of the old days gave way to small undecked fishing-boats.

The Reformation in Iceland wakened men's minds, but it left their circumstances little changed. When it was accomplished, the little knot of able men who came to the front did much in preserving the records of the past, while Odd and Hallgrim exhibit the noblest impulses of their time. The Hanse trade replaced the English for the worse; and the Danish monopoly which succeeded it when the Danish kings began to act again with vigour was still less profitable. The subservient Lutheran clergy became the most powerful class in the island, while the system of underleasing at rackrent and short lease with unsecured tenant right extended over at least a quarter of the better land.

A new plague, that of the English, Gascon and Algerine pirates, at the close of the 16th century and opening of the 17th, caused widespread panic and some devastation in 1579, 1613–16 and 1627. But the 18th century is the most gloomy in Iceland's annals. Smallpox, famine, sheep disease and the eruptions of 1765 and 1783 follow each other in terrible succession. Against such visitations, which reduced the population by about a fourth, little could be done. The few literary men, whose work was done and whose books were published abroad, were only concerned with the past, and Jon Vidalin is the one man of mark, beside Eggert Olafsson, who worked and wrote for his own generation.

Gradually the ideas which were agitating Europe spread through Scandinavia into Iceland, and its claims were more respectfully listened to. The continental system, which, by its leading to the blockade of Denmark, threatened to starve Iceland, was neutralized by special action of the British government. Trade and fishery grew a little brisker, and at length the turn came.

The rationalistic movement, headed by Magnus Stephenson, a patriotic, narrow-minded lawyer, did little good as far as church reform went, but was accompanied by a more successful effort to

educate the people. Newspapers and periodicals were published, and the very stir which the ecclesiastical disputes encouraged did good. When free trade came, and when the free constitution of Denmark had produced its legitimate effects, the endeavours of a few patriots such as Jon Sigurdsson were able to push on the next generation a step further. Questions of a modern political complexion arose; the cattle export controversy and the great home rule struggle began. After thirty years' agitation home rule was conceded in 1874 and in 1918 Iceland was recognized as a separate kingdom, with unlimited sovereignty, in personal union with Denmark. According to the Act of Union there are no real joint affairs; Denmark, however, provisionally till 1940, takes charge of the foreign affairs of Iceland as its mandatory. For the same period Danish and Icelandic citizens, residing in either State, enjoy in every respect equal rights. Since 1915 Iceland has had its own merchant flag; since 1918 its own national arms. Abroad Danish legations act on behalf of both Denmark and Iceland. Iceland has had a legation in Denmark, and Denmark a legation in Iceland since 1921; other states are represented in Iceland by consulates.

ICELANDIC LANGUAGE. Closely akin to Norwegian, Old Icelandic was spoken in Iceland and in Greenland. A voluminous literature dates from the first half of the 12th century, written in the Latin alphabet and adapted to the special requirements of this language. No traces are found of any older runic literature. The runic monuments (about 45) are almost worthless from a philological point of view. The oldest, which date from the early 13th century, are later than the oldest manuscripts in the Latin alphabet.

Form of the Language.—The oldest form of the Icelandic language is preserved in the later manuscripts of the 13th century, which contain poems by the oldest Icelandic poets, the metrical form having been the means of preserving the ancient language.

Two of the oldest and most essential characteristics of Icelandic as opposed to Norwegian are the more complete vowel assimilation (*þionosto, þionasto*); and the retention of initial *h* before *r* (*hrcinlega, rcinlega*), *l* and *n*. Other differences, some of which occur at this period, others a little later, are—in Icel., lengthening of *a, o, u* before *lf, lg, lk, lm* and *lþ* (as Icel. *hálfr*, Norw. and oldest Icel. *halfr*, half); later still, also of *a, i, u* and *y* before *ng* and *nk;* Icel. *æ* and *ey* for older *ǿ* and *ǿy* (as in Icel. *dæma, heyra,* Norw. and oldest Icel. *dǿma*, to deem, *hǿyra*, to hear); Icel. termination of 2nd plur. of verbs in *ð* (*þ*) or *t*, but Norw. often in *–r* (as Icel. *takið, –t*, Norw. *takir*, you take). At the middle of the 13th century the written language undergoes material changes. Thus in unaccented syllables *i* now appears for older *e*, and *u* (at first only when followed by one or more consonants belonging to the same syllable) for *o;* the passive ends in *–z* for *–sk*. Other differences from Norwegian are now completely established. With the beginning of the 14th century there appear several new linguistic phenomena: a *u* is inserted between final *r* and a preceding consonant (as in *rikur,* mighty); *ǫ* (pronounced as an open *o*) passes into *ö* (the character *ö* was not introduced till the 16th century), or before *ng, nk* into *au* (as *lǫng fiǫll,* pronounced *laung fiöll*); *e* before *ng, nk* passes into *ei;* a little later *é* passes into *ie,* and the passive changes its termination from *–z,* oldest *–sk,* into *zt* (or *zst*) (as in *kallazt,* to be called). The post-classical period of Old Icelandic (1350–1530) already shows marked differences that are characteristic of Modern Icelandic; *kn* has, except in the northern dialects, passed into *hn,* as *knútr,* knot; as early as the 15th century we find *ddl* for *ll* and *rl* (as *falla,* pronounced *faddla,* to fall), *ddn* for *nn* and *rn* (as *horn,* pron. *hoddn,* horn), and a little later the passive ends in *–st, e.g., kallast,* to be called.

Dialects.—Dialectical differences do not occur to any great extent in the Old Icelandic literary language. To what extent the language of Greenland differed from that of Iceland we cannot judge from the few runic monuments which have come down to us from that colony.

Modern Icelandic.—The speech of modern Iceland has developed quite naturally from the ancient tongue. It bears a strong resemblance to the modern Scandinavian tongues, especially Norwegian. With the tendency in recent years toward uniformity in speech among the Danes, Swedes and Norwegians, this *rapprochement* has become more marked and a fluent speaker of what is sometimes called Dano-Norwegian would have little difficulty in speaking and understanding modern Icelandic. The semi-vowels are modified in certain well-defined ways (Icelandic *liuom* is Norw. *lifom*), and vocalic assimilation is still strong in Icelandic, whereas it tends to become lost in Norwegian. There is increasing vigour in the modern Icelandic as evidenced by the steady growth of publications. (*See* ICELANDIC LITERATURE.)

ICELANDIC LITERATURE. Iceland has always borne a high renown for song, but has never produced a poet of the highest order, the qualities which in other lands were most sought for and admired in poetry being in Iceland lavished on the saga, a prose epic, while Icelandic poetry is to be rated very high for the one quality which its authors have ever aimed at—melody of sound. To these generalizations there are few exceptions, though Icelandic literature includes a group of poems which possess qualities of high imagination, deep pathos, fresh love of nature, passionate dramatic power, and noble simplicity of language which Icelandic poetry lacks. The solution is that these poems do not belong to Iceland at all. They are the poetry of the "Western islands."

The Western Isles School.—It was from among the Scandinavian colonists of the British coasts that in the first generations coming after the colonization of Iceland a magnificent school of poetry arose, to which we owe works that for power and beauty can be paralleled in no Teutonic language till centuries after their date. To this school, which is totally distinct from the Icelandic, and which ran its own course and perished before the 13th century, the following works belong. Of their authors we have scarcely a name or two; their dates can be rarely exactly fixed, but they lie between the beginning of the 9th and the end of the 10th centuries. The poems are classified into groups:—

(*a*) The *Helgi* trilogy (last third lost save a few verses, but preserved in prose in *Hromund Gripsson's Saga*), the *Raising of Angantyr* and *Death of Hialmar* (in *Hervarar Saga*), the fragments of a *Volsung Lay* (*Völsungakviða*) (part interpolated in earlier poems, part underlying the prose in *Volsunga Saga*), all by one poet, to whom Dr. Vigfusson would also ascribe *Völuspá, Vegtamskviða, Þrymskviða, Grótta Song* and *Völundarkviða*.

(*b*) The Dramatic Poems:—*Flyting of Loki*, the *Fair Skirnis*, the *Hárbarðsljóð* and several fragments, all one man's work, to whose school belong, probably, the *Lay* underlying the story of Ivar's death in *Skjöldunga Saga*.

(*c*) The Didactic Poetry:—*Grimnismál, Vafþrudrismál, Alvi's-smál*, etc.

(*d*) The Genealogical and Mythological Poems:—*Hyndluljóð*, written for one of the Haurda-Kari family, so famous in the Orkneys; *Vaglingatal* and *Haustlöng*, by Thiodolf of Hvin; *Rig's Thul*, etc.

(*e*) The Dirges and Battle Songs—such as that on Hafur-firth Battle *Hrafnsmál*, by Thiodolf of Hvin or Thorbjörn Hornkloti, shortly after 870; Eirik's Dirge (*Eiriksmál*) between 930 and 969; the *Dart-Lay on Clontarf Battle* (1014); *Bjarka-mál* (fragments of which we have, and paraphrase of more is found in *Hrolf Kraki's Saga* and in Saxo).

There are also fragments of poems in *Half's Saga, Asmund Kappa-Bana's Saga,* in the Latin verses of Saxo, and the Shield Lays (*Ragnarsdrápa*) by Bragi, etc., of this school, which closes with the *Sun-Song*, a powerful Christian Dantesque poem, recalling some of the early compositions of the Irish Church, and with the 12th century *Lay of Ragnar, Lay of Starkad, The Proverb Song* (*Hávamál*) and *Krákumál*, to which we may add those singular Gloss-poems, the *Þulur*, which also belong to the Western Isles.

To Greenland, Iceland's farthest colony, founded in the 10th century, we owe the two *Lays of Atli*, and probably *Hymiskviða*, which, though of a weirder, harsher cast, yet belong to the Western isles school and not to Iceland.

In form all these poems belong to two or three classes:—*kviða*, an epic "cantilena"; *tal*, a genealogical poem; *drápa*, songs of praise, etc., written in modifications of the old Teutonic metre which we know in Beowulf; *galdr* and *lokkr*, spell and charm songs in a more lyric measure; and *mál*, a dialogue poem, and *ljód*, a lay, in elegiac measure suited to the subject.

The characteristics of this Western school are no doubt the result of the contact of Scandinavian colonists of the viking-tide, living lives of the wildest adventure, with an imaginative and civilized race, that exercised upon them a very strong and lasting influence (the effects of which were also felt in Iceland, but in a different way). The frequent intermarriages which mingled the best families of either race are sufficient proof of the close communion of Northmen and Celts in the 9th and 10th centuries, while there are in the poems themselves traces of Celtic mythology, language and manners.

Many of these poems were Englished in prose by the translator of Mallet, by B. Thorpe in his *Saemund's Edda*, and two or three by Messrs. Morris and Magnússon, as appendices to their translation of *Völsunga Saga*. Earlier translations in verse are those in Dryden's *Miscellany* (vol. vi.), A. Cottle's *Edda*, Mathias's *Translations*, and W. Herbert's *Old Icelandic Poetry*. Gray's versions of *Darrafar-ljóð* and *Vegtamskviða* are well known.

When one turns to the early poetry of the Scandinavian continent, preserved in the rune-staves on the memorial stones of Sweden, Norway and Denmark, in the didactic *Hávamál*, the *Great Volsung Lay* (*i.e.*, Sigurd II., Fafnis's Lay, Sigrdrifa's Lay) and *Hamðsmál*, all continental, and all entirely consonant to the remains of Old English poetry in metre, feeling and treatment, one can see that it is with this school that the Icelandic "makers" are in sympathy, and that from it their verse naturally descends. While shrewdness, plain straightforwardness, and a certain stern way of looking at life are common to both, the Icelandic school adds a complexity of structure and ornament, an elaborate mythological and enigmatical phraseology and a regularity of rhyme, assonance, luxuriance, quantity and syllabification, which it caught from the Latin and Celtic poets, and adapted with exquisite ingenuity to its own main object, that of securing the greatest possible beauty of sound.

G. Vigfússon first promulgated the idea that the Eddic poems originated in the British isles, whether in the Northern and Western isles, or, as he later thought, in the Channel islands. Sophus Bugge, in *The Home of the Eddic Poems*, has attempted to show from internal evidence "that the oldest, and, indeed, the great majority of both the mythological and heroic poems were composed by Norwegians in the British isles, the greater number perhaps in northern England, but some, it may be, in Ireland, in Scotland, or in the Scottish isles." Finnur Jónsson holds that the great majority of the poems were composed in Norway, while Björn M. Olsen claims that most of them were composed by Icelanders. But, wherever the poems may have had their origin, they were evidently the work of men who were in contact with the civilizations of England and Ireland and were strongly influenced by the English and Irish literatures.

Early Icelandic Poets.—The first generations of Icelandic poets resemble in many ways the later troubadours; the books of the kings and the sagas are full of their strange lives. Men of good birth (nearly always, too, of Celtic blood on one side at least), they leave Iceland young and attach themselves to the kings and earls of the north, living in their courts as their henchmen, sharing their adventures in weal and woe, praising their victories, and hymning their deaths if they did not fall by their sides—men of quick passion, unhappy in their loves, jealous of rival poets and of their own fame, ever ready to answer criticism with a satire or with a sword-thrust, but clinging through all to their art, in which they attained most marvellous skill.

Such men were Egil, the foe of Eirik Bloodaxe and the friend of Aethelstan; Kormák, the hot-headed champion; Eyvind, King Haakon's poet, called Skaldaspillir, because he copied in his dirge over that king the older and finer *Eiríksmal;* Gunnlaug, who sang at Aethelred's court, and fell at the hands of a brother bard, Hrafn; Hallfred, Olaf Tryggvason's poet, who lies in Iona by the side of Macbeth; Sighvat, St. Olaf's henchman, most prolific of all his comrades; Thormod, Coalbrow's poet, who died singing after Sticklestad battle; Ref, Ottar the Black, Arnor the earls' poet, and, of those whose poetry was almost confined to Iceland, Gretti, Biorn the Hitdale champion, and the two model Icelandic masters, Einar Skulason and Markus the Lawman, both of the 12th century.

It is impossible to do more here than mention the names of the most famous of the long roll of poets which are noted in the works of Snorri and in the two *Skálda-tal*. They range from the rough and noble pathos of Egil, the mystic obscurity of Kormák, the pride and grief of Hallfred, and the marvellous fluency of Sighvat, to the florid intricacy of Einar and Markus.

The art of poetry stood for the Icelanders in lieu of music; scarcely any prominent man but knew how to turn a mocking or laudatory stanza, and down to the fall of the commonwealth the accomplishment was in high request. In the literary age the chief poets belong to the great Sturlung family, Snorri and his two nephews, Sturla and Olaf, the White Poet, being the most famous "makers" of their day. Indeed, it is in Snorri's *Edda*, a poetic grammar of a very perfect kind, that the best examples of the whole of northern poetry are to be found. The last part, *Háttatal*, a treatise on metre, was written for Earl Skuli about 1222, in imitation of Earl Rognvald and Hall's *Háttalykill* (*Clavis metrica*) of 1150. The second part, *Skáldskapar-mál*, a gradus of synonyms and epithets, which contains over 240 quotations from 65 poets, and ten anonymous lays—a treasury of verse—was composed *c.* 1230. The first part, an exquisite sketch of northern mythology, *Gylfa-ginning*, was probably prefixed to the whole later. There is some of Sturla's poetry in his *Islendinga Saga*, and verses of Snorri occur in the *Grammatical Treatise* on figures of speech, etc., of Olaf, which contains about 140 quotations from various authors, and was written about 1250.

Besides those sources, the *Kings' Lives* of Snorri and later authors contain a great deal of verse by Icelandic poets. King Harold Sigurdsson, who fell at Stamford Bridge 1066, was both a good critic and composed himself. Many tales are told of him and his poet visitors and henchmen. The Icelandic sagas also comprise much verse which is partly genuine, partly the work of the 12th and 13th century editors. Thus there are genuine pieces in *Nial's Saga* (chaps. 34, 78, 103, 126, 146), in *Eyrbyggja, Laxdœla, Egil's Saga* (part only), *Grettla* (two and a half stanzas, cf. *Landnámabók*), *Biorn's Saga, Gunnlaug's Saga, Havard's Saga, Kormak's Saga, Viga-Glum's Saga, Erik the Red's Saga* and *Fóstbrœðra Saga*. In *Nial's, Gisli's* and *Droplaug's Sons' Sagas* there is good verse of a later poet, and in many sagas worthless rubbish foisted in as ornamental.

To these may be added two or three works of a semi-literary kind, composed by learned men, not by heroes and warriors. Such are *Konunga-tal, Hugsvinnsmál* (a paraphrase of Cato's Distichs), *Merlin's Prophecy* (paraphrased from Geoffrey of Monmouth by Gunnlaug the monk), *Jómsvíkinga-drápa* (by Bishop Ketil), and the *Islendinga-drápa*, which has preserved brief notices of several lost sagas concerning Icelandic worthies, with which *Guðmundar-drápa*, though of the 14th century, may be also placed.

Rimur.—Just as the change of law gave the death-blow to an already perishing commonwealth, so the rush of mediaeval influence, which followed the union with Norway, completed a process which had been in force since the end of the 11th century, when it overthrew the old Icelandic poetry in favour of the *rimur*.

The introduction of the *danz*, ballads (or *fornkvaedi*, as they are now called) for singing, with a burden, usually relating to a love-tale, which were immensely popular with the people and performed by whole companies at weddings, yule feasts and the like, had relegated the regular Icelandic poetry to more serious events or to the more cultivated of the chiefs. But these "jigs," as the Elizabethans would have called them, dissatisfied the popular ear in one way: they were, like old English ballads, which they closely resembled, in rhyme, but void of alliteration, and accordingly they were modified and replaced by the *rimur*, the staple

literary product of the 15th century. These were rhymed but also alliterative, in regular form, with prologue or *mansong* (often the prettiest part of the whole), main portion telling the tale (mostly derived in early days from the French romances of the Carlovingian, Arthurian or Alexandrian cycles, or from the mythic or *skrök-sögur*), and epilogue. Their chief value to us lies in their having preserved versions of several French poems now lost, and in their evidence as to the feelings and bent of Icelanders in the "Dark Age" of the island's history. The ring and melody which they all possess is their chief beauty.

Of the earliest, *Olâfsrima*, by Einar Gilsson (*c.* 1350), and the best, the Aristophanic *Skîða-rima* (*c.* 1430), by Einar Fostri, the names may be given. *Rimur* on sacred subjects were called *diktur;* of these, on the legends of the saints' lives, many remain. The most notable of its class is the *Lilja* of Eystein Asgrimsson, a monk of Holyfell (*c.* 1350), a most "sweet sounding song." Later the poems of the famous Jon Arason (b. 1484), last Catholic bishop of Hólar (*c.* 1530), *Ljómur* ("gleams") and *Pislargrâtr* ("passion-tears"), deserve mention. Arason is also celebrated as having introduced printing into Iceland.

Taste has sunk since the old days; but still this *rimur* poetry is popular and genuine. Moreover, the very prosaic and artificial verse of Sturla and the last of the old school deserved the oblivion which came over them, as a casual perusal of the stanzas scattered through *Islendinga* will prove. It is interesting to notice that a certain number of *kenningar* (poetical paraphrases) have survived from the old school even to the present day, though the mass of them have happily perished. The change in the *phonesis* of the language is well illustrated by the new metres as compared with the old Icelandic *drôtt-kvaedi* in its varied forms. Most of the older *rimur* and *diktur* are as yet unprinted. Many of the *fornkvaedi* are printed in a volume of the old *Nordiske Litteratur Samfund.*

The effect of the Reformation was deeply felt in Icelandic literature, both prose and verse. The name of Hallgrim Petursson, whose *Passion-hymns*, "the flower of all Icelandic poetry," have been the most popular composition in the language, is foremost of all writers since the second change of faith. The gentle sweetness of thought, and the exquisite harmony of wording in his poems, more than justify the popular verdict. His *Hymns* were finished in 1660 and published in 1666, two great Protestant poets thus being contemporaries. A collection of Reformation hymns, adapted, many of them, from the German, the *Hólar-book*, had preceded them in 1619. There was a good deal of verse-writing of a secular kind, far inferior in every way, during this period. In spite of the many physical distresses that weighed upon the island, ballads (*fornkvaedi*) were still written, ceasing about 1750, *rimur* composed, and more elaborate compositions published.

The most notable names are those of the improvisatore Stephen the Blind; Thorlak Gudbrandsson, author of *Ulfar-Rimur*, d. 1707; John Magnusson, who wrote *Hristafla*, a didactic poem; Stefan Olafsson, composer of psalms, *rimur*, etc., d. 1688; Gunnar Pálsson, the author of *Gunnarslag*, often printed with the Eddic poems, *c.* 1791; and Eggert Olafsson, traveller, naturalist and patriot, whose untimely death in 1768 was a great loss to his country. His *Búnaðr-bálkur*, a Georgic written, like Tusser's *Points*, with a practical view of raising the state of agriculture, has always been much prized. Paul Vidalin's ditties are very naïve and clever.

Of later poets, down to more recent times, perhaps the best was Sigurd of Broadfirth, many of whose prettiest poems were composed in Greenland like those of Jon Biarnisson before him, *c.* 1750; John Thorlaksson's translation of Milton's great epic into Eddic verse is praiseworthy in intention, but, as may be imagined, falls far short of its aim. He also turned Pope's *Essay on Man* and Klopstock's *Messiah* into Icelandic. Benedikt Gröndal tried the same experiment with Homer in his *Ilion's Kvaedi*, *c.* 1825. There is a fine prose translation of the *Odyssey* by Sveinbjörn Egilson, the lexicographer, both faithful and poetic in high degree.

Sagas.—The real strength of old Icelandic literature is shown in its most indigenous growth, the "Saga" (see also Saga). This is, in its purest form, the life of a hero, composed in regular form, governed by fixed rules, and intended for oral recitation. It bears the strongest likeness to the epic in all save its unrestricted form, in both are found, as fixed essentials, simplicity of plot, chronological order of events, set phrases used even in describing the restless play of emotion or the changeful fortunes of a fight or a storm, while in both the absence of digression, comment or intrusion of the narrator's person is invariably maintained. The saga grew up in the quieter days which followed the change of faith (1000), when the deeds of the great families' heroes were still cherished by their descendants, and the exploits of the great kings of Norway and Denmark handed down with reverence. Telling of stories was a recognized form of entertainment at all feasts and gatherings, and it was the necessity of the reciter which gradually worked them into a regular form, by which the memory was relieved and the artistic features of the story allowed to be more carefully elaborated. That this form was so perfect must be attributed to Irish influence, without which indeed there would have been a saga, but not the same saga. It is to the west that the best sagas belong; it is to the west that nearly every classic writer whose name we know belongs; and it is precisely in the west that the admixture of Irish blood is greatest. In comparing the Irish tales with the saga, there will be felt deep divergencies in matter, style and taste, the richness of one contrasting with the chastened simplicity of the other; the one's half comic, half-earnest bombast is wholly unlike the other's grim humour, the marvellous, so unearthly in the one, is almost credible in the other; but in both are the keen grasp of character, the biting phrase, the love of action and the delight in blood which almost assumes the garb of a religious passion.

When the saga had been fixed by a generation or two of oral reciters, it was written down; and this stereotyped the form, so that afterwards when literary works were composed by learned men (such as Abbot Karl's *Sverri's Saga* and Sturla's *Islendinga*) the same style was adopted.

Taking first the sagas relating to Icelanders, of which some 35 or 40 remain out of thrice that number, they were first written down on separate scrolls, no doubt mainly for the reciter's convenience, between 1140 and 1200, in the generation which succeeded Ari, and felt the impulse his books had given to writing. They then went through the different phases which such popular compositions have to pass in all lands—editing and compounding (1120–60), padding and amplifying (1200–1300), and finally collection in large mss. (14th century). Sagas exist showing all these phases, some primitive and rough, some refined and beautified, some diluted and weakened, according as their copyists have been faithful, artistic or foolish; for the first generation of mss. have all perished. We have also complex sagas put together in the 13th century out of the scrolls relating to a given locality, such a group as still exists untouched in *Vápnfirdinga* being fused into such a saga as *Njála* or *Laxdæla*. Of the authors nothing is known; we can only guess that some belong to the Sturlung school. According to subject they fall into two classes, those relating to the older generation before Christianity and those telling of St. Olaf's contemporaries; only two fall into a third generation.

Beginning with the sagas of the west, most perfect in style and form, the earliest in subject is that of *Gold-Thori* (*c.* 940), whose adventurous career it relates; *Hœnsa-Þórissaga* tells of the burning of Blund-Ketil, a noble chief, an event which led to Thord Gelli's reforms next year (*c.* 964); *Gíslasaga* (960–980) tells of the career and death of that ill-fated outlaw; it is beautifully written, and the verses by the editor (13th century) are good and appropriate; *Hord's Saga* (980) is the life of a band of outlaws on Whalesfirth, and especially of their leader Hord. Of later subject are the sagas of *Havard* and his revenge for his son, murdered by a neighbouring chief (997–1002); of the *Heiðarvigasaga* (990–1015), a typical tale of a great blood feud, written in the most primitive prose; of Gunnlaug and Hrafn (*Gunnlaugssaga Ormstungu*, 980–1008), the rival poets and their ill-starred love. The verse in this saga is important and interest-

ing. To the west also belong the three great complex sagas *Egla, Eyrbyggja* and *Laxdaela*. The first (870–980), after noticing the migration of the father and grandfather of the hero poet Egil, and the origin of the feud between them and the kings of Norway, treats fully of Egil's career, his enmity with Eirik Bloodaxe, his service with Aethelstan, and finally, after many adventures abroad, of his latter days in Iceland at Borg, illustrating very clearly what manner of men those great settlers and their descendants were, and the feelings of pride and freedom which led them to Iceland. The style is that of Snorri, who had himself dwelt at Borg. *Eyrbyggja* (890–1031) is the saga of politics, the most loosely woven of all the compound stories. It includes a mass of information on the law, religion, traditions, etc., of the heathen days in Iceland, and the lives of Eric, the real discoverer of Greenland, Biorn of Broadwick, a famous chief, and Snorri, the greatest statesman of his day. Dr. Vigfússon would ascribe its editing and completion to Sturla the Lawman, *c.* 1250. *Laxdaela* (910–1026) is the saga of Romance. Its heroine Gudrun is the most famous of all Icelandic ladies. Her love for Kiartan the poet, and his career abroad, his betrayal by his friend Bolli, the sad death of Kiartan at his hands, the revenge taken for him on Bolli, whose slayers are themselves afterwards put to death, and the end of Gudrun, who becomes an anchorite after her stormy life, make up the pith of the story. The contrast of the characters, the rich style and fine dialogue which are so remarkable in this saga, have much in common with the best works of the Sturlung school.

Of the north there are the sagas of *Kormák* (930–960), most primitive of all, a tale of a wild poet's love and feuds, containing many notices of the heathen times; of *Vatzdaelasaga* (890–980), relating to the settlement and the chief family in Waterdale; of *Hallfred* the poet (996–1014), narrating his fortune at King Olaf's court, his love affairs in Iceland, and finally his death and burial at Iona; of *Reyk-daela* (990), which preserves the lives of Askell and his son Viga-Skuti; of *Svarf-daela* (980–990), a cruel, coarse story of the old days, with some good scenes in it, unfortunately imperfect, chapters 1–10 being forged; of *Viga-Glum* (970–990), a fine story of a heathen hero, brave, crafty and cruel. To the north also belong the sagas of *Gretti* the Strong (1010–31), the life and death of the most famous of Icelandic outlaws, the real story of whose career is mixed up with the mythical adventures of Beowulf, here put down to Gretti, and with the late romantic episodes and fabulous folk-tales (Dr. Vigfússon would ascribe the best parts of this saga to Sturla; its last editor, whose additions would be better away, must have touched it up about 1300), and the stories of the *Ljósvetninga-saga* (1000–60). Gudmund the Mighty and his family and neighbours are the heroes of these tales, which form a little cycle. The *Banda-mannia* saga (1050–60), the only comedy among the sagas, is also a northern tale; it relates the struggles of a plebeian who gets a chieftancy against the old families of the neighbourhood, whom he successfully outwits; *Öl-kofra þáttr* is a later imitation of it in the same humorous strain. The sagas of the north are rougher and coarser than those of the west, but have a good deal of individual character.

Of tales relating to the east there survive the Weapon-firth cycle—the tales of *Thorstein the White* (*c.* 900), of *Thorstein the Staffsmitten* (*c.* 985), of *Gunnar Thidrand's Bane* (1000–08) and of the *Weapon-firth Men* (975–990), all relating to the family of Hof and their friends and kin for several generations—and the story of *Hrafnkell Frey's Priest* (*c.* 960), the most idyllic of sagas and best of the eastern tales. Of later times there are *Droplaug's Sons' Saga* (997–1007), written probably about 1110, and preserved in the uncouth style of the original (a brother's revenge for his brother's death is the substance of it; *Brand-krossa þáttr* is an appendix to it), and the tales of *Thorstein Hall o' Side's Son* (*c.* 1014) and his brother *Thidrandi* (*c.* 996), which belong to the cycle of *Hall o' Side's Saga*, unhappily lost; they are weird tales of bloodshed and magic, with idyllic and pathetic episodes.

The Nial Saga.—The sagas of the south are either lost or absorbed in that of *Nial* (970–1014), a long and complex story into which are woven the tales of *Gunnar Nial*, and parts of others, as *Brian Boroimhe, Hall o' Side*, etc. It is, whether we look at style, contents or legal and historical weight, the foremost of all sagas. It deals especially with law, and contains the pith and the moral of all early Icelandic history. Its hero Nial, type of the good lawyer, is contrasted with its villain Mord, the example of cunning, chicane and legal wrong doing; and a great part of the saga is taken up with the three cases and suits of the divorce, the death of Hoskuld and the burning of Nial, which are given with great minuteness. The number and variety of its *dramatis personae* give it the liveliest interest throughout. The women Hallgerda, Bergthora and Ragnhild are as sharply contrasted as the men Gunnar, Skarphedin, Flosi and Kari. The pathos of such tragedies as the death of Gunnar and Hoskuld and the burning is interrupted by the humour of the Althing scenes and the intellectual interest of the legal proceedings. The plot, dealing first with the life and death of Gunnar, type of the chivalry of his day, then with the burning of Nial by Flosi, and how it came about, and lastly with Kari's revenge on the burners, is the ideal saga-plot. The author must have been of the east, a good lawyer and genealogist, and have composed it about 1250, to judge from internal evidence. It has been overworked by a later editor, *c.* 1300, who inserted many spurious verses.

Relating partly to Iceland, but mostly to Greenland and Vinland (N. America), are the *Flóamannasaga* (985–990), a good story of the adventures of Thorgils and of the struggles of shipwrecked colonists in Greenland, a graphic and terrible picture; and *Eiríkssaga rauða* (990–1000), two versions, one northern (Flatey-book), one western, the better (in *Hawk's Book*, and AM. 557), the story of the discovery of Greenland and Vinland (America) by the Icelanders at the end of the 9th century. Later is the *Fóstbraeðrasaga* (1015–30), a very interesting story, told in a quaint romantic style, of Thorgeir, the reckless henchman of King Olaf, and how his death was revenged in Greenland by his sworn brother the true-hearted Thormod Coalbrow's poet, who afterward dies at Sticklestad. The tale of *Einar Sokkason* (*c.* 1125) may also be noticed. The lost saga of *Poet Helgi*, of which only fragments remain, was also laid in Greenland.

Besides complete sagas there are embedded in the *Heimskringla* numerous small *þaettir* or episodes, small tales of Icelanders' adventures, often relating to poets and their lives at the kings' courts; one or two of these seem to be fragments of sagas now lost. Among the more notable are those of *Orm Storolfsson, Ogmund Dijtt, Halldor Snorrason, Thorstein Oxfoot, Hromund Halt, Thorwald Tasaldi, Svadi* and *Arnor Herlingar-nef, Audunn of Westfirth, Sneglu-Halli, Hrafn of Hrutfiord, Hreidar Heimski, Gisli Illugison, Ivar* the poet, *Gull-Aesu Thord, Einar Skulason* the poet, *Mani* the poet, etc.

The forged Icelandic sagas appear as early as the 13th century. They are very poor, and either worked up on hints given in genuine stories or altogether apocryphal.

History.—About the year of the battle of Hastings was born Ari Froði Thorgilsson (1067–1148), one of the blood of Queen Aud, who founded the famous historical school of Iceland, and himself produced its greatest monument in a work which can be compared for value with the English Domesday Book. Nearly all that we know of the heathen commonwealth may be traced to the collections of Ari. It was he too that fixed the style in which history should be composed in Iceland. It was he that secured and put into order the vast mass of fragmentary tradition that was already dying out in his day. And perhaps it is the highest praise of all to him that he wrote in his own "Danish tongue," and so ensured the use of that tongue by the cultured of after generations. Ari's great work is *Konungabók*, or *The Book of Kings*, relating the history of the kings of Norway from the rise of the Yngling dynasty down to the death of Harald Sigurdsson in the year of his own birth. This book he composed from the dictation of old men such as Odd Kolsson, from the genealogical poems, and from the various dirges, battle-songs and eulogia of the poets. It is most probable that he also compiled shorter *Kings' Books* relating to Denmark and perhaps to England. The *Konungabók* is preserved under the *Heimskringla* of

Snorri Sturluson, parts of it almost as they came from Ari's hands, for example *Ynglinga* and *Harald Fairhair's Saga*, and the prefaces stating the plan and critical foundations of the work, parts of it only used as a framework for the magnificent superstructure of the lives of the two Olafs, and of Harald Hardrada and his nephew Magnus the Good. The best text of Ari's *Konungabók* (*Ynglinga*, and the sagas down to but not including Olaf Tryggvason's) is that of *Frisbók*.

The *Book of Settlements* (*Landnámabók*) is a wonderful performance, both in its scheme and carrying out. It is divided into five parts, the first of which contains a brief account of the discovery of the island; the other four, one by one taking a quarter of the land, describe the name, pedigree and history of each settler in geographical order, notice the most important facts in the history of his descendants, the names of their homesteads, their courts and temples, thus including mention of 4,000 persons, one-third of whom are women, and 2,000 places. The mass of information contained in so small a space, the clearness and accuracy of the details, the immense amount of life which is breathed into the whole, astonish the reader, when he reflects that this colossal task was accomplished by one man, for his collaborator Kolsegg merely filled up his plan with regard to part of the east coast, a district with which Ari in his western home at Stad was little familiar. *Landnámabók* has reached us in two complete editions, one edited by Sturla, who brought down the genealogies to his own grandfather and grandmother, Sturla and Gudny, and one by Hawk, who traces the pedigrees still later to himself.

Ari also wrote a *Book of Icelanders* (*Islendingabók*, *c.* 1127), which has perished as a whole, but fragments of it are embedded in many sagas and *Kings' Lives;* it seems to have been a complete epitome of his earlier works, together with an account of the constitutional history, ecclesiastical and civil, of Iceland. An abridgement of the latter part of it, the little *Libellus Islandorum* (to which the title of the bigger *Liber—Islendingabók*—is often given), was made by the historian for his friends Bishops Ketil and Thorlak, for whom he wrote the *Liber* (*c.* 1137). This charming little book is, with the much later collections of laws, our sole authority for the Icelandic constitution of the commonwealth, but, "much as it tells, the lost *Liber* would have been of still greater importance." *Kristni-Saga*, the story of the christening of Iceland, is also a work of Ari's, "overlaid" by a later editor, but often preserving Ari's very words. This saga, together with several scattered tales of early Christians in Iceland before the change of faith (1002), may have made up a section of the lost *Liber*. Of the author of these works little is known. He lived in quiet days a quiet life; but he shows himself in his works, as Snorri describes him, "a man wise, of good memory and a speaker of the truth." If Thucydides is justly accounted the first political historian, Ari may be fitly styled the first of scientific historians.

A famous contemporary and friend of Ari is Saemund (1056–1131), a great churchman, whose learning so impressed his age that he got the reputation of a magician. He was the friend of Bishop John, the founder of the great Odd-Verjar family, and the author of a *Book of Kings* from Harald Fairhair to Magnus the Good, in which he seems to have fixed the exact chronology of each reign. It is most probable that he wrote in Latin. The idea that he had anything to do with the poetic *Edda* in general, or the *Sun's Song* in particular, is unsupported by evidence.

The flame which Ari had kindled was fed by his successors in the 12th century. Eirik Oddsson (*c.* 1150) wrote the lives of Sigurd Evil-beacon and the sons of Harold Gille, in his *Hryggjar-Stykki* (Sheldrake), of which parts remain in the mss. collections of *Kings' Lives, Morkin-skinna*, etc. Karl Jonsson, abbot of Thingore, the Benedictine minster, wrote (*c.* 1184) *Sverrissaga* from the lips of that great king, a fine racy biography, with a style and spirit of its own. *Böglunga-Sögur* tell the story of the civil wars which followed Sverri's death. They are probably by a contemporary.

The Latin *Lives of St. Olaf*, Odd's in Latin (*c.* 1175), compiled from original authorities, and the *Legendary Life*, by another monk whose name is lost, are of the mediaeval Latin school of Saemund to which Gunnlaug belonged.

Snorri's Heimskringla. Snorri Sturluson (*q.v.*) was known to his contemporaries as a statesman and poet; to us he is above all an historian. Snorri (1179–1241) wrote the *Lives of the Kings* (*Heimskringla*), from Olaf Tryggvason to Sigurd the Crusader inclusive; and we have them substantially as they came from his hand in the *Great King Olaf's Saga; St. Olaf's Saga*, as in *Heimskringla* and the Stockholm ms.; and the succeeding *Kings' Lives*, as in *Hulda* and *Hrokkinskinna*, in which, however, a few episodes have been inserted.

These works were indebted for their facts to Ari's labours, and to sagas written since Ari's death; but the style and treatment of them are Snorri's own. The true Thucydidean speeches, the dramatic power of grasping character, and the pathos and poetry that run through the stories, along with a humour such as is shown in the *Edda*, and a varied grace of style that never flags or palls, make Snorri one of the greatest of historians.

Here it should be noticed that *Heimskringla* and its class of mss. (*Eirspennil, Jöfraskinna, Gullinskinna, Fris bók* and *Kringla*) do not give the full text of Snorri's works. They are abridgements made in Norway by Icelanders for their Norwegian patrons, the *Life of St. Olaf* alone being preserved intact, for the great interest of the Norwegians lay in him, but all the other *Kings' Lives* being more or less mutilated, so that they cannot be trusted for historic purposes; nor do they give a fair idea of Snorri's style.

Ágrip is a 12th century compendium of the *Kings' Lives* from Harald Fairhair to Sverri, by a scholastic writer of the school of Saemund. As the only Icelandic abridgement of Norwegian history taken not from Snorri but sources now lost, it is of worth. Its real title is *Konunga tal*.

Noregs Konunga tal, now called *Fagrskinna*, is a Norse compendium of the *Kings' Lives* from Halfdan the Black to Sverri's accession, probably written for King Haakon, to whom it was read on his death bed. It is an original work, and contains much not found elsewhere. As non-Icelandic it is only noticed here for completeness.

Styrmi Karason, a contemporary of Snorri's, dying in 1245, was a distinguished churchman (lawman twice) and scholar. He wrote a *Life of St. Olaf*, now lost, his authority is cited. He also copied out *Landnámabók* and *Sverri's Life* from his mss., of which surviving copies were taken.

Sturla, Snorri's nephew, wrote the *Hakonssaga* and *Magnussaga* at the request of King Magnus, finishing the first *c.* 1265, the latter *c.* 1280. King Haakon's Life is preserved in full; of the other only fragments remain. These are the last of the series of historic works which Ari's labours began, from which the history of Norway for 300 years must be gathered.

A few books relating the history of other Scandinavian realms will complete this survey. In *Skjöldunga bók* was told the history of the early kings of Denmark, perhaps derived from Ari's collections, and running parallel to *Ynglinga*. The earlier part of it has perished save a fragment *Sögu brot*, and citations and paraphrases in Saxo, and the mythical *Ragnar Lodbrok's* and *Gongu-Hrolf's Sagas;* the latter part, *Lives of Harold Bluetooth and the Kings down to Sveyn II.*, is still in existence and known as *Skjöldunga*.

The *Knútssaga* is of later origin and separate authorships, parallel to Snorri's *Heimskringla*, but earlier in date. The *Lives of King Valdemar and his Son*, written *c.* 1185, by a contemporary of Abbot Karl's, are the last of this series. The whole were edited and compiled into one book, often quoted as *Skjöldunga*, by a 13th century editor, possibly Olaf, the White Poet, Sturla's brother, guest and friend of King Valdemar II. *Jómsvikinga Saga*, the history of the pirates of Jom, down to Knut the Great's days, also relates to Danish history.

The complex work now known as *Orkneyinga* is made up of the *Earls' Saga*, lives of the first great earls, Turf-Einar, Thorfinn, etc.; the *Life of St. Magnus*, founded partly on Abbot Robert's Latin life of him (*c.* 1150) an Orkney work, partly on Norse or Icelandic biographies; a *Miracle-book* of the same saint; the *Lives of Earl Rognwald and Sveyn*, the last of the vikings, and

a few episodes such as the *Burning of Bishop Adam*. A scholastic sketch of the rise of the Scandinavian empire, the *Foundation of Norway*, dating *c.* 1120, is prefixed to the whole.

Faereyinga tells the tale of the conversion of the Faereys or Faroes, and the lives of its chiefs Sigmund and Leif, composed in the 13th century from their separate sagas by an Icelander of the Sturlung school.

Biographies.—The saga has already been shown in two forms, its original epic shape and its later development applied to the lives of Norwegian and Danish kings and earls, as heroic but deeper and broader subjects than before. In the 13th century it is put to a third use, to tell the plain story of men's lives for their contemporaries, after satisfying which demand it dies away forever.

These biographies are more literary and mediaeval and less poetic than the Icelandic sagas and kings' lives; their simplicity, truth, realism and purity of style are the same. They run in two parallel streams, some being concerned with chiefs and champions, some with bishops. The former are mostly found embedded in the complex mass of stories known as *Sturlunga*, from which Dr. Vigfússon extricated them, and for the first time set them in order. Among them are the sagas of *Thorgils and Haflidi* (1118–21), the feud and peacemaking of two great chiefs, contemporaries of Ari; of *Sturla* (1150–83), the founder of the great Sturlung family, down to the settlement of his great lawsuit by Jon Loptsson, who thereupon took his son Snorri the historian to fosterage—a humorous story but with traces of decadence about it, and glimpses of the evil days that were to come; of the *Önundar-brennusaga* (1185–1200), a tale of feud and fire-raising in the north of the island, the hero of which, Gudmund Dyri, goes at last into a cloister; of *Hrafn Sveinbjarnarson* (1190–1213), the noblest Icelander of his day, warrior, leech, seaman, craftsman, poet and chief, whose life at home, travels and pilgrimages abroad (Hrafn was one of the first to visit Becket's shrine), and death at the hands of a foe whom he had twice spared, are recounted by a loving friend in pious memory of his virtues, *c.* 1220; of *Árom Hjörleifsson* (1200–55), a man whose strength, courage and adventures befit rather a henchman of Olaf Tryggvason than one of King Haakon's thanes (the beginning of the feuds that rise round Bishop Gudmund are told here), of the *Svinefell-men* (1248–52), a pitiful story of a family feud in the far east of Iceland.

But the most important works of this class are the *Islendinga Saga* and *Thorgils Saga* of Lawman Sturla. Sturla and his brother Olaf were the sons of Thord Sturluson and his mistress Thora. Sturla was born and brought up in prosperous times, but his manhood was passed in the midst of strife, in which his family fell one by one, and he himself, though a peaceful man who cared little for politics, was more than once forced to fly for his life. While in refuge with King Magnus, in Norway, he wrote his two sagas of that king and his father. After his first stay in Norway he came back in 1271, with the new Norse law-book, and served a second time as lawman. The *Islendinga* must have been the work of his later years, composed at Fairey in Broadfirth, where he died, July 30, 1284, aged about 70 years. The saga of *Thorgils Skardi* (1252–61) seems to have been the first of his works on Icelandic contemporary history; it deals with the life of his own nephew, especially his career in Iceland from 1252 to 1258. The second part of *Islendinga* (1242–62), which relates to the second part of the civil war, telling of the careers of Thord Kakali, Kolbein the Young, Earl Gizur and Hrafn Oddsson. The end is imperfect, there being a blank of some years before the fragmentary ending to which an editor has affixed a notice of the author's death. The first part of *Islendinga* (1202–42) tells of the beginning and first part of the civil wars, the lives of Snorri and Sighvat, Sturla's uncles, of his cousin and namesake Sturla Sighvatsson, of Bishop Gudmund, and Thorwald Gizursson,—the fall of the Sturlungs, and with them the last hopes of the great houses to maintain the commonwealth, being the climax of the story.

Sturla's power lies in his faithfulness to nature, minute observance of detail and purity of style. The great extent of his subject, and the difficulty of dealing with it in the saga form, are most skilfully overcome; nor does he allow prejudice or favour to stand in the way of the truth. He ranks below Ari in value and below Snorri in power; but no one else can dispute his place in the first rank of Icelandic writers.

Of the ecclesiastical biographers, an anonymous Skalholt clerk is the best. He wrote *Hungrvaka*, lives of the first five bishops of Skalholt, and biographies of his patron Bishop Paul (*Pálssaga*) and also of St. Thorlak (*Thorlákssaga*). They are full of interesting notices of social and church life. Thorlak was a learned man, and had studied at Paris and Lincoln, which he left in 1161. These lives cover the years 1056–1193. The life of St. John, a great reformer, a contemporary of Thorodd, whom he employed to build a church for him, is by another author (1052–1121). The life of Gudmund (*Guðmundar Saga Góða*), a priest, recounts the early life of this Icelandic Becket till his election as bishop (1160–1202); his after career must be sought out in *Islendinga*. It is written by a friend and contemporary. A later life by Arngrim, abbot of Thingore, written *c.* 1350, as evidence of his subject's sanctity, tells a good deal about Icelandic life, etc. The lives of Bishops Arni and Lawrence bring down our knowledge of Icelandic history into the 14th century. The former work, *Arna Saga Biskups*, is imperfect; it is the record of the struggles of church and State over patronage rights and glebes, written *c.* 1315; it now covers only the years 1269–91; a great many documents are given in it, after the modern fashion. The latter, *Lárentius Saga Biskups*, by his disciple, priest Einar Haflidason, is a charming biography of a good and pious man, whose chequered career in Norway and Iceland is picturesquely told (1324–31). It is the last of the sagas. *Bishop Jon's Table-Talk* (1325–39) is also worth noticing; it contains many popular stories which the good bishop, who had studied at Bologna and Paris, was wont to tell to his friends.

The *Annals* are now almost the sole material for Icelandic history; they had begun earlier, but after 1331 they got fuller and richer, till they end in 1430. The best are *Annales Regii*, ending 1306, *Einar Haflidason's Annals*, known as "Lawman's Annals," reaching to 1392, and preserved with others in *Flatey-book*, and the *New Annals*, last of all. The *Diplomatarium Islandicum*, edited by Jon Sigurdsson, contains what remains of deeds, inventories, letters, etc., from the old days, completing our scanty material for this dark period of the island's history.

Literature of Foreign Origin.—After the union with Norway and change of law genuine tradition died out with the great houses. The ordinary mediaeval literature reached Iceland through Norway, and every one began to put it into a vernacular dress, so neglecting their own classics that but for a few collectors like Lawman Hauk they would have perished entirely.

The Norwegian kings, Haakon Haakonson (*c.* 1225), and Haakon V. (*c.* 1305), employed Icelanders at their courts in translating the French romances of the Alexander, Arthur and Charlemagne cycles. Some 40 or 50 of these *Riddara-Sögur* (Romances of Chivalry) remain. They reached Iceland and were eagerly read, many *rimur* being founded on them. Norse versions of *Mary of Brittany's Lays*, the stories of *Brutus* and of *Troy*, and part of the *Pharsalia* translated are also found. The *Speculum Regale*, with its interesting geographical and social information, is also Norse, written *c.* 1240, by a Halogalander. The computistic and arithmetical treatises of Stiorn-Odd, Biarni the Number-skilled (d. 1173), and Hauk Erlendsson the Lawman (d. 1334), and the geography of Ivar Bardsson, a Norwegian (*c.* 1340), are of course of foreign origin. A few tracts on geography, etc., in Hauk's book, and a *Guide to the Holy Land*, by Nicholas, abbot of Thwera (d. 1158), complete the list of scientific works.

The stories which contain the last lees of the old mythology and pre-history seem to be also non-Icelandic, but amplified by Icelandic editors, who probably got the plots from the Western islands. *Völsunga Saga* and *Hervarar Saga* contain quotations and paraphrases of lays by the Helgi poet, and *Half's*, *Ragnar's* and *Asmund Kappabana's Sagas* all have bits of western poetry in them. *Hrolf Kraki's Saga* paraphrases part of *Bjarkamál*; *Hromund Gripsson's* gives the story of Helgi and Kara (the lost third of the Helgi trilogy), *Gautrek's*, *Arrow Odd's*, *Fritliof's Sagas*, etc.,

contain shreds of true tradition amidst a mass of later fictitious matter of no worth. With the *Riddara-Sögur* they enjoyed great popularity in the 15th century, and gave matter for many *rimur*. *Thidrik's Saga*, a late version of the Völsung story, is of Norse composition (*c.* 1230), from north German sources.

The mediaeval religious literature of western Europe also influenced Iceland, and the *Homilies* (like the *Laws*) were, according to Thorodd, the earliest books written in the vernacular, antedating even Ari's histories. The lives of the *Virgin*, the *Apostles* and the *Saints* fill many mss. (edited in four large volumes by Prof. Unger), and are the works of many authors, chiefly of the 13th and 14th centuries; amongst them are the lives of *SS. Edward the Confessor, Oswald of Northumbria, Dunstan* and *Thomas of Canterbury*. Of the authors we know Priest Berg Gunsteinsson (d. 1211); Kygri-Biorn, bishop-elect (d. 1237); Bishop Brand (d. 1264); Abbot Runolf (d. 1307); Bishop Lawrence's son Arni (*c.* 1330); Abbot Berg (*c.* 1340), etc. A paraphrase of the historical books of the Bible was made by Bishop Brand (d. 1264), called *Gyðinga Sögur*. About 1310 King Haakon V. ordered a commentary on the Bible to be made, which was completed down to Exodus xix. To this Brand's work was afterwards affixed, and the whole is known as *Stjórn*. The Norse version of the famous *Barlaam and Josaphat*, made for Prince Haakon (*c.* 1240), must not be forgotten.

Post-classical Literature.—The post-classical literature falls chiefly under three heads—religious, literary and scientific. Under the first comes foremost the noble translation of the New Testament by Odd Gottskalksson, son of the bishop of Hólar. Brought up in Norway, he travelled in Denmark and Germany, and took upon him the new faith before he returned to Iceland, where he became secretary to Bishop Ogmund of Skalholt. Here he began by translating the Gospel of Matthew into his mother-tongue in secret. Having finished the remainder of the New Testament at his own house at Olves, he took it to Denmark, where it was printed at Roskild in 1540. Odd afterwards translated the Psalms, and several devotional works of the day, Corvinus's *Epistles*, etc. He was made lawman of the north and west, and, while travelling in his districts, was drowned in the river Laxá in Kjós, June 1556. Three years after his death the first press was set up in Iceland by John Matthewson, at Breidabolstad, in Hunafloe, and a *Gospel and Epistle Book*, according to Odd's version, issued from it in 1562. In 1584 Bishop Gudbrand, who had brought over a splendid font of type from Denmark in 1575 (which he completed with his own hands), printed a translation of the whole Bible at Hólar, incorporating Odd's versions and some books (Proverbs and the Son of Sirach, 1580) translated by Bishop Gizar, but supplying most of the Old Testament himself. This fine volume was the basis of every Bible issued for Iceland till 1826, when it was replaced by a bad modern version. For beauty of language and faithful simplicity of style, the finer parts of this version, especially the New Testament, have never been surpassed.

The most notable theological work Iceland ever produced is the *Postil-Book* of Bishop John Vidalin (1666–1720), whose bold homely style and stirring eloquence made "John's Book," as it is lovingly called, a favourite in every household, till in the 19th century it was replaced for the worse by the more sentimental and polished Danish tracts and sermons. Theological literature is very popular, and many works on this subject, chiefly translations, will be found in the lists of Icelandic bibliographers.

The first modern scientific work is the *Iter per patriam* of Eggert Olafsson and Biarni Paulsson, which gives an account of the physical peculiarities—fauna, flora, etc.—of the island as far as could be done at the date of its appearance, 1772. The island was first made known to "the world" by this book and by the sketch of Unno von Troil, a Swede, who accompanied Sir Joseph Banks to Iceland in 1772, and afterwards wrote a series of "letters" on the land and its literature, etc. This tour was the forerunner of an endless series of "travels," of which those of Sir W. J. Hooker, Sir G. S. Mackenzie (1810), Ebenezer Henderson (1818), Joseph Paul Gaimard (1838–43), Paijkull (1867), and, lastly, that of Sir Richard Burton, an excellent account of the land and people, full of information (1875), are the best.

Iceland is emphatically a land of proverbs, while of folk-tales, those other keys to the people's heart, there is plentiful store. Early work in this direction was done by Jon Gudmundsson, Olaf the Old and John Olafsson in the 17th century, who all put traditions on paper, and their labours were completed by the magnificent collection of Jon Arnason (1862–64), who was inspired by the example of the Grimms. Many tales are but weak echoes of the sagas; many were family legends, many are old fairy tales in a garb suited to their new northern home; but besides all these, there are a number of traditions and superstitions of indigenous origin.

The Renaissance of Iceland dates from the beginning of the 17th century, when a school of antiquaries arose. Arngrim Jonsson's *Brevis Commentarius* (1593), and *Crymogaea* (1609), were the first-fruits of this movement, of which Bishops Odd, Thorlak and Bryniulf (worthy parallels to Parker and Laud) were the wise and earnest supporters. The first (d. 1630) collected much material for church history. The second (d. 1656) saved *Sturlunga* and the *Bishops' Lives*, encouraged John Egilsson to write his *New Hungerwaker*, lives of the bishops of the Dark Ages and Reformation, and helped Biorn of Skardsa (d. 1655), a bold and patriotic antiquary (whose *Annals* continue Einar's), in his researches. The last (d. 1675) collected a fine library of mss., and employed the famous copyist John Erlendsson, to whom and the bishop's brother, John Gizurarson (d. 1648), we are indebted for transcripts of many lost mss.

Torfaeus (1636–1719) and Bartholin, a Dane (d. 1690), roused the taste for northern literature in Europe, a taste which has never since flagged; and soon after them Arni Magnusson (1663–1730) transferred all that remained of vellum and good paper mss. in Iceland to Denmark, and laid the foundations of the famous library and bequest, for which all Icelandic students are so much beholden. For over 40 years Arni stuck to his task, rescuing every scrap he could lay hands on from the risks of the Icelandic climate and carelessness, and when he died only one good mss. remained in the island. Besides his magnificent collection, there are a few mss. of great value at Upsala, at Stockholm, and in the old royal collection at Copenhagen. Those in the university library in the latter city perished in the fire of 1728. Sagas were printed at Upsala and Copenhagen in the 17th century, and the Arnamagnaean fund has been working since 1772. In that year appeared also the first volume of Bishop Finn Jonsson's *Historia Ecclesiastica Islandiae*, a work of high value and much erudition, containing not only ecclesiastical but civil and literary history, illustrated by a well-chosen mass of documents, 870–1740. It has been continued by Bishop P. Peterson to modern times, 1740–1840. The results, however, of modern observers and scholars must be sought for in the periodicals, *Safn*, *Félagsrit*, *Nýi Félagsrit* and others. John Espolin's *Islands Arbockur* is very good up to its date, 1832.

A brilliant sketch of Icelandic classic literature is given by Dr. Gudbrandr Vigfússon in the Prolegomena to *Sturlunga Saga* (1879). It replaces much earlier work, especially the *Sciagraphia* of Halfdan Einarsson (1777), and the *Saga-Bibliotek* of Müller. The numerous editions of the classics by the Icelandic societies, the Danish Société des Antiquités, Nordisk Litteratur Samfund, and the new Gammel Nordisk Litteratur Samfund, the splendid Norwegian editions of Unger, the labours of the Icelanders Sigurdsson and Gislason, and of those foreign scholars in Scandinavia and Germany who have thrown themselves into the work of illustrating, publishing and editing the sagas and poems (men like P. A. Munch, S. Bugge, F. W. Bergmann, Th. Möbius and K. von Maurer, to name only a few), can only be referred to here. *See* also Finnur Jónsson, *Den Oldnorske og Oldislanske Litteraturs Historie* (1893–1900); R. B. Anderson's translation (Chicago, 1884) of Winkel Horn's *History of the Literature of the Scandinavian North;* and W. Morris and E. Magnússon's *Saga Library*. (F. Y. P.; R. P. Co.)

RECENT LITERATURE

The recent literature of Iceland has been in a more flourishing state than ever before since the 13th century. Lyrical poetry is by far the largest and most interesting portion of it. The great influence of Jónas Hallgrímsson (1807–45) is still felt, and his school was the reigning one up to the end of the 19th century, although then a change seemed to be in sight. The most successful poet of this school is Steingrímr Thorsteinsson (1830–1913).

He is specially famous for his splendid descriptions of scenery (*The Song of Gilsbakki*), his love-songs and his sarcastic epigrams. As a translator he has enriched the literature with *The Arabian Nights, Sakuntala, King Lear* and several other masterpieces of foreign literature. Equal in fame is Matthías Jochumsson, who, following another of Jónas Hallgrímsson's many ways, has successfully revived the old metres of the classical Icelandic poets, whom he resembles in his majestic, but sometimes too gorgeous, language. As an artist he is inferior to Steingrímr Thorsteinsson, but surpasses him in bold flight of imagination. He has successfully treated subjects from Icelandic history *Grettisljóð*, a series of poems about the famous outlaw Grettir. His chief fault is a certain carelessness in writing; he can never write a bad poem, but rarely a poem absolutely flawless. He has translated Tegnér's *Frithiofs Saga*, several plays of Shakespeare and some other foreign masterpieces. The great religious poet of Iceland, Hallgrímr Péturssson, has found a worthy successor in Valdemar Briem (b. 1848), whose *Songs of the Bible* are deservedly popular. He is like Matthías Jochumsson in the copious flow of his rhetoric; some of his poems are perfect both as regards form and content, but he sometimes neglects the latter while polishing the former. An interesting position is occupied by Benedict Gröndal, whose travesties of the old romantic stories, *e.g.*, "The Battle of the Plains of Death," a burlesque on the battle of Solferino, and his Aristophanic drama *Gaudreiðin* ("The Magic Ride") about contemporary events, are among the best satirical and humorous productions of Icelandic literature.

Influenced by Jónas Hallgrímsson with regard to language and poetic diction, but keeping unbroken the traditions of Icelandic mediaeval poetry maintained by Sigurðr Breiðfjörð (1798–1846), is another school of poets, very unlike the first. In the middle of the 19th century this school was best represented by Hjálmar Jónsson from Bóla (1796–1875), a poor farmer with little education but endowed with great poetical talents, and the author of satirical verses not inferior to those of Juvenal both in force and coarseness. In the last decades of the 19th century this school produced two poets of a very high order, both distinctly original and Icelandic. One is Páll Ólafsson (1827–1906). His songs are mostly written in the mediaeval quatrains (*ferskeytla*), and are generally of a humorous and satirical character; his convivial songs are known by heart by every modern Icelander; and although some of the poets of the present day are more admired, there is none who is more loved by the people. The other is Þorsteinn Erlingsson (b. 1858). His exquisite satirical songs, in an easy and elegant but still manly and splendid language, have raised much discussion. Of his poems may be mentioned *The Oath*, a series of most beautiful ballads, with a tragical love-story of the 17th century as their base, but with many and happy satirical allusions to modern life; *Jörundr*, a long poem about the convict king, the Danish pirate Jörgensen, who nearly succeeded in making himself the master of Iceland, and *The Fate of the Gods* and *The Men of the West* (the Americans), two poems which, with their anti-clerical and half-socialistic tendencies, have caused strong protests from orthodox Lutheran clergy. Near to this school, but still standing apart, is Grímur Thomsen.

In the beginning of the '80s a new school arose—having its origin in the colony of Icelandic students at the University of Copenhagen. They had all attended the lectures of Georg Brandes, the great reformer of Scandinavian literature, and, influenced by his literary theories, they chose their models in the realistic school. This school is very dissimilar from the half-romantic school of Jónas Hallgrímsson; it is nearer the national Icelandic school represented by Páll Ólafsson and Þorsteinn Elingsson, but differs from those writers by introducing foreign elements hitherto unknown in Icelandic literature, and—especially in the case of the prose-writers—by imitating closely the style and manner of some of the great Norwegian novelists. Their influence brought the Icelandic literature into new roads, and it is interesting to see how the tough Icelandic element gradually assimilates the foreign. Of the lyrical poets, Hannes Hafsteinn (b. 1861) is by far the most important. In his splendid ballad, *The Death of Skarphedinn*, and in his beautiful series of songs describing a voyage through some of the most picturesque parts of Iceland, he is entirely original; but in his love-songs, beautiful as many of them are, a strong foreign influence can be observed. Among the innovations of this poet we may note a predilection for new metres, sometimes adopted from foreign languages, sometimes invented by himself, a thing practised rarely and generally with small success by the Icelandic poets. Among the many later lyrical poets Einar Benediktsson and St. G. Stephansson, resident in Canada, deserve special mention, both rather heavy in style, but rich in ideas and weighty in thought. Lighter and more elegant in style are David Stefánsson, Stefán frá Hvítadal and Hulda (pseudonym of Unnur Bjarklind).

No Icelandic novelist has as yet equalled Jón Thóroddsen (1819–68). The influence of the realistic school has of late been predominant. The most distinguished writer of that school has been Gestur Pálsson (1852–91), whose short stories with their sharp and biting satire have produced many imitations in Iceland. The best are *A Home of Love* and *Captain Sigurd*. Jónas Jónasson (b. 1856), a clergyman of northern Iceland, has, in a series of novels and short stories, given accurate, but somewhat dry, descriptions of the more gloomy sides of Icelandic country life. His best novel is *Randíðr í Hvassafelli*, an historical novel of the middle ages. Besides these we may mention Torfhildur Hólm, one of the few women who have distinguished themselves in Icelandic literature. Her novels are mostly historical. Of the younger novelists the best are Einar H. Kvaran, Jónas Gudlaugsson and Gunnar Gunnarsson. Gudmundur Fridjónsson, Jón Trausti (pseudonym of Gudmundur Magnússon) and Gudmundur G. Hagalín portray folk life with considerable skill. J. M. Bjarnason and Laura Salverson both reside in Canada and depict the life of the Icelandic settlers there, the latter writing in English, e.g., *The Viking Heart*. The last decade of the 19th century saw the establishment of a permanent theatre at Reykjavík, the precursor of the National Theatre of Iceland, founded and endowed by the Althing early in the third decade of the present century. The poet Matthías Jochumsson wrote several dramas, but their chief merits are lyrical. The most popular of Icelandic dramatists as yet is Indriði Einarsson, whose plays, chiefly historical, in spite of excessive rhetoric, possess a true dramatic value. Jóhann Sigurjónsson wrote one of the most powerful of modern dramas, *Fjalla-Eyvindur*, while Gudmundur Kamban's plays achieved a great success at the Royal Theatre in Copenhagen. The drama, *The Mother-in-Law*, by an Icelandic countrywoman, Kristín Sigfúsdóttir, was produced at Reykjavík and Winnipeg, and is much admired.

In geography and geology Þorvaldr Thoroddsen has acquired a European fame for his researches and travels in Iceland, especially in the rarely-visited interior. Of his numerous writings in Icelandic, Danish and German, the *History of Icelandic Geography* is a monumental work. In history Páll Melsteð's (b. 1812) chief work, the large *History of the World*, belongs to this period, and its pure style has had a beneficial influence upon modern Icelandic prose.

Of the younger historians we may mention Þorkell Bjarnason (*History of the Reformation in Iceland*) Jón Aðils, Páll E. Ólason, and Jón Helgason. Jón Þorkelsson (b. 1859), archivist, has rendered great services to the study of Icelandic history and literature by his editions of the *Diplomatarium Islandicum* and *Obituaria Islandica*, and his *Icelandic Poetry in the 15th and 16th Century*, written in Danish, an indispensable work for any student of that period. J. Th. Thoroddsen has written with distinction on geography, and Sigfús Sigfússon on folk-lore. A leading position among Icelandic lexicographers is occupied by Jón Þorkelsson (1822–1904), whose *Supplement til islandske Ordbøger*, an Icelandic-Danish vocabulary (three separate collections), has hardly been equalled in learning and accuracy. Other distinguished philologists are the late *rektor* of the Latin school at Reykjavík, Björn Magnússon Olsen (*Researches on Sturlunga, Ari the Wise, The Runes in the Old Icelandic Literature*—the last two works in Danish); Finnur Jónsson, professor at the University of Copenhagen (*History of the Old Norwegian and Icelandic Literature*, in Danish, and excellent editions of many old Icelandic classical

works); Valtýr Guðmundsson, lecturer at the University of Copenhagen (several works on the old architecture of Scandinavia) and editor of the influential Icelandic literary and political review, *Eimreiðin* ("The Locomotive"); G. T. Zoëga and Sigfús Blöndal, whose Icelandic-Danish dictionary is the first complete dictionary of modern Icelandic.

See J. C. Poestion, *Islandische Dichter der Neuzeit* (Leipzig, 1897); C. Küchler, *Geschichte der isländischen Dichtung der Neuzeit* (Leipzig, 1896); Ph. Schweitzer, *Island; Land und Leute* (Leipzig, 1885); Alexander Baumgartner, *Island und die Faroer* (Freiburg im Breisgau, 1889); Halldór Hermannsson, *Islandica*, vol. 6 (16 vol., 1908-24); *Icelandic Authors of To-day* (1913); Sigurdur Nordal, *Islenzk Lestrarbok* (1924); Edmund Gosse and W. A. Craigie, *The Oxford Book of Scandinavian Verse* (1925). (S. Bl.; R. P. Co.)

ICELAND MOSS, a lichen (*Cetraria islandica*) whose erect or ascending foliaceous habit gives it something of the appearance of a moss, whence probably the name. It is often of a pale chestnut colour, but varies considerably, being sometimes almost entirely greyish white; and grows to a height of from 3 to 4 in., the branches being channelled or rolled into tubes, which terminate in flattened lobes with fringed edges. It grows abundantly in the mountainous regions of northern countries, and it is specially characteristic of the lava slopes and plains of the west and north of Iceland. It is found on the mountains of north Wales, north England, Scotland and south-west Ireland. As met with in commerce it is a light-grey harsh cartilaginous body, almost destitute of colour, and having a slightly bitter taste. It contains about 70% of lichenin or lichen-starch, a body isomeric with common starch, but wanting any appearance of structure. It forms a nutritious and easily digested carbohydrate food; it is not, however, in great request.

ICE MANUFACTURE: *see* REFRIGERATION AND ICE MANUFACTURE.

ICENI, a race of ancient Britain who occupied the part of England now known as Norfolk and Suffolk. After the death of their king Prasutagus in A.D. 60 the Romans established their authority, and the Iceni were eventually conquered and became part of the Roman Empire. *See* BOADICEA.

ICE-PLANT, the popular name for *Mesembryanthemum crystallinum* (family Aizoaceae), a hardy annual most effective for rockwork in mild climates. It is a low-growing, spreading, herbaceous plant with the fleshy stem and leaves covered with large glittering papillae which give it the appearance of being coated with ice. It is a dry-country plant, a native of Greece and other parts of the Mediterranean region, the Canary Islands, South Africa and California. *Mesembryanthemum* is a large genus (containing about 350 species) of erect or prostrate fleshy herbs or low shrubs, mostly natives of South Africa, and rarely hardy in the British Isles or the northeastern United States, where they are mostly grown as greenhouse plants. They bear conspicuous white, yellow or red flowers with many petals inserted in the calyx-tube. The thick fleshy leaves are very variable in shape, and often have spiny rigid hairs on the margin. They are essentially sun-loving plants. The best-known member of the genus is *M. cordifolium, var. variegatum,* with heart-shaped green and silvery leaves and bright rosy-purple flowers. It is extensively used for edging flower-beds and borders during the summer months. Besides the ice-plant three other species grow on the coast of California, the sea fig or beach strawberry (*M. aequilaterale*), with thick, three-sided leaves, and the small-leaved fig-marigold (*M. nodiflorum*), both native, and also the Hottentot fig (*M. edule*) of South Africa, with fleshy, edible fruit, cultivated as a sand-dune binder but now naturalized along the coast near Los Angeles.

ICE-YACHTING, the sport of sailing and racing ice-boats, is practised in Great Britain, Norway and Sweden to some extent, and is very popular in Holland and on the Gulf of Finland, but its highest development is in the United States and Canada. The Dutch ice-yacht is a flat-bottomed boat resting crossways upon a planking about 3ft. wide and 16ft. long, to which are affixed four steel runners, one each at bow, stern and each end of the planking. The rudder is a fifth runner fixed to a tiller. Heavy mainsails and jibs are generally used and the boat is built more for safety than for speed. The ice-boat of the Gulf of Finland is a V-shaped frame with a heavy plank running from bow to stern, in which the mast is stepped. The stern or steering runner is worked by a tiller or wheel. The sail is a large lug and the boom and gaff are attached to the mast by travellers. The passengers sit upon planks or rope netting.

In 1879 H. Relyea built the "Robert Scott," which had a single backbone and wire guy-ropes, and it became the model for all American river ice-yachts. Masts were now stepped farther forward, jibs were shortened, booms cut down, and the centre of sail-balance was brought more inboard and higher up, causing the centres of effort and resistance to come more in harmony. The shallow steering-box became elliptical. In 1881 occurred the first race for the American Challenge Pennant, which represents the championship of the Hudson river, the clubs competing including the Hudson river, North Shrewsbury, Orange lake, Newburgh and Carthage Ice-Yacht Clubs. The races are usually sailed five times round a triangle of which each leg measures one mile, at least two of the legs being to windward. Ice-yachts are divided into four classes, carrying respectively 600 sq.ft. of canvas or more, between 450 and 600, between 300 and 450, and less than 300 sq.ft. Ice-yachting is very popular on the Great Lakes, both in the United States and Canada, the Kingston (Ontario) Club having a fleet of over 25 sail. Other important centres of the sport are Lakes Minnetonka and White Bear in Minnesota, Lakes Winnebago and Pepin in Wisconsin, Bar Harbor lake in Maine, the St. Lawrence river, Quinte Bay and Lake Champlain.

A modern ice-yacht is made of a single-piece backbone the entire length of the boat, and a runner-plank upon which it rests at right angles, the two forming a kite-shaped frame. The best woods for these pieces are basswood, butternut and pine. They are cut from the log in such a way that the heart of the timber expands, giving the planks a permanent curve, which, in the finished boat, is turned upward. The two forward runners, usually made of soft cast iron and about 2ft. 7in. long and 2½in. high, are set into oak frames a little over 5ft. long and 5in high. The runners have a cutting edge of 90°, though a V-shaped edge is often preferred for racing. The rudder is a runner about 3ft. 7in. long, worked by a tiller, sometimes made very long, 7½ft. not being uncommon. This enables the helmsman to lie in the box at full length and steer with his feet, leaving his hands free to tend the sheet. Masts and spars are generally made hollow for racing-yachts and the rigging is pliable steel wire. The sails are of 10oz. duck for a boat carrying 400 sq.ft. of canvas. They have very high peaks, short hoists and long booms. The mainsail and jib rig is general, but a double-masted lateen rig has been found advantageous.

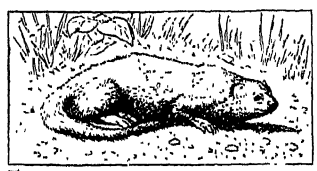
An ice-yacht about 40ft. in length will carry six or seven passengers or crew, who are distributed in such a manner as to preserve the balance of the boat. In a good breeze the crew lie out on the windward side of the runner-plank to balance the boat and reduce the pressure on the leeward runner. A course of 20m. with many turns has been sailed on the Hudson in less than 48 minutes, the record for a measured mile with flying start being at the rate of about 72m. an hour. In a high wind, however, ice-yachts often move at the rate of 85 and even 90m. an hour.

See *Ice Sports,* in the "Isthmian Library"; *Skating, Curling, Tobogganing,* etc., in the "Badminton Library."

ICHANG, a treaty port of China on the left bank of the Yang-tze kiang in western Hupeh. Although a relatively small town, with about 60,000 inhabitants, Ichang serves an important economic function in the trade of Szechwan and the Yang-tze Valley. Ten miles above the port begins the rugged country, 350 m. in extent, through which the Yang-tze breaks, in a series of four great limestone gorges and some 60 rapids and whirlpools the grandeur of which has been a favourite theme of many Chinese poets, especially Li-Tai-po. Hence Ichang, as the highest point of uninterrupted navigation, is a transhipment point between steamers and junks plying from Hankow and the special boats designed for the passage of the gorges. Formerly this took place entirely in junks hauled by gangs of coolies over the rapids. Much of the trade is still junk-borne, but in 1909 was inaugurated a

service of small, high-powered flat-bottomed steamers which now carry a large proportion of the cotton, cotton-goods, oils, rice and refined sugar passing upstream. A special insurance on goods sent through the gorges is obtainable at the port. An increasing amount of the downstream trade passes through the new customs office at Wanhsien on the Szechwan side of the gorges. Ichang was opened to foreign trade by the Chefoo Convention of 1876. There is a small foreign settlement between the native city and the sheltered anchorage. In 1926 the total trade of the port was valued at 16,820,989 HK.Tls., made up as follows: net foreign imports: 3,635,347; net Chinese imports: 9,616,893; exports: 3,568,749.

ICHNEUMON, the name applied to a number of small African weasel-shaped mammals belonging to the carnivorous family *Viverridae,* the Indian representatives being known as mongooses (*q.v.*). A large number of species of the genus *Herpestes* are known and range over southern Asia and all Africa, *Ichneumon* also occurring in South Spain. It is covered with long, harsh, tawny-grey fur, darker on the head and along the middle of the back; its legs are reddish and its feet and tail black. It lives largely on rats and mice, birds and reptiles, and for this reason it is domesticated.



THE ICHNEUMON OR EGYPTIAN MONGOOSE

ICHNEUMON-FLY, a general name applied to parasitic insects of the section Ichneumonoidea, order Hymenoptera, from the typical genus *Ichneumon,* belonging to the chief family of that section. The species of the families *Ichneumonidae, Braconidae, Evaniidae, Proctotrypidae,* and *Chalcididae* are often indiscriminately called "Ichneumons," but the "super-family" of the Ichneumonoidea in the classification of W. H. Ashmead contains only the *Evaniidae,* the *Stephanidae,* and the large assemblage of insects usually included in the two families of the *Ichneumonidae* and the *Braconidae.* The *Ichneumonidae* proper are one of the most extensive groups of insects. Gravenhorst (1829) described some 1,650 European species, to which many subsequent additions have been made. They have all long narrow bodies; a small free head with long filiform or setaceous antennae, which are never elbowed, and have always more than 16 joints; the abdomen attached to the thorax at its hinder extremity between the base of the posterior coxae, and provided in the female with a straight ovipositor often exserted and very long; and the wings veined, with perfect cells on the disc of the front pair.

Their parasitic habits render these flies of great importance in the economy of nature, as they serve to check any inordinate increase in the numbers of injurious insects. Without their aid it would in many cases be impossible for the agriculturist to hold his own against the ravages of his minute insect foes, whose habits are not sufficiently known to render artificial checks or destroying agents available. The females deposit their eggs in or on the eggs, larvae or pupae of other insects of all orders, chiefly *Lepidoptera,* the caterpillars of butterflies and moths being specially attacked (as also are spiders). Anyone who has watched insect life during the summer can hardly have failed to notice the busy way in which the parent ichneumon, a small four-winged fly, with constantly vibrating antennae, searches for her prey; and the clusters of minute cocoons round the remains of some cabbage-butterfly caterpillar must also have been observed by many. This is the work of *Apanteles* (or *Microgaster*) *glomeratus,* one of the *Braconidae,* which in days past was a source of disquietude to naturalists, who believed that the life of the one defunct larva had *transmigrated* into the numerous smaller flies reared from it. Ichneumon-flies which attack external feeders have a short ovipositor, but those attached to wood-feeding insects have that organ of great length to reach the haunts of their concealed prey. Thus a species from Japan (*Bracon penetrator*) has its ovipositor nine times the length of the body; and the large species of *Rhyssa* and *Ephialtes,* parasitic on *Sirex* and large wood-boring beetles in temperate Europe, have very long instruments (with which when handled they will endeavour to sting, sometimes penetrating the skin), in order to get at their secreted victims. A common reddish-coloured species of *Ophion* (*O. obscurum*), with a sabre-shaped abdomen, is noteworthy from the fact of its eggs being attached by stalks outside the body of the caterpillar of the puss-moth (*Cerura vinula*).

The larvae of the ichneumon-flies are white, fleshy, cylindrical, footless grubs; the majority of them spin silk cocoons before pupating, often in a mass (sometimes almost geometrically), and sometimes in layers of different colours and texture.

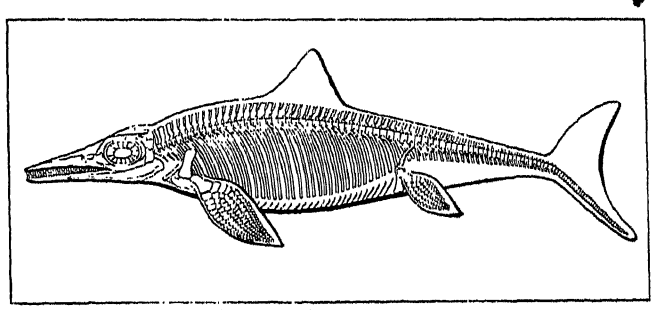
The literature on Ichneumon-flies is considerable and technical in character. W. H. Ashmead has written a comprehensive summary on the group (*Proc. U.S. Nat. Mus.* xxiii., 1901) and some account of their parasitic behaviour is given by R. A. Cushman (*Proc. Entom. Soc. Washington,* xxviii., 1925). The British species are described by C. Morley, *Ichneumons of Great Britain* (Plymouth, 1903–14), and T. A. Marshall (*Trans. Entom. Soc.,* 1885–1899).

ICHNOGRAPHY, an obsolete, architectural term for a horizontal section or plan of a building.

ICHTHYOLOGY, the study of fishes (*see* CYCLOSTOMATA, FISHES, SELACHIANS).

ICHTHYOPHAGI (Gr. for "fish-eaters"), the name given by ancient geographers to several coast-dwelling peoples in different parts of the world and ethnically unrelated. Nearchus mentions such a race as inhabiting the barren shores of the Mekran on the Arabian sea; Pausanias locates them on the western coast of the Red sea. Ptolemy speaks of fish-eaters in Ethiopia, and on the west coast of Africa; while Pliny relates the existence of such tribes on the islands in the Persian gulf.

ICHTHYOSAURIA, a group of extinct reptiles which breathed by lungs but were completely adapted for life in water. They existed during the age of reptiles, the Mesozoic epoch of geology, before the warm-blooded mammals and birds began to flourish, and they filled the place in the seas now occupied by the whales and porpoises. In general, their adaptation to marine life was like that of the modern porpoises, but they never lost their hind pair of limbs, their tail fin was extended in a vertical plane instead of horizontally, and the end of their backbone was always prolonged into this fin. *Ichthyosaurus* (or fish-lizard) itself, which is known by numerous complete skeletons from the Lias, chiefly of England and Germany, is represented not only by the bones but also by the skin and some other soft parts, which are often well preserved in the Upper Lias of Holzmaden, Württemberg. The head is relatively large and tapers forward into a slender, elongated snout. The margins of the head bones are thin and deeply overlapping, as in fishes and porpoises. The eye is very large and surrounded by a rigid ring of sclerotic plates. The teeth, numerous and pointed, are inserted in a single row in a groove in each jaw. The backbone consists of short biconcave vertebrae which, originally separated by elastic tissue, would produce flexibility like that of the backbone of a fish. There is no neck, and there are no vertebrae modified for contact with the supports of the hinder pair of limbs; the stoutest vertebrae are just in front of the base of the tail fin, and behind this fulcrum the backbone rapidly tapers and is sharply bent downwards to strengthen the lower lobe of the fin. The vertical tail-fin is fan-shaped, without any stiffening rays, and there is a soft triangular median fin on the back. The paired limbs are paddles, with the arm bones (leg



FROM THE BRITISH MUSEUM "GUIDE TO FOSSILS, REPTILES AND FISHES"

SKELETON OF THE EXTINCT MARINE REPTILE, ICHTHYOSAURUS COMMUNIS, WITH OUTLINE OF BODY AND FINS; FROM LOWER LIAS OF LYME REGIS, DORSET

bones) short and pressed together, and the fingers (toes) enclosed in a continuous covering of flesh and skin. The hind-limbs are often relatively small. The tail-fin would be used for progression, while the paired limbs would be for balancing. The skin is known to have been completely smooth. Remains of food in the intestine show that *Ichthyosaurus* fed chiefly on cuttle fishes and fishes, but no example is known showing any spiral marking on the food mass. The isolated spirally marked coprolites commonly ascribed to *Ichthyosaurus* doubtless belong to the associated Hybodont sharks. The skeletons of young within some specimens of *Ichthyosaurus* prove that it was viviparous.

The earliest Ichthyosauria, found in the Triassic rocks of Europe, Spitsbergen and North America, include many comparatively small species not more than a metre in length. Their head bones are less extensively overlapping than in the later forms; the teeth are in separate sockets and not all uniformly conical; the vertebrae are sometimes a little elongated and not deeply concave at the ends; the tail-fin is an elongated flap of skin on the back, not yet fan-shaped; and the limb-bones are comparatively elongated. They therefore suggest that the Ichthyosauria, like the modern whales and porpoises, were descended from land animals. In the Liassic or Lower Jurassic rocks the Ichthyosauria attain their greatest size, being sometimes 10 to 12 metres in length. In the Middle and Upper Jurassic rocks some genera, such as *Ophthalmosaurus* and *Baptanodon*, are almost or completely toothless, and the paddles become extremely flexible owing to the thick layer of cartilage persisting round all their bones. In the Cretaceous rocks, just before their extinction, the Ichthyosauria exhibit their widest geographical distribution, their remains having been found in nearly all parts of the world, from Europe in the north to New Zealand in the south.

See R. Owen, *Monograph of the Fossil Reptilia of the Liassic Formations*, part 3 (Palaeontographical Society, London, 1881); F. von Huene, *Die Ichthyosaurier des Lias* (Berlin, 1922). (A. S. W.)

ICHTHYOSIS or **XERODERMA,** a general thickening of the whole skin and marked accumulation of the epidermic elements, with atrophy of the sebaceous glands, giving rise to a hard, dry, scaly condition. This disease generally first appears in infancy, and is probably congenital. It differs in intensity and in distribution, and is little amenable to treatment. A somewhat similar condition (leukoplakia) affects the tongue in syphilitic subjects and cancer may start in one of the patches.

ICKNIELD STREET. (1) The Saxon name (earlier *Icenhylt*) of a prehistoric (not Roman) "Ridgeway"—along the Berkshire downs and the Chilterns, which crossed the Thames near Streatley and ended somewhere near Tring or Dunstable. In some places there are traces of a double road, one line on the hills and one in the valley below, as if for summer and winter use. No modern highroad follows it for any distance. Antiquaries have supposed that it once ran on to Royston, Newmarket and Norfolk, where dwelt the Iceni, before the Roman conquest. But the name does not occur in early documents so far east, and it has certainly nothing to do with that of the Iceni (Haverfield, *Victoria History of Norfolk*, i. 286). (2) A Roman road which ran through Derby, Lichfield, Birmingham and Alcester is sometimes called Icknield Street and sometimes Rycknield Street. The origin of this nomenclature is very obscure.

See *Victoria History of Warwick*, i. 239, *and of Derbyshire*, i. 243; cf., C. Fox, *Archaeology of the Cambridge Region*, and Askins on *A Romano-British Site on Cowbury Hill, Berks*, p. 29 (1916).

ICON, generally any image or portrait-figure. The word is specially applied to the representations in the Eastern Church of sacred personages, which are either flat paintings or in very low relief, sculptured figures being forbidden. (*See* BYZANTINE ART.)

The term "iconography" once confined to the study of engravings is now applied to the history of portrait images in Christian art, though it is also used with a qualifying adjective of Greek, Roman and other art.

ICONIUM (mod. *Konia*), a city of Asia Minor, the last of the Phrygian land towards Lycaonia, was usually attributed to Lycaonia in the Roman time, but retained its old Phrygian connection and population to a comparatively late date. It lies in an excellently fertile plain, 6 m. from the Pisidian mountains on the west, with mountains more distant on the north and south, while to the east the plain stretches away for hundreds of miles. Streams from the Pisidian mountains aid the cultivation of the land on the south-west and south of the city, and on the east and north-east a great part of the naturally fertile soil has been irrigated since 1914 with water brought from Beyshehr Lake. Trees grow nowhere except in the gardens near the city.

Originally a Phrygian city, as is implied in Acts xiv. 6, it was in a political sense the chief city of the Lycaonian tetrarchy added to the Galatian country about 105 B.C., and it was part of the Roman province Galatia from 25 B.C. to about A.D. 295. Then it was included in the province Pisidia (as Ammianus Marcellinus describes it) till 372, after which it formed part of the new province Lycaonia so long as the provincial division lasted. Later it was a principal city of the theme of Anatolia. It was thrice visited by Paul, probably in A.D. 47, 50 and 53; and it is the principal scene of the tale of Paul and Thecla (which though apocryphal has certainly some historical basis; *see* THECLA). There was a distinct Roman element in Iconium, arising doubtless from the presence of Roman traders. This was recognized by Claudius, who granted the honorary title Claudiconium, and by Hadrian, who elevated the city to the rank of a Roman colony about A.D. 130 under the name Colonia Aelia Hadriana Augusta Iconiensium. In later Roman and Byzantine times it must have been a large and wealthy city. It was a metropolis and an archbishopric, and one of the earliest councils of the Christian church was held there in A.D. 235. The ecclesiastical organization of Lycaonia and the country round Iconium on all sides was complete in the early 4th century, and monuments of later 3rd and 4th century Christianity are extremely numerous. It suffered much from the Arab raids in the three centuries following A.D. 660; its capture in 708 is mentioned, but it never was held as a city of the caliphs. The period of its greatest splendour was after the conquest by the Seljuk Turks about 1073–74. It soon became the capital of the Seljuk state. The palace of the sultans and the mosque of Ala ed-dīn Kaikobād formerly covered a great part of the Acropolis hill in the northern part of the city. Farther south there is still the great complex of buildings which till recently formed the chief seat of the Mevlevi dervishes, a sect widely spread over Anatolia, but now disbanded; their "Tekke" has been converted into a museum. The walls, about 2 m. in circumference, consisted of a core of rubble and concrete, coated with ancient stones, inscriptions, sculptures and architectural marbles, forming a striking sight. Beyond the walls extended the gardens and villas of a prosperous Oriental population.

When the Seljuk state broke up, and the Osmanli or Ottoman sovereignty arose, Konia decayed. The walls and the palace, still perfect in the beginning of the 19th century, were gradually pulled down for building material, and in 1882 there remained only a small part of the walls, from which all the outer stones had been removed, while the palace was a ruin. At that time and for some years later a large part of Konia was almost deserted. But about 1895 the advent of the Anatolian railway began to restore its prosperity. The water supply was also improved. The sacred buildings were patched up (except a few which were quite ruinous) and the walls wholly removed, but an unsightly fragment of a palace-tower still remained in 1906. In 1904–1905 the first two sections of the Baghdad railway, to Karaman and Eregli, were built.

Iconium is 389 m. by rail from Smyrna by way of Afiun Qarahisar. Pop. (1927) 101,674. Carpets are manufactured and mercury is mined.

ICONOCLASTS, breakers of images, a name applied in the 8th and 9th centuries to the opponents of the use of images in Christian worship. (*See* ROMAN EMPIRE, LATER.)

At the period of the Reformation (*q.v.*) the name was given to those who advocated the destruction of images in the churches.

ICONOSTASIS, the screen in a Greek, Russian or Armenian church, which encloses the sanctuary. It is generally of masonry, high enough to reach the spring of the vault and extends into the body of the church as far as the easternmost nave pier. In its

nave front there are usually three doors. The face of the screen is often decorated with many tiers of small arcades; each arch encloses the representation of a saint. In Russian churches only the hands, feet and faces of the painted representation or ikon are exposed; the rest of the panel is covered with elaborate, engraved, embossed metal work. In earlier times in Greece, however, the entire image was painted.

ICOSAHEDRON: *see* SOLIDS, GEOMETRIC.

ICTERUS, a genus of birds belonging to the family, *Icteridae* intermediate between the finches (*q.v.*) and starlings (*q.v.*); many of them are called troupials; others are known as the American grackles (*q.v.*). One of the best-known species is *Icterus spurius,* the garden oriole, an inhabitant of northern South and Central America and the United States. Very many species exist in the Neotropical region, though a few migrate northward in summer. They are nearly all gregarious, many of them with loud and melodious notes, rendering them favourites in captivity. Some have a plumage wholly black, others are richly clad; the well-known Baltimore oriole, golden robin or hangnest of the United States, *Icterus galbula,* has plumage of brightly contrasted black and orange, the tinctures of the armorial bearing of Lord Baltimore, the original grantee of Maryland. The most divergent form of *Icteridae* seems to be that known in the United States as the meadow-lark, *Sturnella magna,* while the bobolink or rice-bird (*q.v.*) with its bunting-like bill, is not much less aberrant.



BY COURTESY OF THE NATIONAL ASSOCIATION OF AUDUBON SOCIETIES

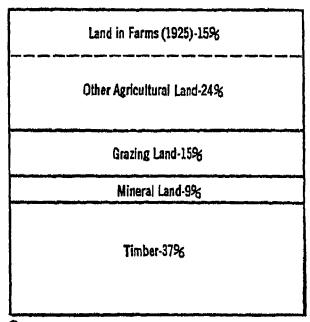
BALTIMORE ORIOLES COMPLETING THE CONSTRUCTION OF THEIR NEST

ICTINUS, Greek architect of the 5th century B.C., was the architect of the Parthenon at Athens, of the Hall of the Mysteries at Eleusis, and of the temple of Apollo Epicurius at Bassae, near Phigalia.

IDA (d. 559), first king of Bernicia, became king in 547, soon after the foundation of the kingdom of Bernicia by the Angles. He built the fortress of Bebbanburh (Bamborough) and after his death his kingdom, which did not extend south of the Tees, passed in turn to six of his sons. The surname of "Flame-Bearer," sometimes applied to him, refers not to Ida, but to his son Theodoric (d. 587).

IDAHO, the "Gem State," one of the far north-western States of the U.S., is situated between 42° and 49° N. and 111° and 117° W. It is bounded on the north by British Columbia in the Dominion of Canada, on the east by Montana and Wyoming, on the south by Utah and Nevada, and on the west by Oregon and Washington. Its area, of which 534sq.m. are water surface, is 83,880sq.m., or 53,346,560ac. This is about the size of England and Scotland combined, or of New England plus New Jersey. The name is an expression of the Shoshonee Indians, *Ee-dah-how,* meaning, "Look, the sun is coming down the mountain!" It was used by the Indians to arouse the camp in the morning. The popular name "Gem State" is derived from the expression "gem of the mountain," often erroneously given as a translation of the Indian name.

Physical Features.—Idaho lies entirely on the western watershed of the Rocky mountains, and, excepting a small area in the south-east which is drained by Bear river into the Great Salt Lake basin, it is drained by the Columbia river and its branches. The chief of these branches is the Snake river, which takes its rise in Yellowstone park and flows in a great bend south and west nearly 800m. through southern Idaho until it strikes the western border, then flowing northward 200m. farther and forming the boundary between Idaho and Oregon and between Idaho and Washington. At Lewiston it turns abruptly to the west and leaves the State. Below Idaho Falls for about 600m. of its course its walls are canyon like in character, the river flowing from several hundred to several thousand feet below the level of the plain above. Finally as it flows north it cuts through a mountain range (once a barrier to the Snake, which made all southern Idaho a lake) in the famous Seven Devils canyon, with walls in places 5,000ft. high. Along the Snake's southern and western course are successively Idaho falls, American falls, Twin falls, Shoshone falls, Auger falls and Salmon falls. Shoshone falls are 43 ft. higher than Niagara and did not suffer in comparison with the latter until extensive irrigation diminished the volume of water in the Snake. These falls, together with numberless rapids, some of them miles in length, make the river useless for the transportation of produce, but furnish a tremendous potential water-power supply.



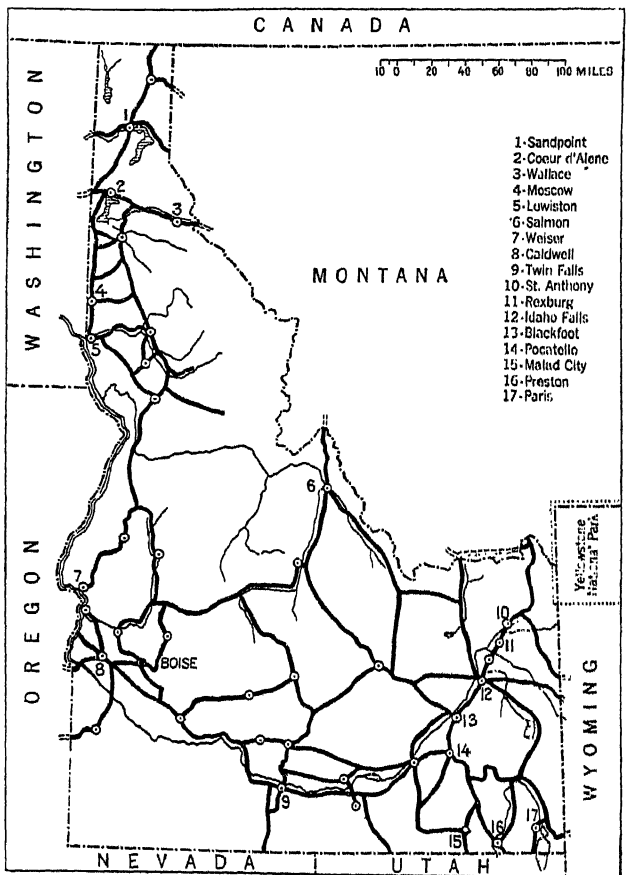
CLASSIFICATION OF LAND—THE TOTAL LAND AREA OF IDAHO IS MORE THAN THAT OF ALL NEW ENGLAND, NEW JERSEY, DELAWARE AND MARYLAND

Bordering the Snake river in a belt 50 to 75m. wide are the Snake river plains, originally arid, desolate sage-brush land, but now irrigated and Idaho's chief agricultural region. These plains were built up by a series of lava sheets from extinct volcanic craters to the north, and the volcanic-ash soil is rich in mineral elements of plant food, such as phosphorous and potash. In the northern plain between Arco and Carey is a district containing about 63 volcanic craters, lava and cinder cones, which was set apart in 1924 as the "Craters of the Moon" national monument. It is a region with weird landscape effects and furnishes the best example of fissure lava flows in North America. South of the plains the land rises to a divide between the Columbia basin and the Great Salt Lake basin. This divide in places breaks into low mountain ranges. In the south-east the Bear river range forms a northern extension of the Wasatch range of Utah. In the south-west the Owyhee mountains and their foothills occupy a large area.

The main mountain system of the State, however, is formed by those ranges (the Cabinet, Coeur d'Alene, Bitter Root and Beaverhead) which lie along the north-east boundary, together with their various spurs extending westward and south-westward toward the central part of the State. From these mountains flow the Salmon and Clearwater rivers, the main branches of the Snake. Through narrow valleys and canyons often impassable, they drain the most thinly settled and the wildest and most rugged section of the State. Most of the region, an area several times larger than Switzerland, is still impenetrable except by pack-horse. Its existence has prevented the construction of a railway connecting north and south Idaho, and not until 1927 was a north and south highway completed. All travel previously between the two settled regions of the State had to pass through Oregon and Washington. The wilderness region is bounded on the south by the Sawtooth mountains, a range which also forms the northern boundary of the Snake river valley. These mountains rival in sublimity any range in the United States. They contain Hyndman peak (12,078ft.), the highest point in Idaho. Other high and beautiful ranges of the region are the Salmon river mountains and the Lost river range. South of the latter are Big Lost river and a number of smaller streams which disappear after reaching the upper Snake river plains in the driest portion of Idaho. North of the Salmon river country is the Clearwater country, through which runs the Lo Lo trail travelled by Lewis and Clark. This trail passes through the largest area of virgin timber still standing in the United States. The whole region furnishes excellent hunting of the white-tail and mule deer, elk, bear, mountain goat and blue and ruffed grouse and other game birds. The State game warden reports deer and moose to be increasing. Beautiful mountain lakes abound in fish and furnish enchanting camping sites. The region is also rich in mineral resources, which

must wait for transportation facilities before they can be profitably developed.

The northern part of the State is low (average 3,000ft.) compared with the average level of the State (5,000ft.), and this low altitude gives it an advantage in climate which offsets its northern position. There are ranges of great height and beauty, but the valleys between are broad and fertile. Towards the Washington boundary in particular, there are many fine farming regions. An abundant rainfall in this northern section (20 to 35 in. annually) makes irrigation unnecessary. Here are the largest and most beautiful of Idaho's lakes—Priest lake, Pend Oreille and Coeur d'Alene. Across this narrow northern portion flow the Clark Fork and Kootenai rivers on their way to join the Columbia. The lowest portion of the State is at Lewiston, where the Snake river leaves the State at an altitude of only 720ft.



MAP SHOWING THE MAIN ROADS OF IDAHO

The vast extent and varied topography of Idaho give it a number of distinct climate zones. The entire State comes under the modifying influence of the equable climate of the North Pacific ocean and is protected by its great north-eastern mountain barrier from the severe cold waves that sweep the plains east of the continental divide. The mean annual temperature varies from about 36° (coldest region centring in Custer county, around the Sawtooth range) to 55° along the middle reaches of the Snake river. In the lower valleys of the Snake and its tributaries the weather is mild enough for even the more tender fruits. The orchards of this region are becoming famous. Precipitation varies even more than temperature, but in general it is greatest in the mountainous region and least in the open plains. The driest regions are along the great south-west bend of the Snake, in the Lost River country, and in the upper reaches of the Salmon river. Tornadoes and severe storms are virtually unknown.

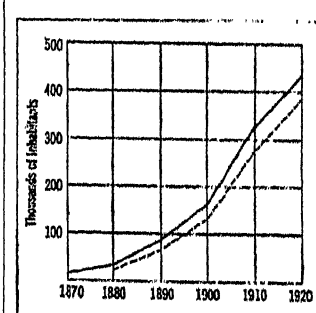
Government.—Idaho is governed by a constitution adopted in 1889, which went into effect when the State entered the Union, July 3, 1890. From time to time, as new needs and conditions presented themselves, this constitution has been amended, and by 1925, 27 amendments were in effect.

The executive department is made up of elected and appointed officers, all serving two years. Those elected are the governor, lieutenant governor, secretary of State, State auditor, State treasurer, attorney general, superintendent of public instruction, and inspector of mines. In addition to the usual duties of their offices, these officers serve on the State library commission and on special administrative boards, such as the board of pardons, the board of land commissioners, the board of equalization, the board of canvassers and the board of examiners. In 1919 an act of the legislature grouped 51 bureaus, boards and commissions into nine departments. Later the nine departments were reduced to seven: the departments of agriculture, finance, law enforcement, public investments, public welfare, public works and reclamation. Each department is headed by a commissioner appointed by the governor and responsible directly to him.

The legislature consists of two houses, whose members are elected biennially. A senator is elected from each county, and a representative for every 2,500 votes or fraction thereof exceeding 1,000 in each county. In 1927 there were 44 senators and 68 representatives. The legislature meets at Boisé for its regular session the first Monday of January in odd-numbered years. Special sessions may be called by the governor if he decides that they are necessary. A two-thirds vote of the legislature can override the governor's vote.

The judiciary consists of a supreme court, holding five terms yearly, its five justices being elected for six years, and 11 district courts with 16 judges, each holding office for four years. At least two terms of the district court must be held in each county each year. Each county also has a probate court trying lesser cases both of civil and of criminal nature, and normally there are two justices of the peace in each county precinct.

Population.—The first census of Idaho was in 1870, when the population was 14,999; in 1880 it was 32,610; in 1890, 88,548; in 1900, 161,772; in 1910, 325,594; and in 1920, 431,866. The increase between 1900 and 1910 was 101.3%; between 1910 and 1920 it was 32.6%. Basing its calculations upon the latter percentage, the U.S. census bureau estimated the population in 1927 to be 534,000; but probably the percentage of increase had not been maintained. Of the population in 1920, 98.6% was white. The remaining 1.4% was made up of 4,028 Indians (approximately the same number as in 1880), 920 negroes, 584 Chinese and 1,569 Japanese. The Chinese have gradually decreased since placer-mining days, but the Japanese are slowly increasing. Of the Indians 1,700 belong to the Bannock and Shoshone tribes residing on the Fort Hall reservation. These are the most primitive of all the north-western tribes, retaining their old-time tribal customs despite the influences of civilized communities all about them. Only 120 of 470 families on the reservation live in permanent homes. The Nez Percé Indians number about 1,400 and are the most interesting historically as well as the most advanced. They and the Coeur d'Alenes, who number about 650, have always been self-supporting. The land of their reservations has been allotted to individuals of the tribes, instead of being held in common. In the extreme north near Bonner's ferry, are a small band of Kootenai Indians who have no reservation, but settled on homesteads along the Kootenai river.



GROWTH OF POPULATION 1870–1920, SHOWING TOTAL AND NATIVE WHITE

Of the total population in 1920, 9.2% were foreign born and 11.3% were born of foreign parentage. The Scandinavian countries contributed 9,734 of the foreign born; Great Britain and Ireland, 7,664; Germany, 4,143; and various other countries, less than 1,500 each. The urban population in 1920 was 119,037; the rural population, 312,829. The percentage of urban population had increased from 21.5 in 1910 to 27.6 in 1920. Idaho has 36 in-

corporated cities, of which Boisé, the capital, is the largest, with an estimated population of 23,042 in 1925. Pocatello, with a population estimated at 18,335 in 1925, is the metropolis of the eastern part of the State. Burley, Caldwell, Coeur d'Alene, Idaho Falls, Lewiston, Nampa and Twin Falls were the other cities over 5,000 in population.

Finance.—The general fund for ordinary running expenses of the State is derived from an annual tax levied on the counties, a tax on insurance companies, interest on current funds in the State depositories, fees paid by corporations, fees of the departments of the State and other sources. Expenditures from this fund are authorized biennially by the legislature under a budget system. In addition to the general fund there are no less than 75 special funds for particular purposes, each with its income derived as far as possible from its own activities and services. Such, for example, is the game fund, with its income derived from licences, or the highway fund, with much of its income derived from a tax of two cents a gallon on gasolene. The lands for public school endowment and for special institutions are also administered as special funds.

In the biennial period 1924–26 State receipts totalled $17,995,964; disbursements $17,905,911. The general fund received $4,592,855, and disbursed $4,942,466. The assessed value of the State in 1925 was $478,686,746, a decrease from $499,471,287 in 1920. On this assessed value in 1925 a tax of $1,675,000 (3·4 mills) was levied for the general fund, and $535,000 (1·2 mills) for special funds. The general tax of 3·4 mills may be compared with that of 7·6 in 1919, 5·5 in 1921, 4·7 in 1923. Despite this tax reduction, the State was gradually reducing a debt which had been increased mainly by highway expenditures. There were still in June, 1926, State bonds outstanding to the amount of $5,649,500, $3,420,000 of them being for roads and bridges, $1,375,000 for a new State capitol, and the rest for other State buildings and institutions.

The value of all property in the State was estimated in 1922 at $1,534,000,000, as compared with $579,000,000 in 1912. There were 161 banks in the State in 1925, with total resources of $91,900,000. Their savings deposits were $25,539,000 in 1925, a decrease from the $32,512,000 of 1920, but an increase over the $24,206,000 of 1924.

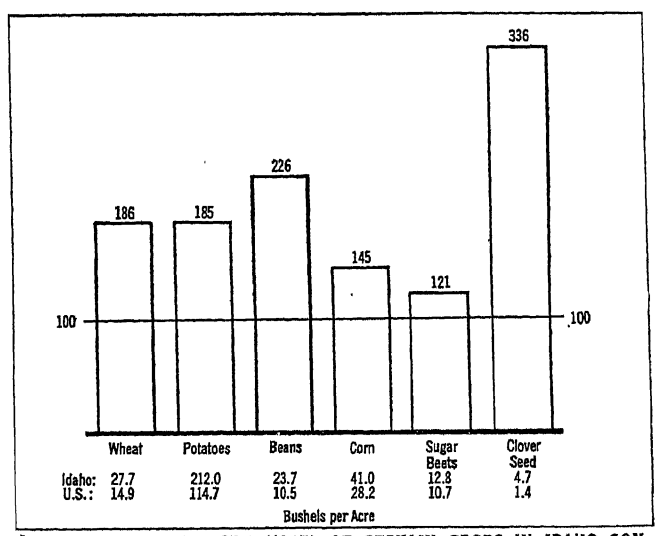
Education.—A radical change in the Idaho public school system was made in 1913, when the legislature provided that from the primary grades to the State university the administration should be controlled by a single State board of education instead of six separate boards as it had been. This board consists of six members, five of them appointed by the governor (one each year for a term of five years), the sixth being the State superintendent of public instruction, an *ex officio* member. Besides the elementary and secondary schools, the board has under its supervision the University of Idaho, at Moscow, the State normal schools at Lewiston and Albion, the Idaho Technical institute at Pocatello, the Idaho Industrial school at St. Anthony, and the State school for the deaf and blind at Gooding.

The public school population of Idaho in 1926 was 138,885, a slight decrease from the peak of 141,991 in 1922, but an increase over the 137,756 of 1920. The actual enrolment in 1925–26 was 117,360. There were 4,377 teachers employed, and their average salary was $1,084.12. Of the total enrolment, 21,730 were pupils in the 78 high schools of the State. Total school expenditure has increased from $2,175,000 in 1910 to $8,591,000 in 1926, and $10,053,454 in 1926. Approximately one-half of this was paid for teachers' salaries. The sources of the current school income for 1926 were State appropriations, $608,682; county appropriations, $2,742,654; special school tax, $4,290,185; and miscellaneous, $1,518,288. School expenditure in 1926 was $72.34 per capita of the school population, as compared with $63.24 in 1920. For the benefit of the common schools, the Federal Government granted 2,963,698 acres of land, now owned and administered by the State. There are special grants also which serve as an endowment for the higher institutions.

Enrolment at the University of Idaho has increased rapidly from 1,435 in 1921–22 to 2,266 in 1925–26. Efforts have been made to alleviate the resultant overcrowding. A new science hall was completed in 1925 at a cost of $216,000, and the budget approved for 1927–28 carried an appropriation of $420,000 for a new library and a new heating plant. In 1926 the faculty was increased by 20 members, making a total staff of 143. The approved budget for maintenance for the biennium 1927–28 was $2,749,403, as compared with $2,031,987 for the previous biennium. Of this amount $1,998,273 came from the State and the rest from Federal appropriations, land endowments, fees, etc. In the Lewiston State Normal school, enrolment for the year 1925–26 was 363; in the Albion State Normal school, it was 387. There is also the College of Idaho, a co-educational, non-sectarian institution under Presbyterian control, at Caldwell, which had 499 students and a teaching staff of 32 in 1924–25.

In 1903 a State library commission was established to manage the travelling library of the State, and to give assistance to any community trying to establish a free reading-room. In 1926 there were over 30,000 books in the library, and 200 cases were in circulation. There is little illiteracy, the State ranking third in the Union in 1920, with a percentage of 1·5. Over half of the illiterates were foreign born.

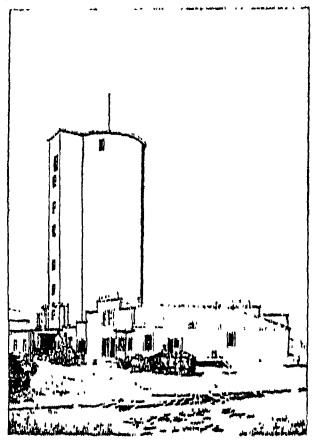
Charitable and Penal Institutions.—The State penitentiary at Boisé, had in 1926 an average of 363 inmates constantly under custody. This, when compared with the average of 280 for the biennium 1923–24, showed an alarming increase and resulted in an acute overcrowding problem. A modern shirt-factory furnished an occupation for two-thirds of the inmates, and was so successful financially that it paid both a small wage to the workers and a large share of the institutional expense. Under the administration of the department of public welfare are an insane asylum (342 inmates in 1926), at Blackfoot; the Northern Idaho Sanitarium (277 inmates in 1926), at Orofino; the Idaho Sanitarium (285 inmates in 1926) for mental defectives, at Nampa; a State sanitarium for invalids, at Lava Hot Springs; and the Soldiers' Home (88 inmates in 1926), at Boisé. The State board of education has under its administration an industrial training school for boys and girls (314 in attendance in 1926), at St. Anthony, and a school for the deaf and blind (90 enrolled in 1926), at Gooding. There is also at Boisé a foundation for homeless children, under private auspices.



AVERAGE YIELD PER ACRE (1927) OF CERTAIN CROPS IN IDAHO COMPARED WITH AVERAGE FOR U.S. AS 100. IDAHO RANKED FIRST IN 1927 AS TO YIELD PER ACRE OF WHEAT, BEANS, SUGAR BEETS, AND CLOVER SEED; SECOND AS TO YIELD PER ACRE OF POTATOES AND CORN

Agriculture and Live Stock.—Agriculture and live stock raising—which in Idaho can no longer be separated—rank as the most important industries. Agriculture is of three types, according to the amount of rainfall. In the northern part of the State and in other regions where the rainfall is over 18in. annually, humid farming can be practised. The cut-over forest lands in the north are among the richest lands of the State. Along the Snake

river irrigation must be relied on entirely, but it has been developed to such an extent that the region produces the largest share of Idaho's crops. Here the soils are volcanic and contain a rich supply of the mineral plant foods. The lack of nitrogen is soon overcome by ploughing in clover and alfalfa crops. Any failure of the irrigation ditches, such as occurred in the abnormally dry year of 1919 and partially in other years, is prevented for the future by the completion in 1926 of the enlarged American falls dam which creates the largest storage reservoir in America. This will hold the spring flood waters of the Snake, which formerly were wasted. On the bench lands and the borders of the Snake river plains, dry farming is carried on extensively. This was the type of agriculture that was expanded most to meet the abnormal demands of the World War years, and it is among dry-land farmers that the largest number of failures have occurred in the subsequent period of depression. The value of farm property increased from $67,271,000 in 1900 to $305,317,000 in 1910, and $716,138,000 in 1920, since when there has been a decrease. The land valued in 1920 at $511,866,000 was in 1925 valued at only $310,243,000. The value of buildings and live stock has also decreased, though less disastrously. The number of farms decreased from 42,106 in 1920 to 40,593 in 1925; the acreage, from 8,376,000 to 8,140,000; and farm population, from 200,902 to 172,216. The mortgage debt of Idaho farmers increased from $14,557,000 in 1910 to $69,868,000 in 1920, 59% of the farms owned being mortgaged in 1920. Tenants operated 24·4% of the farms in 1925, as compared with 15·9% in 1920. These figures show the agricultural crisis that Idaho has experienced since the World War. In addition to the general depression of prices, it was aggravated there by several exceptionally dry years.



BY COURTESY OF BUREAU OF RECLAMATION

A CONCRETE GRAIN ELEVATOR IN THE IDAHO WHEAT BELT

The total value of the 22 chief crops in 1919 was $111,940,000; in 1924, it was $73,009,000; in 1925, $103,681,000; and in 1926, $82,611,000. Wheat and hay are the State's most valuable crops. In 1926 1,045,000ac. were planted to wheat, yielding approximately 24,633,000 bushels, valued at $26,173,000. The average yield, 23·5 bushels per acre, is exceptionally high as compared with the averages in such important wheat States as Kansas (14·8), North Dakota (8·0), Montana (12·4) and Minnesota (12·9). In 1926 121,000 tons of hay, 2,768,000 tons of meadow hay, and 2,157,000 tons of alfalfa were harvested, meadow hay yielding an average of 2·7 tons per acre and the alfalfa yielding 3·2 tons. In 1926 66,000 acres of corn (maize) produced 2,706,000 bushels, an average of 41 bushels per ac., which is higher than in any except the Atlantic States, and may be compared with Iowa's average of 37 bushels per acre. In 1926 Idaho produced 4,760,000 bushels of oats and 4,144,000 bushels of barley. Potatoes are an important Idaho crop, and the 1926 production of 16,198,000 bushels was greater than that of any other State west of the Mississippi except Minnesota. The average yield was 178 bushels per acre, an average higher than that of any other State but Maine. The 1925 shipments, totalling 18,271 cars, were exceeded only by those of Maine and Minnesota. Sugar-beet has been an important crop, but low prices have decreased the acreage. Only 17,000 acres were harvested in 1926, as compared with 38,000 acres in 1925.

Idaho has consistently shipped more apples than any other western State except Washington, and the shipments are increasing fast. In 1925 they totalled 7,485 car-loads. The principal varieties are the Jonathan and the Rome Beauty. The principal growing valleys are the Boisé and Payette and those around Lewiston. A careful State orchard census in 1924 showed commercial orchards (not including home orchards of less than 50 trees) amounting to 27,707 acres, including 956,310 apple trees, 448,495 plum trees, 71,522 peach trees and 73,821 apricot, cherry, and pear trees. Idaho is one of the leading States in output of prunes.

As there are no large consuming centres in Idaho, growers must seek distant markets. These have been opening up rapidly on the Pacific coast, especially in California. This has also stimulated dairying. Milch-cows and heifers increased from 160,000 head in 1925 to 170,000 head in 1927, and their value from $8,000,000 to $11,050,000. Creamery butter production rose from 4,660,000 lb. in 1920 to 15,101,000 in 1925. Cheese production rose from 1,722,000 lb. to 7,830,000 lb. in the same years, giving Idaho a rank of fifth among the States in its output.

The sheep-raising industry suffered greatly immediately after the World War. Sheep valued at $28,300,000 in 1920 dropped in value to $13,415,000 in 1921. Increased wool prices in 1924, however, aided the industry, and in 1927 Idaho's sheep were valued at $21,326,000. In 1925, 14,300,000 lb. of wool were shipped, and the estimate for 1926 was 14,507,000 lb. Near Du Bois there is a U.S. sheep experiment station of 44,810 acres, devoted to a study of the problems of range sheep men in the western States.

Mining.—The total value of Idaho's mineral production from the discovery of gold in 1860 to 1927 is estimated at $1,030,000,000. The leading minerals in the order of their importance are lead, silver, zinc, copper and gold. The annual production of these minerals in the decade before the World War averaged $24,500,000 in value. During the war the output of lead, silver, zinc and copper, because of the high prices these metals commanded, increased over 100%, but the production of gold decreased 60%. The total mineral production of 1917 was valued at $54,845,153. After the war the decline in demand and prices, combined with high freight rates and high wages, caused the greatest depression of mining in 20 years. The production for 1921 totalled only $10,804,014, many of the leading producers suspending operations entirely. Between 1921 and 1926, however, prices of metals slowly increased, so that old mines were reopened and new developments and explorations carried out. By 1925 all the producing mines were maintaining capacity production.

The total value of the five leading metals in 1926 was $42,971,930, an increase of $4,394,681 over that of 1924. The increase was mainly in the amount of lead and zinc produced and in the higher prices at which these metals sold, the lead output being worth $23,930,319, and the zinc $9,858,574. The silver output decreased slightly, but higher prices gave it a value of $5,324,178. There was a substantial increase in the production of copper, the 1925 output being $473,217, but a decided decrease in the production of gold, the 1925 valuation, $415,640, being the lowest in the State's history. Of the State's mineral production, 92·52% was from the lead-silver-zinc belt of the Coeur d'Alene region in Shoshone county. In 1925 there was a great increase in the number of small producers, which is generally accepted as a sign of health in the mining industry. Most of these were in the southern part of the State. The year was also a good one for labour, the pay-roll being one of the largest in the State's mining history. The average miner's wage increased from about $4·50 per day in 1921 to $5·50 in 1925.

The lead, silver and zinc ores are always found associated with each other, and the mining of one can hardly be carried on separately from the other. Much of Idaho's success in mining has been due to milling experiments and inventions which make it possible to treat these complex ores at very little increase in milling costs, giving at the same time high-grade concentrates and increased percentage of recovery.

Only Missouri produced more lead than Idaho until 1925, when Utah with a sudden increase passed ahead. Only Utah and Montana produced more silver. Only a few regions in the State have been thoroughly prospected. Lead-zinc-silver discoveries in the granite areas of Valley and Custer counties in 1925 attracted nation-wide attention. Other known deposits, in remote regions,

await transportation facilities before they can be developed. The mining industry has suffered greatly from speculative promotion, which is now curtailed by "blue sky" laws requiring the filing of all publicity literature, so that some check can be made upon the truth of promoters' claims.

Lumbering.—More than one-third (37%) of Idaho is covered with forests. The total stand of timber has been officially estimated at 98,000,000,000 board ft., of which 58·1% is owned by the Federal Government, 10·7% by the State, and 30·75% by private holders. There are 19 national forests, containing 20,503,893 acres. They were created in 1905, but before this there were many choice areas in private hands, and it has been from these that most of the commercial timber has been cut. In 1923 the cut for the State was 1,073,000,000 board ft.; in 1924 it was 1,018,000,000 board ft. The principal trees in order of their commercial importance are white pine, western or "yellow" pine, spruce, cedar, white fir, larch and red fir.

Manufactures.—Manufacturing in Idaho is built mostly upon the transformation of the raw products of the agricultural, mining and lumbering industries. There were 510 establishments in 1923, employing 15,347 men and paying $22,886,000 in wages. The value of manufactured products was $87,429,000, $44,295,000 of which was added by manufacture. This exceeds the value of any previous year's output, there having been a steady increase since the depression of 1921.

Idaho ranks as the fifth State in the Union in the richness of its water-power resources, so that an ample and cheap supply for future manufacturing is assured. In resources developed, Idaho in 1925 was fourth among the States, 45 plants developing 224,368 h.p. The valuation of all transmission lines in that year was 19,267,718. Water-power resources still undeveloped were estimated by the U.S. geological survey at from 2,262,000 to 5,067,000 horse-power.

History.—Idaho was a part of the "Oregon Country" claimed by Spain, Russia, Great Britain and the United States. Spain relinquished her claims in 1819, Russia in 1824. Great Britain and the U.S. then held the region jointly until a treaty in 1846 gave the U.S. sole possession south of the 49th parallel. The strongest claim of the U.S. was exploration by the Lewis and Clark expedition, the first known white men in Idaho. The expedition found its way across the mountains from Montana by Lemhi Pass in Aug. 1805. The leaders intended to follow to its mouth the first westward stream they encountered, but the impassable canyons along the Salmon forced them to recross the range into Montana. They travelled north through the Bitter Root valley and turned west to re-enter Idaho through Lo Lo Pass. This famous Indian thoroughfare led them down the ridges between the tributaries of the Clearwater river until they reached its navigable waters. Here they built canoes and embarked westward out of the State toward the Columbia. Their return in 1806 was by the same route.

Lewis and Clark were none too early, for in 1809 David Thompson and Finan McDonald, traders of the North-West Company, a British organization, entered Idaho from the north and on the shores of Lake Pend Oreille built a trading post, the first building in the State. In the spring of 1809–10, 46 packs of fur of 90 lb. each were taken out—Idaho's first commercial contribution to the outside world. In 1810 Andrew Henry, of the Missouri Fur company, built the second building in Idaho, on Henry's Fork of the Snake river, the first establishment of a citizen of the U.S. west of the continental divide. Another expedition from the U.S. consisting of 56 men under the command of Wilson Price Hunt, was sent overland to the mouth of the Columbia river by John Jacob Astor, and visited Fort Henry in 1811. Their adventures and disasters in attempting to cross southern Idaho are accurately and vividly told by Washington Irving in *Astoria*. They were the first party to make the trip along the route later followed, in the main, by the Oregon trail.

During the War of 1812 the Americans were forced to give up the region; and with little competition; British traders controlled the fortunes of Idaho for the next 35 years. In 1818 Donald McKenzie was put in charge of the Snake river brigade, and for four years he led large trapping parties into the region, searching for the best beaver territory. These expeditions were continued for many years by Peter Skene Ogden and John Work, later chiefs of the brigade. Their journals show the thoroughness of their knowledge of the region's topography. In 1834 Nathaniel Wyeth, a Boston man, built Fort Hall on the upper Snake river in an ambitious attempt to establish a trade in the region. To draw away his trade the Hudson's Bay Company built Fort Boisé the same year. Both forts later became famous hostelries to emigrants on the Oregon trail.

Movements over this trail began in 1842, when Dr. Elijah White led the first party of 100 to Oregon. Extensive travel began the following year, the first train numbering nearly 1,000 men, women and children. Except for those unfortunates who found graves by the wayside, none of these travellers remained in Idaho, nor did those thousands remain who later crossed south-eastern Idaho on the California trail. It was a back-wave of this emigration, lured by the discoveries of gold in 1860, that was to result in the permanent settling of the State.

Meanwhile, the Rev. Henry Spalding and his wife, sent out by the American Board for Foreign Missions, had established a school for the Indians on Lapwai creek, east of Lewiston (1836), and the first home of a white family where the first white child was born and reared. Seeds were planted in the hope of interesting the Indians in agriculture, and apple trees were set out and irrigating and power ditches were made and used, at the end of which was established and operated a small grist and sawmill. The first printing-press in the Oregon country was brought to Lapwai by pack-horse and set up to print a primer, a hymn-book and the Gospel of Matthew in the Nez Percé language. Father Desmet, the pioneer of Catholicism in the North-west, also established the Sacred Heart mission among the Coeur d'Alene Indians in 1842. In the spring of 1846 William Craig located a few miles up Lapwai creek from the Spalding mission a homestead of 640 ac., under the Oregon donation act, the earliest title in Idaho for which a patent was issued, although the title initiated by the Spalding Mission site ten years earlier was recognized and bought later by the Government before issuance of patent. A Mormon mission and colony had been attempted in the valley of the Lemhi river in 1855, but were recalled by President Young in 1858 because of the hostility of the Bannock and Shoshone Indians. In 1860 a band of Mormon home-seekers made the first permanent agricultural settlement, at Franklin, just north of the southern boundary. They thought themselves to be still in Utah, but the survey later showed they were in Idaho. Here they proceeded to irrigate their little ten-ac. tracts and opened the first school for whites.

The discovery of gold by Capt. E. D. Pierce in 1860 upon Orofino creek, a tributary of the Clearwater river, was more potent in the immediate fortunes of the territory. News of the rich strike started a stampede from Walla Walla in the spring of 1861. In May there were a thousand men in the new town of Pierce city, where, about Sept. 1, the officials of the first county in Idaho began functioning, though as Shoshone county of Washington territory. Lewiston was founded at the confluence of the Snake and Clearwater rivers, where the boats unloaded and the pack-trains started. Prospectors soon claimed other deposits, and Elk city and Florence became the lively centres of new districts to the south. More permanent deposits were discovered at Warren in 1862. Pack-horse trails were the only approach to some of these famous camps high in the rugged mountains.

Gold was discovered in the Boisé basin of southern Idaho in 1862. By 1864 there were 16,000 people in the basin. Idaho city was the metropolis. Discoveries were also made in Owyhee county, where Ruby city and Silver city became the main camps. Silver ledges and gold-bearing quartz were found, and eastern capital was attracted by unmistakable signs of permanency. Idaho was organized as a territory in 1863, including, in addition to its present limits, also Wyoming, Montana and the portions of Nebraska, North and South Dakota west of the eastern line of Colorado continued north. William H. Wallace was ap-

pointed the first governor, and in December the first legislature met in Lewiston. In the second legislature, southern Idaho men predominated, and the capital was moved to Boisé, where it has since remained. Idaho's first newspaper, the *Golden Age*, was started in Lewiston, Aug. 2, 1862, and in 1863 the publishing of the first southern Idaho newspaper, the *Boisé News*, began. In 1864 two stage lines were established from the Columbia river in the basin, and one from Salt Lake city. The telegraph did not reach Boisé until 1875.

The influx of miners and ranchers on territory reserved for the Indians made the tribes restless. There were three outbreaks between 1870 and 1880. The Nez Percé chiefs refused to sign a treaty giving up fertile valleys where the whites had already settled; and when the Government tried to coerce them, they resisted. One expedition sent against them was disastrously defeated in Whitebird canyon. After a long period of skirmishing Gen. Howard met the Indians in a two days' battle near Kamiah. A charge the second day dislodged the Indians from their riflepits, and they fled eastward over the Lo Lo trail. It was the beginning of Chief Joseph's masterly retreat of 1,300m., which ended when he was finally captured by Gen. Miles in the Bear Paw mountains of Montana. The Bannocks, in an ugly mood after the Nez Percé war, would not stay on their reservation, and hostilities ensued. Their resistance might have been formidable had not Buffalo Horn, their able leader, been killed early in the war. This broke their spirit, and Gen. Howard easily defeated the disorganized remnants of their forces.

The first agricultural and live stock developments began in valleys near the mining districts. Such were the Boisé, Payette and Weiser valleys and the valleys in the vicinity of Lewiston. Some settlers raised garden vegetables and oats and wheat, while others merely kept horse ranches, and cut the hay along the river bottoms for feed. Ranches of the latter sort became numerous along the Oregon and Montana trails. Cattle and sheep also reached Idaho over the Oregon trail, the owners of the herds settling in the fertile valleys along the route. Spanish cattle came from Utah and California. Drought in California in the years 1863, 1864 and 1871 sent large herds northward. By 1875 the ranges were well stocked, and the next year the first drove was sent east. The stock industry naturally began in the southern counties because the country was not so heavily wooded, nor was it so far from the Union Pacific railway, which was depended upon for transportation. The Oregon Short line, which was built across southern Idaho in 1882–84, greatly stimulated stock raising and general settlement. The building of the Northern Pacific across northern Idaho, 1880–82, did the same for that region. One of the wildest stampedes in the history of mining took place into this northern Coeur d'Alene country in 1884. The quartz then discovered was to make this one of the richest silver-lead regions in the world.

Farming in southern Idaho depended upon irrigation. Private enterprises in favourable localities were first resorted to, but the land that could be so irrigated was limited. Corporations were then formed to build larger canal systems. But they became so exorbitant in their demands and partial in their grants of water that the farmers hated them. Laws were passed whereby farmers themselves could control irrigation ditches. In 1894 the Carey act gave each of the States 1,000,000ac. if the State would undertake to irrigate the land. After 1902 development under this act was rapid, and Idaho has a greater number of Carey projects than any other State. In 1902 Congress passed the Reclamation act, providing for the financing of large developments of the Federal Government. The developments in Idaho under this act are the Minidoka, King Hill and Boisé projects. An important feature of the Boisé project is the Arrowrock dam, 351ft. high. The development of dry-land farming in the second decade of the present century, especially in Madison, Bonneville, Fremont, Jefferson, Bingham and Power counties, raised the income from agriculture far above that from mining, which had formerly been the most valuable industry. Despite the depression following the World War, agriculture has retained its leadership.

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IDAHO FALLS, a city of E. Idaho, U.S.A., on the Snake river, 123 m. S.W. of the western entrance to Yellowstone park, at an altitude of 4,708 ft.; the county seat of Bonneville county. It is on the Oregon Short Line of the Union Pacific system, and on Federal highway 91, at the southern terminus of 191. The population was 8,064 in 1920 (90% native white), and was estimated locally at 10,752 in 1928. It is the shipping point and trading centre of a vast irrigated region of 1,250,000 ac., devoted to a variety of crops, and to stock-raising, wool growing, dairying and cheese-making, bee-keeping and cattle and sheep feeding. In or near the city are several large beet sugar factories (including the first one built in Idaho, in 1903), a seed cleaning mill which supplies peas and beans for gardens from Maine to California, a factory which extracts hundreds of tons of alfalfa and sweet clover honey, grain elevators, flour and potato flour mills and potato and wool warehouses.

The falls are at the head of a narrow canyon. Here a toll bridge was built in 1866, and around it grew up a supply station for the freighters travelling the Utah-Montana trail. The town was long called Eagle Rock, because an eagle had a nest on a large rock in the stream just above the bridge. It was chartered as a city in 1891.

IDAR, an Indian State forming part of the Mahi Kantha agency, within the Gujarat division of Bombay. It has an area of 1,669 sq.m. and a pop. (1921) of 226,344. Much of the territory is held by kinsmen of the rajah on feudal tenure. The products are grain, oil-seeds and sugar cane. The town of Idar, 64 m. N.E. of Ahmedabad, was formerly the capital, but the small town of Himmatnagar is the present capital. The State was created in the 18th century, by a branch of the great Rathor clan of Rajputs, to which Jodhpur and Bikaner belong. It suffered from the depredations of the Mahrattas, and still pays tribute to the gaekwar of Baroda. In 1901 the succession devolved on the famous Sir Pertab Singh, but he abdicated in 1911 to assume the regency of Jodhpur, and the present chief, Maharajah Sir Daulat Singhji, is his adopted son. The Maharajah is entitled to a salute of 15 guns.

IDAS, in Greek legend, son of Aphareus of the royal house of Messene, brother of Lynceus. In Homer (*Iliad*, ix. 556 et seq.), he is called the strongest of men on earth. He carried off Marpessa, daughter of Evenus, as his wife, and dared to bend his bow against Apollo, who was also her suitor. Zeus intervened, and left the choice to Marpessa, who declared in favour of Idas, fearing that the god might desert her when she grew old (Apollodorus i. 60–61). The Apharetidae are best known for their fight with the Dioscuri. A quarrel had arisen about the division of a herd of cattle which the four had stolen. Idas claimed the whole, and drove the cattle off to Messene. The Dioscuri overtook him and lay in wait in a hollow oak. But Lynceus, whose keenness of sight was proverbial, saw Castor through the trunk and warned his brother, who thereupon slew the mortal Castor; finally Polydeuces slew Lynceus, and Idas was struck by lightning (Apollodorus iii. 134–137; Pindar, *Nem.*, x. 60; Pausanias iv. 3. 1). According to others, the Dioscuri had carried off the daughters of Leucippus, who had been betrothed to the Apharetidae (Ovid, *Fasti*, v. 699; Theocritus xxii. 137). The scene of the combat is placed near the grave of Aphareus at Messene, at Aphidne in Attica, or in Laconia; and there are other variations of detail in the accounts (*see* also Hyginus, *Fab.*, 80). The grave of Idas and Lynceus was shown at Sparta, according to Pausanias

(iii. 13), whose own opinion, however, is that they were buried in Messenia.

See Roscher's *Lexikon* s.v. *Idas, Leukippiden, Lynkeus, Marpessa.*

IDDESLEIGH, STAFFORD HENRY NORTHCOTE, 1ST EARL OF (1818–1887), British statesman, was born in London, on Oct. 27, 1818. On leaving Balliol college, Oxford, he became in 1843 private secretary to Gladstone at the Board of Trade. He was afterwards legal secretary to the board; and after acting as one of the secretaries to the Great Exhibition of 1851, co-operated with Sir Charles Trevelyan in framing the report which revolutionized the conditions of appointment to the Civil Service. He succeeded his grandfather as 8th baronet in 1851. He entered parliament in 1855 as Conservative M.P. for Dudley, and was elected for Stamford in 1858, a seat which he exchanged in 1866 for North Devon. Steadily supporting his party, he became president of the Board of Trade in 1866, secretary of State for India in 1867, and chancellor of the exchequer in 1874. In the interval between these last two appointments he had been one of the commissioners for the settlement of the "Alabama" difficulty with the United States, and on Disraeli's elevation to the House of Lords in 1876 he became leader of the Conservative party in the Commons. As a finance minister he was largely dominated by the lines of policy laid down by Gladstone; but he distinguished himself by his dealings with the Debt, especially his introduction of the New Sinking Fund (1876), by which he fixed the annual charge for the Debt in such a way as to provide for a regular series of payments off the capital. He was transferred to the Lords in 1885, when Salisbury became prime minister. Taking the titles of earl of Iddesleigh and Viscount St. Cyres, he was included in the cabinet as first lord of the treasury. In Salisbury's 1886 ministry he was secretary of state for foreign affairs, but the arrangement was unsatisfactory, and his resignation had just been decided upon when on Jan. 12, 1887, he died very suddenly at Salisbury's official residence in Downing Street.

He wrote *Twenty Years of Financial Policy* (1862). *See* Andrew Lang, *Life of Lord Iddesleigh* (1890).

IDEA, a term used both popularly and in philosophical terminology with the general sense of "mental vision," (Gr. ἰδέα connected with ἰδεῖν, to see). To have no *idea* how a thing happened is to be without a mental picture of an occurrence. In this general sense it is synonymous with concept (*q.v.*) in its popular usage. In philosophy the term "idea" is common to all languages and periods, but there is scarcely any term which has been used with so many different shades of meaning. Plato used it in the sphere of metaphysics for the eternally existing reality, the archetype, of which the objects of sense are more or less imperfect copies. Chairs may be of different forms, sizes, colours and so forth, but "laid up in the mind of God" there is the one permanent *idea* or type, of which the many physical chairs are derived with various degrees of imperfection. From this doctrine it follows that these *ideas* are the sole reality (*see* further IDEALISM); in opposition to it are the empirical thinkers of all time who find reality in particular physical objects (*see* HYLOZOISM, EMPIRICISM, etc.). For other meanings of the word *see* PSYCHOLOGY.

IDEAL means primarily that which is of the nature of an idea. It is, however, more commonly used to denote that which is perfect or supreme of its kind. *See* IDEA and IDEALISM.

IDEALISM, a term generally used for the attitude of mind which is prone to represent things in an imaginative light and to lay emphasis exclusively or primarily on abstract perfection (*i.e.*, on "ideals") (from Gr. ἰδέα, archetype or model, through Fr. *idéalisme*). With this meaning the philosophical use of the term has little in common.

To understand the philosophical theory that has come to be known under this title, we may ask (1) what in general it is and how it is differentiated from other theories of knowledge and reality, (2) how it has risen in the history of philosophy, (3) what position it occupies at the present time in the world of speculation.

General Definition of Idealism.—Idealism as a philosophical doctrine conceives of knowledge or experience as a process in which the two factors of subject and object stand in a relation of entire interdependence on each other as warp and woof. Apart from the activity of the self or subject in sensory reaction, memory and association, imagination, judgment and inference, there can be no world of objects. A thing-in-itself which is not a thing to some consciousness is an entirely unrealizable, because self-contradictory, conception. But this is only one side. It is equally true that a subject apart from an object is unintelligible. As the object exists for knowledge through the constructive activity of the subject, so the subject lives in the construction of the object. To seek for the true self in any region into which its opposite in the form of a not-self does not enter is to grasp a shadow. It is in seeking to realize its own ideas in the world of knowledge, feeling and action that the mind comes into possession of itself; it is in becoming permeated and transformed by the mind's ideas that the world develops for us the fullness of its reality as object.

Thus defined, idealism is opposed to ordinary common-sense dualism, which regards knowledge or experience as the result of the more or less accidental relation between two separate and independent entities—the mind and its ideas on one side, the thing with its attributes on the other—that serve to limit and condition each other from without. It is equally opposed to the doctrine which represents the subject itself and its states and judgments as the single immediate datum of consciousness, and all else, whether objects in an external world or persons other than the individual subject whose states are known to itself, as having a merely problematic existence resting upon analogy or other process of indirect inference. This theory is sometimes known as idealism. But it falls short of idealism as above defined in that it recognizes only one side of the antithesis of subject and object, and so falls short of the doctrine which takes its stand on the complete correlativity of the two factors in experience. It is for this reason that it is sometimes known as subjective or incomplete idealism. Finally the theory defined is opposed to all forms of realism, whether in the older form which sought to reduce mind to a function of matter, or in any of the newer forms which seek for the ultimate essence of both mind and matter in some unknown force or energy which, while in itself it is neither, yet contains the potentiality of both. It is true that in some modern developments of idealism the ultimate reality is conceived of in an impersonal way, but it is usually added that this ultimate or absolute being is not something lower but higher than self-conscious personality, including it as a more fully developed form may be said to include a more elementary.

Origin and Development of Idealism.—In its self-conscious form idealism is a modern doctrine. In it the self or subject may be said to have come to its rights. This was possible in any complete sense only after the introspective movement represented by the middle ages had done its work, and the thought of the individual mind and will as possessed of relative independence had worked itself out into some degree of clearness. In this respect Descartes' dictum—*cogito ergo sum*—may be said to have struck the keynote of modern philosophy, and all subsequent speculation to have been merely a prolonged commentary upon it. While in its completer form it is thus a doctrine distinctive of modern times, idealism has its roots far back in the history of thought. One of the chief proofs that has been urged of the truth of its point of view is the persistency with which it has always asserted itself at a certain stage in philosophical reflection and as the solution of certain recurrent speculative difficulties. All thought starts from the ordinary dualism or pluralism which conceives of the world as consisting of the juxtaposition of mutually independent things and persons. The first movement is in the direction of dispelling this appearance of independence. They are seen to be united under the relation of cause and effect, as attributes of an underlying substance, or again as temporal manifestations of some single entity or energy which constitutes the eternal essence of the things that come before our knowledge. But in the pantheism that thus takes the place of the old dualism there seems no permanent place left for the individual. Mind and will in their individual manifestations fade into the general background without significance except as a link in a necessary

chain. Deliverance from the pantheistic conception of the universe was sought in the recognition of the central place occupied by thought and purpose in the actual world, and as a consequence of this, of the illegitimacy of the abstraction whereby material energy is taken for the ultimate reality.

Ancient Idealism: Socrates and Plato.—The first illustration of this movement on a large scale was given in the Socratic reaction against the pantheistic conclusions of early Greek philosophy (*see* IONIAN SCHOOL). The whole movement of which Socrates was a part may be said to have been in the direction of the assertion of the rights of the subject. Its keynote is to be found in the principle "man is the measure." This was interpreted by its author, Protagoras, and by the Sophists in general in a subjective sense, with the result that it became the motto of a sceptical and individualistic movement in contemporary philosophy and ethics. It was not less against this form of idealism than against the determinism of the early physicists that Socrates protested. Along two lines the thought of Socrates led to idealistic conclusions which may be said to have formed the basis of all subsequent advance. (1) He perceived the importance of the universal or conceptual element in knowledge, and thus at a single stroke broke through the hard realism of ordinary common sense, disproved all forms of naturalism that were founded on the denial of the reality of concepts, and cut away the ground from a merely sensational and subjective idealism. This is what Aristotle means by claiming for Socrates that he was the founder of definition. (2) He taught that life was explicable only as a system of ends. Goodness consists in the knowledge of what these are. It is by his hold upon them that the individual is able to give unity and reality to his will. In expounding these ideas Socrates limited himself to the sphere of practice. Moreover, the end or ideal of the practical life was conceived of in too vague a way to be of much practical use. His principle, however, was essentially sound, and led directly to the Platonic Idealism.

Plato extended the Socratic discovery to the whole of reality and while seeking to see the pre-Socratics with the eyes of Socrates sought "to see Socrates with the eyes of the pre-Socratics." Not only were the virtues to be explained by their relation to a common or universal good which only intelligence could apprehend, but there was nothing in all the furniture of heaven or earth which in like manner did not receive reality from the share it had in such an intelligible idea or essence. But these ideas are themselves intelligible only in relation to one another and to the whole. Accordingly Plato conceived of them as forming a system and finding their reality in the degree in which they embody the one all-embracing idea, conceived of not under the form of an efficient but of a final cause, an inner principle of action or tendency in things to realize the fullness of their own nature which in the last resort was identical with the nature of the whole. This Plato expressed in the myth of the Sun, but the garment of mythology in which Plato clothed his idealism, beautiful as it is in itself and full of suggestion, covered an essential weakness. The more Plato dwelt upon his world of ideas, the more they seemed to recede from the world of reality, standing over against it as principles of condemnation instead of revealing themselves in it. In this way the Good was made to appear as an end imposed upon things from without by a creative intelligence instead of as an inner principle of adaptation.

Aristotle.—On one side of his thought Aristotle represents a reaction against idealism and a return to the position of common-sense dualism, but on another, and this the deeper side, he represents the attempt to restore the theory in a more satisfactory form. His account of the process of knowledge in his logical treatises exhibits the idealistic bent in his philosophy. This is as far removed as possible either from dualism or from empiricism. The universal is the real; it is that which gives coherence and individuality to the particulars of sense which apart from it are like the routed or disbanded units of an army. Still more manifestly in his *Ethics* and *Politics* Aristotle makes it clear that it is the common or universal will that gives substance and reality to the individual. In spite of these and other anticipations of a fuller idealism, the idea remains as a form imposed from without on a reality otherwise conceived of as independent of it. As we advance from the logic to the metaphysics and from that to his ontology, it becomes clear that the concepts are only "categories" or predicates of a reality lying outside of them, and there is an ultimate division between the world as the object or matter of thought and the thinking or moving principle which gives it life. It is this that gives the Aristotelian doctrine in its more abstract statements an air of uncertainty. Yet besides the particular contribution that Aristotle made to idealistic philosophy in his logical and ethical interpretations, he advanced the case in two directions: (*a*) He made it clear that no explanation of the world could be satisfactory that was not based on the notion of continuity in the sense of an order of existence in which the reality of the lower was to be sought for in the extent to which it gave expression to the potentialities of its own nature—which were also the potentialities of the whole of which it was a part. (*b*) From this it followed that, difficult as we might find it to explain the relation of terms so remote from each other as sense and thought, the particular and the universal, matter and mind, these oppositions cannot in their nature be absolute. These truths, however, were hidden from Aristotle's successors, who for the most part lost the thread which Socrates had put into their hand. When the authority of Aristotle was again invoked, it was its dualistic and formal, not its idealistic and metaphysical, side that was in harmony with the spirit of the age. Apart from one or two of the greatest minds, notably Dante, what appealed to the thinkers of the middle ages was not the idea of reality as a progressive self-revelation of an inner principle working through nature and human life, but the formal principles of classification which it seemed to offer for a material of thought and action accepted from another source.

Modern Idealism.—Modern like ancient idealism came into being as a correction of the view that threatened to resolve the world of matter and mind alike into the changing manifestations of some single non-spiritual force or substance. While, however, ancient philosophy may be said to have been unilinear, modern philosophy had a twofold origin, and till the time of Kant may be said to have pursued two independent courses.

Cartesianism.—All philosophy is the search for reality and rational certainty as opposed to mere formalism on the one hand, to authority and dogmatism on the other. In this sense modern philosophy had a common root in revolt against mediaevalism. In England this revolt sought for the certainty and clearness that reason requires in the assurance of an outer world given to immediate sense experience; on the continent of Europe, in the assurance of an inner world given immediately in thought. Though starting from apparently opposite poles and following widely different courses the two movements led more or less directly to the same results. It is easy to understand how English sensationism issued at once in the trenchant naturalism of Hobbes. It is less comprehensible how the Cartesian philosophy from the starting-point of thought allied itself with a similar point of view. This can be understood only by a study of the details of Descartes' philosophy. Suffice it to say that in spite of its spiritualistic starting-point its general result was to give a stimulus to the prevailing scientific tendency as represented by Galileo, Kepler and Harvey to the principle of mechanical explanations of the phenomena of the universe. True it was precisely against this that Descartes' immediate successors struggled. But the time-spirit was too strong for them. Determinism had other forms besides that of a crude materialism, and the direction that Malebranche succeeded in giving to speculation led to Spinoza's pantheism.

Berkeley.—The foundations of idealism in the modern sense were laid by the thinkers who sought breathing room for mind and will in a deeper analysis of the relations of the subject to the world that it knows. From the outset English philosophy had a leaning to the psychological point of view, and Locke was only carrying on the tradition of his predecessors and particularly of Hobbes in definitely accepting it as the basis of his *Essay*. It was, however, Berkeley who first sought to utilize the conclusions that were implicit in Locke's starting-point. Berkeley's statement of the view that all knowledge is relative to the subject—that no object can be known except under the form which our powers of

sense-perception, our memory and imagination, our notions and inference, give it—is still the most striking that we possess. To have established this position was a great step in speculation. Henceforth ordinary dogmatic dualism was excluded from philosophy; any attempt to revive it, whether with Dr. Johnson by an appeal to common prejudice, or in the more reflective Johnsonianism of the 18th-century Scottish philosophers, must be an anachronism. Equally impossible was it thenceforth to assert the mediate or immediate certainty of material substance as the cause either of events in nature or of sensations in ourselves. But with these advances came the danger of falling into error from which common-sense dualism and naturalistic monism were free. From the point of view which Berkeley had inherited from Locke it seemed to follow that not only material substance, but the whole conception of a world of objects, is at most an inference from subjective modifications which are the only immediately certain objects of knowledge. The implications of such a view were first clearly apparent when Hume showed that on the basis of it there seemed to be nothing that we could confidently affirm except the order of our own impressions and ideas. This being so, not only were physics and mathematics impossible as sciences of necessary objective truth, but our apparent consciousness of a permanent self and object alike must be delusive.

Kant and Leibniz.—It was these paradoxes that Kant sought to rebut by a more thoroughgoing criticism of the basis of knowledge, the substance of which is summed up in his celebrated Refutation of Idealism, wherein he sought to undermine Hume's scepticism by carrying it one step further and demonstrating that not only is all knowledge of self or object excluded, but the consciousness of any series of impressions and ideas is itself impossible except in relation to some external permanent and universally accepted world of objects.

But Kant's refutation of subjective idealism and his vindication of the place of the object can be fully understood only when we take into account the other defect in the teaching of his predecessors that he sought in his *Critique* to correct. In continental philosophy the reaction against mechanical and pantheistic explanations of the universe found even more definite utterance than in English psychological empiricism in the metaphysical system of Leibniz, whose theory of self-determined monads can be understood only when taken in the light of the assertion of the rights of the subject against the Substance of Spinoza and the atoms of the materialist. But Leibniz also anticipated Kant in seeking to correct the empirical point of view of the English philosophers. True, sense-given material is necessary in order that we may have thought. "But by what means," he asks, "can experience and the senses give ideas? Has the soul windows? Is it like a writing tablet? Is it like wax? It is plain that all those who think thus of the soul make it at bottom corporeal. True, nothing is in the intellect which has not been in the senses, but we must add except the intellect itself. The soul contains the notions of being, substance, unity, identity, cause, perception, reasoning and many others which the senses cannot give" (*Nouveaux essais*, ii. 1). But Leibniz's conception of the priority of spirit had too little foundation, and the different elements he sought to combine were too loosely related to one another to stand the strain of the two forces of empiricism and materialism that were opposed to his idealism. More particularly by the confusion in which he left the relation between the two logical principles of identity and of sufficient reason underlying respectively analytic and synthetic, deductive and inductive thought, he may be said to have undermined in another way the idealism he strove to establish. It was in seeking to close up the fissure in his system represented by this dualism that his successors succeeded only in adding weakness to weakness by reducing the principle of sufficient reason to that of formal identity (*see* WOLFF) and representing all thought as in essence analytic. From this it immediately followed that, so far as the connection of our experiences of the external world does not show itself irreducible to that of formal identity, it must remain unintelligible. As empiricism had foundered on the difficulty of showing how our thoughts could be an object of sense experience, so Leibnizian formalism foundered on that of understanding how the material of sense could be an object of thought. On one view as on the other scientific demonstration was impossible.

The extremity to which philosophy had been brought by empiricism on the one hand and formalism on the other was Kant's opportunity. Leibniz's principle of the "nisi intellectus ipse" was expanded by him into a demonstration the completest yet effected by philosophy of the part played by thought not merely in the manipulation of the material of experience but in the actual constitution of the object that is known. On the other hand he insisted on the objective reference of this activity without which it was impossible to get beyond the circle of our own thoughts. The parts of the *Critique of Pure Reason*, more particularly the "Deduction of the Categories" in which this theory is worked out, may be said to have laid the foundation of modern idealism—"articulum stantis aut cadentis doctrinae." In spite of the defects of Kant's statement—to which it is necessary to return—the place of the concepts and ideals of the mind and the synthetic organizing activity which these involve was established with a trenchancy which has been acknowledged by all schools alike. The "Copernican revolution" which he claimed to have effected may be said to have become the starting-point of all modern philosophy. Yet the divergent uses that have been made of it witness to the ambiguity of his statement which is traceable to the fact that Kant was himself too deeply rooted in the thought of his predecessors and carried with him too much of their spirit to be able entirely to free himself from their assumptions and abstractions. His philosophy was more like Michaelangelo's famous sculpture of the Dawn, a spirit yet encumbered with the stubble of the material from which it was hewn, than a clear cut figure with unmistakable outlines. Chief among these encumbering presuppositions was that of a fundamental distinction between perception and conception and consequent upon it between the synthetic and the analytic use of thought. It is upon this in the last resort that the distinction between the phenomenal world of our experience and a noumenal world beyond it is founded. Kant perceives that "perception without conception is blind, conception without perception is empty," but if he goes so far ought he not to have gone still further and inquired whether there can be any perception at all without a concept, any concept which does not presuppose a precept, and, if this is impossible, whether the distinction between a world of appearance which is known and a world of things-in-themselves which is not, is not illusory?

Hegel.—It was by asking precisely these questions that Hegel gave the finishing strokes to the Kantian philosophy. The starting-point of all valid philosophy must be the perception that the essence of all conscious apprehension is the union of opposites—of which that of subject and object is the most fundamental and all-pervasive. True, before differences can be united they must have been separated, but this merely proves that differentiation or analysis is only one factor in a single process. Equally fundamental is the element of synthesis. Nor is it possible at any point in knowledge to prove the existence of a merely given object in whose determination the thinking subject has played no part, nor a merely thinking subject in whose structure the object is not an organic factor. In coming, as at a certain point in its development it does, to the consciousness of an object, the mind does not find itself in the presence of an opponent, or of anything essentially alien to itself but of that which gives content and stability to its own existence. True, the stability it seems thus to find is incomplete. The mind cannot rest in the immediate appearance of the object without involving us in contradiction. The sun does not "rise," the dew does not "fall." But this only means that the unity between subject and object to which the gift of consciousness commits us is incompletely realized in that appearance: the apparent truth has to submit to correction and supplementation before it can be accepted as real truth. It does not mean that there is anywhere a mere fact which is not also an interpretation, nor an interpreting mind whose ideas have no hold upon fact. From this it follows that ultimate or absolute reality is to be sought not beyond the region of experience, but in the fullest and most harmonious statement of the facts of our experience. True a com-

pletely harmonious world whether of theory or of practice remains an ideal. But the fact that we have already in part realized the ideal and that the degree in which we have realized it is the degree in which we may regard our experience as trustworthy, is proof that the ideal is no mere idea as Kant taught, but the very substance of reality.

Intelligible as this development of Kantian idealism seems in the light of subsequent philosophy, the first statement of it in Hegel was not free from obscurity. The unity of opposites translated into its most abstract terms as the "identity of being and not-being," the principle that the "real is the rational," the apparent substitution of "bloodless" categories for the substance of concrete reality gave it an air of paradox in the eyes of metaphysicians, while physicists were scandalized by the premature attempts at a complete philosophy of nature and history. For this Hegel was doubtless partly to blame. But philosophical critics of his own and a later day are not hereby absolved from a certain perversity in interpreting these doctrines in a sense precisely opposite to that in which they were intended. The doctrine of the unity of contraries so far from being the denial of the law of non-contradiction is founded on an absolute reliance upon it. Freed from paradox it means that in every object of thought there are different aspects or elements each of which if brought separately into consciousness may be so emphasized as to appear to contradict another. Unity may be made to contradict diversity, permanence change, the particular the universal, individuality relatedness. Ordinary consciousness ignores these "latent fires"; ordinary discussion brings them to light and divides men into factions and parties over them; philosophy not because it denies but because it acknowledges the law of non-contradiction as supreme is pledged to seek a point of view from which they may be seen to be in essential harmony with one another as different sides of the same truth. The "rationality of the real" has in like manner been interpreted as intended to sanctify the existing order. Hegel undoubtedly meant to affirm that the actual was rational in the face of the philosophy which set up subjective feeling and reason against it. But idealism has insisted from the time of Plato on the distinction between what is actual in time and space and the reality that can only partially be revealed in it. Hegel carried this principle further than had yet been done. His phrase does not therefore sanctify the established fact but, on the contrary, declares that it partakes of reality only so far as it embodies the ideal of a coherent and stable system which it is not. As little is idealism responsible for any attempt to pass off logical abstractions for concrete reality. The "Logic" of Hegel is merely the continuation of Kant's "Deduction" of the categories and ideas of the reason which has generally been recognized as the soberest of attempts to set forth the presuppositions which underlie all experience. "What Hegel attempts to show is just that the categories by which thought must determine its object are stages in a process that, beginning with the idea of 'Being,' the simplest of all determinations is driven on by its own dialectic till its reaches the idea of self-consciousness. In other words the intelligence when it once begins to define an object for itself, finds itself launched on a movement of self-asserting synthesis in which it cannot stop until it has recognized that the unity of the object with itself involves its unity with all other objects and with the mind that knows it. Hence, whatever we begin by saying, we must ultimately say 'mind'" (Caird, *Kant*, i. 443).

Idealism in England and America.—While the form in which these doctrines were stated proved fatal to them in the country of their birth, they took deep root in the next generation in English philosophy. Here the stone that the builders rejected was made the head of the corner. The influences which led to this result were manifold. From the side of literature the way was prepared for it by the genius of Coleridge, Wordsworth and Carlyle; from the side of morals and politics by the profound discontent of the constructive spirit of the century with the disintegrating conceptions inherited from utilitarianism. In taking root in England idealism had to contend against the traditional empiricism represented by Mill on the one hand and the pseudo-Kantianism which was rendered current by Mansel and Hamilton on the other. As contrasted with the first it stood for the necessity of recognizing a universal or ideal element as a constitutive factor in all experience whether cognitive or volitional; as contrasted with the latter for the ultimate unity of subject and object, knowledge and reality, and therefore for the denial of the existence of any thing-in-itself for ever outside the range of experience. Its polemic against the philosophy of experience has exposed it to general misunderstanding, as though it claimed some *a priori* path to truth. In reality it stands for a more thoroughgoing and consistent application of the test of experience. The defect of English empiricism from the outset had been the uncritical acceptance of the metaphysical dogma of a pure unadulterated sense-experience as the criterion of truth. This assumption idealism examines and rejects in the name of experience itself. Similarly it only carried the doctrine of relativity to its logical conclusion in denying that there could be any absolute relativity. Object stands in essential relation to subject, subject to object. This being so, it is wholly illogical to seek for any test of the truth and reality of either except in the form which that relation itself takes. In its subsequent development idealism in England has passed through several clearly marked stages which may be distinguished as (*a*) that of exploration and tentative exposition in the writings of J. F. Ferrier, J. Hutchison Stirling, Benjamin Jowett, W. T. Harris; (*b*) of confident application to the central problems of logic, ethics and politics, fine art and religion, and as a principle of constructive criticism and interpretation chiefly in T. H. Green, E. Caird, B. Bosanquet; (*c*) of vigorous effort to develop on fresh lines its underlying metaphysics in F. H. Bradley, J. M. E. McTaggart, A. E. Taylor, Josiah Royce and others. Under the influence of these writers idealism, as above expounded though with difference of interpretation in individual writers, may be said towards the end of the 19th century to have been on its way to becoming the leading philosophy in the British Isles and America.

Reaction against Traditional Idealism.—But it was not to be expected that the position idealism had thus won for itself would remain long unchallenged. It had its roots in a literature and in forms of thought remote from the common track; it had been formulated before the great advances in psychology which marked the course of the century; its latest word seemed to involve consequences that brought it into conflict with the vital interest the human mind has in freedom and the possibility of real initiation. It is not, therefore, surprising that there should have been a vigorous reaction. This has taken mainly two opposite forms. On the one hand the attack has come from the old ground of the danger that is threatened to the reality of the external world and may be said to be in the interest of the object. On the other hand the theory has been attacked in the interest of the subject on the ground that in the statuesque world of ideas into which it introduces us it leaves no room for the element of movement and process which recent psychology and metaphysic alike have taught us underlies all life. The conflict of idealism with these two lines of criticism—the accusation of subjectivism on the one side, of intellectualism and rigid objectivism on the other—may be said to have constituted the history of Anglo-Saxon philosophy during the first two decades of the 20th century.

New Dualism.—Whatever is to be said of ancient Idealism, the modern doctrine may be said notably in Kant to have been in the main a vindication of the subjective factor in knowledge. But that space and time, matter and cause should owe their origin to the action of the mind has always seemed paradoxical to common sense. Nor is the impression which its enunciation in Kant made, likely to have been lightened in this country by the connection that was sure to be traced between Berkeleyanism and the new teaching or by the form which the doctrine received at the hands of T. H. Green, its leading English representative between 1870 and 1880. If what is real in things is ultimately nothing but their relations, and if relations are inconceivable apart from the relating mind, what is this but the dissolution of the solid ground of external reality which my consciousness seems to assure me underlies and eludes all the conceptual network by which I try to bring one part of my experience into connection with another? It is quite true that modern idealists like Berkeley himself have

sought to save themselves from the gulf of subjectivism by calling in the aid of a universal or infinite mind or by an appeal to a total or absolute experience to which our own is relative. But the former device is too obviously a *deus ex machina*, the purpose of which would be equally well served by supposing with Fichte the individual self to be endowed with the power of subconsciously extraditing a world which returns to it in consciousness under the form of a foreign creation. The appeal to an Absolute on the other hand is only to substitute one difficulty for another. For granting that it places the centre of reality beyond the individual self it does so only at the price of reducing the reality of the latter to an appearance; and if only one thing is real what becomes of the many different things which again my consciousness assures me are the one world with which I can have any practical concern? To meet these difficulties and give back to us the assurance of the substantiality of the world without us it has therefore been thought necessary to maintain two propositions which are taken to be the refutation of idealism. (1) There is given to us immediately in knowledge a world entirely independent of and different from our own impressions on the one hand and the conceptions by which we seek to establish relations between them upon the other. The relation of these impressions (and for the matter of that their inter-relations among themselves) to our minds is only one out of many. As a leading writer puts it: "There is such a thing as greenness having various relations, among *others* that of being perceived." (*Mind*, N. S. xii. p. 433.) (2) Things may be, and may be known to be simply different. They may exclude one another, exist so to speak in a condition of armed neutrality to one another, without being positively thereby related to one another or altered by any change taking place in any of them. As the same writer puts it: "There is such a thing as numerical difference, different from conceptual difference," or expressing the same thing in other words "there are relations not grounded in the nature of the related terms." (*Proc. Arist. Soc.*, 1901, p. 110.)

In this double-barrelled criticism it is important to distinguish what is really relevant. Modern idealism differs from the arrested idealism of Berkeley precisely in the point on which dualism insists. In all knowledge we are in touch not merely with the self and its passing states, but with a real object which is different from them. On this head there is no difference, and idealism need have no difficulty in accepting all that its opponents here contend. The difference between the two theories does not consist in any difference of emphasis on the objective side of knowledge, but in the standard by which the reality of the object is to be tested—the difference is logical not metaphysical—it concerns the definition of truth or falsity in the knowledge of the reality which both admit. To idealism there can be no ultimate test, but the possibility of giving any fact which claims to be true its place in a coherent system of mutually related truths. To this dualism opposes the doctrine that truth and falsehood are a matter of mere immediate intuition: "There is no problem at all in truth and falsehood, some propositions are true and some false just as some roses are red and some white." (*Mind*, N. S. xiii. p. 523.)

Pragmatism.—More widespread and of more serious import is the attack to which idealism has been subjected from the side of the subject and subjective interests which has found expression in Pragmatism and kindred movements. Here also it is important to distinguish what is relevant from what is irrelevant in the line of criticism represented by these writers. There need be no contradiction between idealism and a reasonable pragmatism. In so far as the older doctrine is open to the charge of neglecting the conative and teleological side of experience it can afford to be grateful to its critics for recalling it to its own eponymous principle of the priority of the "ideal" to the "idea," of *needs* to the conception of their object. The real issue comes into view in the attempt, undertaken in the interest of freedom, to substitute for the notion of the world as a cosmos (with a permanent, resistant structure) one of it as only so far cosmic as to be capable of being infinitely moulded to human desire.

To the older idealism as to the new the essence of mind or spirit is freedom. But the guarantee of freedom is to be sought for not in the denial of law, but in the whole nature of mind and its relation to the structure of experience. *Without mind no orderly world:* only through the action of the subject and its "ideas" are the confused and incoherent data of sense-perception (themselves shot through with both strands) built up into that system of things which we call Nature, and which stands out against the subject as the body stands out against the soul whose functioning may be said to have created it. On the other hand, *without the world no mind:* only through the action of the environment upon the subject is the idealizing activity in which it finds its being called into existence. Herein lies the paradox which is also the deepest truth of our spiritual life. In interpreting its environment first as a world of things that seem to stand in a relation of exclusion to one another and to itself, then as a natural system governed by rigid mechanical necessity, the mind can yet feel that in its very opposition the world is akin to it, bone of its bone and flesh of its flesh. What is true of mind is true of will. Idealism starts from the relativity of the world to purposive consciousness. But this again may be so stated as to represent only one side of the truth. It is equally true that the will is relative to the world of objects and interests to which it is attached through instincts and feelings, habits and sentiments. In isolation from its object the will is as much an abstraction as thought apart from the world of percepts, memories and associations which give it content and stability. And just as mind does not lose but gains in individuality in proportion as it parts with any claim to the capricious determination of what its world shall be, and becomes dominated by the conception of an order which is immutable, so the will becomes free and "personal" in proportion as it identifies itself with objects and interests, and subordinates itself to laws and requirements, which involve the suppression of all that is merely arbitrary and subjective. Here, too, subject and object grow together. The power and vitality of the one is the power and vitality of the other, and this is so because they are not two things with separate roots but are both rooted in a common reality which, while it includes both is more than either.

Seeing nothing but irreconcilable contradiction between the conceptions of the world as immutable law and a self-determining subject the new idealism seeks other means of vindicating the reality of freedom. It agrees with older forms of libertarianism in taking its stand on the fact of spontaneity as primary and self-evidencing, but it is not content to assert its existence side by side with rigidly determined sequence. It carries the war into the camp of the enemy by seeking to demonstrate that the completely determined action which is set over against freedom as the basis of explanation in the material world is merely a hypothesis which, while it serves sufficiently well the limited purpose for which it is devised, is incapable of verification in the ultimate constituents of physical nature. There seems in fact nothing to prevent us from holding that while natural laws express the average tendencies of multitudes they give no clue to the movement of individuals. Some have gone farther and argued that from the nature of the case no causal explanation of any real change in the world of things is possible. A cause is that which contains the effect, but this is precisely what can never be proved with respect to anything that is claimed as a real cause in the concrete world. Everywhere the effect reveals an element which is indiscoverable in the cause with the result that the identity we seek for ever eludes us. Even the resultant of mechanical forces refuses to resolve itself into its constituents. In the "resultant" there is a new direction, and with it a new quality the component forces of which no analysis can discover.

It is not here possible to do more than indicate what appear to be the valid elements in these two conflicting interpretations of the requirements of a true idealism. On behalf of the older it may be affirmed that no solution is likely to find acceptance which involves the rejection of unity and intelligible order as the primary principle of our world. The assertion of this principle by Kant was the corner-stone of idealistic philosophy in general, underlying as it does the conception of a permanent subject not less than that of a permanent object. As little from the side of logic is it likely that any theory will find acceptance which reduces all thought to a process of analysis and the discovery of

abstract identity. There is no logical principle which requires that we should derive qualitative change by logical analysis from quantitative difference. Everywhere experience is synthetic: it gives us multiplicity in unity. Explanation does not require the annihilation of all differences but the apprehension of them as in organic relation to one another and to the whole to which they belong. The revival as in the above argument of the idea that the function of thought is the elimination of difference, and that rational connection must fail where absolute identity is indiscoverable merely shows how imperfectly Kant's lesson has been learned by some of those who prophesy in his name. Apart from the narrowness which would limit human interest to "practice," as pragmatism fain would do, there is paradox in a theory which, at a moment when the best inspiration in poetry, sociology and physical science comes from the idea of the unity of the world, gives in its adhesion to an irrational pluralism on the ground of its preponderating practical value.

On the other hand, idealism would be false to itself if it interpreted the unity which it thus seeks to establish in any sense that is incompatible with the validity of moral distinctions and human responsibility in the fullest sense of the term. It would on its side be, indeed, a paradox if at a time when the validity of human ideals and the responsibility of nations and individuals to realize them is more universally recognized than ever before on our planet, the philosophical theory which hitherto has been chiefly identified with their vindication should be turned against them. Perhaps the depth and extent of the dissatisfaction are sufficient evidence that most recent developments are not free from ambiguity on this vital issue. But what is thus suggested is not a rash departure from the general point of view of idealism, but a cautious inquiry into the possibility of reaching a conception of the world in which a place can be found at once for the idea of unity and determination and of movement and freedom.

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(J. H. Mu.)

IDELER, CHRISTIAN LUDWIG (1766–1846), German chronologist and astronomer, was born near Perleberg on Sept. 21, 1766. After holding various official posts under the Prussian government he became professor at the university of Berlin in 1821, and 18 years later foreign member of the Institute of France. From 1816 to 1822 he was tutor to the young princes William Frederick and Charles. He died in Berlin on Aug. 10, 1846. He devoted his life chiefly to the examination of ancient systems of chronology. In 1825–26 he published his great work, *Handbuch der mathematischen und technischen Chronologie* (2 vols.; 2nd ed., 1883), re-edited as *Lehrbuch der Chronologie* (1831); a supplementary volume, *Die Zeitrechnung der Chinesen*, appeared in 1839.

IDENTIFICATION: *see* FINGER-PRINTS, EVIDENCE, INVESTIGATION: *Criminal.*

IDENTITY PHILOSOPHY is a system of philosophy which treats mind and matter, subject and object or thought and existence, as merely two aspects or expressions of the same ultimate reality (or underlying identity). There are many systems of philosophy which answer more or less to this general description, though different in other respects. Indeed some of them are on the verge of idealism, and some are on the verge of materialism. The most familiar instances of Identity Philosophies, ancient and modern, are the systems of the Eleatics, Spinoza, Fichte, Schelling and Hegel.

See BODY AND MIND, ONTOLOGY and the articles on the philosophers named above.

IDENTITY, PRINCIPLE OF. Identity means sameness, and a thing can only be the same as itself. Two or more things may be very similar to each other; they cannot be the same as each other, except in the sense of "extremely similar to one another"—a sense in which "same" and "identical" are sometimes used. In a statement of the type "*S* is identical with *P*," *S* and *P* can only be two names of one and the same object. In all consistent thought and discourse it is assumed that the object of thought has a certain definite character which it retains more or less. This assumption is one of the so-called Laws of Thought. It is known as the Postulate or Principle of Identity, and is frequently expressed in the formula *A is A*. This assumption may appear to conflict with the obvious changes in the objects of daily experience. But *change* implies *identity*. A thing is not said to change when something else is substituted for it. Change implies a certain continuity or identity of the old with the new. In some cases indeed absence of change might be strong evidence *against* identity. If I meet a youth who looks exactly like my school-fellow looked forty years ago, I am quite sure it is a different person, though possibly closely related to him. In calling the Principle of Identity an assumption or postulate it is not intended to suggest that it is *merely* an intellectual assumption; it is believed to be true of things, even if this cannot be proved to be the case. *See* THOUGHT, LAWS OF. For identity in logic *see* EXPLANATION, and for identity in mathematics *see* EQUATIONS, THEORY OF.

See also H. W. B. Joseph, *Introduction to Logic* (1916); J. S. Mackenzie, *Elements of Constructive Philosophy* (1917).

IDEOGRAPH, a symbol or character painted, written or inscribed, representing ideas, not sounds; it occurs in Chinese and in most Egyptian hieroglyphs (Gr. *ἰδέα*, idea and *γράφειν*, to write). (*See* WRITING.)

IDES. The name given in the Roman calendar to the 15th day of the month with the exception of March, May, July and October, the Ides in these months falling on the 13th day. *See* CALENDAR.

IDIOBLAST, a botanical term for an individual cell which is distinguished by its shape, size or contents, such as the stone-cells in the soft tissue of a pear.

IDIOCY: *see* INSANITY.

IDIOM, a form of expression in words, grammatical construction, phraseology, etc., which is peculiar to a language; sometimes also a variety of a particular language, a dialect (Gr. *ἰδίωμα*, something peculiar and personal).

IDIOSYNCRASY, a physical or mental condition peculiar to an individual, usually taking the form of a special susceptibility to particular stimuli; thus it is an idiosyncrasy of one individual that abnormal sensations of discomfort should be excited by certain odours or colours, by the presence in the room of a cat, etc.; similarly, certain persons are found to be peculiarly responsive or irresponsive to the action of particular drugs. The word is also used, generally, of any eccentricity or peculiarity of character, appearance, etc.

IDOCRASE, a rock-forming mineral of complex composition. It is a basic calcium and aluminium silicate containing small amounts of iron, magnesium, water, fluorine, etc., and sometimes boron; the approximate formula is $H_4Ca_{10}(Al,Fe)_6Si_6O_{26}$. It crystallizes in the tetragonal system, but often exhibits optical anomalies, and the optical sign varies from positive to negative. Well-developed crystals are of frequent occurrence. They usually have the form of four- or eight-sided prisms terminated by the basal planes and pyramid-planes. Crystals are transparent to translucent, vitreous in lustre and vary in colour from brown to green; a sky-blue variety, called *cyprine*, owes its colour to the presence of a trace of copper. The specific gravity is 3.4 and the hardness 6½. The name vesuvianite is also in common use for this mineral.

Idocrase is typically a mineral of contact-metamorphic origin, occurring most frequently in crystalline limestones at their contact with igneous rock-masses; it also occurs in serpentine, chlorite-schist and gneiss, and is usually associated with garnet, diopside, wollastonite, etc. Localities which have yielded fine crystallized specimens are the Ala valley in Piedmont, Monte Somma (Vesuvius), the River Wilui in Siberia ("wiluite"), Christiansand in Norway, etc. When found as transparent crystals of a good green or brown colour it is occasionally cut as a gem-stone. A compact variety ("californite"), closely resembling jade in appear-

ance, has been used as an ornamental stone.

IDOL, in philosophy, means a prejudice of some kind which is a hindrance to objective, impartial or free thought. The term was first used in this sense by Giordano Bruno and adopted from him by Francis Bacon, who is chiefly responsible for the vogue which it has. Bacon distinguished four kinds of idols, namely: (1) *idols of the tribe,* prejudices more or less common to the whole human race; (2) *idols of the cave,* prejudices peculiar to individuals; (3) *idols of the market place,* prejudices encouraged by one's social group and mother tongue; (4) *idols of the theatre,* or prejudices or false notions taught and encouraged by various schools of thought.

See F. Bacon, *Novum Organum.*

IDOLATRY, the worship of idols, *i.e.,* images or other objects believed to represent or be the abode of a superhuman personality. The term is often used generically to include such varied forms as litholatry, dendrolatry, pyrolatry, zoolatry and even necrolatry. In an age when the study of religion was practically confined to Judaism and Christianity, idolatry was regarded as a degeneration from an uncorrupt primeval faith, but the comparative and historical investigation of religion has shown it to be rather a stage of an upward movement, and that by no means the earliest.

As the earlier stages in the development of the religious consciousness persist and are often manifest in idolatry, so in the higher stages, when men have attained loftier spiritual ideas, idolatry itself survives and is abundantly visible as a reactionary tendency. The history of the Jewish people whom the prophets sought, for long in vain, to wean from worshipping images is an illustration; so, too, the vulgarities of modern popular Hinduism contrasted with the lofty teaching of the Indian sacred books.

In the New Testament the word εἰδωλολατρεία (*idololatria*), afterwards shortened occasionally to εἰδωλατρεία (*idolatria*), occurs in all four times, viz., in 1 Cor. x. 14; Gal. v. 20; 1 Peter iv. 3; Col. iii. 5. In the last of these passages it is used to describe the sin of covetousness or "mammon-worship." In the other places it indicates with the utmost generality all the rites and practices of those special forms of paganism with which Christianity first came into collision. It can only be understood by reference to the LXX., where εἴδωλον (like the word "idol" in A.V.) occasionally translates indifferently no fewer than 16 words by which in the Old Testament the objects of what the later Jews called "strange worship" are denoted (see *Encyclopaedia Biblica*). In the widest acceptation of the word, idolatry in any form is absolutely forbidden in the second commandment, which runs: "Thou shalt not make unto thee a graven image; [and] to no visible shape in heaven above, or in the earth beneath, or in the water under the earth, shalt thou bow down or render service." (*See* DECALOGUE.)

It is obvious that two religious votaries in an attitude of reverence before an image may be moved by very different ideas of what the image is and signifies, although their outward attitude is the same. The one may regard it as merely an image, picture, or representation of a higher being, and in itself void of value or power. Its value is that of mere resemblance or some kind of acquired association. But the other may regard it as the tenement or vehicle of the god and fraught with Divine influence. In modern Christendom the former is the attitude which the Roman Church officially inculcates towards sacred pictures and statues; they are intended to convey to the eyes of the faithful, especially to the illiterate among them, facts about Jesus, the Virgin, and the Saints. The other attitude is that into which simple-minded peasants may easily lapse, as it is that which characterizes other religions, ancient or modern, which use images of any kind; and it is this attitude which may be conveniently called "idolatry" or image-worship.

The invectives against idolatry of the early Jewish and Christian apologists, of Philo, Minucius, Felix, Tertullian, Arnobius, Lactantius, and others, throw light on the question how an ancient pagan regarded his idols. One capital argument of the Christians was the absurdity of a man making an idol and then adoring or being afraid of the work of his own hands. Lactantius preserves the answer of the pagans so criticized (*De origine erroris,* ii. 2): we do not, they said, fear the images themselves, but those beings after whose likeness they were fashioned and by whose names they were consecrated. And Augustine (*De civ. dei,* viii. 23) relates how, according to Hermes, the spirits entered "by invitation" so that the images became "bodies of the gods." Image-worship is essentially a form or rather an outcome of animism, now known to represent a type of religion arising subsequently to its really primitive forms. An image fashioned like a god and having this advantage over a mere stock or stone, that it declares itself and reveals at a glance to what god it is sacred, is believed to attract and influence the god to choose it as his home and tenement. Religious ceremonial is much more hopeful and efficacious for a worshipper who thus has means of approaching the god he worships in visible and tangible form, and even of coercing it. Having the god thus at hand and bound up with the material object, the simple-minded worshipper can punish it if his prayers are left unanswered (*cf.* Tylor, *Primitive Culture,* ii. 170). Suetonius relates (Aug. 16) that Augustus, having lost some ships in a storm, punished Neptune by refusing to allow his image to be carried in procession at the games. *See* RELIGION (*History of*), and ANIMISM with references there to be found.

BIBLIOGRAPHY.—On the whole subject *see* art. "Images and Idols" in Hastings, *Encyclopaedia of Religion and Ethics,* vol. vii. (1914), with extensive bibliography and references; also Tylor, *Primitive Culture* (ed. 1903); Farnell, *Evolution of Religion* (1905).

IDOMENEUS (ē-dŏm-ĕn-ūs), in Greek legend, son of Deucalion, grandson of Minos and Pasiphaë, and king of Crete. He courted Helen, and took a distinguished part in the Trojan War. According to Homer (*Odyssey,* iii. 191), he returned home safely with all his countrymen who had survived the war; in later tradition, having been overtaken by a violent storm, he vowed to sacrifice to Poseidon the first living thing that met him when he reached home. This proved to be his son, whom he slew in accordance with his vow; whereupon a plague broke out and Idomeneus was driven out. He fled to the district of Sallentum in Calabria, and subsequently to Colophon in Asia Minor, where he settled near the temple of the Clarian Apollo and was buried on Mt. Cercaphus (Virgil, *Aeneid,* iii. 121, 400, 531, and Servius on those passages). But the Cretans showed his grave at Cnossus, where he was worshipped as a hero with Meriones (Diod. Sic. v. 79).

For this story (a well-known *märchen,* "Home-comer's Vow," *cf.* Jephtha's daughter) *see* H. J. Rose *Handbook of Greek Mythology* (1928), ch. x.

IDRIA, a mining town in the province of Gorizia, Italy, 29 m. N.E. by road from Gorizia. Pop. (1921) 5,041 (town), 5,592 (commune). It is in the narrow Alpine valley of the Idria, an affluent of the Isonzo, and has rich mines of quicksilver accidentally discovered in 1490. The mercurial ore lies in a bed of clay slate, and is found both mingled with schist and in the form of cinnabar. The yield of pure metal is high compared with the amount of the refuse. The mines of Idria rank second to those of Almaden in Spain, which are the richest in the world.

IDRIALIN, a mineral wax accompanying the mercury ore in Idria. According to Goldschmidt it can be extracted by means of xylol, amyl alcohol or turpentine; also without decomposition, by distillation in a current of hydrogen, or carbon dioxide. It is a white crystalline body, with difficulty fusible, boiling above 440° C. (824° F.), of the composition $C_{30}H_{58}O$. Its solution in glacial acetic acid, by oxidation with chromic acid, yields a red powdery solid and a fatty acid fusing at 62° C., and exhibiting all the characters of a mixture of palmitic and stearic acids.

IDRISI or Edrisi (Abu Abdallah Mohammed Ibn Mohammed Ibn Abdallah Ibn Idrisi, *c.* A.D. 1099–1154), Arabic geographer. His great-grandfather, Idrisi II., "Biamrillah," a member of the princely house which had reigned as caliphs in north-west Africa, was prince of Malaga. After his death in 1055, Malaga was seized by Granada, and the Idrisi family then probably migrated to Ceuta, where a freedman of theirs held power. Here the geographer was born in A.H. 493 (A.D. 1099). He studied at Cordova and visited before A.D. 1154, both Lisbon and

the mines of Andalusia. He had also resided near Morocco city, and once was at (Algerian) Constantine. In A.D. 1117 he visited the cave of the Seven Sleepers at Ephesus; he probably travelled extensively in Asia Minor. Some have inferred that he had seen part of the coasts of France and England. Roger II. of Sicily (1101–54) invited him to his court between 1125 and 1150. Idrisi made for the Norman king a celestial sphere and a disk representing the known world of his day—both in silver. Roger bestowed on him rich presents, and employed him in the compilation of a fresh description of the "inhabited earth" from observation. The king and his geographer sent emissaries to various countries to observe, record and design; and Idrisi inserted in the new geography the information they brought. Thus was gradually completed (by the month of Shawwal, A.H. 548 = mid-January, A.D. 1154), the famous work, best known, from its patron and originator, as *Al Rojari*, but whose fullest title seems to have been, *The going out of a Curious Man to explore the Regions of the Globe, its Provinces, Islands, Cities and their Dimensions and Situation.* This has been abbreviated to *The Amusement of him who desires to traverse the Earth*, or *The Relaxation of a Curious Mind.* The title of *Nubian Geography*, based upon Sionita and Hezronita's misreading of a passage relating to Nubia and the Nile, is misleading. The *Rogerian Treatise* contains a full description of the world as far as it was known to the author. The "inhabited earth" is divided into seven "climates," beginning at the equinoctial line, and extending northwards to the limit at which the earth was supposed to be rendered uninhabitable by cold. Each climate is then divided by perpendicular lines into eleven equal parts, beginning with the western coast of Africa and ending with the eastern coast of Asia. The whole world is thus formed into 77 equal square compartments. The inconveniences of the arrangement (ignoring all divisions, physical, political, linguistic or religious, which did not coincide with those of his "climates") are obvious.

We find few traces of his influence on European thought and knowledge. The chief exception is perhaps in the delineation of Africa in the world-maps of Marino Sanuto (*q.v.*) and Pietro Vesconte. His account of the voyage of the *Maghrurin* or "Deceived Men" of Lisbon in the Atlantic (a voyage on which they seem to have visited Madeira and one of the Canaries) may have had some effect in stimulating the later ocean enterprise of Christian mariners; but we have no direct evidence. In spite of the record of the Lisbon Wanderers, he shares the common Muslim dread of the black, viscous, stormy and wind-swept waters of the western ocean, whose limits no one knew, and over which thick and perpetual darkness brooded. But his breadth of view, his recognition of scientific truths (such as the roundness of the world) and his wide knowledge and intelligent application of preceding work (such as that of Ptolemy, Masudi and Al Jayhani) must not be forgotten. He also preserves and embodies a considerable amount of private and special information—especially as to Scandinavia, portions of the African coast, the river Niger (whose name is perhaps first to be found, after Ptolemy's doubtful Nigeir, in Idrisi), portions of the African coast, Egypt, Syria, Italy, France, the Adriatic shore-lands, Germany and the Atlantic islands. Unfortunately the place-names are often illegible or hopelessly corrupted in the manuscripts. Idrisi's world-map, with all its shortcomings, is perhaps the best product of the Mohammedan cartography of the middle ages.

Besides the *Rojari*, Idrisi wrote another geographical work cited by Abulfida as *The Book of Kingdoms*, but apparently entitled by its author *The Gardens of Humanity and the Amusement of the Soul.* This was composed for William the Bad (1154–66), son and successor of Roger II., but is now lost.

Two manuscripts of Idrisi exist in the Bibliothèque Nationale, Paris, and two others in the Bodleian Library, Oxford. One of the English mss., brought from Egypt by Greaves, is illustrated by a map of the known world, and by 33 sectional maps (for each part of the first three climates). The second manuscript, brought by Pococke from Syria, is dated A.H. 906, or A.D. 1500. It consists of 320 leaves, and is illustrated by one general and 77 particular maps. The general map was published by Dr. Vincent in his *Periplus of the Erythraean Sea.* A copy of Idrisi's work in the Escorial was destroyed by the fire of 1671.

A French translation of the whole of Idrisi's geography, based on one of the mss. of the Bibliothèque Nationale, Paris, was published by Amédée Jaubert in 1836–40, and forms volumes v. and vi. of the *Recueil de voyages* issued by the Paris Société de Géographie. Part of a contemplated critical edition was prepared by de Goeje: *Description de l'Afrique et de l'Espagne par Edrisi, texte arabe, publié avec une traduction, des notes et un glossaire par R. Dozy et M. J. de Goeje* (Leiden, E. J. Brill, 1866). Other parts of Idrisi's work have been separately edited; e.g., "Spain" (*Descripción de España de . . . Edrisi*), by J. A. Condé, in Arabic and Spanish (Madrid, 1799); "Sicily" (*Descrizione della Sicilia . . . di Elidrisi*), by P. D. Magri and F. Tardia (Palermo, 1764); "Italy" (*Italia descritta nel "libro del Re Ruggero," compilato da Edrisi*), by M. Amari and C. Schiaparelli, in Arabic and Italian (Rome, 1883); "Syria" (*Syria descripta a . . . El Edrisio . . .*), by E. F. C. Rosenmüller, in Arabic and Latin, 1825, and (*Idrisii . . . Syria*), by J. Gildemeister (Bonn, 1885) (the last a Beilage to vol. viii. of the *Zeitschrift d. deutsch. Palästina Vereins*). *See* also M. Casiri, *Bibliotheca Arabico Hispana Escurialensis* (2 vols., Madrid, 1760–70); V. Lagus, "Idrisii notitiam terrarum Balticarum ex commerciis Scandinavorum et Italorum . . . ortam esse" in *Atti del IV° Congresso internaz. degli orientalisti in Firenze*, p. 305 (Florence, 1880); R. A. Brandel, "Om och ur den arabiske geografen Idrisi," *Akad. afhand.* (Upsala, 1894). (C. R. B.)

IDUMAEA, the Greek equivalent of Edom (אֱדוֹם), a territory which, in the works of the Biblical writers, is considered to lie S.E. of the Dead Sea, between the land of Moab and the Gulf of Akaba. The apparently theophorous name Obed Edom (2 Sam. vi. 10) shows that Edom is the name of a divinity.

The early history of Edom is obscure; Egyptian references to it are few, and do not give us much light regarding its early inhabitants. In the early records of the Pentateuch, the country is often referred to by the name of Seir, the general name for the whole range of mountains on the east side of the Jordan-Araba depression south of the Dead Sea. These mountains were occupied, as early as we can find any record, by a cave-dwelling aboriginal race known as Horites, who were smitten by the much-discussed king Chedorlaomer (Gen. xiv. 6) and according to Deut. ii. 22 were driven out by the Semitic tribes of Esau's descendants. The Horites are to us little more than a name, though the discovery of cave-dwellers of very early date at Gezer in the excavations of 1902–1905 has enabled us to form some idea as to their probable culture-status and physical character.

The occupants of Edom during practically the whole period of Biblical history were the Bedouin tribes which claimed descent through Esau from Abraham, and were acknowledged by the Israelites (Deut. xxiii. 7) as kin. That they intermarried with the earlier stock is suggested by the passage in Gen. xxxvi. 2, naming, as one of the wives of Esau, Aholibamah, daughter of Zibeon the Horite (corrected by verse 20). Among the peculiarities of the Edomites was government by certain officials known as אַלּוּפִים, which the English versions (by too close a reminiscence of the Vulgate *duces*) translate "dukes." The now naturalized word "sheikhs" would be the exact rendering. In addition to this Bedouin organization there was the curious institution of an elective monarchy, some of whose kings are catalogued in Gen. xxxvi. 31–39 and 1 Chron. i. 43–54. These kings reigned at some date anterior to the time of Saul. No deductions as to their chronology can be based on the silence regarding them in Moses's song, Exodus xv. 15. There was a king in Edom (Num. xx. 14) who refused passage to the Israelites in their wanderings.

In later times by the constant westward pressure of the eastern Arabs, which (after the restraining force of the great Mesopotamian kingdoms was weakened) assumed irresistible strength, the ancient Edomites were forced across the Jordan-Araba depression, and with their name migrated to the south of western Palestine. In 1 Maccabees v. 65 we find them at Hebron, and this is one of the first indications that we discover of the cis-Jordanic Idumaea of Josephus and the Talmud.

Josephus used the name Idumaea as including not only Gobalitis, the original Mount Seir, but also Amalekitis, the land of Amalek, west of this, and Akrabatine, the ancient Acrabbim, S.W. of the Dead Sea. Jerome describes Idumaea as extending from Beit Jibrin to Petra, and ascribes the great caves at the former place to cave-dwellers like the aboriginal Horites. Ptolemy's account presents us with the last stage, in which the name Idumaea is entirely restricted to the cis-Jordanic district, and the old trans-Jordanic region is absorbed in Arabia. (R. A. S. M.; X.)

IDUN or **IDUNA,** in Scandinavian mythology, the goddess of youth and spring, daughter of the dwarf Svald, wife of Bragi, was keeper of the golden apples, the eating of which preserved to the gods their eternal youth. Idun personifies the year between March and September, and her myth represents the annual imprisonment of spring by winter.

IDYL or **IDYLL,** a short poem of a pastoral or rural character, in which something of the element of landscape is preserved or felt. The earliest commentators of antiquity used the term to designate a great variety of brief and homely poems, in which the description of natural objects was introduced, but the pastoral idea came into existence in connection with the Alexandrian school and particularly with Theocritus, Bion and Moschus, in the 3rd century before Christ. It appears, however, that εἰδύλλιον was not, even then, used consciously as the name of a form of verse, but as a diminutive of εἶδος, and merely signified "a little piece in the style of" whatever adjective might follow. Thus the idyls of the pastoral poets were εἰδύλλια αἰτολκά, little pieces in the goatherd style. We possess ten of the so-called "Idyls" of Theocritus, and these are the type from which the popular idea of this kind of poem is taken. The word was revived at the Renaissance. In 1658 the English critic, Edward Phillips, defined an "idyl" as "a kind of eclogue," but it was seldom used to describe a modern poem. The general use, or abuse, of the word in the second half of the 19th century, both in English and French, arises from the popularity of two works, by two eminent poets. The *Idylles héroiques* (1858) of Victor de Laprade and the *Idylls of the King* (1859) of Tennyson enjoyed a success in either country which led to a wide imitation of the title among those who had, perhaps, a very inexact idea of its meaning. On the whole, it is impossible to admit that the idyl has a place among definite literary forms.

IESI (anc. *Aesis*), a town and episcopal see of the Marches, Italy, province of Ancona, 17 m. W. by S. from Ancona town by rail, 318 ft. above sea-level. Pop. (1921) 15,759 (town), 25,949 (commune). It lies on the left bank of the river Aesis (mod. Esino). It still retains its picturesque mediaeval town walls. S. Marco is an interesting 13th century church. The Palazzo del Comune is a fine, simple, early Renaissance building (1487–1503) by Francesco di Giorgio Martini. The courtyard with its loggie was built by Andrea Sansovino in 1519. The picture gallery contains some good pictures by Lorenzo Lotto. The castle was built by Baccio Pontelli (1488). Iesi was the birthplace of the emperor Frederic II. (1194), and also of the composer Giovanni Battista Pergolesi (1710–1736). The silk spinning industry is of considerable importance. The Aesis formed the boundary of Italy proper from about 250 B.C. to the time of Sulla (*c.* 82 B.C.); and, in Augustus' division of Italy, that between Umbria (the 6th region) and Picenum (the 5th).

See L. Marinelli in *Cronache d'Arte* iv. (1928) "Le Mure di Iesi."

IFFLAND, AUGUST WILHELM (1759–1814), German actor and dramatic author, was born at Hanover on April 19, 1759. At 18 the boy ran away to Gotha in order to prepare himself for a theatrical career. He was taught by Hans Ekhof, and in 1779 was engaged at the Mannheim theatre, then rising into prominence. In 1796 he settled in Berlin, where he became director of the national theatre of Prussia; and in 1811 he was made general director of all representations before royalty. Iffland produced the classical works of Goethe and Schiller with conscientious care; but the kind of play in which he was most at home, both as actor and playwright, was the domestic drama, the sentimental play of everyday life. Among his best-known plays are *Die Jäger, Dienstpflicht, Die Advokaten, Die Mündel* and *Die Hagestolzen.* In 1798–1802 he issued his *Dramatische Werke* in 16 volumes, to which he added an autobiography (*Meine theatralische Laufbahn*). In 1807–09 Iffland brought out two volumes of *Neue dramatische Werke.* Iffland died at Berlin on Sept. 22, 1814.

See K. Duncker, *Iffland in seinen Schriften als Künstler, Lehrer, und Direktor der Berliner Bühne* (1859); W. Koffka, *Iffland und Dalberg* (1865); and Lampe, *Studien über Iffland als Dramatiker* (Celle, 1899). Iffland's interesting autobiography, *Meine theatralische Laufbahn,* was republished by H. Holstein in 1885.

IGARA, a people closely resembling the Yoruba, inhabiting the provinces of Munshi and Nassarawa, Northern Nigeria, and who speak a Yoruba dialect.

See Meek, *The Northern Tribes of Nigeria* (1925).

IGLAU: *see* JIHLAVA.

IGLESIAS, a town and episcopal see of Sardinia in the province of Cagliari, 34 m. W.N.W. from Cagliari by rail, 620 ft. above sea-level. Pop. (1921) 11,651 (town), 19,844 (commune). It is a mining centre with a school of mines in the southwestern mountains. Minerals go by a small railway via Monteponi (with its large lead and zinc mine) to Portovesme (15 m. S.W. of Iglesias in the sheltered gulf of Carloforte) where they are shipped. The cathedral of Iglesias, built by the Pisans, has a good façade (restored); the interior is late Spanish Gothic. San Francesco is a fine Gothic church with a gallery over the entrance, while Sta. Chiara and the church of the Capuchins (the former dating from 1285) are transitional Romanesque Gothic. The battlemented town walls are well preserved; the castle, built in 1325, now contains a glass factory.

IGLESIAS POSSE, PABLO (1850–1925), Spanish politician was born at El Ferrol on Oct. 15, 1850. On the death of his father he was placed in a foundling asylum where after repeated attempts at escape he remained for some years. In 1871 he became secretary of the International Proletarian Federation and in 1872 founded the Typographical Societies of which he became president in 1885. He helped form the first Spanish Socialist group in 1879 and was elected to the House of Deputies in 1910. In 1923, when Primo de Rivera overthrew the constitution and closed the doors of the Cortes, he was chief of the Parliamentary Socialist Party. He became editor of *El Socialista,* the organ of the Spanish labour movement in 1886. For activities on behalf of the workers he served eight terms of imprisonment. He died in Madrid on Dec. 8, 1925.

See Meliá, *Pablo Iglesias Posse. Rasgos de su vida íntima* (1926).

IGNATIEV, NICHOLAS PAVLOVICH, COUNT (1832–1908), Russian diplomatist, was born at St. Petersburg (Leningrad) on Jan. 29, 1832. At 17 he became an officer of the Guards. His diplomatic career began at the Congress of Paris, after the Crimean War, where he took an active part as military attaché in the negotiations regarding the rectification of the Russian frontier on the Lower Danube. Two years later (1858) he was sent with a small escort on a dangerous mission to Khiva and Bokhara. The khan of Khiva laid a plan for detaining him as a hostage, but he returned safely, after concluding with the khan of Bokhara a treaty of friendship. He was Russian envoy at Peking when the Chinese Government was terrified by the advance of the Anglo-French expedition of 1860 and the burning of the Summer Palace; he used the occasion to secure for Russia not only the left bank of the Amur, the original object of the mission, but also a large extent of territory and sea-coast south of that river. Ignatiev was ambassador at Constantinople from 1864 till 1877. Here his chief aim was to liberate from Turkish domination and bring under the influence of Russia the Christian nationalities in general and the Bulgarians in particular. His diplomacy led up to the Russo-Turkish war of 1877–78, at the close of which he negotiated with the Turkish plenipotentiaries the treaty of San Stefano. Ignatiev then retired in semi-disgrace. After the accession of Alexander III. in 1881, he was appointed minister of the interior to carry out a nationalist, reactionary policy, but was dismissed in 1882. He died on July 3, 1908.

IGNATIUS (Ἰγνάτιος), bishop of Antioch, a father of the Church. Our only trustworthy information is derived from the letters which he wrote to various churches on his last journey from Antioch to Rome, and from the short epistle of Polycarp to the Philippians. For the complicated controversy over the three recensions of the letters of Ignatius the reader is referred to the authorities quoted in the bibliography. The general consensus of opinion appears to be that the letters contained in the Medicean ms. at Florence, addressed to the Ephesians, Magnesians, Trallians, Romans, Philadelphians, Smyrnaeans and to Polycarp are genuine, and that they were written in the reign of Trajan. Harnack placed them in the latter years of Trajan or

possibly 117–125. Most scholars date them a few years earlier (110–117).

The letters of Ignatius unfortunately, unlike the Epistles of St. Paul, contain scant autobiographical material. We are told absolutely nothing about the history of his career. The fact that like St. Paul he describes himself as an ἔκτρωμα (*Rom.* 9), and that he speaks of himself as "the last of the Antiochene Christians" (*Trall.* 13; *Smyrn.* xi.), seems to suggest that he had been converted from paganism somewhat late in life and that the process of conversion had been abrupt and violent. He bore the surname of Theophorus, *i.e.*, "God-clad" or "bearing God." At the time when the Epistles were written he had just been sentenced to death, and was being sent in charge of a band of soldiers to Rome to fight the beasts in the amphitheatre. The fact that he was condemned to the amphitheatre proves that he could not have been a Roman citizen. We lose sight of him at Troas, but the presumption is that he was martyred at Rome.

But if the Epistles tell us little of the life of Ignatius, they give us an excellent picture of the man himself, and are a mirror in which we see reflected certain ideals of the life and thought of the day. Ignatius, as Schaff says, "is the incarnation of three closely connected ideas: the glory of martyrdom, the omnipotence of episcopacy, and the hatred of heresy and schism."

Zeal for martyrdom in later days became a disease in the Church, but in the case of Ignatius it is the mark of a hero. The heroic note runs through all the Epistles; thus he says:

> I bid all men know that of my own free will I die for God, unless ye should hinder me . . . Let me be given to the wild beasts, for through them I can attain unto God. I am God's wheat, and I am ground by the wild beasts that I may be found the pure bread of Christ. Entice the wild beasts that they may become my sepulchre . . . ; come fire and cross and grapplings with wild beasts, wrenching of bones, hacking of limbs, crushings of my whole body; only be it mine to attain unto Jesus Christ (*Rom.* 4–5).

Ignatius constantly contends for the recognition of the authority of the ministers of the church. "Do nothing," he writes to the Magnesians, "without the bishop and the presbyters." The "three orders" are essential to the church; without them no church is worthy of the name (cf. *Trall.* 3). "It is not lawful apart from the bishop either to baptize or to hold a love-feast" (*Smyrn.* 8). Respect is due to the bishop as to God, to the presbyters as the council of God and the college of apostles, to the deacons as to Jesus Christ (*Trall.* 3). These terms must not, of course, be taken in their developed modern sense. The "bishop" of Ignatius seems to represent the modern pastor of a church. As Zahn has shown, Ignatius is not striving to introduce a special form of ministry, nor is he endeavouring to substitute one form for another. His particular interest is not so much in the form of ministry as in the unity of the church. Centrifugal forces were at work.

Ignatius was resisting this fatal tendency which threatened ruin to the faith. The only remedy for it in those days was to exalt the authority of the ministry and make it the centre of church life. It should be noted that (1) there is no trace of the later doctrine of apostolical succession; (2) the ministry is never sacerdotal in the letters of Ignatius. As Lightfoot puts it: "The ecclesiastical order was enforced by him (Ignatius) almost solely as a security for doctrinal purity. The threefold ministry was the husk, the shell, which protected the precious kernel of the truth" (i. 40).

Ignatius fights most vehemently against the current forms of heresy. The chief danger to the church came from the Docetists who denied the reality of the humanity of Christ and ascribed to him a phantom body. Hence we find Ignatius laying the utmost stress on the fact that Christ "was *truly* born and ate and drank, was *truly* persecuted under Pontius Pilate . . . was *truly* raised from the dead" (*Trall.* 9). "I know that He was in the flesh even after the resurrection, and when He came to Peter and his company, He said to them, 'Lay hold and handle me, and see that I am not an incorporeal spirit'" (*Smyrn.* 3). Equally emphatic is Ignatius's protest against a return to Judaism. "It is monstrous to talk of Jesus Christ and to practise Judaism, for Christianity did not believe in Judaism but Judaism in Christianity" (*Magn.* 10).

As far as Christology is concerned, there are two points to be noted: (1) Ignatius is the earliest writer outside the New Testament to describe Christ under the categories of current philosophy; *cf.* the famous passage in *Eph.* 7. "There is one only physician, of flesh and of spirit (σαρκικὸς ἅμα καὶ πνευματικός), generate and ingenerate (γεννητὸς καὶ ἀγέννητος), God in man, true life in death, son of Mary and son of God, first passible and then impassible" (πρῶτον παθητὸς καὶ ἀπαθής). (2) Ignatius is also the first writer outside the New Testament to mention the Virgin Birth, upon which he lays the utmost stress. "Hidden from the prince of this world were the virginity of Mary and her child-bearing and likewise also the death of the Lord, three mysteries to be cried aloud, the which were wrought in the silence of God" (*Eph.* 19). Here, it will be observed, we have the nucleus of the later doctrine of the deception of Satan. In regard to the Eucharist also later ideas occur in Ignatius. It is termed a μυστήριον (*Trall.* 2), and the influence of the Greek mysteries is seen in such language as that used in *Eph.* 20, where Ignatius describes the Eucharistic bread as "the medicine of immortality and the antidote against death."

When Ignatius says, too, that "The heretics abstain from Eucharist because they do not allow that the Eucharist is the flesh of Christ," the words seem to imply that materialistic ideas were beginning to find an entrance into the church (*Smyrn.* 6). Other points that call for special notice are: (1) Ignatius's rather extravagant angelology. In one place, for instance, he speaks of himself as being able to comprehend heavenly things and "the arrays of angels and the musterings of principalities" (*Trall.* 5). (2) His view of the Old Testament. In one important passage Ignatius emphatically states his belief in the supremacy of Christ even over "the archives" of the faith, *i.e.*, the Old Testament: "As for me, my archives—my inviolable archives—are Jesus Christ, His cross, His death, His resurrection and faith through Him" (*Philadel.* 8).

See T. Zahn, *Ignatius von Antiochien* (Gotha, 1873); J. B. Lightfoot, *Apostolic Fathers*, part ii. (London, 2nd ed., 1889); F. X. Funk, *Die Echtheit der ignat. Briefe* (Tübingen, 1883); A. Harnack, *Chronologie der altchristlichen Litteratur* (Leipzig, 1897). There is a good bibliography in G. Krüger, *Early Christian Literature* (Eng. trans., 1897, pp. 28–29); Rackl, *Die Christologie des heil. Ignaz von Antiochien* (1914). *See* also Apostolic Fathers.

IGNIS FATUUS, the name applied to the pale flame, also called will-o'-the-wisp and jack-o'-lantern, sometimes seen flickering over marshy ground and, it is said, over churchyards. No entirely satisfactory explanation has been put forward but it is generally believed that the effect is due to the spontaneous ignition of gases (especially methane or marsh gas, CH_4) produced by the disintegration of dead plant and, possibly, animal matter.

IGNORAMUS, properly an English law term for the endorsement on the bill of indictment made by a grand jury when they "throw out" the bill, *i.e.*, when they do not consider that the case should go to a petty jury. The expression is now obsolete, "not a true bill," "no bill," being used. The expressions "ignoramus jury," "ignoramus Whig," etc., were common in the political satires and pamphlets of the years following on the throwing out of the bill for high treason against the 2nd earl of Shaftesbury in 1681. The application of the term to an ignorant person dates from the early part of the 17th century. This term, in a legal sense, is not in use in the United States.

IGNORANCE. In the law among the English-speaking peoples, as in Roman law, ignorance of the law is, in general, no ground for avoiding the consequences of an act. As regards criminal offences, the maxim as to *ignorantia juris* admits of no exception, even in the case of a foreigner temporarily in England, who is likely to be ignorant of English law. In Roman law the harshness of the rule was mitigated in the case of women, soldiers and persons under the age of 25, unless they had good legal advice within reach (*Dig.* xxii. 6. 9), while in England judges often inflict mitigated sentences when a criminal did not and could not reasonably be expected to know the law, especially if it be very recent. Ignorance of foreign law is ignorance of fact. A compromise of claims, doubtful in law, is good and cannot be

upset by subsequent solving of the doubt (*Stewart* v. *Stewart* 6 Cl. and F. 911). Ignorance of a matter of fact may in general be alleged in avoidance of the consequences of acts and agreements, but such ignorance cannot be pleaded where it is the duty of a person to know, or where, having the means of knowledge at his disposal, he wilfully or negligently fails to avail himself of it. (*See* CONTRACT.)

In logic, ignorance is that state of mind which for want of evidence is equally unable to affirm or deny one thing or another. Doubt, on the other hand, can neither affirm nor deny because the evidence seems equally strong for both. (For *Ignoratio Elenchi* [irrelevant conclusion] *see* FALLACY.)

IGNORANTINES, a name sometimes given to the Brothers of the Christian Schools, owing to a clause in the constitution of the order forbidding the admission of priests with a theological training. (*See* INSTITUTE OF THE CHRISTIAN BROTHERS.)

IGOROT, a tribe of Luzon, in the Philippines, calling itself *Ifugao:* a name used separately also for a subtribe of Igorot and



BY COURTESY OF THE SMITHSONIAN INSTITUTION

IGOROT FAMILY ENGAGED IN DOMESTIC PURSUITS OUTSIDE THEIR HOME

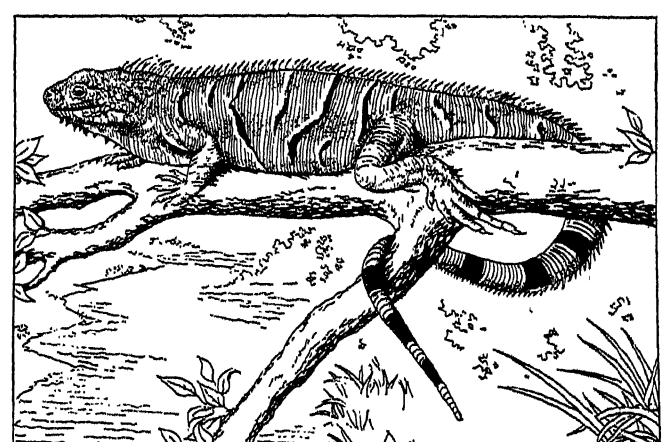
the linguistic equivalent of *apayao,* a name used for a member of the other group of Luzon tribes, which includes the Ilocano, Tinguian and Kalinga groups. (*See* TINGUIAN.) Their political unit is a village State, divided into wards with separate buildings for the unmarried of either sex, regulated by the old men, and having a graded nobility of wealth. Irrigated rice is cultivated, buffalos, pigs, fowls and dogs are kept, the latter being eaten. Marriage is forbidden to first cousins and monogamy prevails. Tattooing is practised, the sun being tattooed on the back of the hand (*cf.* KAREN). The spear and axe are the weapons used; gold, copper and iron are mined, smelted and worked, the piston-bellows being employed, and metal cast by the *cire perdue* process. The dead are dried in a sitting posture and are placed on their backs in graves or caves, wooden figures being made to accommodate the soul. Near each village is a spirit tree. Souls dying natural deaths are also believed to go to a home of the dead under ground, while those dying in battle or child-birth ascend to heaven (*cf.* DAFLA), the abode of Lumawig, who is worshipped as a Creator and culture hero. Rich men are buried in terraces. Head-hunting (*q.v.*) is practised (*cf.* NAGA, and ASIA: *Ethnology*).

See Jenks, *Bontoc Igorot* (1905).

IGUALADA, a town of north-eastern Spain, in the province of Barcelona, on the left bank of the river Noya, a right-hand tributary of the Llobregat, and at the northern terminus of the Igualada-Martorell-Barcelona railway. Pop. (1920) 12,512. Igualada is the central market of a rich agricultural and wine-producing district. The local industries, chiefly developed since 1880, include the manufacture of cotton, linen, wool, ribbons, cloth, chocolate, soap, brandies, leather, cards and nails. The famous mountain and convent of Montserrat or Monserrat (*q.v.*) is 12 m. east.

IGUANA, the name strictly applicable to the lizards of the family Iguanidae; the same name, or its corruption "goanna," is sometimes misapplied to the monitors (family Varanidae). With three exceptions all the genera (numbering about 50 and containing over 400 species) belong to the New World; the exceptional genera are *Brachylophus* in the Fiji islands and *Hoplurus* and *Chalarodon* in Madagascar. The family can be regarded as the New World analogue of the Old World Agamidae, which family it closely resembles in its structure and in the modifications which its members have undergone. The only absolute distinction between the two families is in the position of the teeth; in the Agamidae they are fused to the crest of the jaw bones and in the Iguanidae attached to the inner slope below this crest. In many, however, the teeth are peculiar in being blade- or spear-shaped, with the upper cutting edges strongly serrated. As a rule the iguanas are clothed with small scales and have a large dewlap, a pouch situated beneath the head and neck, and often a crest from the nape of the neck to the extremity of the tail; this crest is composed of narrow, elongate scales which gradually diminish in size posteriorly. The tongue is short and not protractile.

Perhaps the best known species is the common iguana (*Iguana tuberculata*) which occurs throughout tropical Central and South America. Reaching a length of as much as 6 ft., this animal is much sought for as an article of diet, the flesh being greatly esteemed; in habits it is arboreal, its favourite haunts being trees which overhang water, into which it will unhesitatingly plunge if disturbed. Like most of the arboreal species, the ground colour is greenish, relieved in this particular case by brown bands which, though indistinct on the body, form regular annuli on the tail. The food consists largely of tender leaves and fruits but the lizards are by no means averse to a mixed diet and will readily eat small birds and mammals. Another semi-arboreal genus is the likewise tropical American *Basiliscus,* whose members exhibit some curious modifications. The body is compressed from side to side, the tail very long and whip-like, the hinder part of the head produced into a flat lobe like a cock's comb and the outer edges of the toes provided with a wide fringe of elongate scales; the males of all species have a crest along the back but in two species (*B. basiliscus* and *B. plumifrons*) this is enormously developed, being as deep as the body, supported by rays like the fins of a fish, and covered with very thin scales. In addition to these structural peculiarities they have the power, shared only by a few other forms of this family, of being able



COMMON IGUANA (IGUANA TUBERCULATA) OF TROPICAL AMERICA

to run across the surface of water; if disturbed near the water they scutter across it on their hind-limbs, the body being held almost upright with the tail raised as a counterpoise and the fore-limbs folded against their sides. *Basiliscus* itself does not dive, but the related *Derioptyx* of Cuba rushes across the surface in the same way and in some quiet corner dives to the bottom, where it remains until the alarm has passed. *Amblyrhynchus* has achieved fame as the only marine lizard. Its aquatic nature has usually been exaggerated, however, and actually it seldom takes to the water. Large herds of these lizards used to

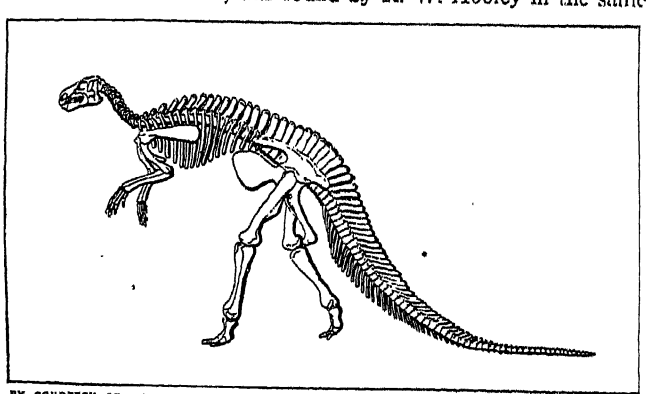
frequent the rocky shores of the Galapagos islands feeding on the sea-weeds between tide-marks.

The terrestrial species of the family are usually duller in colour than the arboreal ones and the body is, as a rule, depressed rather than compressed; this depression has been carried to an extreme in the so-called horned toads (*Phrynosoma*) of the deserts of the United States and Mexico. As well as being depressed, they have, like many desert dwelling animals, developed an armour of spines the largest of which occur on the back of the head and neck and are relatively huge. This lizard offers a very close analogy to the Australian moloch lizard, an agamid which under similar conditions has developed a very similar appearance. An unique characteristic of the members of this genus is their ability to squirt a fine jet of blood from the eye; this extraordinary phenomenon, which has never been satisfactorily explained, only occurs under stress of great emotion, fright or anger. The lizard puffs itself up until the eyes bulge and then a very fine stream of blood is shot out of the eye, sometimes to a distance of five feet. No special mechanism for this discharge has been found and the eye does not appear to be injured.

Another peculiarly modified genus is *Anolis* which occurs throughout the warmer districts of both North and South America and which is particularly abundant among the West Indian islands. Many of the lizards of this genus have the basal joints of their fingers and toes dilated and covered with transverse lamellae like those of a gecko and these adhesive pads, together with the powerful claws, render the animals excellent climbers. They have wonderful powers of changing colour, rivalling in this respect the chamaeleons; in fact they are frequently called "American chamaeleons." The males often have enormously developed dewlaps which may be brilliantly coloured and can be expanded and contracted at will, like a fan.

Most iguanids reproduce by means of eggs though a few species are ovoviviparous. (H. W. P.)

IGUANODON, a large extinct amphibious reptile. Its remains were first discovered in the Wealden (Lower Cretaceous) estuarine deposits of Sussex by G. A. Mantell, who named it *Iguanodon,* in allusion to the resemblance between its teeth and those of the lizard *Iguana* of tropical America. In 1877 several nearly complete skeletons now in the Royal Museum of Natural History at Brussels, were found in the Wealden rocks near Mons, Belgium. More recently another nearly complete skeleton, now in the British Museum, was found by R. W. Hooley in the same



BY COURTESY OF THE AMERICAN MUSEUM OF NATURAL HISTORY

SKELETON (RECONSTRUCTED) OF THE IGUANODON, AN EXTINCT MAMMOTH REPTILE THAT RANGED SOUTHERN ENGLAND AND NORTHERN EUROPE DURING THE CRETACEOUS PERIOD

rocks at Atherfield in the Isle of Wight. *Iguanodon* is interesting as being the first gigantic extinct reptile which it was attempted to restore by comparison with a modern lizard. Mantell's early restoration proved a failure, because it was unknown at the time that this reptile belonged to an extinct order, Dinosauria (*q.v.*), which differed from all modern reptiles in having limbs adapted for supporting the body when at rest, and in having more than two vertebrae fused together to form a sacrum above the hind-limbs like the sacrum of birds and mammals. Like nearly all the more active dinosaurs, it had comparatively large and heavy hind quarters, passing into a long tail; and footprints show that it walked only on its hind limbs, using the tail for balancing the fore-quarters.

The typical species, *I. mantelli,* is from 5 to 6 metres long, and must have measured about 4 metres in height when standing upright. The largest known species seem to have been sometimes 10 metres long. The head is relatively large, laterally compressed, and about twice as long as deep. Its long axis is bent downwards for cropping its vegetable food. The front of both jaws is toothless and must have been covered with a horny beak. The lower half of the beak is supported by a separate "predentary" bone. The edge of each jaw further back bears a single row of teeth, which differ from those of all existing reptiles in being often worn down to stumps by mastication. Under the teeth actually in use are numerous successional teeth. The neck and front half of the back are made flexible by ball and socket joints between the vertebrae. The front half of the tail is deep and laterally compressed, evidently for swimming. The small fore limbs must have been very mobile, and the thumb in the five-fingered hand is reduced to a bony spur. The supporting bones of the hind limbs are much like those of ostriches, though they differ in never being fused into one mass. The three toes of the heavy hind foot are so much like those of birds that the fossilized footprints were originally mistaken for those of birds. The body lacks armour, but the skin was hardened with a close covering of small irregular tubercles. Footprints are common on the Wealden sandstones of Sussex, and several series have been observed without any trace of the forefeet and rarely a mark of the tail.

Nothing is satisfactorily known about the possible ancestors of *Iguanodon,* and few of its closely allied contemporaries have been discovered. The comparatively small *Hypsilophodon,* which occurs with it in the Wealden of the Isle of Wight, differs in having the teeth extending to the front of each jaw. The equally small *Psittacosaurus,* from rocks of nearly the same geological age in Mongolia, has the toothless front of the jaws shaped almost like the beak of a parrot. The successors of *Iguanodon,* the Trachodontidae, in the Upper Cretaceous, were more adapted for aquatic life, and their toothless beak was shaped almost like the end of the bill of a duck. The side of each jaw bore a powerful grinding dentition, several rows of teeth being in use at one time. Many of the trachodonts were peculiar in exhibiting a bony crest on the top of the head.

See L. Dollo, *Bull. Mus. Roy. d'Hist. Nat. Bruxelles* (1882–84); R. W. Hooley, *Quart. Journ. Geol. Soc.* (1913); also a special *Guide* published by the Royal Museum of Natural History, Brussels.

(A. S. W.)

IGUVIUM (mod. Gubbio, *q.v.*), a town of Umbria, among the mountains, about 23 m. north-north-east of Perusia and connected with it by a by-road, which joined the Via Flaminia near the temple of Iuppiter Appeninus, at the modern Scheggia. It appears to have been important in pre-Roman times, both from its coins and from the celebrated *tabulae Iguvinae* (*see* below).

We find it in possession of a treaty with Rome, similar to that of the Caerites Umbri; and in 167 B.C. it was used as a place of safe custody for the Illyrian King Gentius and his sons. After the Social War, in which it took no part, it received full citizen rights and was included in the tribus Clustumina. Under the empire we hear almost nothing of it. Silius Italicus mentions it as subject to fogs. A bishop of Iguvium is mentioned as early as A.D. 413. It was taken and destroyed by the Goths in 552, but rebuilt with the help of Narses. The Umbrian town had three gates only, and probably lay on the steep mountain side as the present town does, while the Roman city lay in the lower ground. Here is the theatre, restored by Cn. Satrius Rufus in the time of Augustus. The diameter of the orchestra is 76½ ft. and of the whole 230 ft.; the stage is well preserved and so are parts of the external arcades of the auditorium. Not far off are ruins probably of ancient baths, and the concrete core of a large tomb with a vaulted chamber within.

Iguvine Tables.—The famous *Iguvine* (less correctly *Eugubine*) *Tables,* were discovered at Iguvium in 1444, bought by

the municipality in 1456, and are still preserved in the town hall. They were originally nine in number, and two of the nine were taken to Venice in 1540 and never reappeared. The existing seven were first published in 1724.

BIBLIOGRAPHY.—Otfried Müller (*Die Etrusker*, 1828), pointed out that though their alphabet was akin to the Etruscan their language was Italic. Lepsius, in his essay *De tabulis Eugubinis* (1833), finally determined the value of the Umbrian signs and the received order of the Tables, pointing out that those in Latin alphabet were the latest. He published what may be called the *editio princeps* in 1841. The first edition, with a full commentary based on scientific principles, was that of Aufrecht and Kirchoff in 1849–51, and on this all subsequent interpretations are based (Bréal, Paris, 1875; Bücheler, *Umbrica*, Bonn, 1883, a reprint and enlargement of articles in Fleckeisen's *Jahrbuch*, 1875, pp. 127 and 313). The text is everywhere perfectly legible, and is excellently represented in photographs by the marquis Ranghiasci-Brancaleone, published with Bréal's edition. *See* also R. S. Conway, *Italic Dialects*, 1897.

IHNE, WILHELM (1821–1902), German historian, was born on Feb. 2, 1821, at Fürst and was educated at Bonn. In 1843 he came to England as a private tutor, and after two years of teaching at Elberfeld (1847–49), became headmaster of a school at Liverpool. In 1863 he returned to his native country, and ten years later, was appointed professor at Heidelberg, where he died on May 22, 1902. Ihne's chief publications are: *Forschungen auf dem Gebiet der röm Verfassungsgeschichte* (1847, Eng. trans. 1853); *Plea for the Emperor Tiberius* (1856), and *Röm. Geschichte* (8 Bde., 1868–90).

IJAW, a people inhabiting the provinces of Owerri and Warri, Southern Nigeria. No tribal organization exists; hereditary chiefs in the towns have civil and religious functions, aided by councils of elders. Extended family groups live side by side. Marriage is permitted between near relations. When the bride-price is high, the wife cannot leave her husband, and children belong to the father; when it is small, divorce is possible and children belong to the mother. The brother inherits. They practise agriculture and arboriculture, are animists, have secret societies and age classes. There are slight indications of totemism.

See P. Amaury Talbot, *The Peoples of Southern Nigeria* (1926).

IJOLITE, in petrology an igneous rock composed essentially of nepheline and an alkaline pyroxene, usually aegirine-augite. The rock was originally described from Russia where it occurs in various parts of the Kola Peninsula. Typically the pyroxene is well crystallized, the nepheline allotriomorphic. Accessory minerals include melanite-garnet, titanite, apatite, cancrinite and calcite. This rock is the plutonic equivalent of the volcanic nephelinites and hypabyssal nepheline dolerites. Ijolites are also known from Norway (Fen district) and British Columbia (Ice river), but they are quite rare. The rocks known as urtite and melteigite are essentially similar assemblages. In the former nepheline largely preponderates, while melteigite is a melanocratic variant with excess pyroxene. (C. E. T.)

IKHNATON (sometimes spelt AKHENATON), the name assumed by Amenhotep IV. of Egypt.

An adequate understanding of the origins and the history of the religious revolution carried through by this earliest known idealist is impossible without some knowledge of the historical and political situation of his generation. When he came to the throne (*c.* 1375 B.C.) there were plenty of men still living whose fathers had fought in the great wars of Thutmose III., who consolidated the conquests of his ancestors and united the contiguous regions of Asia and Africa into the first stable empire in history. His genius and his far reaching victories made him the first character of universal aspects, the first world hero. Such a towering personality inevitably affected the thought of the early world. The earliest gods of Egypt had been nature-gods. As the great Pharaonic State arose, the impressive figure of the sovereign profoundly influenced religion; the forms of the State passed over into human conceptions of the gods, and the Sun-god, the greatest of them all, was conceived as a pharaoh ruling the other divinities.

When therefore the power of the Pharaohs was extended to include a world empire, this greatly expanded arena of action deeply affected Egyptian conceptions of the Sun-god's realm. In the career of Thutmose III. the idea of universal power, of a world-empire was personalized and visibly bodied forth. This first great *human* personality of world wide aspects began to affect Egyptian ideas of *divine* personality. Men began to feel the thrill of universalism, expressed, it should be observed, in terms of *political* power. Other relations with the outside world beyond the limits of the Nile valley had not clearly disengaged for the Nile-dwellers the "world idea" as we may call it. For example, a net-work of commercial connections with surrounding countries had arisen centuries earlier and had resulted in a literature of adventure in far-off countries, as illustrated by such tales as the shipwrecked sailor or the story of the wandering hero, Sinuhe; but such knowledge of distant lands had done little toward bringing the great world without into the purview of Egyptian thinking. Neither did the universal power of natural laws, everywhere visibly active in uniform operation, suggest to these early men the world idea. Many a merchant had seen a stone fall in distant Babylon precisely as it did in Egyptian Thebes, but it had not occurred to him or to any man in that far-off age, that the same natural force reigned in these widely separated countries. It was universalism expressed in terms of *imperial power* which first caught the imagination of the thinking men of the Egyptian empire, and disclosed to them the universal sweep of the Sun-god's dominion as a physical fact. In the ancient East monotheism was but imperialism in religion.

The Sun-god Aton.—As early as 1400 B.C. under the magnificent emperor, Amenhotep III., great-grandson of Thutmose III., the expanded conception of the Sun-god's power was gaining currency. In order to give this magnified Sun-god a new identity, not embarrassed by older and more limited conceptions, "Aton," an ancient name for the physical sun, was employed to designate him. When Amenhotep III. died (*c.* 1375 B.C.), his son and successor, Amenhotep IV., was closely associated with the new ideas. He assumed the office of the High Priest of Aton, with the same title, "Great Seer," as that of the high priest of the old Sun-god Re at Heliopolis. It is clear therefore, that the new movement was closely connected with the old Solar theology and probably with its organized priesthood likewise.

The new and transformed Sun-god was obviously conceived as far more than the merely material sun. It is evident that the young Pharaoh was deifying the light of the sun or its vital heat, which he found accompanying all life. Light or heat plays an important part in the new faith, similar to that which we find it assuming in the early cosmogonic philosophies of the Greeks. In harmony with this conception the god is constantly stated to be everywhere active by means of his "rays." It is perfectly certain that in an age so early in the development of natural science the king could not have had the vaguest notion of the physico-chemical aspects of his assumption that all life issued from the rays of the sun, any more than had the Greeks in dealing with a similar thought. Yet the fundamental idea is surprisingly true, and as we shall see surprisingly fruitful.

With the international arena of his empire in view the Pharaoh devised a new symbol for the new god. It depicted the sun as a disk from which diverging rays radiated downward, each ray terminating in a human hand. As suggesting a power issuing from its celestial source and putting its hand upon the world and the affairs of men, it was a masterly symbol. It broke sharply with tradition, and for that very reason it was capable of practical introduction into the many countries making up the empire; for it could be understood by a foreigner at a glance, and this was far from being the case with any of the traditional symbols of the old Egyptian religion. To indicate the imperial power of Aton, however, Amenhotep IV. did employ an Egyptian device. He now enclosed the god's full name, as already introduced by the king's father, in two royal cartouches identical with those of the Pharaoh, thus suggesting for the god an earthly dominion like that of the Pharaoh.

Conflict Between Amon and Aton.—The king's zeal for the new cult was evident from the beginning. To Thebes, the imperial capital, he gave the new name, "City of the Brightness of Aton," its temple quarter was called, "Brightness of Aton

the Great," while the new Aton sanctuary itself was designated as "Gem-Aton," a term of unknown meaning. The priesthood of Amon who had long been the State god at Thebes, was a rich and influential body, and the high priest of Amon was head of a national sacerdotal organization including all the priesthoods of the country. Politically this Amonite priesthood had gained great power. A bitter conflict thus broke out, at first probably, chiefly between Amon and the intruder Aton, but eventually also between Aton and the older gods. The struggle eventually rendered Thebes intolerable to the young revolutionary. He broke with all the old priesthoods and began a drastic persecution to make Aton the sole god of the empire, not merely in the king's own thought, but in very fact. As far as their visible and external manifestations were concerned, this extermination of the old gods could be and was accomplished. Even the word "gods," the plural of the common noun "god," was carefully expunged from the monuments. In the tomb of Ramose, his father's old prime minister, a tomb still surviving in the Theban cemetery, Amenhotep IV.'s emissaries hewed out the word "gods" no less than nine times, clearly indicating their intentions, notwithstanding three untouched occurrences of the word which escaped their notice and which we still find in out-of-the-way corners of this marvellously sculptured tomb.

The persecution of Amon was especially severe and to-day the splendid monuments of Thebes are still dotted with unsightly holes where the hated god's name once stood. The young iconoclast was even involved in the expungement of his own father's name, Amenhotep, for it contained the name of the hostile god. Living as he probably was, in his father's splendid Theban palace, the wreckage of which is still visible, he finally brought himself to disfigure its sumptuous wall and ceiling decorations with unsightly blemishes where he blotted out his own father's name. With regard to his own name he was himself in the same embarrassing predicament, bearing as he also did, the illustrious throne name "Amenhotep," meaning "He in whom Amon is content." The king therefore cast off his old name, with all its traditional associations of power and splendor, and chose another of similar significance, "Ikhnaton," which means "Aton is satisfied," or "He in whom Aton is satisfied."

The New Capital, Akhetaton.—It is evident that this terrible revolution, violating all that was dearest and most sacred in Egyptian life and traditions, must have been a devastating experience for the young sovereign. Thebes became an impossible place of residence. His father's palace was disfigured by his own hand and the towering pylons and obelisks of Karnak and Luxor were a continual reminder of all that his fathers had contributed to the glory of Amon and the old gods. He therefore determined to forsake the capital and imperial residence of his ancestors. In each of the three great divisions of the empire, Egypt, Nubia and Asia, he built a city consecrated to Aton, and in the Egyptian Aton city he took up his own residence. He chose as its site a spacious bay in the Nile cliffs about 160 m. above the Delta and nearly 300 m. below Thebes. He called it "Akhetaton," which means "Horizon of Aton" and it is known in modern times as Tell el-Amarna. The city thus established was designated as the real capital of the empire. In the sixth year of his reign and shortly after he had changed his name, we find the young king living in his new residence.

The evidence indicates that all that was devised and done in the new city and in the development and propagation of the Aton faith, was the work of the king himself. Everything bears the stamp of his individuality. The men about him must have been irresistibly swayed by his unbending will, for he was evidently not one to stop half way. But Ikhnaton understood enough of the old policy of the Pharaohs to know that he must hold his party by tangible rewards, and his leading followers enjoyed liberal bounty at his hands. Thus one of his priests of Aton and at the same time his master of the royal horse, named Eye, who had by good fortune happened to marry the childhood nurse of the king, states in his tomb inscriptions: "He doubles to me my favours in silver and gold." The commander of Ikhnaton's army likewise says: "He hath doubled to me my favours like the numbers of the sand. I am the head of the officials, at the head of the people; my lord has advanced me because I have carried out his teaching, and I hear his word without ceasing. My eyes behold thy beauty every day, O my lord, wise like Aton, satisfied with truth. How prosperous is he who hears thy teaching of life!" Although there probably was a nucleus of men who really appreciated the ideal aspects of the king's teaching, such inscriptions make it evident that many were not uninfluenced by "the loaves and the fishes."

A beautiful cliff-tomb hewn in the eastern cliffs by royal craftsmen at the king's command was the Pharaoh's most welcome demonstration of favour to each one of his followers. The walls of such a tomb chapel bore fresh and natural pictures from the life of the people in Akhetaton, the new capital, particularly incidents in the life of the dead man, and preferably his intercourse with the king. Thus the city of Akhetaton is now better known to us from its cemetery than from its ruins.

Throughout these tombs, both in relief and inscription, the nobles take delight in reiterating the intimate relation between Aton and the king. Over and over again they show the king and the queen standing together under the disk of Aton, whose enveloping rays terminating in hands, descend and embrace the king's figure. The nobles constantly pray to the god for the king, saying that he "came forth from thy rays," or "thou hast formed him out of thine own rays"; and interspersed through their prayers were numerous current phrases of the Aton faith, which had now become conventional, replacing those of the old orthodox religion which it must have been very awkward for them to cease using. On State occasions instead of the old stock phrases, with innumerable references to the traditional gods, every noble who would enjoy the king's favour was evidently obliged to display his familiarity with the Aton faith by a liberal use of these new allusions. The source of such phrases was really the king himself, and something of the "teaching" whence they were taken, so often attributed to him, is preserved in these "Amarna tombs," as we now commonly call them.

Hymn to Aton.—Among the fragments of the Aton faith which have survived in these tombs are two hymns to Aton, the longer and finer of which is worthy of being known in modern literature. It was probably written by the king himself. In the following translation the effort has been chiefly to furnish an accurate rendering. The headings of the strophes are insertions by the present writer, intended to make clear the arrangement of the subject matter, especially striking because it is identical with that in Psalm civ. of the Old Testament, which is many centuries later.

NIGHT

When thou settest in the western horizon of the sky,
The earth is in darkness like the dead;
They sleep in their chambers,
Their heads are wrapped up,
Their nostrils are stopped,
And none seeth the other,
While all their things are stolen,
Which are under their heads,
And they know it not.
Every lion cometh forth from his den,
All serpents, they sting.
Darkness . . .
The world is in silence,
He that made them resteth in his horizon.

DAY AND MAN

Bright is the earth when thou risest in the horizon.
When thou shinest as Aton by day
Thou drivest away the darkness.
When thou sendest forth thy rays,
The Two Lands (Egypt) are in daily festivity,
Awake and standing upon their feet
When thou hast raised them up.
Their limbs bathed, they take their clothing,
Their arms uplifted in adoration to thy dawning
(Then) in all the world they do their work.

DAY AND THE ANIMALS AND PLANTS

All cattle rest upon their pasturage,
The trees and the plants flourish,
The birds flutter in their marshes,

Their wings uplifted in adoration to thee.
All the sheep dance upon their feet,
All winged things fly,
They live when thou hast shone upon them.

DAY AND THE WATERS

The barques sail up-stream and down-stream alike.
Every highway is open because thou dawnest.
The fish in the river leap up before thee.
Thy rays are in the midst of the great green sea.

CREATION OF MAN

Creator of the germ in woman,
Maker of seed in man,
Giving life to the son in the body of his mother,
Soothing him that he may not weep,
Nurse (even) in the womb,
Giver of breath to animate every one that he maketh!
When he cometh forth from the womb . . . on the day of his birth,
Thou openest his mouth in speech,
Thou suppliest his necessities.

CREATION OF ANIMALS

When the fledgling in the egg chirps in the shell
Thou givest him breath therein to preserve him alive.
When thou hast brought him together (?)
To (the point of) bursting it in the egg,
He cometh forth from the egg
To chirp with all his might (?).
He goeth about upon his two feet
When he hath come forth therefrom.

THE WHOLE CREATION

How manifold are thy works!
They are hidden from before (us),
O sole God, whose powers no other possesseth.
Thou didst create the earth according to thy heart
While thou wast alone:
Men, all cattle, large and small,
All that are upon the earth,
That go about upon their feet;
(All) that are on high,
That fly with their wings.
The foreign countries, Syria and Kush,
The land of Egypt,
Thou settest every man into his place,
Thou suppliest their necessities.
Every one has his possessions,
And his days are reckoned.
The tongues are divers in speech,
Their forms likewise and their skins are distinguished.
(For) thou makest different the strangers.

We may conjecture that this hymn, partially reproduced above, was a fragment from the ritual of Aton as it was celebrated from day to day in the Aton temple at Amarna. Unhappily it was copied in but one tomb; in the others we have a miscellany of current quotations and stock phrases which made up the knowledge of the new faith as it had been apprehended by the scribes and painters who decorated these tombs. It is our misfortune that the fragments of the Aton faith, which have survived to us in the Amarna cemetery, our chief source, have thus filtered mechanically through the indifferent hands and the starved and listless minds of a few petty bureaucrats on the outskirts of a great religious and intellectual movement.

The New Universalism.—Nevertheless in this great hymn the new universalism of the empire finds full expression and the royal singer sweeps his eye from the far-off cataracts of the Nubian Nile to the remotest lands of Syria. He was looking beyond the nationalism which had prevailed for over 2,000 years, and he was consciously endeavouring to displace it by a world religion. Irrespective of race or nationality, he bases the universal sway of God upon his fatherly care of all men alike. He calls Aton "the father and the mother of all that he has made," and the hymn which we have just quoted above is very explicit in its insistence that Aton's fatherly care of all men entirely disregards diversity of speech or difference in colour. To the proud and exclusive Egyptian he points to the all-embracing bounty of the common father of humanity, even placing Syria and Nubia before Egypt as he catalogues the divisions of his empire.

Ikhnaton had gained the conception of a world-lord in two aspects: first, as the creator of the natural world; and second, as a benevolent father actively concerned for the daily maintenance of all his creatures, even the meanest. His hymns are the earliest known expression of deep emotion in the recognition of divine goodness and benevolence. Mingled with it is an almost ecstatic rapture in the thought of the all-enveloping light in which he saw revealed both the beauty and the goodness of the natural order. It reminds us of Him who bade us "consider the lilies." The picture of the lily-grown marshes, where, as another hymn tells us, the flowers are "drunken" in the intoxicating radiance of Aton, where the birds unfold their wings and lift them "in adoration of the living Aton," where the cattle dance with delight in the sunshine, and the fish in the river beyond leap up to greet the light, the universal light whose beams are even "in the midst of the great green sea"—all this discloses a discernment of the presence of God in nature, and an appreciation of the revelation of God in the visible world such as we find centuries later in the Hebrew psalms, and especially in our own poets since Wordsworth.

While the creative power and the benevolence of his god were very explicitly affirmed by Ikhnaton, our sources do not show us that he had risen from a discernment of the beneficence to a conception of the righteousness in the character of God, nor of his demand for this in the character of men. Nevertheless, there is in Ikhnaton's "teaching," as it is thus fragmentarily preserved in the hymns and tomb-inscriptions of his nobles, a constant emphasis upon "truth" such as is not found before nor since. The king always attached to his name the extraordinary phrase "living in truth," and that this phrase was not meaningless is evident as we discern the character of his daily life.

To him "living in truth" meant sincere acceptance of the daily facts of living in a simple and unconventional manner never before seen in the life of a sovereign and quite impossible of harmonization with the outward pomp and splendour of an oriental emperor. For him what *was* was right, and its propriety was evident by its very existence. Even in public he divested his daily round of those outward and formal observances which his royal ancestors had observed for 2,000 years. Thus, his family life was open and unconcealed before the people, even in intimate manifestations of family affection. He took the greatest delight in his children and appeared with them and the queen their mother on all possible occasions as if he had been but the humblest scribe in the Aton-temple. He had himself depicted on the monuments while enjoying the most familiar and unaffected intercourse with his family, and when he drove in his chariot to the temple to carry on its formal service, the queen and the daughters she had borne him likewise drove thither through the acclaiming multitudes and shared with the king the temple service. All that was natural was to him true, and he never failed practically to exemplify this belief, however radically he was obliged to disregard tradition.

Effect of the Revolution on Art.—These revolutionary changes in religion and in the position and character of the head of the State were not confined to theology, statecraft or palace proprieties. They unavoidably affected also the art of the time, and it was the intention of Ikhnaton to modify art in accordance with his regard for "truth." His chief sculptor, Bek, appended to his title the words, "whom his majesty himself taught." It is evident that the artists of Ikhnaton's court were taught by him to make the chisel and the brush tell the story of what they actually saw. The result was a simple and beautiful realism that saw more clearly than any art had ever seen before. They caught the instantaneous postures of animal life; the coursing hound, the fleeing game, the wild bull leaping in the marsh; for all these belonged to the "truth" in which Ikhnaton lived. The exalted divinity which for untold centuries had invested the Pharaoh's person with inviolable sacredness was stripped away without hesitation. Ikhnaton's artists represented him as they saw him, in attitudes of parental affection as he fondled his little daughters, or even as the object of the wifely solicitude of his queen as she stands in his presence in affectionate concern for his needs. Such is the lovely scene on the back of the famous palace chair, preserved to us in the tomb of Tutankhamun. For the first time in

the history of art the subject of a great composition was a human relationship, and to depict it the artists of the day shook off the shackles of immemorial tradition. The monuments of Egypt and even the furniture and equipment of daily life bore what they had never borne before, a Pharaoh depicted in the natural and unaffected relations of life, and completely liberated from the rigid and conventional posture demanded by both the traditions of court propriety and by the venerable teachings of the State theology regarding the divinity of the sovereign. It is in this extraordinary art, which we commonly call the "Amarna school" or "Amarna art," that the revolution of Ikhnaton is most clearly disclosed as the earliest known age of spiritual emancipation.

Loss of the Empire.—A man wholly absorbed in a revolution like this found little time or inclination to devote any attention to the critical state of the empire. For three generations the royal house of Egypt had stood in close relations to the kings of Western Asia, and especially the kings of Mitanni on the Upper Euphrates had given their daughters in marriage to the Pharaoh. Supported by such alliances Ikhnaton failed to appreciate the gravity of the new movements which were transforming the political situation in Western Asia. In the north the expanding power of the Hittites gradually absorbed all the Pharaoh's vassal States in Syria; while in the south, *i.e.*, in Palestine, the incoming mercenary bands of nomads were steadily taking possession of Palestine, which the Pharaohs had held for centuries. It was this movement of nomadic hordes from the desert toward a settled life in the Palestinian towns, which carried the Hebrews into Palestine. At Akhetaton, the new and beautiful home of the Aton faith, the temple of Aton resounded with hymns to the new god of the empire, while the empire itself was no more.

The storm which had thus broken over Ikhnaton's Asiatic empire was not more disastrous than that which threatened him in Egypt; but there was no faltering in his steadfast policy. At his command temples of Aton had arisen all over a land which was now convulsed with revolution. Some years after Ikhnaton had disappeared, his son-in-law, Tutankhamun, left the following description of the hopeless situation of Egypt both at home and abroad: "The temples of the gods and goddesses were [desolated] from Elephantine [First Cataract] as far the marshes of the delta. . . . Their holy places were forsaken and had become overgrown tracts . . ., their sanctuaries were like that which has never been, and their houses were trodden roads. The land was in an evil pass, and as for the gods, they had forsaken this land. If people were sent to Syria to extend the borders of Egypt, they prospered not at all; if men prayed to a god for succour, he came not; . . . if men besought a goddess likewise, she came not at all."

Opposition to the New Religion.—Ikhnaton had endeavoured to exterminate some of the most cherished beliefs of the people, especially those regarding the hereafter. Throughout the entire cemetery of his new capital not a single tomb contains the name of Osiris, upon whom every Egyptian, following the faith and practice of his ancestors, expected to depend for protection and guidance through the terrible fears and dangers that beset the dead in the world beyond the grave. This attempted banishment of Osiris must have aroused the fiercest opposition among the people. Eighteen hundred years after Ikhnaton's revolution, the Christian emperor, Theodosius, endeavoured to banish from Egypt the old pagan gods of the people, in an effort to introduce exclusively the God of the Christians. Long after the death of Theodosius the old gods of Egypt continued nevertheless to be worshiped by the people of Upper Egypt. What the power of the Roman emperor failed to accomplish could not of course be attained under much less favourable circumstances by Ikhnaton. The Aton-faith remained but the cherished theory of the idealist Ikhnaton and a little court circle surrounding his person; it never really became the religion of the people.

To the secret resentment and opposition of the people we must also add the dangerous activities of the dispossessed priesthoods, especially the politically powerful former priests of Amon, the old State god. Even more dangerous was the disaffection and discontent among the leaders of the army as they beheld the Egyptian empire in Asia falling to pieces for lack of effective military intervention. One of these leaders indeed, an officer named Haremhab who had long been a favoured partisan of Ikhnaton, not only contrived to win the support of the military class, but also gained the favor of the priests of Amon, who were of course looking for just such a man. Thus both the people and the priestly and military groups alike were united in plans for the overthrow of the hated dreamer in the palace of the Pharaohs, of whose thoughts they understood so little, and who incensed them with the teaching that both the Asiatics and the Egyptians were all children of the same kindly Father. In this dangerous situation, having no son to succeed him, he gave his eldest daughter in marriage to one of his favourites, and needing support, appointed his son-in-law as co-regent with himself. His position seems to have been complicated by family troubles in these closing days, and we find the name of his queen expunged from some of the family monuments at Amarna. He survived but a short time after arranging the co-regency and about 1368 B.C., in the 17th year of his reign, when he was probably not yet 30 years of age, he passed away.

It must be admitted that Ikhnaton pursued his aims with fatuous blindness and feverish fanaticism regardless of the destructive costs. There is something hectic and abnormal in this extraordinary man, suggesting a mind which may even have been diseased. Some question has been raised regarding the identity of the body found in his coffin; but it should be noted that the skull found with this body is one of the largest human crania ever found. However much we may censure him for the loss of his empire, however much we may condemn the fanaticism with which he pursued his aim, it must be recognized that there died with him a spirit such as the world had never seen before—a brave soul, undauntedly facing and opposing the momentum of century long tradition, in which it had never occurred to any mind before his to do anything but thoughtlessly acquiesce. He was the first of the long line of revolters against tradition and thoughtless acceptance of the past. He stepped out of the long line of conventionally colourless Pharaohs that he might disseminate ideas far beyond and above the capacity of his age to understand. Among the Hebrews, seven or eight hundred years later, we look for such men. We must look back upon him to-day not only as the world's first idealist and the world's first *individual*, but also as the earliest monotheist and the first prophet of internationalism—the most remarkable figure of the Ancient World before the Hebrews.

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IKI, an island belonging to Japan, lying off the north-western coast of Kyushu, in 33° 45′ N. lat. and 129° 40′ E. long. It has a circumference of 86 m., an area of 51 sq.m., and a population of *c.* 50,000. The island is, for the most part, a tableland about 500 ft. above sea-level. The anchorage is at Gonoura, on the south-west. A part of Kublai Khan's Mongols landed at Iki when about to invade Japan in the 13th century, for it lies in the direct route from Korea to Japan via Tsashima.

ILAGAN, a municipality (with administration centre and 57 *barrios* or districts), and capital of the province of Isabela, Luzon, Philippine Islands, on an elevated site at the confluence of the Abuluan and Cagayan rivers, about 200 m. N.N.E. of Manila. It was formerly included in the province of Nueva Ecija. Pop. (1918), 23,279. The surrounding country is the largest tobacco-growing region in the Philippines. Considerable corn is also raised. In 1918, it had 7 manufacturing establishments with output valued at 44,900 pesos. Of the 21 schools, 19 were public. The language spoken is Ibanag.

ILCHESTER, market town, Somersetshire, England, in the valley of the river Ivel or Yeo, 5 m. N.W. of Yeovil. Pop. (1921) 449. Ilchester (*Cair Pensavelcoit, Ischalis, Ivelcestre, Yevelchester*) was a fortified British settlement, and later a military station of the Romans, on the Fosse Way. Its importance continued in Saxon times, and in 1086 it was a royal borough with 107 burgesses. In 1180 a gild merchant was established, and the county gaol was completed in 1188. Henry II. granted a charter, confirmed by John in 1203, which gave Ilchester the same liberties as Winchester, and its bailiffs are mentioned before 1230. The borough was incorporated in 1556. Ilchester was the centre of the county administration from the reign of Edward III. until the 19th century, when the change from road to rail travelling completed the decay of the town, and the corporation was abolished in 1886. Parliamentary representation began in 1298, and the town continued to return two members until 1832. The Wednesday market dates from before the Conquest. It possesses almshouses founded in 1426 and an ancient mace of the former corporation.

ÎLE-DE-FRANCE, an old district of France, forming a kind of an island, bounded by the Seine, the Marne, the Beuvronne, the Thève and the Oise. In this sense the name is not found in written documents before 1429; but in the second half of the 15th century it designated a wide military province of government, bounded on the north by Picardy, on the west by Normandy, on the south by Orléanais and Nivernais, and on the east by Champagne. Its capital was Paris. From the territory of Île-de-France, were formed under the Revolution the department of the Seine, together with the greater part of the Seine-et-Oise, Seine-et-Marne, Oise and Aisne, and a small part of Loiret and Nièvre. (The term Île-de-France is also used for Mauritius, *q.v.*)

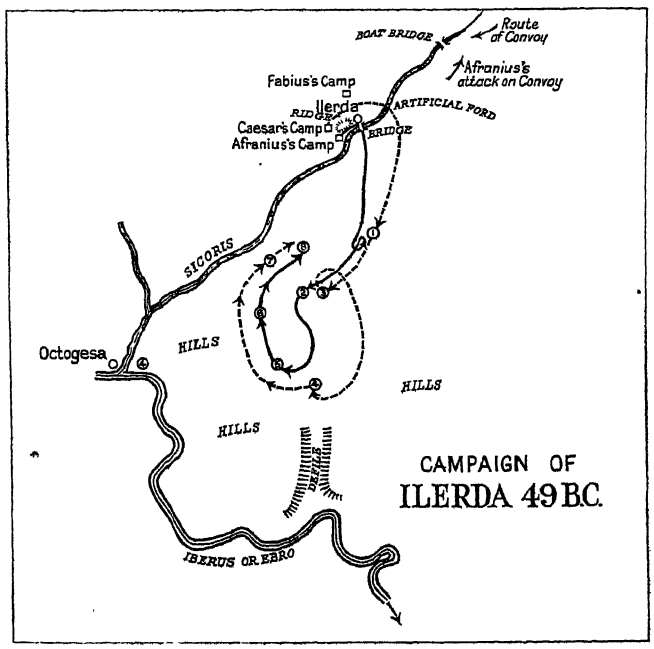
See A. Longnon, "L'Île-de-France, son origine, ses limites, ses gouverneurs," in the *Mémoires de la Société de l'histoire de Paris et de l'Île-de-France,* vol. i. (1875).

ILERDA, CAMPAIGN OF (49 B.C.). On Dec. 17 Julius Caesar, the leader of the democratic party in the Second Civil War, crossed the Rubicon and in sixty days was master of Italy. As he failed however to shut Pompey up in Brundisium, this general sailed for Dyrrachium. The problem which now confronted Caesar was a complex one. He was without a fleet, and though the aristocratic party was no longer in the ascendant, Italy was still at Pompey's mercy because he could cut her off from her grain supplies in Egypt, Sicily and Sardinia. In Greece Pompey's resources were great both in men and money, and that he would there increase the strength of his already powerful army was certain. In Spain he still possessed seven legions who threatened Gaul, and might be brought to Italy. Caesar determined to strike at weakness rather than at strength. Abandoning any idea of moving through Illyria against Pompey, and trusting that the dilatory nature of his antagonist would enable him to gain time, on March 9, 49 B.C., he left Rome for Massilia with the intention of disposing of Pompey's legions in Spain before he turned on Pompey himself.

Pompey's generals in Spain were Afranius and Petreius, their total forces numbering some 70,000 men, to which Caesar could oppose but 40,000, including three legions under Fabius which he forthwith sent from Narbo across the Pyrenees. At Ilerda on the river Sicoris which flows into the Ebro, Fabius found Afranius strongly encamped, and entrenched himself within three miles of him. Shortly after, Caesar arriving, active operations were at once begun by moving the camp close up to the enemy's so as to restrict the movement of his foragers. In order to cut Afranius off from the bridge at Ilerda, Caesar attempted to occupy a ridge which lay between the camps, but the XIV. legion was driven back. Counter-attacking with the IX. legion he drove a large party of the enemy into Ilerda and then tried to assault this city by forcing his way up a ravine; here he nearly met with a disaster, and had much difficulty in extricating himself.

Two days after this battle, which reflected no great credit on Caesar, his bridges over the Sicoris were swept away by a flood, and his communications with Gaul severed; worse still, his convoys could no longer reach him. Learning that he was expecting a large convoy, Afranius crossed the bridge at Ilerda with three legions and all his cavalry and attacked it. The attack, however, failed, and Caesar building a boat bridge 22 miles north of his camp enabled his convoy to cross, and his cavalry to attack Afranius's foragers.

In order further to restrict his enemy, by running the river into a number of artificial channels he created a ford near his camp



PLAN OF CAMPAIGN AT ILERDA, 49 B.C., WHERE JULIUS CAESAR FORCED HIS ENEMY TO RETIRE WITHOUT GIVING BATTLE

which forced the Pompeians to transport two legions over the Sicoris to protect their communications, and then, on June 23, still holding the bridge they crossed their whole army over to the left bank, and set out towards the Ebro. Caesar having now dislodged his enemy, his next step was not to defeat him but to force him to surrender. Not only would this save him casualties but augment his army, as all prisoners would be incorporated in it. He wished to gain his object by manoeuvring rather than by fighting. Sending his Gallic cavalry over the ford, these nimble horsemen greatly impeded the enemy's march, and gained time for Caesar to cross his infantry. The manoeuvres now carried out were remarkable, and are shown on the plan. (1) Caesar rapidly followed Afranius and forced him to form front; (2) Afranius retired skirmishing, Caesar following; (3) Afranius decided to retire on Octogesa, Caesar pretending to withdraw, and Afranius made towards the defile; (4) Caesar counter-marched and cut him off from the defile; (5) Afranius reverted to retirement on Octogesa; Afranius was now strategically beaten, and Caesar could have annihilated him but refused to do so; (6) Afranius made for the Sicoris to obtain water; (7) Caesar headed him off; (8) Afranius attempted to regain Ilerda, but was forced to surrender on July 2. The result of these masterly and bloodless manoeuvres were, that not only did Pompey lose Spain but also his oldest and best legions, and simultaneously Caesar at little loss added immensely to his own strength. Of their kind the manoeuvres of Ilerda have seldom been rivalled and never surpassed. *See* PHARSALUS. (J. F. C. F.)

ILETSK, a settlement in the province of Orenburg in the R.S.F.S.R., in 51° 10′ N. and 55° E., 48 m. S. of the town of Orenburg by the railway to Tashkent, near the Ilek river, a tributary of the Ural. Pop. (1926) 11,058. Rock-salt is worked here to the extent of about 100,000 tons annually. The place is resorted to for its salt, mud and brine baths, and its *koumiss* cures.

ILFELD, a town in the Prussian province of Hanover, at the south foot of the Harz, at the entrance to the Bährethal, 8 m. N. from Nordhausen by the rail to Wernigerode. Pop. 1,925. Ilfeld, as a town, dates from the 14th century, when it sprang

up round a Benedictine monastery. It manufactures parquet-flooring, paper and plaster of Paris, and has coal mines.

ILFORD (GREAT ILFORD), an urban district of Essex, England, on the Roding, 7 m. E.N.E. of London by rail. Pop. (1901) 41,234; (1921) 85,194. A portion of Hainault Forest lies within the parish. The hospital of St. Mary and St. Thomas, founded in the 12th century as a leper hospital, now contains almshouses and a chapel. Claybury Hall is a mental hospital (1893) of the London County Council. There are large photographic material works and paper-mills. LITTLE ILFORD is a parish on the opposite (west) side of the Roding. The church of St. Mary retains Norman portions.

ILFRACOMBE, a watering-place of Devonshire, England, on the Bristol channel, 225 m. W. by S. of London by rail. Pop. of urban district (1926) 11,772. In the late 13th century it obtained a grant for holding a fair and market, and in the reign of Edward III. it supplied six ships and 96 men for the expedition against Calais. During the Civil War, it was in 1644 captured by the Royalists, but in 1646 it fell into the hands of Fairfax. The old town is built on the cliffs above the harbour. Behind it rise the terraces of a more modern town. Wooded heights form a semi-circle round the town, which is protected from sea winds by Capstone hill. The restored church of Holy Trinity dates originally from the 12th century.

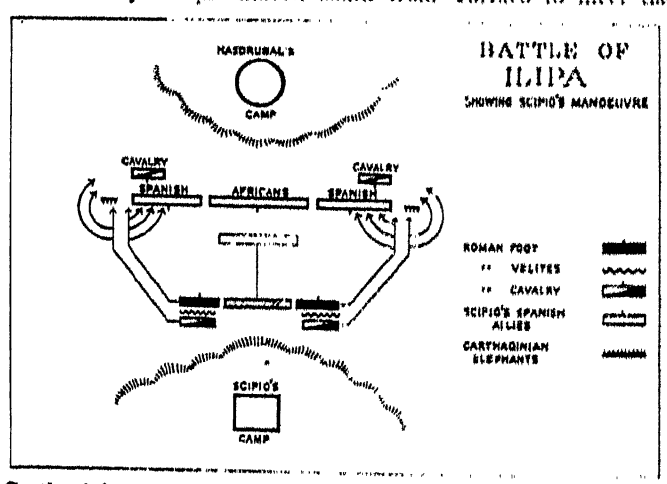
ILG, PAUL (1875–), Swiss poet and dramatist, was born at Salenstein (Thurgau) on March 14, 1875. He was engaged in business down to 1899, since when he has been an author and editor. Among his chief novels are *Der Lebensdrang* (1906), *Der Landstörtzer* (1909), *Das Menschlein Matthias* (1913), *Der Starke Mann* (1916) and *Probus* (1922). He has also written the dramas *Der Führer* (1919), *Der Mann Gottes* (1924), *Der Kampf mit dem Drachen* (1927) and *Ga Llama* (1928). Ilg belongs to the realistic school, and his writing is strong and direct.

ILHAVO, a Portuguese seaport on the lagoon of Aveiro (*q.v.*). Pop. (1920) 12,691. Ilhavo is inhabited chiefly by fishermen, but has a celebrated manufactory of glass and porcelain, the Vista-Alegre, at which the art of glass-cutting has reached a high degree of perfection. Salt is largely exported. Ilhavo is celebrated for the beauty of its women.

ILI, a river of Central Asia, flowing for the greater part of its course through the Kazakstan A.S.S.R. The head-stream, called the Tekez, rises at an altitude of 11,600 ft. east of Lake Issyk-kul in 82° 25′ E. and 43° 23′ N., on the west slopes of mount Kash-katur. At first it flows eastward and north-eastward, until, after emerging from the mountains, it meets the Kungez, and then, assuming the name of Ili, it turns westwards and flows between the Temurlik-tau and Trans-Ili or Kungei Ala-tau mountains on the south and the Borokhoro and Talki ranges on the north for about 300 m. to Iliysk. The valley between 79° 30′ and 82° E. is 50 m. wide, and the portion above the town of Kulja (Old Kulja) in east Turkistan is fertile and populous, Taranchi villages following each other in rapid succession, and the pastures being well stocked with sheep, cattle and horses. At Iliysk the river turns north-west, and after traversing a region of desert and marsh falls by at least seven mouths into the Balkash lake, the first bifurcation of the delta taking place about 115 m. up the river. But it is only the southern arm of the delta that permanently carries water. The total length of the river is over 900 m. From Old Kulja to New Kulja the Ili is navigable for at most only two and a half months in the year, and even then considerable difficulty is occasioned by the shoals and sandbanks. From New Kulja to Iliysk (280 m.) navigation is easy when the water is high, and practicable even at its lowest for small boats. At Iliysk there is a ferry on the road from Kopal to Alma-Ata (Vyernyi). The principal tributaries of the Ili are the Kash, Chilik and Charyn. Many streams flow towards it from the mountains on both sides, but most of them are used up by the irrigation canals and never reach their goal. The wealth of coal in the valley is said to be great, and when the Chinese owned the country they worked gold and silver with profit. Fort Ili or Iliysk, a modern Russian establishment, must not be confounded with Ili, the old capital of the Chinese province of the same name. The latter, otherwise known as Hoi-yuan-chen, New Kulja (Gulja), or Manchu Kulja, was formerly a city of 70,000 inhabitants, but now lies completely deserted. Old Kulja, Tatar Kulja or Nin-yuan, is now the principal town of the district. The Chinese district of Ili formerly included the whole of the valley of the Ili river as far as Issyk-kul, but now only its upper part. It belongs administratively to the province of Sinkiang or East Turkistan. (*See* KULJA.)

ILION, a village of Herkimer county, N.Y., U.S.A.; 1 m. S.E. of Utica, on the Mohawk river and the State Barge canal. It is served by the New York Central and the West Shore railways. The population in 1925 was 10,426. It has notable manufactures, including the Remington typewriters, cash registers and firearms, as well as office furniture. The factories employ over 5,000 persons and their annual output is valued at nearly $28,000,000. As early as 1816 a store was established here, but permanent settlement began on the completion of the Erie canal in 1825. The village was known by several different names in its earlier years. It was incorporated in 1852. In 1828 Eliphalet Remington (1793–1861) established a small factory for making firearms. He invented, and with the assistance of his sons (Philo, Samuel, and Eliphalet) improved the famous Remington rifle, which was used in great quantities by the U.S. army and adopted by several foreign governments. In 1856 the company began making farm tools, in 1870 sewing-machines, and in 1874 typewriters.

ILIPA, BATTLE OF, 206 B.C. This was the culminating battle of the campaigns by which Publius Cornelius Scipio (*q.v.*), afterwards named Africanus, overthrew the Carthaginian power in Spain, and thereby paved the way for his subsequent campaign in Africa which ended in the defeat of Hannibal at Zama (*q.v.*) and the capitulation of Carthage. In military history Ilipa ranks with Gaugamela and Cannae as one of the supreme tactical masterpieces in the military history of the ancient world, and indeed outshines any as an example of a victory ensured by the dislocation of thought and will produced in the mind of one commander by the other before even the fighting troops came into contact. After suffering a series of defeats since Scipio's opening seizure of Cartagena (*q.v.*) in the spring of 209 B.C. the Carthaginians made their last great effort. Hasdrubal Gisco, encouraged by Mago, Hannibal's brother, raised and armed fresh levies, and with an army of 70,000 foot, 4,000 horse and 32 elephants marched north to Ilipa (or Silpia), which was not far from where Seville stands to-day. Scipio moved south from Tarraco to meet the



Carthaginians, collecting auxiliaries on his way. Advancing to the neighbourhood of Ilipa with a total force, Romans and allies, of 45,000 foot and 3,000 horse, he came in sight of the Carthaginians, and encamped on certain low hills opposite them. It deserves notice that his advance was on a line which, in the event of victory, would cut them off from the nearest road to Gades, this road running along the south bank of the Baetis River.

The two camps lay facing each other across the valley between the two low ridges. For several successive days Hasdrubal led his army out and offered battle. On each occasion Scipio waited

until the Carthaginians were moving out before he followed suit. Neither side, however, began the attack, and towards sundown the two armies, weary of standing, retired to their camps—the Carthaginians always first. One cannot doubt, in view of the upshot, that on Scipio's side the delay had a special motive. On each occasion also the legions were placed in the Roman centre opposite to the Carthaginian and African regulars, with the Spanish allies on the wings of each army. It became common talk in the camp that this order of battle was definite, and Scipio waited until this belief had taken firm hold.

Then he acted. He had observed that the Carthaginians made their daily advance at a late hour, and had himself purposely waited still later, to fix this habit on his opponent's mind. Late in the evening he sent orders through the camp that the troops should be fed and armed before daylight, and the cavalry have their horses saddled. Then, while it was scarcely yet daylight, he sent on the cavalry and light troops to attack the enemy's outposts, and himself followed with the legions. This was the first surprise change, and its effect was that the Carthaginians, caught napping by the onset of the Roman cavalry and light troops, had to arm themselves and sally forth without a meal. It further ensured that Hasdrubal would have no time to alter his normal disposition even should the idea occur to him; for the second surprise change was that Scipio reversed his former order of battle, and placed the Spanish in his centre and the legions on the wings. The Roman infantry made no attempt to advance for some hours, the reason being Scipio's desire and design to let his hungry opponents feel the effects of their lost breakfast. There was no risk to his other surprise change by so doing, for once drawn up in order of battle, the Carthaginians dared not alter their array in face of a watchful and ready opponent.

It was about the seventh hour when he ordered the line to advance, but the Spanish centre only at a slow pace. On arriving within 800 yards of the enemy, he himself, leading the right wing, wheeled to the right, and made an oblique advance outwards. The left wing executed a similar movement. Advancing rapidly, so that the slow-moving centre was well refused, the Roman infantry cohorts wheeled successively into line as they neared the enemy's line, and fell directly on the enemy's flanks, which but for this manoeuvre would have overlapped them. While the heavy infantry thus pressed the enemy's wings in front, the cavalry and light infantry, under orders, wheeled outwards again, and, sweeping round the enemy's flanks, took them in enfilade. This convergent blow on each wing, sufficiently dislocating because it forced the defenders to face attack from two directions simultaneously, was made more decisive in that it fell on the Spanish irregulars. To add to Hasdrubal's troubles, the cavalry flank attacks drove his elephants, mad with fright, in upon the Carthaginian centre, spreading confusion. All this time the Carthaginian centre was standing helplessly inactive, unable to help the wings for fear of attack by Scipio's Spaniards, who threatened it without coming to close quarters. Scipio's calculation had enabled him to "fix" the enemy's centre with a minimum expenditure of force, and thus to concentrate the maximum for his decisive double manoeuvre.

Hasdrubal's wings destroyed, the centre, worn out by hunger and fatigue, fell back, at first in good order; but gradually under relentless pressure they broke up and fled to their entrenched camp. A drenching downpour, churning the ground in mud under the soldiers' feet, gave them a temporary respite and prevented the Romans storming the camp on their heels. During the night Hasdrubal evacuated his camp, but as Scipio's strategic advance had placed the Romans across the line of retreat to Gades, Hasdrubal was forced to retire down the western bank towards the Atlantic. Nearly all his Spanish allies deserted him.

Scipio's light troops were evidently alive to the duty of maintaining contact with the enemy, for he got word from them as soon as it was light of Hasdrubal's departure. He at once followed them up, sending the cavalry ahead, and so rapid was the pursuit that, despite being misled by guides in attempting a short-cut to get across Hasdrubal's new line of retreat, the cavalry and light infantry caught him up. Harassing him continuously, by attacks in flank or in rear, they forced such frequent halts that the legions were able to come up. "After this it was no longer a fight, but a butchering as of cattle," till only Hasdrubal and 6,000 half-armed men escaped to the neighbouring hills, out of 70,000 odd who had fought at Ilipa.

Military history contains no more classic example of generalship than this battle of Ilipa. Frederick's "oblique order" appears immature beside Scipio's double oblique manoeuvre and envelopment, which effected a crushing concentration of strength against weakness while the enemy's centre was surely "fixed." Scipio left the enemy no chance for the change of front which cost Frederick so dear at Kolin. Masterly as were his battle tactics, still more remarkable perhaps were the decisiveness and rapidity of their exploitation, which had hardly an equal in military history until Napoleon came to develop the pursuit as the vital complement of battle and one of the supreme tests of generalship. (B. H. L. H.)

ILKESTON, market town, municipal borough, Ilkeston parliamentary division, Derbyshire, England, 9 m. north-east of Derby on the L.M.S. and L.N.E. railways. Pop. (1921) 32,266. It is situated on a hill commanding fine views of the Erewash valley. The church of St. Mary is Norman and Early English, and has a fine chancel screen (13th century). The manufactures are principally hosiery, lace and various kinds of stoneware; coal and iron are wrought in the neighbourhood. An alkaline mineral spring was discovered in 1830. The town is mentioned in Domesday, obtained a grant for a market and fair in 1251, and received its charter of incorporation in 1887.

ILKLEY, an urban district in the West Riding of Yorkshire, England, 16 m. N.W. from Leeds on the L.M.S. and L.N.E. railways, in Middle Wharfedale and extending to Ilkley moor. Pop. (1921), 9,098. It is a health resort and has several hydropathic establishments. The remains of Bolton abbey lie in the Wharfe valley 5 m. above Ilkley. Camden was the first authority to recognize Ilkley as a Roman site, and associated it with *Olicana*. Little excavation work and few discoveries were made until the 19th century, when Roman objects were found. A systematic excavation of the fort began in July 1919. Much of the site has been destroyed since Roman times. From the structure of the rampart and from finds from deep levels, it is inferred that the fort was established before the end of the 1st century and that a civil settlement sprang up around it. Occupation continued, with breaks, into the 4th century, but the exact date of the final withdrawal of Roman garrisons is still in dispute.

ILL, a river of France, entirely within the departments of Bas-Rhin and Haut-Rhin. It rises on a north foothill of the Jura, south-west of Basel, and flows north-north-east, parallel with the Rhine, which it enters from the left, 9 m. below Strassburg. Its course lies for the most part through low meadowland; and the stream, which is 123 m. long, receives numerous small affluents, which pour out of the short narrow valleys of the Vosges. It is navigable from Ladhof near Colmar to its confluence with the Rhine, a distance of 59 m. It is on this river, and not on the Rhine, that the principal towns of Upper Alsace are situated, *e.g.*, Mulhouse, Colmar, Schlestadt and Strasbourg. The Ill feeds two important canals, the Rhine-Marne canal and the Rhine-Rhone canal, both starting from the neighbourhood of Strasbourg.

ILLAWARRA, a fertile district of New South Wales, Australia, extending from about 33 m. S. of Sydney, along the coast southwards for 40 m. to Shoalhaven. It is thickly populated, and supplies Sydney with the greater part of its dairy produce. There are also numerous collieries, and iron ore, fireclay and freestone are plentiful. The Illawarra Lake, a salt lagoon, 9 m. long and 3 m. wide, is encircled by hills and is connected with the sea by a narrow channel; quantities of fish are caught and wild fowl are abundant along its shores. The chief towns in the district are Bulli, Wollongong, Kiama and Geringong.

ILLE-ET-VILAINE, a maritime department of north-western France, formed in 1790 out of the eastern part of the old province of Brittany. Pop. (1926) 561,688. Area 2,699 sq.m. It is bounded N. by the English Channel, the Bay of St. Michel and the department of Manche; E. by Mayenne; S. by Loire-

Inférieure; and W. by Morbihan and Côtes-du-Nord. The department consists of the basin of the upper Vilaine, with those of its tributaries (all navigable), the Ille from the north, the Seiche from the east, and the Meu from the west, and the coastland north of the low watershed from the estuary of the Rance on the west to that of the Couesnon on the east. The Vilaine is navigable as far north as Rennes, which is connected by canal via the Ille with Evran on the Rance. The rich Marais de Dol, protected by dykes from the sea, occupies most of the north coastal plain. The coast is rocky and dangerous. The climate is oceanic, temperate and rainy, with fogs in spring and autumn. The soil, originally poor, has been improved by the use of artificial manure. Cereals are grown, chiefly wheat, buckwheat, oats and barley. Potatoes, beetroot, early vegetables, flax and hemp are also largely grown, and tobacco is cultivated in the arrondissement of St. Malo. Orchards are abundant, especially near Dol. Stock-raising and dairying are important. Lead mines and quarries of slate, granite, etc., are worked. There are boat-building yards, iron and copper foundries and forges, and a widespread tanning industry. Sail-cloth, rope, pottery, boots and shoes (Fougères), farming implements, paper and furniture are also made. The chief ports are St. Malo and St. Servan. Fishing is very active on the coast, and St. Malo, St. Servan and Cancale send fleets to the Newfoundland codbanks. There are also important oyster-fisheries in the Bay of St. Michel, especially at Cancale. Dinard is the chief of a group of fashionable bathing-resorts. Exports include agricultural products, butter, mine-posts and dried fish; imports, live-stock, coal, timber, building materials and wheat. The department is served by the Ouest-État railway. Ille-et-Vilaine is divided into the arrondissements of Fougères, St. Malo, Redon and Rennes, and it consists of 43 cantons and 360 communes. The chief town is Rennes, which is the seat of an archbishop and of a court of appeal, headquarters of the X. army corps, and the centre of an académie (educational division).

ILLEGITIMACY, the state of being of illegitimate birth (from Lat. *illegitimus,* not in accordance with the law, hence born out of wedlock). Illegitimacy may be measured in various ways, the most common being by stating the proportion of illegitimate to total births. Another method, claimed as being a better one, is to relate illegitimate births to the total unmarried, widowed and divorced women of conceptive age in the population under review. The superiority of this latter method is very doubtful, for it is difficult to say what accurate conclusions can be drawn from it. Were illegitimacy an index of either morality or continence in any given community this second method would have a decided value, but no one who has studied the subject would be likely to advance such a claim. A fall in the illegitimate rate calculated in either way may merely indicate a spreading familiarity with the use of contraceptives. By relating the illegitimate to total births we do get a reliable measure of the contribution made to the population by the "unmarried mother," and consequently of the proportion of the population which is of illegitimate birth.

Factors Affecting.—The factors which are alleged to affect illegitimacy are many and varied, but the evidence in regard to a large proportion is extremely contradictory. Those which may be reckoned to be based upon indisputable statistical evidence are relatively few. The most important of these is undoubtedly habit and custom, or, in other words, the presence or absence of social stigma attached to the unmarried mother or the illegitimate child. If in any country the social status of the unmarried mother or the illegitimate child does not differ materially from that of the wife and her legitimate offspring the rate of illegitimacy will be high, and the greater the social obloquy incurred by bearing an illegitimate child the lower that rate will be. The factor second in importance is the extent of legal disability incurred by parent or offspring; then the existence or non-existence of barriers (legal, social, economic) to early or easy marriage and, finally, the formalities prescribed for subsequent legitimation or the total absence of these. Each one of these has its effect, in varying degree, on the illegitimate rate.

Two other alleged factors are religion and climate, but these must be reckoned doubtful if not disproven. It is stated, for example, that Roman Catholic countries show a lower rate than those of other cults, and the fact that in Ireland the rate of illegitimacy is little more than half that of England and Wales and about one-third that of Scotland is invariably put forward as a convincing proof. But Roman Catholic Austria had an illegitimate birth-rate three times that of England and Wales and 50% above that of Hungary. On the climatic side, it has been more or less generally accepted that the warmer countries of southern Europe had a higher proportion of illegitimates. But the highest rates are found in the more northern countries, in Denmark and in Sweden, whilst in Iceland the rate is higher still. Another popular idea is that the great cities have a higher illegitimate rate than the rural districts, but on this point also the available evidence is contradictory. The rural districts of England and Wales have a much higher illegitimate birth rate than has London, while on the mainland of Scotland the rural rate is considerably above that for the towns. On the other hand, in the Netherlands the proportion of illegitimate to total births rises steadily with the degree of urbanization, being lowest in the towns or villages with fewer than 5,000 inhabitants and highest in the great cities. The same holds good of Finland, where the town rate of illegitimacy is double that of the rural areas.

Variation.—The extent to which illegitimacy prevails in any given country shows relatively slight variations during the course of the last half-century, but the variation from country to country is very wide. Thus in England and Wales the proportion of illegitimate births to 1,000 total births, which was 48 in the quinquennium 1876–1880, was 43 in 1921–25, a decline of 10%. In Scotland the fall in the same period was more marked, being from 85 to 64. In Germany, however, the rate rose from 87 in 1876–80 to 110 in 1921–25, in Sweden from 100 to 148. Here the widest variation in any country is one of 48%. But in the last quinquennium under review the rates in European countries varied from 19 in the Netherlands to 106 in Denmark, 110 in Germany and 145 in Sweden. Going outside Europe, we find within the confines of the British empire an illegitimate birth-rate of about 20 per 1,000 in Ireland and of over 700 per 1,000 in Jamaica. In the following table the rates are given for certain European countries and also for Australia and New Zealand for alternate quinquennia from 1881–85 to 1921–25, the period 1916–20, which was directly affected by the World War, being dealt with separately. In dealing with these rates it must be borne in mind that, where some disability is incurred by illegitimacy, there is an obvious motive for non-registration of such a birth, and that the figures may be affected to some extent by the efficiency or otherwise of the registration system in operation at the time.

TABLE I. *Illegitimate Births per 1,000 Births.*

	1881–85	1891–95	1901–05	1911–15	1921–25
England and Wales	48	43	40	43	44
Scotland	83	74	64	71	68
Denmark	100	94	101	114	106
Finland	70	65	65	78	89
France	78	87	88	90	90
Germany	92	91	84	100	110
Italy	76	69	56	47	47
Netherlands	30	31	23	21	19
Norway	81	71	70	69	66
Sweden	102	105	110	113	145
Switzerland	48	46	44	47	48
Australia	30	50	60	55	47
New Zealand	29	38	43	43	48

This table shows clearly that there is no general trend in the illegitimate birth-proportion in the countries shown. England and Wales, Scotland, Germany and Switzerland show declines up to the third quinquennium, Italy to the fourth, the Netherlands and Norway throughout. In Denmark the rise and fall are erratic, in France there is a persistent rise, in Sweden one much more marked up to the end of the fourth, in Australia and in New Zealand a marked rise up to the end of the third period. Comparing the first with the last, we find that in six of the 13 coun-

tries the rate in the last period is lower than in the first, while in the other seven it is higher. England and Wales, Scotland, Italy, the Netherlands, Norway and Switzerland have the maximum rate in 1881–85, Denmark and Sweden in 1911–15, Australia in 1901–05, Finland and Germany in 1921–25.

Influence of the World War.—During the quinquennium 1916–20, the period most directly affected by the war, the proportions of illegitimate to total births in the belligerent countries shown in Table I. were as follows:—England and Wales 54, an increase of 25% over the rate for the preceding quinquennium; Scotland 76, an increase of 5%; Finland 83, an increase of 6%; France 120, an increase of 33%; Germany 113, an increase of 13%; Italy 45, a *decrease* of 4%; Australia 51, a *decrease* of 7%; New Zealand 45, an increase of 5%. England and Wales, France and Germany show marked increases in the proportions of illegitimate to total births; in Scotland, Finland and New Zealand the increase is insignificant, while in Italy and Australia there was an actual decrease. The rise in the proportion may, of course, have been due either to an actual increase in the number of illegitimate births or to the fall in illegitimate births being less marked than the general fall in births during this period. To make the position clear, the average annual numbers of the illegitimate births in some of these countries in the three quinquennia 1911–15, 1916–20; 1921–25 are given in Table II.

TABLE II. *Average Number of Illegitimate Births per Annum*

	1911–15	1916–20	1921–25
England and Wales	37,329	40,622	32,694
Scotland	8,698	8,315	7,681
Finland	6,865	6,280	7,049
France	..	..	..
Germany	177,645	136,923	154,592
Italy	..	..	..
Australia	7,209	6,462	6,291
New Zealand	1,163	1,077	1,270

In looking at these figures it may be explained that those for France and for Italy are omitted because they deal with different populations, and while rates may be given without departing from substantial accuracy, numbers would prove entirely misleading. Those for Germany for 1921–25 should be increased by some 10% to compensate for the loss of population entailed by the cession of territory to France and Poland; which would bring them up close to the pre-war level. The only case in which an actual increase in the numbers of the illegitimate births is shown is in England and Wales, so that any rise in the proportion of illegitimates in the other countries was due, not to a numerical increase, but to the fact that the proportional decline in illegitimate births was smaller than that for legitimate during the war period. That this was not the case in England and Wales was, presumably, due to the presence of comparatively large numbers of troops from the British dominions.

From the rates shown in the last column of Table I., it would appear that the post-war effects are inconsiderable, the only countries showing any marked increase in the illegitimate rate over that obtaining in the immediate pre-war period being Finland and Germany.

In England and Wales, France and Italy, the rates for these two periods are identical, in Scotland and Australia the latter rate is lower, in New Zealand the rise is too slight to admit of any valid inference being drawn.

United States.—Owing to the fact that in the United States the system of birth registration has been of gradual growth, it has not been possible to give comparative figures as to illegitimacy as in Table I. Of more recent years, however, the figures covering some 70% of the total population are available, and show the position with reliable accuracy. For the triennium 1921–23, the proportion of illegitimate to total births was at the rate of 24 per 1,000. There was, however, a very marked difference for the white and the coloured populations; for the former it was only 14, for the latter 126. In the coloured population, therefore, there were nine illegitimates to one among the whites. The illegitimate proportion in the various States under review varied from seven in Wyoming to 84 in South Carolina; the difference from State to State being mainly determined by the proportion of the coloured to the white population. The illegitimate proportions in the white population are analysed according to the country of birth of the mother, with the following result.

All white mothers	14	per 1,000 total births.
Mothers born in United States	16	,, ,, ,, ,,
,, ,, ,, Canada	13	,, ,, ,, ,,
,, ,, ,, Germany	12	,, ,, ,, ,,
,, ,, ,, Gt. Britain	10·5	,, ,, ,, ,,
,, ,, ,, Ireland	10·3	,, ,, ,, ,,
,, ,, ,, Italy	2	,, ,, ,, ,,

Possibly the most interesting feature of this analysis is the fact that, under similar social conditions, the rate of illegitimacy is practically identical for mothers born in Great Britain and in Ireland, although the illegitimacy rate for Ireland itself is only about half that of England and Wales and one-third that of Scotland.

Extra-European Rates.—In the European countries with which we have dealt and in those inhabited by European stocks, it is evident that the illegitimates form a comparatively insignificant fraction of the total population. The same remark holds good for Japan as the following figures show:—

Illegitimate Births Per 1,000 Total Births

Japan: 1891–95: 116; 1899–1905: 91; 1921–25: 78.

Here the decline in the proportion of illegitimate to total births has been marked and continuous. A different picture is presented by the Central and South American countries for which the figures are available, these being given in Table III.

TABLE III. *Illegitimate Births to 1,000 Total Births*

Period.	Chile	Period.	Costa Rica	Period.	Cuba	Period.	Equador
1903–05	357	1883–85	188	1900–05	342	..	..
1913–15	373	1911–13	237	1911–13	237	..	..
1921–25	364	..	..	..	..	1921–25	345

Period.	Mexico	Period.	Panama	Period.	Salvador	Period.	Uruguay
1895–97	376	..	..	1899–1905	510	1896–1905	259
1910	423	1912–16	689	1911–13	536	1911–13	251
..	..	1921–25	710	1921–25	590	1921–25	288

It is quite evident from these figures that illegitimacy is looked upon in these countries in a light very different from that in which it is regarded in those peopled mainly by Europeans; as in Jamaica and other of the West Indian islands the population is largely recruited from the unmarried. Indeed, in Salvador and Panama those of legitimate birth constitute the smaller fraction of the population, and in several of the others the proportion of illegitimates shows a rising tendency. (S. DE J.)

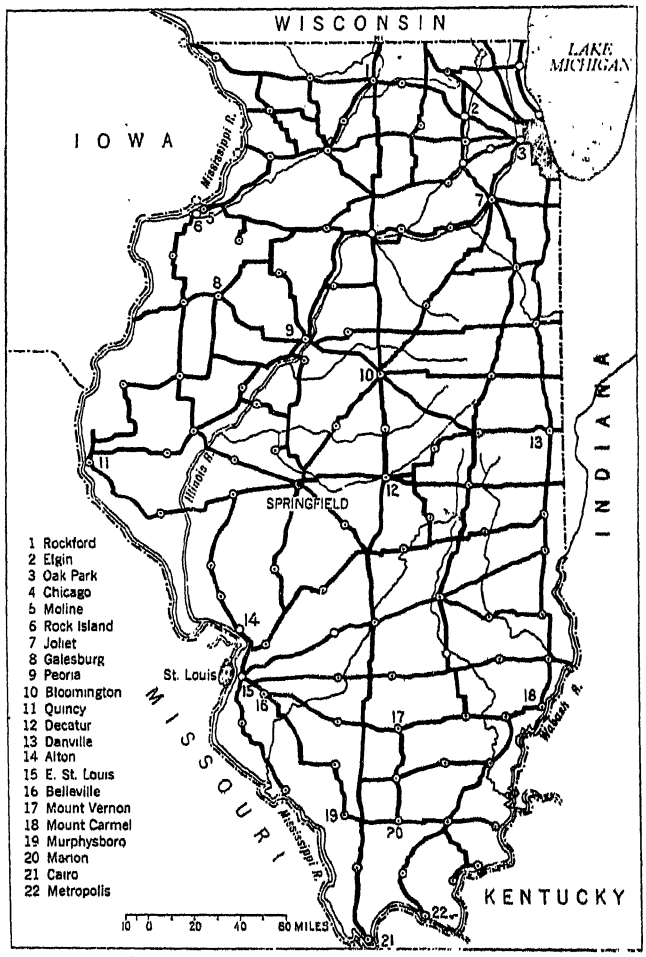
ILLER, a tributary of the Danube. It rises in the Algäuer Alps, flows northward through Upper Bavaria for 103 m., and, after passing Immenstadt and Kempton, joins the Danube near Ulm. (*See* DANUBE.)

ILLINIUM. In 1926, B. S. Hopkins definitely identified the chemical element of atomic number 61 and gave it this name. In the same year Corke, James and Fogg independently obtained it and measured the lines of its X-ray spectrum. (*See* RARE EARTHS.) Certain Italian chemists claimed priority in this discovery and named the element florentium (*q.v.*).

ILLINOIS (il'ĭ-noi or il'ĭ-noiz), the Prairie State, one of the north central group of the United States of America, situated between 37° and 42° 30′ N. lat. and 87° 35′ and 91° 31′ W. longitude. It is bounded on the north by Wisconsin, east by Lake Michigan and Indiana, south-east and south by the Ohio river, which separates it from Kentucky, and south-west and west by the Mississippi river, which separates it from Missouri and Iowa. The enabling act of Congress, which provided for the organization of Illinois territory into a State, extended its jurisdiction to the middle of Lake Michigan and the Mississippi river. The

State's greatest length is 379¼m. and its extreme width is 211 miles. The total area of the State, exclusive of its Lake Michigan jurisdiction, is 56,650sq.m. of which 56,043sq.m. are land.

Physical Features.—The State, except the extreme southern point, lies wholly in the great prairie region. The southern point touches the Coastal Plain Belt at its northward extension along the Mississippi river. The surface of the State is an inclined



MAP SHOWING THE MAIN ROADS OF ILLINOIS

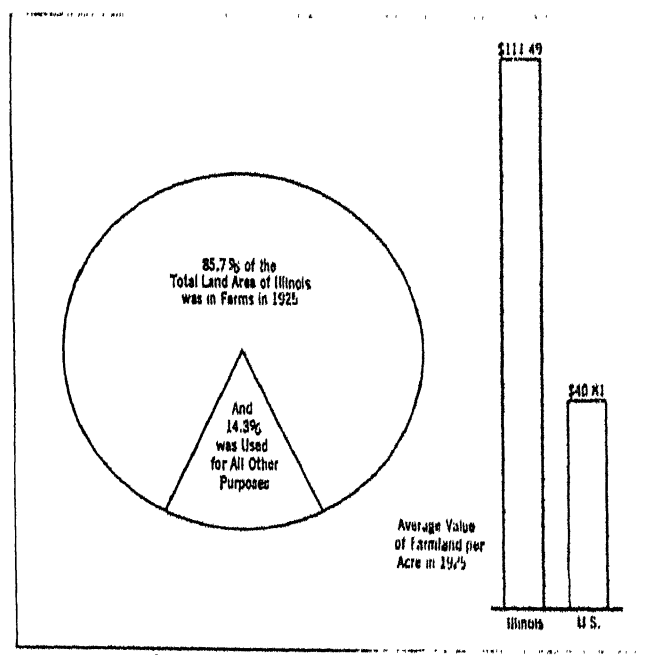
plane whose general slope is toward the south and south-west. Illinois is the most level State in the Union with the exception of Louisiana and Delaware. The average elevation above sea-level is about 600ft.; the highest elevation is Charles Mound (1,257ft.), on the Illinois-Wisconsin boundary lines, one of a group of hills in the north-western part of the State, in Jo Daviess, Stephenson, Winnebago, Boone and McHenry counties. An elevation from 15 to 40m. wide, most of the way about 20m., crosses the southern part of the State from Grand Tower, in Jackson county, on the Mississippi, to Shawneetown, in Gallatin county, on the Ohio, the highest point being 1,065ft. above the sea; from Grand Tower northward along the Mississippi to the mouth of the Illinois there is a slight elevation, and there is another elevation of minor importance along the Wabash. Many of the river bluffs rise to an unusual height, Starved Rock, near Ottawa, in La Salle county, being 150ft. above the bed of the Illinois river. The country south of the elevation (mentioned above) between Grand Tower and Shawneetown was originally covered with forests.

The drainage of Illinois is far better than its low elevation and comparatively level surface would suggest. There are nearly 500 streams in the State, grouped in two river systems, one having the Mississippi, which receives three-fourths of the waters of Illinois, as outlet, the other being tributary to the Wabash or the Ohio river. The most important river is the Illinois which is formed by the junction of the Des Plaines and the Kankakee in the north-western part of Grundy county. It has a course of nearly 500m., crossing the north-central and western portions of the State, draining 24,720 square miles. At some points, notably at Lake Peoria, it broadens into wide expanses resembling lakes. The Kaskaskia, in the south, notable for its variations in volume, and the Rock, in the north, are the other important rivers emptying into the Mississippi; the Embarrass and Little Wabash, the Saline and Cache in the east, are the important tributaries of the Wabash and Ohio rivers. The Chicago river naturally flowed into Lake Michigan, but by the construction of the drainage canal it was turned in 1900 so that it flows into the Mississippi.

The soil of Illinois is remarkable for its fertility. The surface soils are largely composed of drift deposits, varying from 2 to 100ft. in depth; they are often overlaid with a dark coloured loam 10in. or more deep, and in a large portion of the State there is a subsoil of mottled clay. The soil of the prairies is darker and more granular than that of the forests, but all differences disappear with cultivation. The soil of the river valleys is alluvial and especially fertile, the "American Bottom," extending along the Mississippi from Alton to Chester, having been in cultivation for more than 200 years. Along the river bluffs there is a deposit of loess, well suited to the cultivation of fruits and vegetables.

Drainage has proved an important feature in the agricultural development of Illinois. Of the State's 237,180 farms in 1920, 99,248, or 41·8% were reported as provided with drainage, and 33,731 were reported as in need of drainage. The greatest portion of the land in drainage enterprises was in the eastern and the northern parts of the State, though there were many projects in the central and south-eastern parts and along the Mississippi. The organized drainage undertakings within the State in 1920 controlled 4,820m. of ditch and 3,034m. of tile drains.

Climate.—The climate of Illinois is notable for its extremes of temperature. The warm winds which sweep up the Mississippi valley from the Gulf of Mexico are responsible for the extremes of heat, and the arctic winds of the north, which find no moun-



*PROPORTION OF ALL LAND IN FARMS 1925

tain range to break their strength, cause the extremes of cold. The mean annual temperature of Winnebago, near the northern border, is 47°F, and it increases to the southward at the rate of about 2° for every degree of latitude, being 52°F at Springfield, and 58°F in Cairo, at the southern extremity. The lowest temperature ever recorded in the State was 32°F in Feb. 1905, at Ashton in the north-west and the highest was 115°F in July 1901, at Centralia, in the south, making a maximum range of 147 degrees. The range of extreme is somewhat greater in the north than in the south. The mean annual precipitation is about 43in. in the

southern counties, but this decreases to the northward, being about 36in. in the central counties and 34in. along the northern border. The mean annual snowfall increases from 17·5in. at the southern extremity to more than 32in. in the northern counties. In the north the precipitation is 44·8% greater in spring and summer than it is in autumn and winter, but in the south only 36·17% greater. At Cairo the prevailing winds are southerly during all months except February, and as far north as Springfield they are southerly from April to January; but throughout the northern half of the State, except along the shore of Lake Michigan, where they vary from north-east to south-west, the winds are mostly from the west or north-west from October to March and are variable for the remainder of the year. Tornadoes are not unknown to Illinois, one of the most severe on record having visited southern Illinois on March 18, 1925. The property loss was estimated at $16,500,000 and 742 persons were killed and 2,756 were injured.

Government.—Illinois has been governed under two territorial acts of Congress and three Constitutions, the Territorial Constitution Acts of 1809 and 1812, and the three State Constitutions of 1818, 1848 and 1870 (subsequently amended). A new Constitution, submitted to the people on Dec. 12, 1922, was defeated by a vote of 921,398 to 185,298. Amendments may be made by a Constitutional Convention or a two-thirds vote of all members elected by each house of the legislature, ratification by the people being required in either instance. A Constitutional Convention may be called by the general assembly when two-thirds of the members of each house concur and their action, when submitted to the people, is approved by a majority of the votes cast.

The Constitution provides for an executive department consisting of a governor, lieutenant-governor, secretary of State, auditor of public accounts, treasurer, attorney-general and superintendent of public instruction, all elected for four years, with the exception of the treasurer, whose term of service is two years. Despite the difficulty of modifying long-established laws, far-reaching changes have been made. By the Consolidation Act of 1917, over 100 State boards, bureaux and offices, paid and unpaid, created to execute various acts or to supervise the various State debt institutions, were consolidated into nine departments—finance, agriculture, labour, mines and minerals, public works and buildings, public welfare, trade and commerce, registration and education and public health. Reorganization of governmental machinery was begun in 1909 with the abolition of separate boards for the various State charitable institutions and the establishment of one central board of control possessing also certain powers over private charitable institutions. In addition to this board a supervisory State charities commission was created. In 1925, the legislature created a department of purchases and construction and a department of conservation. The heads of these various departments, who are appointed by the governor and senate, have acted as a cabinet for the governor.

Changes in the State's system of appointments were effected by the Act of 1911, which extended the civil service system to the greater part of the State's employees. Civil service now covers all State appointees except those appointed by the governor and confirmed by the senate, the scientific and academic staff of the University of Illinois and the normal schools, and a few others. All examinations are competitive, although for some scientific posts "unassembled examinations" are given which consist of questions as to training and experience. By an amendment of 1917 all appointees may be removed by the appointing authority, but are allowed an appeal to the State civil service commission on allegation that the removal is due to race, politics or religion.

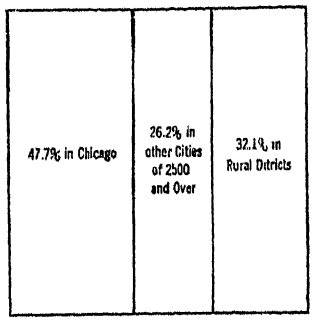
Members of the legislature are chosen by districts, three representatives and one senator from each of the 51 districts, 18 of which are in Cook county. Regular sessions of the legislature meet on the first Wednesday after the first Monday in January in odd-numbered years. The term of senators is four years, that of representatives two years; and in the election of representatives since 1870 there has been a provision for "minority" representation, under which by cumulative voting each voter may cast as many votes for one candidate as there are representatives to be chosen, or he may distribute his votes (giving three votes to one candidate, or one and one-half votes each to two candidates, or one vote each to three candidates), the candidate or candidates receiving the highest number of votes being elected. A similar system of cumulative voting for aldermen may be provided for by ordinance of councils in cities organized under the general State law of 1872. Special legislation is prohibited when general laws are applicable, and special and local legislation is forbidden in any of 23 enumerated cases, among which are divorce, changing of an individual's name or the name of a place, and the grant to a corporation of the right to the name of a place. The general assembly may pass an act over the governor's veto by a two-thirds vote of all the members elected to each house.

The judicial powers are vested in a supreme court, appellate courts, circuit courts, county courts, justices of the peace, police magistrates, and such courts as may be created by law in and for cities and incorporated towns. The supreme court is composed of seven members elected from districts for a term of nine years. The four appellate courts are distributed one for Cook county (which has also two branch appellate courts, both the court and the branches being presided over by three judges appointed by the supreme court) and three other districts, each with three judges appointed in a like manner. The State outside of Cook county is divided into 17 circuits in each of which three judges are elected for a term of six years. The Constitution provides for separate courts in Cook county. The county has a superior court consisting of 29 judges elected for six years, a circuit court consisting of 20 judges elected for a like term, a criminal court, a county court and a probate court. The City of Chicago has a municipal court composed of 36 judges and a city court consisting of 27 members. Each county has a county court consisting of one judge who serves for four years; in some counties probate courts have been established, and in counties of more than 500,000 population juvenile courts for the trial and care of delinquent children are provided for. Each county has a State attorney elected for a term of four years.

The local government of Illinois includes both county and township systems. The earliest American settlers came from the Southern States and naturally introduced the county system; but the increase of population from the New England and Middle States led to a recognition of township organization in the Constitution of 1848, and this form of government, at first prevalent only in the northern counties, is now found in most of the middle and southern counties. Cook county, although it has a township system, is governed, like those counties in which townships are not found, by a board of commissioners, elected by the townships and the City of Chicago. A general law of 1872 provides for the organization of municipalities, only cities and villages being recognized, though there are still some "towns" which have failed to reorganize under the new law. In 1927 there were 232 cities, 29 towns and 839 villages in the State. City charters are granted only to such municipalities as have a population of at least 1,000. Requirements for suffrage are age of 21 years or more, citizenship in the United States, and residence in the State for one year, in the county 90 days, and in the election precinct 30 days preceding the exercise of suffrage. Disfranchisement is brought about by conviction for bribery, felony or infamous crime, and an attempt to vote after such conviction is a felony.

The relation of the State to corporations and industrial problems has been a subject of important legislation. The Constitution declares that the State's rights of eminent domain shall never be so abridged as to prevent the legislature from taking the property and franchises of incorporated companies and subjecting them to the public necessity in a way similar to the treatment of individuals. In 1903 the legislature authorized the municipal ownership of public service corporations. Railways organized or doing business in the State are required by the Constitution to have a public office where books for public inspection are kept, showing the amount of stock, its owners, and the amount of the road's liabilities and assets. No railway company may now issue stock except for money, labour, or property actually received and applied to purposes for which the corporation was organized.

An anti-trust law of 1893 exempted from the definition of trust combinations those formed by producers of agricultural products and live-stock, but the United States Supreme Court in 1902 declared the statute unconstitutional as class legislation. According to a revised mining law of 1899 (subsequently amended), all mines are required to be in charge of certified mine managers, mine examiners, and hoisting engineers, when the services of the engineers are necessary; and every mine must have an escapement shaft distinct from the hoisting shaft. The employment of children under 14 years of age in factories or mines, as well as working employees under 16 years of age for more than 48 hours a week, is forbidden by statute.



DISTRIBUTION OF THE POPULATION IN 1920

Population.—The population of Illinois at certain selected census periods was as follows:—12,282 in 1810; 157,445 in 1830; 1,711,951 in 1860; 3,077,871 in 1880; 4,821,550 in 1900; 5,638,591 in 1910; and 6,485,280 in 1920. The rate of increase 1910–20 was 15% as compared with 14·9% for the whole United States. The population as on July 1, 1927, was estimated to be 7,296,000. In 1870 and 1880 Illinois was fourth among the States of the Union in population, but in 1890 it ranked third, a position it has since maintained. Of the population in 1920, 97·1% was white, and 80·8% was native born. The principal foreign elements were Germans (205,491), Poles (162,405), Russians (117,899), Swedes (105,577), Italians (94,407), and Irish (74,274). The density of population increased from 100·6 per square mile in 1910 to 115·7 per square mile in 1920. The increase of 1910–20 was urban, the rural population continuing to decline. In 1920 the percentage of urban population in towns and cities of 2,500 or over was 67·9% and 41·7% of the total population lived in the City of Chicago. In 1920, 52·5% of the State's population was in cities greater than 25,000. Population in villages of less than 2,500 declined from 12% in 1910 to 10·5% in 1920. Purely rural population fell from 26·4% in 1910 to 21·6% in 1920.

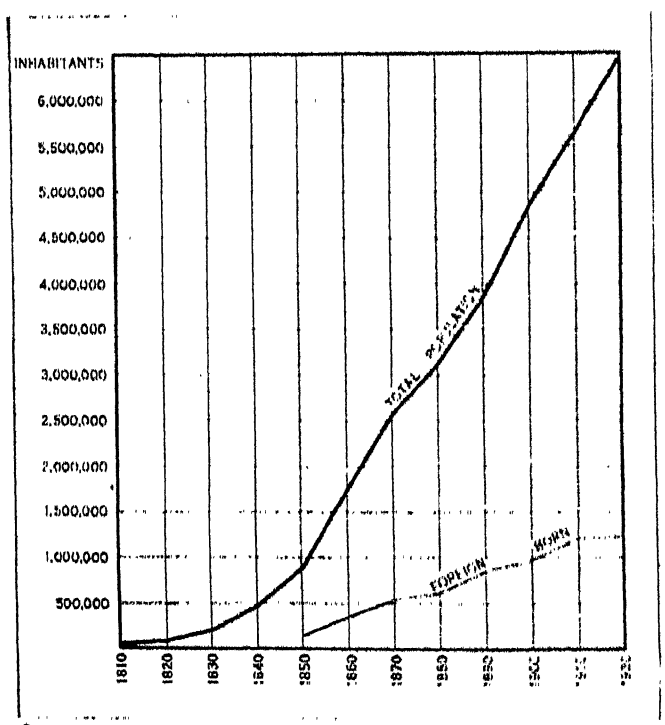
Population of Cities of over 40,000 in 1920

City	Population 1910	Population 1920	Increase %	Estimated 1926
Chicago	2,185,283	2,701,705	23·6	3,048,000
Cicero	14,557	44,995	209·1	65,400
Decatur	31,140	43,818	40·7	55,000
East St. Louis	58,547	66,767	14·0	72,300
Peoria	66,950	76,121	13·7	82,500
Rockford	45,401	65,651	44·6	78,400
Springfield	51,678	59,183	14·5	64,700

Finances.—Expenditure authorized by the legislature for the biennium 1927–29 amounted to $263,295,763. Of the appropriations for the biennium, $102,025,000 was for highway construction and maintenance and $13,854,420 for interest and retirement of highway bonds, making a total of $115,879,420 for highway purposes. To meet this expenditure, $60,000,000 was expected from highway bond issues, and the balance from general income, *i.e.*, receipts other than taxes, including automobile licences, which amounted in the preceding biennium to $26,800,452. Among other more important items of appropriation were: public welfare department including State charitable, penal and reformatory institutions, $39,655,686; omnibus bill, $83,397,459; State treasurer, retirement of and interest on bonds, $24,578,640; public schools, $16,001,500; University of Illinois, $10,725,000; State normal schools, five in number, $3,241,176; agricultural department $5,077,258; health department $1,289,284. The system of revenue is based upon the general property tax; the local assessment of all real and personal property is required, with the aim of recording all kinds of property upon the assessment rolls. Among other sources of revenue are an indirect tax on corporations, motor-vehicle licence fees, an inheritance tax, 7% of the annual gross earnings of the Illinois Central railway, Federal aid, and various miscellaneous fees. The Constitution prohibits the State from lending its credit or making appropriations in aid of any corporation, association or individual, and from constructing internal improvements, and the counties, townships and other political units cannot incur indebtedness in excess of 5% of their assessed property valuation. The legislature may not contract a debt of more than $250,000 except to suppress treason, war or invasion unless approved by a vote of the people. The State's outstanding bonded indebtedness on Jan. 1, 1928, was $145,296,000.

All general banking laws must be submitted to the people for ratification. The northern part of Illinois lies in the 7th Federal Reserve district and the southern part in the 8th, with headquarters respectively in Chicago and St. Louis. In 1927 there were 490 national banks in Illinois with aggregate capital stock of $90,062,000, aggregate surplus of $72,601,000 and total resources of $1,839,001,000. Of these banks 35 are located in Chicago, having resources amounting to $1,501,318,000. Side by side with the national banks is the system of State banks created by the Act of 1887 and operating under the supervision of the auditor of public accounts. In 1927 there were 1,343 State banks with a total capital of $173,370,000, and aggregate resources of $2,778,863,449. Of the State banks 188 were in Chicago, having resources amounting to $1,097,503,609.

Education.—Public education in Illinois had its genesis in the land of the North-west Territory reserved for educational purposes by the ordinance of 1787. The first school law, which provided for State taxation for public schools, was enacted in 1825. Only a few schools were established under this act as the section providing for taxation was soon repealed. Free schools

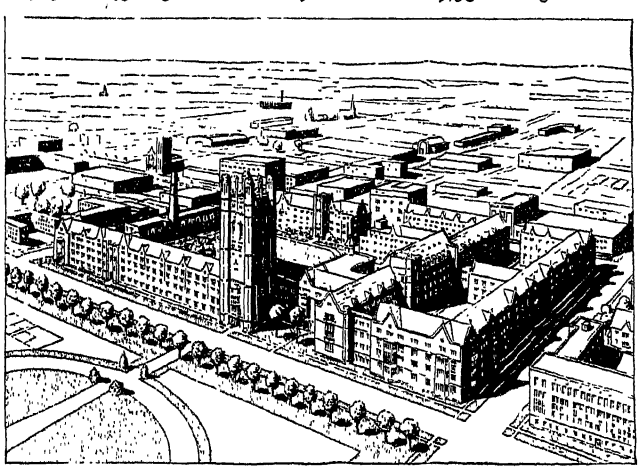


GRAPH SHOWING GROWTH OF POPULATION IN ILLINOIS FROM 1810 TO 1920

supported by the sale of land reserved for education and by local taxation were established as early as 1834. In 1855 a second school law providing for a State school tax was enacted, and this is the foundation of the existing public school system; the Constitution of 1870 also requires the legislature to provide a thorough and efficient system of public schools.

The public schools of the State are free to all between the ages of six and 21 years, and school attendance is compulsory for all children from seven to 16 years of age. Of the population of school age (6–21) in 1925, 1,343,430, or 69% were enrolled in

the public schools. In addition to the public schools there were, in 1925, 1,036 private schools with 214,728 pupils. The distribution of public school enrolment was 1,115,285, or 83% in the kindergarten and elementary schools and 228,145, or 17% in high schools. The high school enrolment represents an increase of 168% during a period of ten years. The total number of teachers in 1925 was 43,865 in elementary schools and 9,531 in high schools.



BY COURTESY OF THE UNIVERSITY OF ILLINOIS

ARCHITECTURAL RENDERING OF THE PROPOSED RESEARCH AND EDUCATIONAL HOSPITALS OF THE STATE OF ILLINOIS, A BUILDING GROUP TO BE ADMINISTERED CO-OPERATIVELY BY THE ILLINOIS STATE DEPARTMENT OF PUBLIC WELFARE AND THE UNIVERSITY OF ILLINOIS

School revenue is derived chiefly from local taxation. The net expenditure, including new grounds and buildings, in 1924 was $115,677,000, or a per caput, based on total population, of $16.82. This is an increase of $46,319,000 over the $69,358,000 expended in 1920. The average length of the school term in 1924 was 8·3 months. A notable development in the public educational system was the growth in the number of township high schools, and the number of community high schools following the legislation of 1917. Under the township high-school law some 200 high schools were organized. Acts of 1913 and 1915 directed the payment by local school authorities of tuition for children who wished to attend high school elsewhere when there was none in their district. During one year, 1920, 232 community high schools were organized, and at the close of the year 1927 the number had risen to 287. The total number of four year high schools in 1925 was 673. With the rapid growth in the number of high school graduates (25,606 in 1925) there was a corresponding increase in the enrolment in the universities and colleges of the State.

The State provides for higher education in the University of Illinois at Urbana and five teachers' colleges situated at Normal, Carbondale, Charleston, De Kalb and Macomb. The university was founded in 1867, through the U.S. land grant of 1862, as the Illinois Industrial university, and received its present name in 1885; since 1870 it has been co-educational. The expansion of the university through the acquisition or organization of new colleges and schools began in 1896 when the Chicago College of Pharmacy became the University of Illinois School of Pharmacy. Since that date important changes have been made. The university in 1928 consisted of a college of liberal arts and sciences, a college of commerce and business administration, a college of education, a college of engineering, a college of agriculture, a college of law, the graduate schools, a library school, a school of journalism, and a school of music at Urbana and a college of medicine, a college of dentistry and a school of pharmacy at Chicago. An agricultural experiment station, an engineering experiment station and the bureaux of educational research and of business research are connected with the university. The faculty in 1927–28 numbered 1,360, and the total enrolment of students for that academic year was 14,071. The five teachers' colleges have an annual enrolment in excess of 12,000.

In addition to the State institutions of higher education in 1927 there were 32 other colleges and universities of recognized standing and one private normal school within the State. The most important of these are the University of Chicago, Northwestern university at Evanston, Illinois Wesleyan university at Bloomington, Knox college at Galesburg, Illinois college at Jacksonville, and Lake Forest college at Lake Forest.

Charities and Corrections.—The department of public welfare is charged with the administration of all charitable and penal institutions in the State. To accomplish this purpose the department has been separated into a number of divisions and in turn each institution is under a manager appointed by and under the direction of the department. In 1925 there were 26 State institutions under the department's supervision. Of these, nine were hospitals for the insane located at Elgin, Kankakee, Jacksonville, Anna, Watertown, Peoria, Chester, Chicago and Alton. There were two institutions for the feeble-minded, the Lincoln State school and colony at Lincoln and a State hospital at Dixon. The State maintained a school for the blind and a school for the deaf at Jacksonville, an industrial home for blind at Chicago, a training school for girls at Geneva and a like institution for boys at St. Charles. Charitable institutions included a home for soldiers and sailors at Quincy, a soldiers' orphans home at Normal, a home for soldiers' widows at Wilmington, a research and educational hospital connected with the college of medicine of the University of Illinois, and an eye and ear infirmary at Chicago. The State's penal institutions were: a State penitentiary and a woman's prison at Joliet, a reformatory at Pontiac, a State farm at Vandalia and the Southern Illinois penitentiary at Menard. The division of child welfare exercises supervision over all orphanages situated within the State. Poor relief is administered by the counties usually through the maintenance of alms-houses. By a law of 1905 all employees in State institutions were put on a civil service basis. The appropriations for the department of public welfare for the biennium 1927–29 was $39,655,686.

Industry, Trade and Transportation.—While the census of manufactures shows Illinois to be an industrial rather than an agricultural State, there has been no absolute decline in its farming. According to the census of 1920 Illinois was second only to Iowa among the States in agricultural importance. Based on crop values, in 1926, Texas was first, Iowa second, California third and Illinois fourth with farm crops amounting to $389,957,000. This production is considerably under the enormous crop of 1924 which had a value of $554,965,000. The land in farms in 1925 was 30,731,947ac., or 85·7% of the total land area. This figure shows a decline from 90·7% of the total area in 1910 and 89·1% in 1920. The total number of farms has shown a corresponding decline, the numbers being 251,872 in 1910, 237,181 in 1920 and 225,601 in 1925. The average size for farms during the above period showed a slight increase; the 129·1ac. average for 1910 increased to 136·2ac. in 1925. The value of farm property increased enormously in the decade 1910–20 but declined sharply after the latter date; the total value of all farm property in 1925 being $4,628,344,531 as compared with $6,666,767,235 in 1920. Tenantry showed a slight decrease between 1920–25 but the number paying cash showed a marked decrease because of depressed market values for farm products.

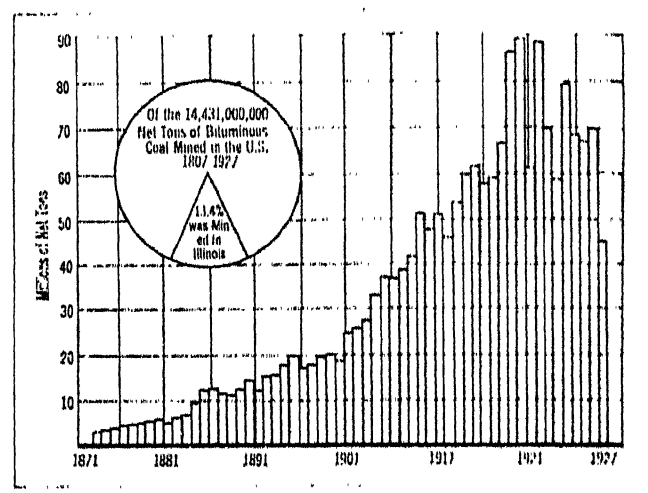
Cereals are still the main crop and corn (maize) is the leading product. The largest maize crop on record was that of 1912 when 426,320,000bu. were produced from 10,658,000ac. or an average of 40bu. per acre. The maize crop of greatest value was that of 1917, which had a value of $459,800,000. In 1926 the crop of 312,979,000bu. was exceeded by that of Iowa only. In 1926, 41,034,000bu. of wheat were produced on 2,283,000ac., a production which gave Illinois the rank of fifth among the States. The production of oats in 1926 showed a sharp decrease from the average for the 20 years previous; the product being 123,516,000bu., a total exceeded by Iowa and Minnesota only. Rye, barley and sweet corn for canning, are other important cereals. Hay in 1926, had a commercial value second only to that of maize, the production for that year being 3,665,000 tons valued at $58,640,000. Apples, peaches, cherries, plums and other fruits are widely grown but are little produced for market. The large urban population of the State makes the animal products very

valuable. In 1924 milk and other dairy products had a value of $62,828,092. In the same year 113,020,993doz. eggs and 32,203,811 chickens were produced with an aggregate value of $60,645,711. In live-stock, Illinois, on Jan. 1, 1926, with 1,039,000 milch cows, ranked fifth among the States; and in all cattle, numbering 2,368,000, ranked seventh. In the number of swine, 4,631,000 and the number of horses, 985,000, Illinois ranked second only to Iowa. Mules, 169,000, and sheep 689,000, were of minor importance as compared with other States. The estimated total value of all live-stock within the State on Jan. 1, 1926, was $289,950,000.

The growth of manufacturing in Illinois, due largely to the development of her exceptional transportation facilities, was the most rapid and remarkable in the industrial history of the United States. In 1850 the State ranked fifteenth, in 1870 sixth, and in 1880 fourth, the same relative position it held in 1923. In 1905 the product of the manufactures was valued at $1,410,342,129, in 1919 the value was $3,366,452,969, and in 1923 the total value had risen to $5,041,113,314. The manufactures in 1923, employed 645,627 wage-earners, working in 14,345 establishments. The most important industry was wholesale slaughtering and the packing of meats, which yielded 12·27% of the total manufactured product of the State in 1923. Illinois has long held first rank in this industry; the product for 1923 exceeded more than twice that of any other State. The manufacture of iron and steel products, and of products depending upon iron and steel as raw material, is second in importance. The iron for these industries is secured from the Lake Superior region, the coal and limestone from mines within the State. The position of Illinois in the heart of the agricultural section and her bountiful supply of iron has caused the State to become the chief producer of agricultural implements. The ten most important industries with the values of their respective products in 1923 were as follows:— slaughtering and meat packing (wholesale) $606,320,553; foundry and machine shops, $275,955,047; iron and steel, steel works and rolling mills, $213,671,552; electrical machinery and supplies, $211,366,206; clothing, men's, $186,683,333; cars, steam road (not built in repair shop), $159,364,227; printing and publishing, book and job, $138,227,215; printing, publishing, newspaper, etc., $132,288,355; cars and general construction, steam, $118,604,362; bread and other bakery products, $105,289,516.

The tendency in manufacturing was toward large-scale production and corporate ownership. Of the 18,593 establishments in the State in 1919, the 799 producing $1,000,000 or over, turned out some 75% of the products. In these industries 389,686 wage-earners were employed. Chicago, with its tributary manufacturing suburbs of Maywood, Harvey, Cicero, Blue Island, Chicago Heights, and, in Indiana, Hammond and Gary, is the greatest manufacturing centre of the State. A lesser manufacturing centre has grown up in the net of railways that centre at East St. Louis, Collinsville, Granite City and Edwardsville. The third centre is formed by Moline and Rock Island with Davenport, Iowa. Joliet and East St. Louis were second and third respectively to Chicago in the value of products in 1919. Manufactures in Chicago are generally diversified. The same is usually true in the smaller centres, although a few cities are noted for their special products. Thus, Rockford is best known for its furniture manufactures, Kewanee for boilers, Elgin for watches, Moline for farm implements and automobiles.

In mining and allied interests Illinois occupies an important place. In 1919 the State ranked third in the total number of persons engaged in the mining industries and fourth among the States in the value of products. In the total value of products for 1925 ($231,658,604), the State ranked seventh, the relative decline in importance being due chiefly to increased petroleum production in other States. Coal constitutes the State's chief product. The great central coal-field of North America extends into Illinois from Indiana as far north as a line from Grundy county to Rock Island, west from Rock Island to Henderson county, then southwest to the southern part of Jackson county, where it runs south into Kentucky, including 54 counties and approximately 35,000 sq.m. of the land surface of the State. During 1926, 69,813,255 short tons were mined with a value equal to 57% of the State's total mineral product. This amount was exceeded only by Pennsylvania and by West Virginia. Clay products were second in importance with an output valued at $33,501,308. Petroleum, the mineral third in importance, was long known to exist within the State but was not seriously exploited until 1906 when the annual production (4,307,050bbl.) for the first time exceeded 1,000,000



COAL PRODUCED EACH YEAR 1871-1927

barrels. In 1924 the production was 81,081,000bbl. valued at $14,220,000, an output somewhat under that of previous years. The producing area covers about 4,800sq.m. in 16 counties in the south-eastern part of the State. Limestone, sandstone, sand, fluor-spar, lead and zinc were other leading products. The quarrying industries were well distributed throughout the State and furnished not only stone for construction work, but also limestone for the iron industry, and sandstone from which a large part of the U.S. silica supply is derived. Illinois has ranked as the leading State in the Union since 1842 in the production of fluor spar, the product in 1924 being 62,067 short tons valued at $1,288,316.

Transportation facilities have been an important factor in the economic development of Illinois. The first settlers used the waterways, some coming by way of the Great Lakes while others used the Ohio river. The first improved transportation facilities were the turnpikes and canals, undertaken in whole or part by the State. The task of connecting Lake Michigan and the Mississippi river was accomplished by the State's building the Illinois and Michigan canal to La Salle, at the head of the navigation on the Illinois river, a work begun in 1836 and completed in 1848. In 1890 the sanitary district of Chicago undertook the construction of a canal between Chicago and Lockport, where the new canal joins the Illinois and Michigan canal. This work was opened in 1900, providing a waterway with a depth of 20ft. for navigation between the above places; but from Lockport to Utica, on the Illinois river, a distance of 62m. there was no adequate means of water transportation. A legislative Act of 1919 provided for the issue of bonds to the amount of $20,000,000 for the construction of an 8ft. channel, "The Illinois Waterway," connecting the points mentioned, but little actual progress had been made up to 1925. The Federal Government completed in Oct. 1907 the construction of a new canal, the Illinois and Mississippi, from Hennepin to Rock river. It had a channel 7ft. deep, 52ft. wide at the bottom and 80ft. wide at the water-line. These waterways are not extensively used to-day. Illinois's most important water transportation system is that of the Great Lakes. Receipts of grain at Chicago by lake have steadily declined of late years, although the lakes are still the usual route for shipment of wheat to eastern points. Iron ore is still shipped to Chicago and South Chicago by way of the Great Lakes.

Steam railways are by far the State's chief means of transportation. With 12,037m. of main line she was in 1924 second only to Texas. For over 30 years little new main line road has been built. The important extension has been in double-tracking and

improvement of the right-of-way and terminals. The field of passenger and light freight and coal transport, since 1900, has been invaded by the electric lines, which in 1924 operated 3,555m. of track. The Illinois traction system operates a ramification of electric lines across the State from Danville to East St. Louis and radiating throughout central Illinois; on certain runs it uses sleeping and parlor cars.

The improvement of roads in the State of Illinois has been given marked attention. A State highway commission was created in 1905, and in 1914 State appropriations for hard roads were made from the proceeds of automobile licence fees. Actual construction was begun in 1914. Road building in Illinois is carried on under four distinct systems—the township, the State aid, the State bond issue and the Federal aid systems. There is an overlapping of mileage among these. Acts of Congress in 1916 and 1919, apportioning Federal aid in behalf of roads, allotted to Illinois $3,300,000 and $8,700,000 respectively. The question of issuing $60,000,000 in bonds based on automobile licence fees for the construction of 4,800m. of hard roads was submitted to the voters of the State in Nov. 1918 and was approved by them. A bond issue of $100,000,000 providing for the continuance of a State-wide system of hard-surface roads was approved by the people at the general election of 1924. The mileage under the $60,000,000 bond issue system, according to the last report at the end of 1926, was 4,794 miles. The mileage under the $100,000,000 bond issue of 1924 is estimated at approximately 5,000m. so that the two systems will provide approximately 9,800 miles. The total net paved mileage in the State under all four systems of construction, excluding city streets, on Jan. 1, 1927, was approximately 5,900m. of which 5,466m. were concrete.

History.—The first Europeans to visit the region now known as Illinois were the French. In 1659 Pierre Radisson and Medard Chouart des Groseilliers seem to have reached the upper Mississippi. It is certain that in 1673 part of the region known as the Illinois country was explored to some extent by two Frenchmen, Louis Joliet and Jacques Marquette, a Jesuit father. Marquette, under orders to begin a mission to the Indians, and Joliet, who acted under orders of Jean Talon, intendant of Canada, ascended the Fox river, crossed the portage between it and the Wisconsin river, and followed that stream to the Mississippi, which they descended to a point below the mouth of the Arkansas. On their return journey they ascended the Illinois river as far as Lake Peoria; they then crossed the portage to Lake Michigan, and in 1675 Marquette founded a mission at the Indian town of Kaskaskia, near the present Utica, Illinois. In 1679 the explorer La Salle, desiring to find the mouth of the Mississippi, ascended the St. Joseph river, crossed the portage separating it from the Kankakee, which he descended to the Illinois, and built in the neighbourhood of Lake Peoria a fort which he called Ft. Crèvecoeur. The vicissitudes of the expedition, and opposition in Canada to his plans prevented him from reaching the mouth of the Illinois until Feb. 6, 1682. After such preliminary explorations, the French made permanent settlements, which had their origin in the missions of the Jesuits and the bartering posts of the French traders. Chief of these were Kaskaskia, established near the mouth of the Kaskaskia river, about 1720; Cahokia, a little below the mouth of the Missouri river, founded at about the same time; and Ft. Chartres, on the Mississippi between Cahokia and Kaskaskia, founded in 1720 to be a link in a chain of fortifications intended to extend from the St. Lawrence to the Gulf of Mexico. A monument of the labours of the missionaries is a manuscript dictionary (*c.* 1720) of the language of the Illinois, with catechism and prayers, probably the work of Father Le Boulanger.

In 1712 the Illinois river was made the northern boundary of the French province of Louisiana, which was granted to Antoine Crozat (1655–1738), and in 1721 the seventh civil and military district of that province was named Illinois, which included more than one half of the present State, the country between the Arkansas river and the line 43° N. lat., as well as the country between the Rocky mountains and the Mississippi; but in 1723 the region around the Wabash river was formed into a separate district. The trade of the Illinois country was now diverted to the settlements in the lower Mississippi river, but the French, although they were successful in gaining the confidence and friendship of the Indians, failed to develop the resources of the country. By the Treaty of Paris, 1763, France ceded to Great Britain her claims to the country between the Ohio and Mississippi rivers, but on account of the resistance of Pontiac, a chief of the Ottawas, who drew into conspiracy most of the tribes between the Ottawa river and the lower Mississippi, the English were not able to take possession of the country until 1765, when the French flag was finally lowered at Ft. Chartres.

The policy of the British Government was not favourable to the economic development of the newly acquired country, since it was feared that its prosperity might react against the trade and industry of Great Britain. But in 1769 and the succeeding years of English control, this policy was relaxed, and immigration from the seaboard colonies, especially from Virginia, began. In 1771 the people of the Illinois country, through a meeting at Kaskaskia, demanded a form of self-government similar to that of Connecticut. The petition was rejected by Gen. Thomas Gage; and Thomas Legge, earl of Dartmouth (1731–1801), secretary of State for plantations and president of the Board of Trade, drew up a plan of government for Illinois in which all officials were appointed by the Crown. This, however, was never operative, for in 1774, by the famous Quebec Act, the Illinois country was annexed to the Province of Quebec, and at the same time the jurisdiction of the French civil law was recognized. These facts explain the considerable sympathy in Illinois for the colonial cause in the War of Independence. Most of the inhabitants, however, were French, and these were loyalists. The English authorities instigated the Indians to make attacks upon the frontiers of the American colonies, and this led to one of the most important events in the history of the Illinois country, the capture of the British posts of Cahokia and Kaskaskia in 1778, and in the following year of Vincennes, Ind., by George Rogers Clark (*q.v.*), who acted under orders of Patrick Henry, governor of Virginia. These conquests had much to do with the securing by the United States of the country west of the Alleghanies and north of the Ohio in the Treaty of Paris, 1783.

The Virginia house of delegates, in 1778, extended the civil jurisdiction of Virginia to the north-west, and appointed Capt. John Todd (1750–82), of Kentucky, governor of the entire territory north of the Ohio, organized as "The County of Illinois." This government was confined to the old French settlements and was entirely inefficient. In 1787, Virginia and the other States having relinquished their claims to the country west of the Alleghanies, the North-west Territory was organized by Congress by the famous ordinance of 1787. Two years later St. Clair county was formed out of the south-west part of the Illinois country, while the eastern portion and the settlements around Vincennes, Ind., were united into the county of Knox, and in 1795 the southern part of St. Clair county was organized into Randolph county, with Kaskaskia as the seat of administration. In 1800 the Illinois country was included in the Territory of Indiana, and in 1809 the western part of Indiana from Vincennes north to Canada was organized as the Territory of Illinois; it included, besides the present State, all of Wisconsin except the northern part of the Green bay peninsula, a large part of Michigan, and all of Minnesota east of the Mississippi. In 1812, by permission of Congress, a representative assembly was chosen, a territorial constitution was adopted, and the territorial delegate in Congress was elected directly by the people.

In 1818 Illinois became a State of the American Union, the enabling act fixing the line 42° 30′ as the northern boundary, instead of that provided by the ordinance of 1787, which passed through the south bend of Lake Michigan. The reason given for this change was that if the Mississippi and Ohio rivers were the only outlets of Illinois trade, the interests of the State would become identified with those of the Southern States; but if an outlet by Lake Michigan were provided, closer relations would be established with the Northern and Middle States, and so "additional security for the perpetuity of the Union" would be afforded.

Throughout the territorial period there was conflict between

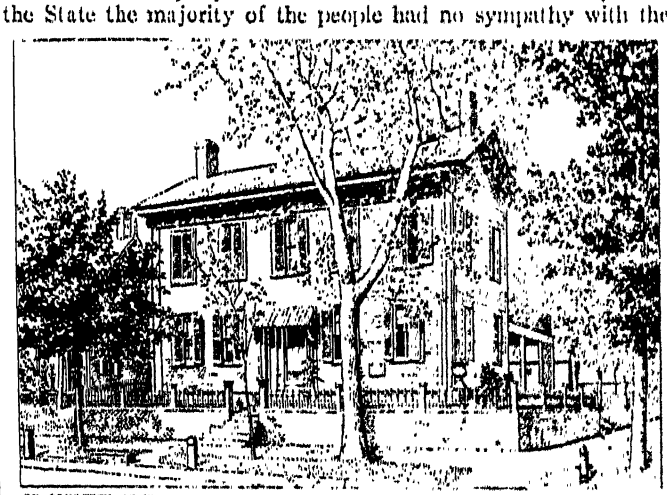
French and English land claims. In 1804 Congress established land offices at Kaskaskia and Vincennes to examine existing claims and to eliminate conflict with future grants; in 1812 new offices were established at Shawneetown and Edwardsville for the sale of public lands; and in 1816 more than 500,000ac. were sold. In 1818, however, many citizens were in debt for their lands, and "squatters" invaded the rights of settlers. Congress therefore reduced the price of land from $2 to $1.25 per acre and adopted the policy of pre-emption, preference being given to the claims of existing settlers. The Indians, however, resisted measures looking toward the extinguishment of their claims to the country. Their dissatisfaction with the treaties signed in 1795 and 1804 caused them to espouse the British cause in the war of 1812, and in 1812 they overpowered a body of soldiers and settlers who had abandoned Ft. Dearborn (*see* CHICAGO). For a number of years after the end of the conflict, the Indians were comparatively peaceful; but in 1831 the delay of the Sacs and Foxes in withdrawing from the lands in northern Illinois caused Governor John Reynolds (1788–1865) to call out the militia. The following year Black Hawk, a Sac leader, opened an unsuccessful war in northern Illinois and Wisconsin (the Black Hawk War); and by 1833 all Indians in Illinois had been removed from the State.

The financial and industrial policy of the State was unfortunate. Money being scarce, the legislature in 1819 chartered a State bank which was authorized to do business on the credit of the State. This bank never operated and a second was chartered in 1820. In a few years the bank failed, and the State in 1831 borrowed money to redeem the depreciated notes issued by the bank. A second State bank was chartered in 1835; two years later it suspended payment, and in 1843 the legislature provided for its liquidation. The State also undertook to establish a system of internal improvements, granting a loan for the construction of the Illinois and Michigan canal in 1836, and in 1837 appropriating $10,000,000 for the building of railroads and other improvements. The experiment proved unsuccessful; the State's credit declined and a heavy debt was incurred, and in 1840 the policy of aiding public improvements was abandoned. Through the efforts of Governor Thomas Ford (1800–50) a movement to repudiate the State was defeated, and a plan was adopted by which the entire debt could be reduced without excessive taxation, and by 1880 practically the entire debt was extinguished.

A notable incident in the history of the State was the immigration of the Mormons from Missouri, about 1840. Their principal settlements were in Hancock county. They succeeded in securing favours from the legislature, and their city of Nauvoo had courts and a military organization that was independent of State control. Political intrigue and claims of independence from the State, as well as charges of polygamy and lawless conduct, aroused such intense opposition to the sect that in 1844 a civil war broke out in Hancock county which resulted in the murder of Joseph Smith and the removal of the Mormons from Illinois in 1846.

The slavery question, however, was the problem of lasting political importance. Slaves had been brought into the Illinois country by the French, and Governor Arthur St. Clair (1734–1818) interpreted the article of the ordinance of 1787, which forbade slavery in the North-west Territory, as a prohibition of the introduction of slaves into the territory, not an interference with existing conditions. The idea arose that negroes could be held as indentured servants, and such servitude was recognized in the Indiana code of 1803, the Illinois Constitution of 1818, and statutes of 1819; indeed, there would probably have been a recognition of slavery in the Constitution of 1818 had it not been feared that such recognition would have prevented the admission of the State to the Union. In 1823 the legislature referred to the people a resolution for a Constitutional Convention to amend the Constitution. The aim, not expressed, was the legalization of slavery. Although a majority of the public men of the State, indeed probably a majority of the entire population, was either born in the Southern States or descended from Southern people, the resolution of the legislature was rejected, the leader of the opposition being Governor Edward Coles (1786–1868), a Virginia slaveholder, who had freed his slaves on coming to Illinois. The opposition to slavery, however, was at first economic, not philanthropic. In 1837 there was only one abolition society in the State, but chiefly through the agitation of Elijah P. Lovejoy (*see* ALTON), the abolition sentiment grew. In 1842 the moral issue had become political, and the Liberty Party was organized, which in 1848 united with the Free Soil Party; but as the Whig Party approved the policy of non-extension of slavery, these parties did not succeed so well united as under separate existence. In 1854, however, the Liberty and Free Soil Parties, the Democrats opposed to the Kansas-Nebraska bill, and some Whigs united, secured a majority in the legislature, and elected Lyman Trumbull U.S. senator. Two years later these elements formally organized as the Republican Party and elected their candidates for State offices. This was the first time that the Democratic Party had been defeated, its organization having been in control since the admission of Illinois to the Union. An important influence in this political revolution was a change in the character of the population. Until 1848 the Southern element predominated in the population, but after that year the immigration from the Northern States was greater than that from the South, and the foreign element also increased. The influence of immigration and sectionalism upon Illinois politics is well illustrated by the fact that the first six governors (1818–38) were born in the Southern States, six of the eight U.S. senators of that period were also Southern born, and all of the representatives, with one exception, also came to Illinois from the Southern States. After 1838 the Eastern States began to be represented among the governors, but until 1901 no governor was elected who was a native of Illinois. *See* E. B. Greene, *Sectional Forces in the History of Illinois* (Publications of the Historical Library of Illinois, no. 8, 1903).

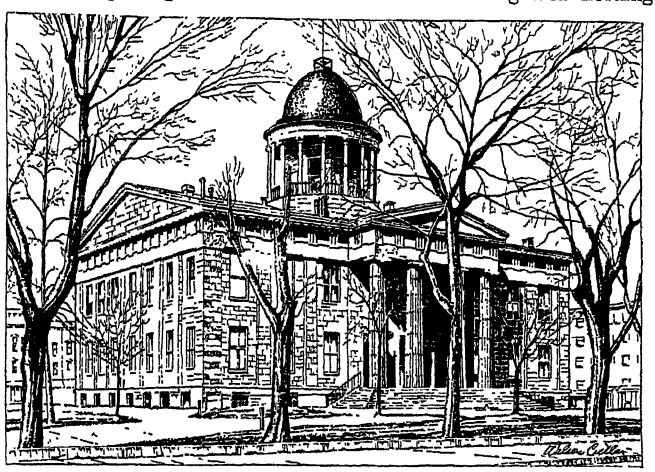
The opposition to slavery continued to be political and economic rather than philanthropic. The Constitution of 1848, which abolished slavery, also forbade the immigration of slaves into the State. In 1858 occurred the famous contest for the office of U.S. senator between Stephen A. Douglas (Democrat) and Abraham Lincoln (Republican). Douglas was elected, but the vote showed that Illinois was becoming more Northern in sympathy, and two years later Lincoln, then candidate for the presidency, carried the State. The policy of Illinois in the early period of secession was one of marked loyalty to the Union; even in the southern part of the State the majority of the people had no sympathy with the pro-slavery men in their efforts to dissolve the Union. The legislature of 1861 provided for a war fund of $2,000,000; and Capt. James H. Stokes (1814–90) of Chicago transferred a large amount of munitions of war from St. Louis, where the secession sentiment was strong, to Alton. The State contributed 255,092 men to the Federal armies. From 1862–64, however, there was some opposition to a continuance of the war. This was at first political; the legislature of 1862 was Democratic, and for political purposes that body adopted resolutions against further conflict, and recommended an armistice, and a national convention to conclude peace.



BY COURTESY OF THE SPRINGFIELD CHAMBER OF COMMERCE

THE LINCOLN HOME AT SPRINGFIELD

The same year a convention met to revise the Constitution. Among its acts was the assumption of the right of ratifying a proposed amendment to the Constitution of the United States which prohibited Congress from interfering with slavery within a State, although the right of ratification belonged to the legislature. The convention also inserted clauses preventing negroes and mulattoes from immigrating into the State and from voting and holding



BY COURTESY OF THE SPRINGFIELD CHAMBER OF COMMERCE

THE OLD STATE CAPITOL AT SPRINGFIELD, USED AS A COUNTY COURTHOUSE SINCE THE COMPLETION OF THE NEW CAPITOL IN 1887

office; and although the Constitution as a whole was rejected by the people, these clauses were ratified. In 1863 more pronounced opposition to the policy of the National Government developed. A mass meeting, which met at Springfield in July, at the instance of the Democratic Party, adopted resolutions that condemned the suspension of the writ of habeas corpus, endorsed the doctrine of State sovereignty, demanded a national assembly to determine terms of peace, and asked President Lincoln to withdraw the proclamation that emancipated the slaves, and so to permit the people of Illinois to fight only for "Union, the Constitution and the enforcement of the laws." The Knights of the Golden Circle (*q.v.*), and other secret societies, whose aims were the promulgation of State sovereignty and the extension of aid to the Confederate States, began to flourish, and it is said that in 1864 there were 50,000 members of the Sons of Liberty in the State. Capt. T. Henry Hines, of the Confederate army, was appointed by Jefferson Davis to co-operate with these societies. For a time his headquarters were in Chicago, and an elaborate attempt to liberate Confederate prisoners in Chicago (known as the Camp Douglas conspiracy) was thwarted by a discovery of the plans. In the elections of 1864 the Republicans and Union Democrats united, and after an exciting campaign they were successful. The new legislature was the first among the legislatures of the States to ratify (Feb. 1, 1865) the 13th amendment.

From the close of the Civil War until the end of the 19th century the Republican Party was generally dominant, but the trend of political development was not without interest. In 1872 many prominent men of the State joined the Liberal Republican Party, among them Governor John M. Palmer, Senator Lyman Trumbull and Gustavus Koerner (1809–96), one of the most prominent representatives of the German element in Illinois. Economic depression gave the Granger movement considerable popularity, and an outgrowth of the Granger organization was the Independent Reform Party of 1874, which advocated retrenchment of expenses, the State regulation of railways and a tariff for revenue only. A Democratic Liberal Party was organized in the same year, one of its leaders being Governor Palmer; consequently, no party had a majority in the legislature elected in 1874. In 1876 the Greenback Party, the successor in Illinois of the Independent Reform Party, secured a strong following; although its candidate for governor was endorsed by the Democrats, the Republicans regained control of the State Administration.

In 1912, as a result of the Progressive secession, the Republican Party for the first time in 16 years lost control of the State, the Democratic presidential electors winning by a vote of 405,038, as against 386,478 for the Progressives and 253,593 for the Republicans. The Democratic State ticket headed by Edward F. Dunne was elected by a somewhat larger plurality. The Democrats, however, did not control the general assembly on joint ballot. By 1914 the normal Republican majority in the State reasserted itself, the popular vote for senator in that year being L. Y. Sherman, Republican, 390,661; Roger Sullivan, Democrat, 373,403; Raymond Robins, Progressive, 203,027. President Woodrow Wilson lost the State in the presidential election of 1916 by 160,000 votes. Frank O. Lowden, Republican, was elected governor over Edward F. Dunne. Len Small succeeded Lowden in 1921 and was re-elected in 1925.

The relations between capital and labour have at times resulted in serious conditions, the number of strikes and lockouts from 1916 to 1926 having been 1,671. The most noted instance of military interference was in 1894, when President Grover Cleveland sent U.S. troops to Chicago to prevent strikers and rioters from interfering with the transmission of the U.S. mails.

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Information concerning population, economic conditions, etc., may be found in the *Fourteenth Census of the United States, State Compendium; Illinois*. Consult also the reports of the various State departments and officials and the *Bulletins* of the Illinois Geological Survey. (D. K.)

ILLINOIS, THE UNIVERSITY OF, an institution of higher learning situated in Urbana, Ill. It arose out of the passage of the Morrill Land Grant Act in 1862, whereby the National Government gave each State in the Union scrip for 50,000 ac. of public land for each senator and representative in Congress "for the endowment, support and maintenance of at least one college whose leading object shall be, without excluding other scientific and classical studies and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts . . . in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life."

The State of Illinois accepted this gift and in Feb. 1867 granted a charter to the Illinois Industrial university. The institution was put under the control of a board of trustees appointed by the governor, excepting two members *ex-officio*, the governor and the State superintendent of public instruction. In 1887 the board was made elective except for the two *ex-officio* members. The university was situated in Urbana-Champaign county, but has extended across the city line into Champaign city, the two cities

being adjacent. In 1885 the name of the institution was changed to The University of Illinois.

The administrative head of the university was known at first as regent. In 1894 the title was changed to president. The university includes at Urbana-Champaign: colleges of liberal arts and sciences, agriculture, engineering, commerce, education, law; schools of library science, music and journalism, and the graduate school. The colleges of medicine, dentistry and the school of pharmacy are in Chicago. A summer session is held at Urbana-Champaign each year. Other great departments are military, physical welfare and health service.

The university has 74 principal buildings in Urbana and Chicago, besides numerous smaller service buildings and 2,298 ac. of land of which 1,925 ac. are devoted to agriculture. The libraries of the university aggregate about 760,000 volumes. The teaching and administrative staff numbered 1,232 in 1928. The student enrolment for the year 1927–28 was 14,071. Of these, the largest group, about 4,200, were in the college of liberal arts and sciences.

In addition to the instructional work of the university, much research is carried on. The agricultural and engineering experiment stations are devoted to research in their respective fields. In all other departments of the university research is carried on either individually or co-operatively. Notable discoveries have been made in various departments, the most noted, perhaps, being the discovery of the element illinium in the chemical laboratory of the university in 1925, this being the only chemical element discovered in the Western Hemisphere. The work of the experiment stations is far-flung. The engineering station assisted in experiments for the ventilation of the New York and New Jersey vehicular tunnel under the Hudson river, as well as in other projects of a similar character.

The main financial support of the university is from State appropriations. In addition, the university receives certain Federal appropriations and has an income from student fees and from various other sources. For the biennial period 1925–27 the budget income for all-purposes aggregated $15,678,560. Of this amount $10,529,914 were State appropriations. (D. K.)

ILLINOIS CENTRAL SYSTEM is the principal north-and-south railroad of the United States. It was incorporated in 1851 to build lines between Cairo and East Dubuque and between Centralia and Chicago, in Illinois. Construction was completed in 1856. Additional lines were subsequently built or acquired in Illinois, Indiana, Wisconsin, Minnesota, South Dakota, Nebraska, Iowa, Missouri, Kentucky, Tennessee, Arkansas, Louisiana, Mississippi, Alabama and Georgia. The system, including the owned but separately operated Central of Georgia Railway, consisted in 1928 of 9,183 m. of line. Three-fourths of the railroad's operating revenue is derived from freight traffic, the principal commodities being coal, lumber, petroleum, sand, gravel, stone, cement, grains, livestock, cotton, fruits and vegetables and miscellaneous manufactured products. Through passenger trains are operated between Chicago and St. Louis and Memphis, New Orleans, the Mississippi Gulf Coast, Birmingham, Savannah and the Florida resorts, and between Chicago and Omaha, Sioux City and Sioux Falls. A subsidiary, the Ocean Steamship Company of Savannah, operates a fleet of steamships between Savannah and New York and Boston. The total investment in property on Dec. 31, 1927, was $828,920,000. (L. A. D.)

ILLITERACY. In the more restricted and technical sense of the term an illiterate person is one who is unable to read and write his own language. The tests of this ability vary greatly, but all are so simple that a person could easily pass them and yet be illiterate in the wider sense.

It has been estimated very roughly that about 60% (820,000,000 persons) of the world's population over 10 years of age cannot read or write. For large parts of Africa, Asia and the Pacific Islands only rough guesses at the population can be made, and illiteracy is considered absolute. In some Catholic countries and in all Mohammedan and Asiatic countries the illiteracy of the female population greatly exceeds that of the male. In some Asiatic countries it is almost complete. The least illiteracy in the world is to be found in the countries to the west and north of Europe, and in countries settled by them. A reason often given for their low percentage of illiteracy is that the Protestant Reformation emphasized the reading of the Bible and thus gave the first incentive to the education of all classes. Church schools initiated such teaching and for a long time retained control of education.

Unfortunately statistics of illiteracy are not collected in a uniform manner in various countries, nor do given figures represent the same age groups, so that much of their value for comparative purposes is lost. To intelligently reveal conditions illiteracy should also be classified as to sex, nationality and race. Only the first is possible in the table given below. Norway, Sweden, Germany and Switzerland claim a negligible amount of illiteracy. Germany ceased keeping statistics in 1913 when her male percentage as revealed by army recruits was ·05. Illiteracy statistics for Great Britain were based upon the proportion of those signing their names in the marriage register with a mark, but even these ceased to be included in the Registrar-general's annual report in 1914 when the percentages stood at 0·8% for males and 1·0% for females. In 1841–45 the figures had been 32·6% and 48·9% respectively. For other important countries the percentages are given in the following table:—

Country	Source	Ages included	Male per cent age	Female per cent age	Year
Australia	Census	Over 5 years	4·6	4·8	1921
Belgium	"	" 6 "	7·6	9·0	1920
Bulgaria	"	" 8 "	32·2	60·8	1920
Canada	"	" 5 "	9·7	8·7	1921
Chile	"	" 8 "	41·1	43·3	1921
Columbia	"	Total population	62·1	63·4	1920
Czecho-Slovakia	"	Over 6 years	0·1	1·8	1921
Egypt	"	" 5 "	85·7	97·0	1917
Esthonia	"	" 7 "	0·1	1·4	1922
Finland	"	" 15 "	1·1	8·3	1920
France	"	" 10 "	0·0	0·4	1921
Greece	"	" 5 "	32·1	60·8	1921
Hungary	"	" 6 "	14·0	17·1	1920
India	"	Total population	87·4	98·1	1921
Italy	"	Over 6 years	38·0	41·0	1921
Japan	Army conscripts		1·3		1919
Lithuania	Census	Over 8 years	38·0	48·8	1923
New Zealand	"	" 5 "	1·4	1·8	1916
Poland	"	" 10 "	20·4	47·8	1921
Portugal	"	" 6 "	42·0	61·5	1920
Spain	"	" 6 "	30·8	43·1	1920
Union of Soviet Socialist Republics	Army conscripts		19·87*		1920
United States	Census	Over 10 years	6·0	5·9	1920

*Census (1920) for Russia in Europe showed 49·8% male and 71·8% female illiteracy.

Illiteracy statistics are most complete in the United States. (*See* UNITED STATES: *Population and Social Conditions.*) The comparatively high percentage of illiteracy there where education is compulsory was due chiefly to the adult negro and foreign-born populations. The illiteracy of native whites in 1920 was 3·0%, of foreign-born whites 13·7%, of children of foreign parents 0·9% and of negroes 27·4%. The low percentage of illiteracy among children of the foreign-born reveals how eagerly the foreign-born take advantage of free education. Negro illiteracy was reduced from 30·4 in 1910 to 22·9% in 1920. The illiteracy among native whites was found chiefly in the isolated rural districts of the older states and in the newer states where the demands of the frontier had prevented an older generation from receiving their educational inheritance. Illiterates among arriving immigrants decreased from 23·5% in 1900–09 to 0·9% in 1926 due to new immigration laws.

Illiteracy in the United States by Geographical Divisions, 1920

	All classes	Native white	Foreign-born	Children of foreign-born	Negroes
New England	4·9	0·6	14·0	0·8	7·1
Middle Atlantic	4·9	0·7	15·7	0·5	5·0
East North Central	2·9	1·0	10·8	0·6	7·3
West North Central	2·0	1·1	6·4	0·5	10·5
South Atlantic	11·5	5·4	12·8	0·9	25·2
East South Central	12·7	6·6	9·1	1·5	27·9
West South Central	10·0	3·9	29·9	6·6	25·3
Mountain	5·2	2·4	12·7	1·0	5·3
Pacific	2·7	0·4	8·6	0·4	4·6

ILLORIN, a province of northern Nigeria, British West Africa. Area 17,779 sq.m.; population (1926) 519,627. It lies west of the Niger and is bounded west by French territory (Dahomey). The province consists mainly of open plains and river valleys and is separated from southern Nigeria by a range of well wooded, iron stone hills. The chief division is the emirate of Illorin, occupying the centre. In the north is the Borgu division made up of the emirates of Kaiama and Bussa. In the east are the Pategi and Lafiagi emirates. The predominant native race is the Yoruba (*q.v.*), but in the districts by the Niger the Nupe prevail. The province is rich in agricultural and sylvan products. Among the former are cotton, rice, peppers, ground-nuts and kolas. The latter include great quantities of shea as well as palm-oil and rubber. The Government maintains an experimental farm in the province, where attention is given largely to cotton and ground-nuts as sources of a big export industry. The capital, also called Illorin, is 160 m. in a direct line north-north-east of Lagos, and is on the railway from that port to Kano. The town (pop., 1926, 83,669) is surrounded by a mud wall partly in ruins, which has a circuit of some 10 miles. Illorin is a great trading centre. A variety of manufactures are carried on, including the making of leather goods, carved wooden vessels, finely plaited mats, embroidered work, shoes of yellow and red leather and pottery of various kinds. Before the establishment of British rule Illorin middlemen transacted all business between the traders from the north, who were not allowed to pass to the south, and those from the south. On the establishment of British authority the town was thrown open to all traders and a number of European merchants are established there. The chief buildings are the British residency, the palace of the emir, the houses of the *balogun* (war chiefs), mosques and churches. From the centre of the town roads radiate like spokes of a wheel to the various gates. Baobabs and other shade trees are numerous.

The town of Illorin was founded, towards the close of the 18th century, by Yoruba, and rose to be the capital of one of the Yoruba kingdoms. About 1825 the kingdom, which had been conquered by the Fula, became an emirate of the Sokoto empire. The Fula, however, maintained the Yoruba system of government, which places the chief power in a council of elders. In 1897 Illorin was occupied by the forces of the Royal Niger Company, and the emir placed himself under the protection and power of the company. After the assumption of direct authority by the British Government in 1900, Illorin was organized for administration on the same system as the remainder of northern Nigeria. The Yoruba showed a keen appreciation of education, to which the Nupe remained indifferent. (*See* BORGU and NIGERIA.) (F. R. C.)

ILLUMINATED MANUSCRIPTS. Illumination, in art, is a term applied to the embellishment of written or printed text or design with colours or gold and, rarely, with silver. The old form of the verb "to illuminate" was "to enlumine," and 13th century laymen who practised the art were called "enlumineurs." While the term should be strictly applied to the brilliant book-ornamentation which was developed in the middle ages, it has been extended, by usage, to the illustration and decoration of early mss. in general.

The decisive changes in the history of the book are similarly turning points in the art of illumination. (*See* BOOK.) The production of precious illuminated mss. survived the introduction of printing by nearly a century. So far as we know, the art of decorating mss. did not create new forms through a development based on writing, but rather it took over pictures and ornaments from other forms of art. The written pages appear at first simple and unadorned, even where the parchment is coloured and the writing is in silver or gold; then simple enlarged initial letters and calligraphic ornament; in the Codices richly adorned title-pages and brilliant displays of ornament in the Canon-tables of Gospel mss. The form and position of the pictures vary exceedingly. Sometimes the illustrations are placed haphazard in the picture borders, in the text, or as framed pictures in the text; they may also occupy full pages, or in the form of a running band in the Codex above or below the text, or, as in the roll, running in a continuous series of pictures from end to end.

Illumination in Antiquity.—The little surviving from the first great period in the history of illumination which reached to about the 4th century, consists of numerous fragments of papyrus rolls. Such fragments include the ancient *Egyptian Book of the Dead,* in which the illustrations are either dashing drawings or coloured pictures. The only fragmentary examples of illustrated rolls of the classical period were found in Egyptian excavations, and our knowledge of this period, as a whole, is very slight. The most ancient and important of these are the fragmentary copy of the *Iliad,* on vellum, in the Ambrosian library, Milan (variously assigned to the 3rd and 5th centuries), of which there are 58 pictures of various sizes, obviously the remains of a magnificent ms.; the small Virgil at the Vatican (Lat. 3,225, 4th century) with pictures set off in a simple frame and inserted in the text, all of which are considered to have been based on Augustan models; and the later Vatican Virgil (*Codex Romanus,* Lat. 3,867, 5th or 6th century), the work of an artist who did not understand his model's technique in painting and was, therefore, unable to copy it. (*See* MANUSCRIPTS, PALAEOGRAPHY.)

Illumination of Christian Books in the East.—Christian illumination dates back to the times to which the few early profane illuminated mss. in our possession belong. The number of ancient Christian illuminated mss. in Greek or in oriental languages is very small. (*See* BIBLE, MANUSCRIPTS.)

Other Theological and Profane Manuscripts.—Among illuminated theological or profane mss. which survive in the original, the most important is the Dioscorides (early 6th century) in Vienna. Few of the manuscripts are dated and localized and many important to early Christian art are preserved only in mediaeval copies; even those actually written in early Christian times may not be originals, but merely copies. Only on this basis can we explain why the Viennese Genesis, made up of various series of illuminations, is closely allied to the Codex Rossanensis, which belongs to another stage in the development of the style. The style is determined mainly by paintings of late antiquity based on Hellenistic models influenced by indigenous art (Coptic, Syrian, etc.).

Miniatures in the Middle Byzantine Period.—The development in Byzantium cannot be traced clearly until after the iconoclastic controversy. As art flourished again, the works of the Byzantine Renaissance, as it is called, began to be produced. To this renaissance belong those Codices which hand on works of late antique or early Christian times, partly in accurate copies, partly in free imitations (Joshua Roll, Kosmas Indikopleustes), Psalters like that at Paris (Grec. 139). On the other hand, the typical middle Byzantine art modelled its style on monumental art.

Although Constantinople decided the trend of artistic production, illumination was also cultivated outside the capital. As practised in the monasteries of Athos, its importance was far-reaching. From the 11th century a school of miniaturists developed in Russia, the works of which are, at first, scarcely to be distinguished from those of Byzantium. The Menology at the Vatican is the only Byzantine ms. in which each miniature is signed by the artist. The style in the later works, and especially in the productions of the monasteries, became dry, but still it persisted,

not only through the Latin conquest (1204–61), but it was also capable of a rebirth after the restoration of the empire under the Palaeologues (1261).

Western Illumination in Early Christian and Carolingian Times.—Few early Christian illuminated manuscripts of Western origin have survived. A comparison between the Quedlinberg Itala fragment in Berlin of this period and the Virgil of the Vatican (Lat. 3,225) proves that the scriptoria which produced it also executed Christian illuminated mss. The affinity between the two is extraordinarily close; the style is clear and simple in character; the pictorial conception gives evidence of naturalness and it is without a trace of the Byzantine spirit. There is evidence that style quickly deteriorated in the West, but the process cannot be traced in detail.

The most important original ms. is St. Augustine's Gospels at Corpus Christi, Cambridge (Nr. 286) which was probably executed in Lower Italy. The Ashburnham Pentateuch at Paris is of a different type; its 19 miniatures are stylistically and iconographically unique, and indicate a connection with oriental models; they are possibly of Spanish origin. These mss. bear witness to a survival of late antique and early Christian art in the West. By comparison, the mass of the mss. produced in the monasteries of the Frank and Lombard kingdoms in the 7th and 8th centuries have quite a different character. Among the large number preserved only a few have figurative representations. Illuminated Bibles or Gospels hardly occur at all. Ornament, in general, is restricted to initials and decorated pages, a method of embellishment based on the art of the *scribe*, not of the *painter*. Compared with the simplicity of the text in late antique mss., it is a complete revolution. Part of the material originated in upper Italy and south France, apparently in the early 7th century. Later, the art was transplanted to central and northern France. The majority of the mss., and especially those richest in decoration, arose in north France in the latter half of the 8th century, *i.e.*, not until the Irish and Anglo-Saxon arts of illumination were already highly developed.

In Britain two fundamentally different tendencies must be distinguished, the Irish and the English. The development in England was determined by the Roman mission and by the close relations kept up between the Italo-Saxon churches and monasteries and Rome itself. In the 8th century, from which period a series of splendid mss. have been handed down, the artists endeavoured to continue the early Christian figurative tradition in stiffly outlined forms, and at the same time displayed rich decorative splendour in the Irish fashion. The most important works of the Canterbury school are S. Augustine's Psalter with a portrait of David (British Museum) and the Codex Aureus in Stockholm.

Irish Illumination.—In spite of numerous contacts with England, Irish illumination is a world apart. It is one of the most interesting phenomena in the whole range of mediaeval art. In the art of illumination it represents, perhaps, a climax never again reached. It is the more remarkable in that it suddenly appears before us, fully developed, without any preliminary stages and with no source to which it can be traced. The three chief Irish works are the Book of Durrow (Dublin, Trinity college, A. 4, 5.), the Book of Kells (*ibid.* A. 1, 6) and the Lindisfarne Gospels (British Museum Cotton, New D. IV.). The Book of Durrow (*c.* 700) is pure Irish in style; the Book of Kells (for which the date 700 has been disputed in favour of a later period) shows traces of foreign ornamental ideas, and the Lindisfarne Gospels (written soon after 700), have pictures of the Evangelists, which are not Irish in style, but are only explained by the influences of the Italo-Saxon monasteries. The contrast arises from the refusal of the Irish artists to attempt naturalistic representation in order to make as free play with the figures of a picture as if they were calligraphic designs, that it is often difficult to see what these plaited figures really mean. This anti-naturalistic method of representation stands in sharp contrast to the whole range of classical antique art in all its derivations. Irish mss. show a richness of decoration unparalleled, so far as is known, up to that time. The various Gospels are preceded by whole pages with carpet-like designs, and the initials at the beginning of the text grow and spread until they, too, cover the whole page.

The Carolingian Renaissance.—Simultaneously with the reform of writing, a project of Charlemagne, there arose a number of new schools of painting which aimed at restoring the connection with antique and early Christian art. The chief works probably did not arise before the beginning of the 9th century; they include the Gospel-book of Ada (? Charlemagne's sister), at Trier, after which we call all these works the Ada-group. These mss. include rich Canon-tables, pictures of the Evangelists and of their symbols under large arcades, symbolical representations of the Church, the Fountain of Life, etc. Obviously there is an ancient pictorial tradition, which we can trace back, on the one side to Syria, on the other to Italy and England. The colouring is varied and splendid, the figures dramatic in movement, the faces fine and full of expression, the outlines of the figures rich in style. On the whole, the treatment, with its sharp and clear outlining of form, shows more of the spirit of drawing than of painting. All this points to models of high artistic importance.

Of a group of schools where work is in decided stylistic contrast to the Ada group is the Palatine school of Aix-la-Chapelle. Its chief work, the Gospel-book of Charlemagne, is preserved among the Crown treasures at Vienna. The treatment is altogether pictorial, the colouring fine and simple without being too varied. The plain style of embellishment, with the greatness of conception in the figures and the soft pictorial treatment, point to early Christian models. This tendency is continued in the school of Hautvillers, where a Gospel-book at Epernay town library was made for Ebo of Reims (816–35). Significant changes of style have set in however; the broad pictorial technique has made room for a hatched treatment, so that it has been supposed that the artist had been accustomed to using a drawing pen. The style is that of the Utrecht Psalter, which has great affinity with later Anglo-Saxon work, and which subsequently exercised a strong influence on development in England. The Utrecht Psalter (Utrecht University library), is at once the most magnificent and the strangest production of Carolingian art. The composition with landscape like stage-scenery reminds one of early Christian models (Joshua-roll). Without a doubt, the Utrecht Psalter has some connection with early Christian art. Nevertheless, it is an essential creation of Carolingian times. The school of Tours was at its prime towards the middle of the 9th century under the lay abbot, Count Vivian. The Gospel-book destined for the emperor Lothaire is the most important work (Paris B.N., Lat. 266). The Tours mss. took over from early Christian models a large number of Bible illustrations, and introduced them into mediaeval art. A quite distinctive style marks the works of the Franco-Saxon school. It shows, unmistakably, a continuation of the Irish and Hiberno-Saxon school, enriched by Carolingian elements. Its strength is based entirely on ornament and it is notable for having spread the art of the initial as developed in England and Ireland.

Anglo-Saxon Illumination.—Anglo-Saxon illumination began to flourish once more under King Edgar (*c.* 960). The new style, based on Carolingian art, suddenly makes its appearance completely developed, in the works of the Winchester school. It is one of the most original and attractive in the whole range of mediaeval art. The artist is not satisfied by normal movements of the neck or head, so the line of the neck is unnaturally prolonged and curved; the draperies appear as if driven by a gale of wind, and end in fluttering points; the seams are broken into numberless small folds. From the standpoint of correctness, much fault might be found with these figures, but as the expression of immense spiritual force they excite our wonder. Anglo-Saxon art, too, reaches its climax when it dispenses with painting in thick colours and contents itself with sketch-like drawings, which may be tinted with various light colours. The chief work of the early period is the Benedictional, which Bishop Aethelwold (963–984) caused to be written, by the scribe Godeman (Chatsworth library).

One of the most important seats of Anglo-Saxon art was at Canterbury. A copy of the Utrecht Psalter (Brit. Mus. Harl. 603) is supposed to have been executed there. More than three hands worked at it, so it must have been made in a large scrip-



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BLANCHE OF CASTILE AND SAINT LOUIS, KING OF FRANCE

Leaf from a *Bible Moralisée*, showing portraits of Blanche of Castile and her son, Saint Louis, king of France. This reproduction is from the original French manuscript, executed in the first quarter of the 13th century, now in the Pierpont Morgan library, New York

torium. The Anglo-Saxon style remained full of life until the middle of the 11th century. It was not confined to England; during the 10th century it crossed the Channel. There the style appears in many works in such freshness and spontaneity that it is likely that Anglo-Saxon artists had emigrated to France. Of this type is the Evangeliar (Boulogne library, No. 11) written at the Abbey of S. Bertin. In northern France there arose, side by side with the illuminations influenced by the Anglo-Saxons, other mss. which, independent in style, are full of intense expression.

The Ottonian Renaissance.—The Ottonian Renaissance flourished in Germany about the same time as the Winchester school. Its political background was the renewal of the Holy Roman Empire by Otto I. Within a few decades an almost inconceivable abundance of magnificent mss. was produced, which we can allot to a number of different schools. These schools differ exceedingly in character, according to whether the artists used Carolingian models or went back direct to early Christian. Middle Byzantine art, too, begins to exercise its influence at this period. The great number of pictures in the Ottonian mss. springs from these various sources. All these schools, on the other hand, are very creative in ornament. They used whole page illuminations with a purple ground and richly formed initials of golden foliated branch work, similar to those found occasionally in Carolingian times, especially in the Metz school. In all the schools of the Ottonian period, painting with thick colours prevails. In the works of the golden age of Ottonian art we notice the intention to approach the illusionistic conception of the late antique. But these endeavours are soon frustrated, and at the beginning of the 11th century decline sets in. The painting becomes more mediaeval in character, the background of the pictures is divided up by ornamental and coloured stripes, for which occasionally the Byzantine gold background is substituted. One of the most prominent centres of artistic activity was the monastery of Reichenau, situated on an island in Lake Constance.

Romanesque Illumination in England, France, Germany and the Low Countries.—Middle 11th century illumination stands at the parting of the ways. Anglo-Saxon schools and the German Ottonian Renaissance were dying out, and so the connection with antique painting disappears. From now onwards the whole of the West is governed by a style based on linear, not pictorially treated, outline-drawing, for which colour is used to tint the surfaces in the flat, with only slight modelling of forms. Art abandons the last reminiscences of the illusionistic manner of the late antique, in which the picture was based on a reality seen either bodily or in the mind's eye. The mediaeval style, which now establishes itself, dispenses with illusion, it gives us the different components of the pictures, *i.e.*, the figures and whatever else is necessary to understand the action, but releases them from contact with natural space. Even the background has chiefly an ornamental importance. A gold ground becomes more and more popular, or border and background consist of a system of frames. This manner of representation permits the artist to pack the most complicated ideas into a picture, if only he has created the corresponding frame to hold the conceptions together, and this tendency now completely dominates the art of illustration. A counter movement is only to be seen in Byzantine art which never altogether lost contact with the antique, and which preserved formulas from the illusionistic age. In the 12th and 13th centuries Byzantine influence penetrated further and further forward into Italy and obtained a strong hold in Germany.

In the West of Europe, especially in northern France and in England, Byzantine influence may also be traced, but it was powerless to check the development which led to Gothic painting, and which was furthered most of all by the art of stained glass. For technical reasons, stained glass, with all its beauty of colour, can never know real modelling; is based on outline-drawing in the proper sense of the word. It had an extremely strong influence on the method of painting, described above, in which numerous figurative representations are combined within a system of frames. Already, in the 12th, and especially in the 13th century, many illuminated mss. show evident traces of having been imitated from stained glass.

Anglo-Norman Illustration.—Soon after 1100 we find various Anglo-Norman scriptoria at the height of their power. Their productions are chiefly enormous Bibles, separate books of the Bible with commentaries, and especially the Psalter. The style abandons the lightness of Anglo-Saxon times. It is now based on stiff linear designs fitted up with opaque pigments of harsh colour. The figures are, especially early in the 12th century, heavy and awkward. A little later the style becomes more spirited. The initial ornaments are astonishingly rich in invention and design, and they are enlivened with numerous fantastic forms of men and animals in strange colours.

Bury St. Edmunds produced the first of the large Bibles so characteristic of the 12th century. Winchester again became, about the middle of the 12th century, the seat of an important school. It produced the Psalter of Bishop Henry of Blois (British Museum, Nero C. IV.).

The wave of Byzantine art had now reached England also and the deeply agitated style with its singular types is replaced by an almost classical conception of art. The chief work of this tendency is the Winchester Psalter of the British Museum. Well-proportioned forms of measured placidity and solemnity of movement meet us in these pictures. Of the greatest importance is the latest copy of the Utrecht Psalter, which was only finished afterwards in Italy (Paris B.N. Lat. 8846).

Continental Schools.—Our knowledge of the history of miniature in France is altogether much slighter than in England. We know of the quick rise and decline of an important scriptorium at Cîteaux, the founder of which was Abbot Stephen Harding. Numerous mss. with most peculiar decoration, especially initial letters of quite fantastic formation, emanate from Limoges and western France. The productions of monasteries in Belgium and northern France are extraordinarily numerous. Many of these are dated and indicate the names of the artists. In the eastern part of this territory, a style approaching the Rhenish predominates, while towards the west, where the narrowness of the straits provided a natural connection with England, the Anglo-Norman affinities already mentioned make their appearance.

In these districts, also, we can establish the presence of a strong Byzantine influence in the critical period round about 1200.

In Germany the development of art, after the Ottonian Renaissance, varied in the different territories. In the south-east, the Middle Byzantine influence, already perceptible in the early 11th century, now became permanent.

In the western and northern districts of Germany Byzantine influence was not so powerful in the 12th century. One work, however, the famous *Hortus Deliciarum* of the abbess Herrad of Landsberg, in Alsace, occupies a position of its own on account of the unusual illuminations it contained. (The original perished in 1870.) Pure pen-drawing had spread in all directions. On the lower Rhine and in north Germany some miniatures were executed in opaque pigments. These are clear and calm in style, and at times they rise to an extraordinary height of monumental dignity, *e.g.*, in the Gospel Book of unknown origin at Paris (B. N. Lat. 17,325) or the Hildesheim mss. of the 12th century (Hildesheim, Ratman Missal, etc.).

With the beginning of the 13th century Byzantine influence extended its power over almost all the country, and its style displays great restlessness. In the latter part of the 13th century the desire to create original forms and to express passionate feeling was so strong that the style was often positively distorted. The Byzantine tendency attains its zenith in the Gospel-book of the town hall at Goslar, and the Missal (Pierpont Morgan's library), executed in the first third of the 13th century. Immediately after the middle of the 13th century numerous fine works were produced, especially in south Germany, where refined Byzantinesque style predominated (Psalter, Munich, Staatsbibl. Lat. 3,900).

Gothic Illumination in France, England, Germany and the Lower Countries.—In the first half of the 13th century a complete change came over French illumination which transformed the fundamental ideas of book-ornamentation. It is based, to begin with, on the cultivation of a refined and dainty style which

caused the contrast between miniatures in Gothic mss. and the art of monumental painting to appear sharper than ever before. It rested, moreover, on the closer assimilation of picture and text, so that the historiated initial becomes predominant in Gothic mss. When the miniature remained independent, it bears the character of a small medallion or of a quatrefoil. The initials, however, expand more and more until they have twined themselves all round the pages of text. Figures dispersed at random in the margin, called drolleries, although they may represent any sort of object conceivable, introduced a new style of embellishment on which all development to 1500 is founded. Paris is regarded as the birth-place of the new style. Several mss. are designated as the property of Queen Blanche or of St. Louis, among them the Psalter of the Arsenal library in Paris. It is the first to show the substitution of medallions for the usual rectangular series of pictures. From other books it is still clearer that the illuminators are keeping very close to the example of stained glass windows (*see* Colour Plate), from which they borrow the complicated arrangement of the medallions.

Great as is the advance made by the mss. of the *Bible moralisée* and the allied mss., they had not yet produced the pure type of Gothic ms. Many other miniatures, however, display a strongly dramatic and restless style, which has a certain affinity to contemporary German work rather than with French Gothic. A number of splendid mss. which are supposed to emanate from Salisbury, are illustrated in this style. Early English examples include the magnificent pictures of the Apocalypse at Trinity college, Cambridge. A great new style, which was to oust all the previous tendencies in France and England, was created under the strong influence of monumental art in Paris about the middle of the 13th century. Its chief works are the Psalters written for St. Louis or other member of the royal family (Paris B.N. Lat. 10,525) and the liturgical mss. executed for the Ste. Chapelle. These works combine two qualities, firstly, the greatest simplicity of style, in that they work out the pure Gothic line, and secondly, a marked attention to reality in ornament and in architectonic details, in costume, etc. It is very difficult to distinguish between French and English work of this period. In spite of numerous English traits we can probably localize in Paris the Psalter of the municipal library at Nuremberg and the Psalter of Queen Isabella, Edward II.'s wife, at Munich. Queen Mary's Psalter at the British Museum is, beyond dispute, an early 14th century English masterpiece. In the work of the East Anglian school can be seen the gradual giving up of Gothic outline-drawing for the sake of a broader pictorial treatment. Its most singular characteristic is extravagant richness of ornamentation displayed in the large border-frames of the decorated pages, interlaced with figures of every shape and kind. In Parisian illumination the characteristic style of the miniaturist, Jean Pucelle, shows the change unmistakably. From now onwards we can follow in the miniatures of the mss. the development of modern painting. The fundamental revolution in style which takes place during this period can only be explained on the assumption of Italian influence arising out of the close connection between Italian and French art, based, in its turn, on political and dynastic relations and the transference of the papal court to Avignon. This may account for the fact that one of Pucelle's masterpieces, the Breviary of Queen Jeanne of Navarre (Yates Thompson collection), contains certain miniatures that can only be understood as imitating Italian pictures of the Trecento.

From the middle of the 14th century onwards, the naturalistic tendency becomes more and more powerful. For this period the phrase, "the naturalism of head and hand," has been coined. Its influence is seen most clearly in the dedication-pictures, where the elements of portraiture in the persons represented, as *e.g.*, Charles V., are unmistakable. In religious pictures, however, Gothic idealism continued until the beginning of the 15th century. The miniatures executed for Charles V. are often set in *quatrefoil* frames, and grey monochrome (grisaille) is preferred to painting in colours. The decisive change in the direction of modernity may best be studied in the mss. illuminated for Charles V.'s brother, the duke of Berry. The name of André Beauneveu, of Valenciennes, is given for the Psalter at Paris (B.N. Fr. 13,091), that of Jacquemart de Hesdin for the Prayer Books at Paris (B. N. Lat. 919) and Brussels (B.R. 11,060-61). In these mss. there is a change in the borders, the dainty sprays of ivy, which had hitherto sprouted loosely over the margins, now completely fill them up, and new *motifs* add to the wealth of ornament. In the miniatures we can see the old Gothic tradition gradually being displaced by Italian art, with a rapid progress in naturalism. The new art reaches its climax in the second decade of the 15th century in two mss. begun for the duke of Berry, which must be classed, beyond dispute, among the most magnificent illustrated books of all times. The unfinished Prayer Book at Chantilly (called, according to the Inventory, *Très riches Heures du duc de Berry*), was illuminated by Pol de Limbourg and his brothers. Pictures which remind us of famous Italian mural paintings stand side by side with faithful representations of reality, as *e.g.*, the Calendar-pictures with the views of the duke's castles or the genre-like February snow-landscape. We are taken a step further by the Prayer Book begun for the duke of Berry, but after his death continued for Count William IV. of Bavaria-Holland. In the pictures of William IV.'s time the Italian style has been completely replaced by a style so near to that of the brothers van Eyck that some of the best pictures have been attributed to them. The miniatures of the two last-named mss. are invaluable to the history of painting.

Spanish and Italian Illumination in the Middle Ages.— Spanish and Italian illumination had only a slight share in the Renaissance movement on which Carolingian, Ottonian and Anglo-Saxon art was based. In Spain, as in Italy, tendencies prevailed, during this period, which can best be compared with the Franco-Saxon school. The Spanish mss. of the 9th to 11th centuries display a rich, but fantastic decoration in which early Christian and Moorish elements are mixed. The figures are anti-naturalistic, reminding one of the Irish style. The most singular Spanish creation is the great series of illustrations to Beatus of Liebana's Commentaries on the Apocalypse which have survived in many copies from the 9th (?) to the 12th centuries (the oldest in the Yates Thompson college, a later one in the P. Morgan library).

The character of Italian illumination varies extremely in the different Italian territories, according to their relations with East and West. A curious blend of contrasting tendencies is to be seen in the book-ornamentation of the Benedictines at Monte Cassino in the 11th and 12th centuries. Here Hiberno-Saxon, Ottonian and Byzantine stylistic elements are intimately combined. Southern Italy made a speciality of Exultet-rolls, as they are called, *i.e.*, mss. adorned with miniatures and written in the form of rolls. Various Italian monasteries produced, from the 11th to the 13th centuries, gigantic Bibles, some of which show a singular beauty of initial which was afterwards imitated in the 15th century. The origin of these Bibles is partly to be sought in Tuscany, where, in the reign of the margravine Matilda, works of a pronounced original character were produced, *e.g.*, the Gospel-book which Matilda presented, in 1109, to the Abbey of Polirone (P. Morgan library). During the 13th century, Italian illumination in the large university towns of northern Italy developed freely and in a manner quite its own. Legal text-books, Bibles, etc., were executed and taken by the students all over Europe. Moreover, the 13th century produced a new type of book, the immense choir-book, which was everywhere used at church services. In general, large miniatures are rare in Italian illuminated mss. Most have only historiated initials, but these are drawn out to great length and spread out over the margins in branch and leaf work. Drolleries were added very early, so that one feels inclined to assume that they made their way to the North from Italy. All this, however, does not exhaust the importance of Italian miniature. Just as in mural and panel painting, Italy was foremost in diffusing the Byzantine style.

We must not overlook the immediate influence of the Crusades in causing an interpenetration of the Western and Byzantine elements. In the Latin kingdoms of the Orient, there were executed for churches and princes magnificent mss. in which such a mixture of styles was inevitable, *e.g.*, the Psalter of Queen Melissenda of

Jerusalem (British Museum), the Missal of the Holy Sepulchre church at Jerusalem (Paris), and many others. Similar works probably emanated from those districts of Italy which were particularly exposed to Byzantine influence. We may, perhaps, put in this class the Missal at Madrid. A similar mixture of style is evident, in a much coarser form, in the Epistolary, written in 1259 at Padua (cathedral treasure). About 1300 a large number of Byzantesque illuminations were produced at Bologna, which are distinguished by copious border-decoration, with figures in the pseudo-classic style. Splendid works of this kind are the Bibles at Paris (B.N. Lat. 18) and at the British Museum (Add. 18,720).

During the 14th century, throughout Italy's busy scriptoria, as at Naples, where French influence is noticeable, numerous mss. rich in miniatures were produced (Bible, subsequently Leo X.'s, now Berlin, Kupferstich-Kabinett). Only rarely can we connect miniatures with the artists who painted on panel. A Virgil in Milan and the Ufficio di San Giorgio in the archives of S. Peter at Rome, are assigned to Simone Martini of Siena.

Miniature Since the 15th Century.—Many illuminated mss. of the later 15th and 16th centuries surpass in wealth of pictures and magnificent embellishment, even the works from the time of the duke of Berry. Their place is finally taken in the 16th century by black and white. The splendid miniatures of the 15th and 16th centuries are, like those of the preceding period, chiefly destined for princes and great courtiers. Three large centres of production are prominent: Flanders (Ghent, Bruges); France (Paris, Tours); Italy (Florence, Ferrara, etc.). Illumination in this period acknowledged no restriction on its choice of subject. The Books of Hours, indeed, still played an important part, but, besides these, there were profane mss. of an incredible variety, among which the Chronicles on the one hand, and the Romances on the other, are prominent.

Flanders.—In the generation following the van Eycks it can only rarely be proved that painters on panel had a hand in illumination. We know a number of miniaturists from their works or from documents, *e.g.*, Jean le Tavernier, Willem Vrelant, Loyset Lyédet, Philippe de Mazerolles, the Bening family. About the middle of the 16th century the activity of the Flemish scriptoria seems to have died out. It is important to note Simon Marmion, unsurpassed in landscape (Book of Hours, British Museum Add. 38,126). A master belonging to the circle of Roger von der Weyden is called after the Romance of Girart de Roussillon Jean le Tavernier, who adorned the Conquêtes de Charlemagne executed for Philip the Good (Vienna, Staatsbibl. 2,549). His second masterpiece, the Chronicle of Hennegau, is at Brussels. (Brussels, B.R. 9,066.)

France.—The production of French mss. during the 15th century will not bear comparison with the Flemish. In connection with the mss. of the duke of Berry, there is the Bedford Missal (British Museum) and the Salisbury Breviary in Paris, with its numberless miniatures. About the middle of the 15th century Jean Fouquet, the most important personality among the French miniaturists, makes his appearance. He died about 1480, at Tours, where he had lived before and after his journey to Rome (between 1443–47). Attested works of his are parts of the *Antiquités Judaïques* at Paris, and the miniatures cut out from the *Heures d'Etienne Chevalier* at Chantilly. Fouquet's art has a touch of the Renaissance which otherwise shows affinities with Flemish naturalism. The miniature survived under Francis I., and even into the time of Louis XIV.

Germany.—In Germany, in the 15th century, illustration passes a humble existence in monasteries and scriptoria which engage in large-scale manufacture of mss. (Diebold Lauber in Hagenau). In contrast with this mass production, there are the splendid mss. of the emperor Maximilian. The finest is the superb border, executed by Dürer and other great German artists, in a copy of the Prayer Book printed by Schönsperger (Munich, Staatsbibl. and Besançon).

Italy.—In Italy the renaissance in the mss. begins with the introduction of the *scrittura umanistica,* which goes back to the model of the fine Italian mss. of the 11th and 12th centuries, from which was also taken the scroll-work design in the frames enclosing the pages of text. Illumination does not really flourish until the middle of the 15th century, when there arose, almost always in connection with the luxury of courts, a number of studios which created a new style and new decorative forms. As in Flanders, the artists are seldom identical with the painters on panel, although, for example, the great art of Mantegna is reflected in miniature. In northern Italy, Milan and Verona were two of the centres. A masterpiece is the Book of Hours of Bona of Savoy, widow of Galeazzo Moria Sforza, duke of Milan, which afterwards came into the possession of Charles V. (British Museum Add. 34,924). In the Ferrara school, where a number of miniaturists worked for the ducal family of Este, Taddeo Crivelli takes the first place (Borso d'Este's Bible, 1455–62, Modena). The most important miniaturist under Borso's successor, Ercole I., is Martino da Modena (Ercole I.'s Breviary at Vienna). Miniature-painting in central Italy was chiefly concentrated at Florence; Francesco d'Antonio del Cherico, with Attavante degli Attavanti, were the two chief miniaturists. (*See* PAINTING; MINIATURE PAINTING; BYZANTINE ART; BOOK; BIBLE; MANUSCRIPT; PALEOGRAPHY.)

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(A. He.)

ILLUMINATI (Lat. *illuminare*), a designation in use from the 15th century, and applied to, or assumed by, enthusiasts of types distinct from each other, according as the "light" claimed was viewed as directly communicated from a higher source, or as due to a clarified and exalted condition of the human intelligence. To the former class belong the *alumbrados* of Spain. Menendez Pelayo first finds the name about 1492 (in the form *aluminados*, 1498), but traces them back to a Gnostic origin, and thinks their views were promoted in Spain through influences from Italy. One of their earliest leaders, born in Salamanca, a labourer's daughter, known as La Beata de Piedrahita, came under the notice of the Inquisition in 1511, as claiming to hold colloquies with our Lord and the Virgin; having high patrons, no decision was taken against her (*Los Heterodoxos Españoles*, 1881, lib. v.). Ignatius Loyola, while studying at Salamanca (1527) was brought before an ecclesiastical commission on a charge of sympathy with the *alumbrados*, but escaped with an admonition. Others were not so fortunate. In 1529 a congregation of unlettered adherents at Toledo was visited with scourging and imprisonment. Greater rigours followed, and for about a century the *alumbrados* afforded many victims to the Inquisition, especially at Cordova. The movement (under the name of *Illuminés*) seems to have reached France from Seville in 1623, and attained some proportions in Picardy when joined (1634) by Pierre Guérin, curé of Saint-Georges de Roye, whose followers, known as Guérinets, were suppressed in 1635 (Hermant, *Hist. des hérésies*, 1717). Another and obscure body of *Illuminés* came to light in the south of France in 1722, and appears to have lingered till 1794, having affinities with those known contemporaneously in this country as "French Prophets," an offshoot of the Camisards. Of different class were the so-called Illuminati, better known as Rosicrucians, who claimed to originate in 1422, but rose into notice in 1537; a secret society, combining with the mysteries of alchemy the possession of esoteric principles of religion. Their positions are embodied in three anonymous treatises of 1614 (Richard et Giraud, *Dict. de la théol. cath.*). A short-lived movement of republican freethought, to whose adherents the name Illuminati was given, was founded on May-day 1776 by Adam Weishaupt (d. 1830), professor of Canon Law at Ingolstadt, an ex-Jesuit. The chosen title of this Order or Society was Perfectibilists (*Perfektibilisten*). Its members, pledged to obedience to their superiors, were divided into three main classes; the first including "novices," "minervals" and "lesser illuminati"; the second consisting of "freemasons," "ordinary," "Scottish" and "Scottish knights"; the third or "mystery" class comprising two grades of "priest" and "regent" and of "magus" and "king." Relations with masonic lodges were established at Munich and Freising in 1780. The order had its branches in most countries of the European continent, but its total numbers never seem to have exceeded two thousand. The scheme had its attraction for literary men, such as Goethe and Herder, and even for the reigning dukes of Gotha and Weimar. Internal rupture preceded its downfall, which was effected by an edict of the Bavarian government in 1785. Later, the title Illuminati was given to the French Martinists, founded in 1754 by Martinez Pasqualis, and to their imitators, the Russian Martinists, headed about 1790 by Professor Schwartz of Moscow; both were Cabalists and allegorists, imbibing ideas from Jakob Boehme and Emmanuel Swedenborg (Bergier, *Dict. de théol.*).

See (especially for details of the movement of Weishaupt) P. Tschackert, in Hauck's *Realencyklopädie* (1901); and on the general subject, W. T. Whitley, art. "Enthusiasts, Religious," in Hastings, *Encyclopaedia of Religion and Ethics.*

ILLUMINATING ENGINEERING, term now used to denote all applications of natural and artificial light in the service of mankind. Progress in Great Britain since 1910 is largely the result of the formation (in 1909) of the Illuminating Engineering Society, in which makers of lamps and lighting appliances and users of light co-operate; all illuminants are represented and all aspects of the subject, economic, hygienic and artistic are considered. A similar body, the pioneer in this field, has been in existence in the United States since 1906, and corresponding bodies have been formed in Germany (1913), Austria and Hungary (1925), Japan (1915) and Holland (1926). In Germany two additional societies operating in Karlsruhe and in the Rhine Westphalia district have also been created. Attention has been paid to illumination at many international congresses, thus promoting the exchange of views between experts in different countries. The reorganization of the International Photometric Commission, founded in 1900, as the International Illumination Commission was stopped by the World War, but a fresh start was made in 1921, and the leading countries are now represented with national committees for the respective countries. (*See* J. W. T. Walsh, "International Co-ordination in Illumination," *Trans. First World Power Congress* [1924], vol. 3.) Much has been done towards standardization and agreement on common principles. Definitions of the main photometric quantities have been adopted, and a more extended series of definitions, symbols, etc., framed, while sub-committees to deal with lighting legislation, automobile headlights, etc., have been formed. At the sessions held in Geneva in 1924 and at Bellagio in 1925 further activities were initiated and the commission is extending its work to deal with various practical problems. Evidence of further progress in this direction was afforded at the International Illumination Congress held in the United States in 1928.

The International Candle.—A noteworthy step, dating from 1909, has been the agreement between France, the United States and Great Britain and, recently, also Russia, on an international candle so that the same unit of light is now in use in all four countries; but in Germany and some other countries the Hefner candle (equal to 0·9 international candle) is still in use. Preservation of the unit of light is now effected by the exchange of specially prepared electric lamp-standards between the official laboratories in the countries concerned. Meantime experiments are being made with a view to evolving an absolute standard of light, *e.g.*, one based on the maintenance of a "black body" at a specified temperature.

Progress in illumination has kept pace with this advance on the scientific side. Electric lamps, filament and arc, have been developed (*see* ELECTRIC LIGHTING). In the field of gas lighting there has been steady progress in design, one instance being the smaller and more compact forms of high pressure gas lamps, now rated to give 60 candles per cu.ft. of gas consumed. In low-pressure gas lighting the use of superheated clusters of inverted mantles has made possible a gain in efficiency estimated at 30%. The distribution of the light from a number of smaller mantles is considered an advantage, and the smaller types of mantles are the most durable. Cluster-lamps giving up to 2,000c.p. are now available.

Theory of Radiation.—Researches into the theory of radiation and the principles underlying illuminants provide a clearer understanding of the luminous efficiency theoretically obtainable. Thus a light source yielding visible white light and no non-luminous vibrations would operate at approximately 260c.p. per watt, whilst if the light were confined to the most efficient yellow-green section of the spectrum as much as 600c.p. per watt might be obtained. But in the case of new illuminants efficiency is not the only consideration; such special qualities as the colour of the light (as in the neon lamps) or the nature of the supplementary invisible radiation (as in the quartz tube mercury vapour lamps) may be of even greater importance.

Reflectors, etc.—The design of shades, globes and reflectors for use with lamps has assumed great importance. By suitable design of a reflector the distribution of light from a source may be altered within wide limits. Thus extensive, intensive and focusing forms of reflectors yielding standard curves of light distribution have been designed, and corresponding rules for height and spacing, designed to give even illumination on the working plane have

been derived. In most cases a shade or reflector is designed to direct most of the light downwards, where it is chiefly needed. But other cases occur, for example in shop window lighting and the illumination of large posters, etc., where reflectors are so designed and spaced as to yield an illumination over an extensive vertical area. Another function of shades and reflectors is to screen the actual source of light from the eye. Even when only vacuum metal filament electric lamps were available the glare from exposed filaments irritated the eye and prevented it from registering the full effect of the illumination provided. In the case of the gas-filled lamps, with their very much brighter filaments, the need for scientific screening is yet more evident. Hence in the leading stores concealed lighting of show-windows, with the light thrown on the goods but the sources concealed from the eyes of observers, is coming to be regarded as the correct method; and it is only in the smaller shops that exposed sources of light are still too frequent. A special instance of a concentrating reflector is to be found in the "floodlighting" units, consisting of an incandescent lamp with a special "bunched" filament at the focus of a parabolic mirror. Such units are miniature searchlights and are now being used to illuminate the façades of buildings. The design and application of such units have been dealt with fully in a paper recently read before the Illuminating Engineering Society by W. J. Jones.[1] With the searchlight proper, using an arc, the dimensions of the source of light can be much reduced and a beam of many millions of candle power attained.

Searchlights.—A notable advance during the World War was the design of searchlights using cooled electrodes leading to a yet smaller and more brilliant source and corresponding greater concentration. The cooling has been effected by two distinct methods, a blast of air and a spray of alcohol; in both cases a very substantial increase in beam-candle power for a given current consumption was obtained.[2] The brightness of the crater in such cases has been estimated at 200,000–300,000 candles per sq.in., as compared with 85,000c.p. per sq.in., in the case of the ordinary searchlight. In Germany, Lummer, working with an arc operating in a chamber under an air-pressure of 22 atmospheres, is said to have attained the enormous brightness of 1,500-000 candles per sq.in. But this method has apparently not yet reached a practical stage.[3]

An apparatus capable of projecting pure spectrum colours on the stage, which is in effect a giant spectroscope, has been designed. By the Mutochrome projector,[4] a series of superimposed patterns can be projected on the screen and the colour of each varied at will. This is likely to prove of considerable value to designers of wallpapers and coloured fabrics, as well as having a possible application for the projection of luminous scenery on the stage.

Artificial Daylight.—Efforts have also been made to provide "artificial daylight," *i.e.*, to correct the light from artificial illuminants and render it equivalent to normal daylight for the matching of colours. Two methods of effecting this correction have been applied. In the Sheringham unit the light from a gas-filled lamp is reflected from an upper surface coated with a pattern of green, blue and a small amount of yellow in suitable proportions. In the system usually associated with the name of F. E. Lamplough the light is filtered through a combination of tinted glass. In either case the efficiency of the apparatus is necessarily low, 60% or more of the original light being lost in making the correction. But the advantage to firms in the dyeing industry and others concerned with delicate colour-matching of having an invariable artificial light, independent of the wide variations of natural daylight, is very considerable. Attention has also been devoted to the production of fittings yielding light visually similar to average daylight, but less completely corrected. Such lighting units which have a relatively high luminous efficiency are recommended for use in picture galleries, shops devoted to coloured objects, etc., and in cases where daylight requires frequently to be supplemented by artificial light. It is suggested that such light is less fatiguing to the eyes than entirely uncorrected artificial light.

The psychological and other problems attending the lighting of streets, schools, factories, shops, etc. and the avoidance of eye strain in cinemas, the importance assigned to proper lighting in factories, and the interests of health, safety and efficiency of work have been investigated by the Illuminating Engineering Society and Home Office committees.[1] Evidence on lighting requirements in factories has been collected from many different sources, and records of over 4,000 tests of illumination in different factories have been presented. The minimum values of illumination in the interests of safety (0·25–0·4ft.c.) are established. Recommendations on the subject of avoidance of glare, flickers and inconvenient shadows have been made, and the illumination required for carrying out work is demonstrated to be not less than three foot-candles for fine work and five foot-candles for very fine work. Consultations with various joint industrial councils are now proceeding with a view to determining what constitutes suitable and adequate lighting for processes in their respective industries.

In the United States detailed codes of industrial lighting have been adopted in various States. In principle these follow closely the recommendations of the British committee. Methods of grading various lighting units according to the degree of "glare" are outlined, and the positions which may safely be assigned to such units in a workshop are tabulated. The codes also contain standards of the illumination requisite for various processes, a distinction being drawn in the most recent codes between the minimum value desirable and higher values recommended in the interests of economic production. A considerable amount of research has been devoted to the relation between conditions of illumination and efficiency of work. Thus it has been shown by Dr. Ives of the United States public health service that the despatching service in post offices was expedited and rendered more accurate by better conditions of illumination;[2] tests in laboratories in Germany have likewise revealed a close connection between illumination and many processes involving exact vision and manual dexterity.[2] The subject of industrial lighting has likewise been studied by the International Labour Bureau of the League of Nations in Geneva.

Particularly difficult cases of industrial lighting also form the subject of study by the committee on illumination, working under the Department for Scientific and Industrial Research, on which eminent architects and medical men, besides lighting experts, are represented. It has published several informative reports, amongst which that dealing with the lighting of printing works has excited special interest. In this enquiry the important conclusion was reached that full efficiency in type-setting by hand is attained only with an illumination of the order of 20–25 foot-candles.[3] This committee also deals with all enquiries bearing on illumination received from the various Government departments. In connection with this and other aspects of lighting, increased attention is now being devoted to the hygienic side, and at the International Congress for the study of industrial hygiene held in Geneva in 1924 a special resolution was passed accepting good illumination as of equal importance with heating, ventilation and sanitary conditions in the interests of health and safety.

Standardization.—Standardization in various fields is being dealt with by various sub-committees, working under the British Engineering Standards Association, which have prepared specifications on the performance and dimensions of electric lamps, and have also issued standard specifications for portable illumina-

[1] *Illum. Eng.* (Jan. 1927).
[2] "The Sperry Searchlight," *Electrician* (Feb. 2, 1917); Haydn T. Harrison, *Illum. Eng.* (March 1918).
[3] L. Bloch, *Lichttechnik* (1921).
[4] *Illum. Eng.* (May 1925)

[1] Reports of Departmental (Home Office) Committee on Lighting in Factories and Workshops, *First Report*, Cmd. 8,000, vol. 1 and 2 (1915); *Second Report*, Cmd. 1418 (1921); *Third Report*, Cmd. 1686 (1922).
[2] *Illum. Eng.* (April 1925).
[3] The Relation between Illumination and Efficiency in Fine Work (Type-setting by Hand); Joint Report issued by the Industrial Fatigue Research Board and the Illumination Research Committee (1926).

tion photometers,[1] reflectors used for industrial lighting,[2] street lighting[3] and illuminating glassware.[4]

Traffic and Lighting.—Experience during recent years has shown that the questions of lighting and transport are closely related. With the progressive increase in the volume of fast-driven motor traffic the necessity for good public lighting has become even more urgent than in the past; and the increase in the number of street accidents year by year has drawn public attention to the importance of the question. A new problem is presented by the lighting of arterial roads connecting cities. These routes are primarily intended for fast motor traffic and their utility will not be realized fully unless adequate artificial lighting is provided, enabling them to be used with safety by night as well as by day. Special methods of illuminating such routes are now the subject of consideration. Light is being used to an ever increasing extent as an aid to the guidance of traffic and, on the initiative of the Association of Public Lighting Engineers a resolution was recently passed advocating standardization of traffic signs and signals.[5]

Many devices eliminating glare from powerful automobile headlights have been suggested, some of the most promising based on the limitation of the main portion of the beam below a certain horizontal plane so as to avoid the direction of rays into the eyes of approaching drivers or pedestrians. But the most hopeful solution lies in the provision of better public lighting, which would render very powerful headlights unnecessary. Progress in these various directions has been aided very greatly by the introduction of simple forms of instruments for measuring illumination of which quite a variety of types is now available. The information acquired in this way has been very helpful in framing recommendations for the degree of illumination necessary for various purposes.

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ILLUSION, the experience and the result of misconstruing or misinterpreting some real sense stimulus or stimuli, as when a wax figure at Madame Tussaud's or similar exhibitions is mistaken for a real policeman, or when a piece of suitably modelled plasticine is mistaken for a sausage. Something is actually there to stimulate the senses, and the sense experience itself is produced in a normal manner, but, owing to established habits of rapid association or the temporary "set" of the mind, the observer mistakes the thing for something different. Many optical and other illusions are perfectly normal and can be experienced by a large number of people at the same time. This happens, for example, at the familiar entertainments consisting of juggling and conjuring tricks, also ordinarily in public places, thanks to the luminous "moving" advertisements which make modern civilization so gay and dazzling at night. The normality and indeed the inevitableness of so many illusions constitute one of the serious problems in any attempt to vindicate the validity of human knowledge. (*See* HALLUCINATION; ABNORMAL PSYCHOLOGY; PSYCHOLOGY [and the bibliography given there]; KNOWLEDGE, THEORY OF.)

See J. Sulby, *Illusions* (1881).

ILLUSTRATION, in art, a picture which tells a story. On the walls of the temples and tombs in Egypt are many pictures which tell a story. These pictures are bound by conventions to such a degree that the individuality of the artist is lost in the imposed formula. There is no drama as we understand it. An exalted personage is simply represented proportionately larger than his fellows. Attitudes and gestures are prescribed. Yet they tell a story and to that extent they are illustrations, but they are more than that: they tell the story of a whole people, of a people's faith and hope and life. They are generic. They do not deal with incident. If one finds two people playing a game, it is an incident in the whole life of all the people and tells the story of that people and a game—not of two definite individuals at a moment in one special game with the specific incidents that attend that particular moment among all others. An illustration is a story-telling picture of a specific incident and its weakness lies in this very thing: that the greater idea is often secondary to the less. Yet in most illustrations, of fiction especially, the picture deals with the lesser idea.

The illustrator's work is the complement of expression in some other medium. A poem can hardly exist which does not awaken in the mind at some moment a suggestion either of picture or music. The sensitive temperament of the artist or the musician is able to realize out of words some parallel idea which can only be conveyed, or can be best conveyed, through his own medium of painting or music. Similarly, painting or music may, and often does, suggest poetry. It is from this inter relation of the emotions governing the different arts that illustration may be said to spring. The success of illustration lies, then, in the instinctive transference of an idea from one idea to another; the more spontaneous it be and the less laboured in application, the better. The mind must be aware of an underlying unity, yet without being intellectually conscious of it.

Greece and Rome. Proceeding another step, to the decorations on Greek vases, we have a more decided association between literature and pictorial art. We have a great legacy of poetry, picture and sculpture derived from Greece. There was a great theme—the heroes, the gods and demi-gods. The many legends and stories made them living beings, understandable because of their human qualities, inspiring because of their magnificence. These extraordinary myths filled the minds of all the people, for the story tellers went about reciting to those who could not read. All of the people perceived splendour in these heroic adventures—physical adventures, of course—and they magnified their heroes into an ideal.

A poet or an artist appears to be an individual, developed by his race, whose business it is to go out and see beauty and come back and tell about it. His business is to go out and see with the eyes of his own people, of his own time, of his own country and to show to them the things they love or reverence in a manner intelligible to them.

To the Greeks, the hero was a glorious human creature; inevitably their artists were moved to sculpture and to an ideal, an ideal which sought to show how magnificent man might become. Their honest service in this respect to their race leaves them unrivalled through all the centuries that have elapsed. Inspired they surely were, but inspired wholly by the passionate impulse of their time. When the draughtsman came along to decorate the vases of his people his motive was usually a simple association of those same heroes, gods and goddesses in one picture, containing, indeed, the essential surroundings, but always governed by the racial delight in perfected humanity. The poets told the same stories, so that to-day the sculpture, the picture and the play or poem mutually illuminate one another. Though not designed to illustrate any special line or poem, the pictures become illustrations of the finest type, generic rather than specific.

The Roman artist began to see landscape and introduce it into his wall paintings, usually to increase the apparent size of the garden upon whose enclosing walls his pictures were usually painted.

The Christian religion provided the next tremendous impulse toward visual art. Again all eyes were turned in one direction, all aspirations toward one glory and all reverence toward the

[1] British Standard Specification for Portable Photometers, no. 230 (1925).
[2] British Standard Specification for Industrial Reflector Fittings for Electric Lighting, no. 232 (1926).
[3] British Standard Specification for Street Lighting, no. 307 (1927).
[4] British Standard Specification for Translucent Illumination Fittings for Interior Lighting, no. 324 (1928).
[5] *Illum. Eng.* (March 1927) p. 85.

sacred personages who suffered that they might bring to the humble masses no less than to the exalted individuals the wonderful message. For the Founder of the Christian religion had made the multitude worthy in its own eyes. He proclaimed their kinship with God and convinced them that they were beloved children of a loving, omnipotent Father in Heaven with Whom they should dwell, after this life of trial, in glory forever.

To a people treated like beasts of burden, driven and trampled upon, such a revelation was of tremendous import. The individual's right to prosperity and happiness here in this world naturally had not yet occurred to the many. They were taught that resignation, contentment and labour for their masters was the service for which they should receive the Divine reward in Heaven. The poet and the artist, born and bred of the peoples under that impulse, did as they were bound to do. They showed to the multitude the thing it reverenced and longed to see. The artists of that day were the sons of the multitude, and sharing in the beliefs of that multitude. They set forth in their paintings that which filled their own hearts no less than the hearts of all men moved by the same revelation.

Gradual Development.—The whole thing became a driving desire to make visible a great drama. They began to perceive the possibility of the dramatic composition which preserved the just proportions, and yet permitted the emphasis to fall upon the important incident in the picture which is known as the "centre of interest."

Composition was not unknown before this time, but it was a composition of design entirely, owing nothing to tone and very little to light and shade. Rarely, in even the best examples of vase paintings, is great action attempted. Generally, the figures express themselves in simple gestures, so that no intolerable suspended motion is noticeable. The Italian painter, finding himself confronted by the necessity to depict dramatic moments full of activity, devised new methods of composition. The suspended moving body or drapery, conforming to realism, is made to flow upon a line in the composition in such a manner that it is no longer a painfully maintained posture, but a part of the rhythm of the composition, an expression of extreme grace and of beauty.

Year in and year out that development went painfully on. They strove mightily, those men; they worked to exhaustion. They had but little to work with, compelled as they were to invent their own materials, colours, brushes, whatever they needed. In the early years of the attempt to reveal to their own eyes, and those of their people, a vision glowing of the spirit, they had nothing with which to do it. They could not draw, they could not paint; they recognized perspective but vaguely and they lacked general knowledge. But they had a story to tell in pictures and they themselves lay under an urgent need to see the visualization of their own dream. It was a story of the spirit—which is beauty. They painted a message from heart to heart. Any man, standing before these old treasured pictures, who is unable to let them appeal directly to his emotions, as is the case with music, can never hope to see them nor to understand why they are treasured.

As time went on jealousy and rivalry arose. The secrets of the craft were carefully guarded. A painter of great ability was crowded with commissions, which were often commands. Daylight was precious. Every moment was needed upon his compositions. He surrounded himself with pupils and from among these he chose helpers according to their ability. Thus came into existence the journeyman-apprentice, who reached his greatest development during the last century. He was the pupil of great technical skill, direct observation and little imagination. He was sent out to get facts. A group of trees was needed for some part of an important composition. He was sent out to make a study of it—not only the group of trees with meadow and clouds, but accurate information of branch and twig, with the pattern of leaf, the modelling of the trunk and the facts about the spreading roots with the plants growing between. He came back with definite knowledge, precise information which the master painter used as he saw fit. He chose what he needed, simplifying it into harmony with its importance in the picture, discarding what was irrelevant. The master painters were great illustrators, and it is from among them that arose the immortal few who are known as the Old Masters, because of the grandeur of their vision and the splendour of their expression of it.

And then the association of picture and its subject-text bound in the same volume came into being in the form of the illuminated manuscript. The same story and the same sincerity inspired these little pictures, truly works of art, though small and painted upon the page of a book and definitely designed to harmonize with the page and with the elaborate initial letter of which, frequently, they were a part. Some of them were superb masterpieces. The size of a picture matters little. If, however, the subject idea is unworthy of a great effort, the picture made too large, and with the inevitable elaboration, appears even more trivial than if proportioned appropriately.

Portraiture.—In ancient portraiture, incidental to all this early art, one seems to observe evidence that likeness primarily was sought. In Egypt imposed conventions prevented any real development of characteristic portraiture, or perhaps the artist was so trained to convention that it was not possible for him to free himself from its influence. Nevertheless, there are examples. small statues and statuettes, which are portraits of individuals, of definite character. Greek portraits, however, painted on small panels, seem meagre studies of character, but were probably sufficiently good likenesses. During the Renaissance portraiture came very much alive, emerging from hampering tradition and convention, until, in the 17th century it reached a magnificent expression. It became a realistic study of character, which was food for imagination. Painting his portrait, the artist came to know the man. He found, as he and everyone else already knew, that men are very much alike, and entirely different, in real life; he discovered that it could be expressed in art. Self-defence had taught every one to discern the mood of another. Every one knew at once whether another was about to strike, to smile, to speak a word of kindness; now the artist began to discover it in terms of his craft. He discovered that he could envelop the characters of his picture in an emotional atmosphere. He perceived in the hat and gloves left by his sitter on chair or table a likeness to their owner and that if they were used in a picture these adjuncts would have something to say as to the character of the man. When he came to paint the genre (*q.v.*) picture, he saw to it that the things belonging to his subject character were exactly the things with which this individual would inevitably surround himself. That is a part of illustration which requires imagination, knowledge and understanding derived from close and habitual observation. Imagination here is spiritual vision. This vision once possessed, aided by all his various funds of knowledge, the artist will perceive how an individual whose character he has studied and come to understand will behave in a given situation. It amounts to a vision of orderly events inevitable for that individual.

The religious story had been told, and while it continued to appear, and still often does, it was no longer in demand to the same extent. The artist was free to choose his subjects where he would, to descend gradually from that height to which the hunger, need and will of his race had driven him. Perhaps the most impressive example of this hangs in the museum of the Louvre. Huge paintings tell the story of the marriage of a man and a woman, but the man was king of France, Henry IV., and the woman a princess of Italy, Marie de' Medici. To the consciousness of that time such nuptials were great and impressive affairs, symbolic and resplendent with the grandeur of nations. Realistic pictures, however gorgeous, would be merely pictures of the pageantry of the event. The artist's task, however, was to make the significance of the event immortal.

Here is another instance where the artist was in accord with the convictions and motives of his time. He may have hated that particular king, but he and all men worshipped kings. To him and to all men this particular episode was of divine moment and significance. The gates of heaven opened; gods and angels with all their attributes of Power, Principalities and Virtues were present at the ceremonial, bearing aloft, in order to magnify those two

royal mortals above mankind, the insignia of their isolation. That is what the pictures tell us.

To this artist, learned in his craft, it was not a very troublesome problem. The art and science of composition taught him how to use every incident in his pictures—numberless attendant figures; the profuse ornament of landscape and cloud; luxurious draperies, architecture, banners, armour—extraordinary in their number, variety and form; to exalt the two principal personages upon the apex of his design and convey that, while in the midst of many, they were solitary, unapproachable, beings apart. Previously he had painted many portraits, landscapes, studies of all kind in astonishing numbers. He had used his countless studies in countless paintings of every sort. He employed many hands besides his own. Nevertheless, he invented and designed his group of pictures as a whole, supervised and brought it into being. They were great inventions, for his imagination was apparently concerned with another aspect of the matter: it was busy with his audience—not in vanity, but in the *completion of his theme*. His business was to convey an idea to the world. He was not realizing a vision of his own and so, in his imagination, he viewed his growing designs with the eyes of the world, inventing his means step by step. Whether he, specially, was hated, whether he was bitterly regarded by jealousy are things aside. His world was with him in this task which it had commanded. He worked for a great audience, for the generations, for all time. He was not at the mercy of the turning page descending into oblivion with a trivial story.

Later Development.—It is not to be understood that no great works of art have occurred since that time. But the times were changing. Democratic ideas began to seep in and spread. New seas and continents were being discovered. Shipping, commerce, international intercourse vastly increased. Wealth was increasing rapidly until it became more than a motive, an ideal. The artist, of necessity sensitive to the psychology of his time, inevitably sensed this ideal. Being no longer under command of church and noble he was free to sell his talents to the highest bidder. He did and became often both politician and courtier, frequenting and contriving that he might frequent, the places whence commissions came. For the palaces of the rich, artists painted huge compositions, many of them splendid but of frivolous thought upon tawdry subjects. Not all of them did this, for some were the spiritual descendants of the great masters; they went back to the country-side. There they painted pictures so full of charm, of beauty and of poetry that they still hold our wonder.

The religious subject in pictorial art is not of paramount importance, nor is any subject. War and the ambitions of men have provided the opportunity for many great paintings. As to the written title of a picture, it is a mere label. The subject is what the passion of his race has taught the artist to think about it. Because the poet, the artist and the inventor—which is to say the poet—is born supremely sensitive to racial motive, he has led in thought and has imagined into material existence the things of its need and desire.

Imagination is the power of creative vision which gives direction to intellect. It is the business of intellect to find means whereby this vision is given material existence. In finding these means intellect must refer again and again to imagination for new directions until the dream comes true.

There is another sort of imagination: a primitive imagination busy with fears and reprisals. It is the mother of superstition and has troubled the mind of man with a terror of natural phenomena. He cowered before the wind, retreated in dismay before the rising waters in the spring-time and shuddered at thunder, whispering that it was the voice of an angry god or the roar of some demon. As he grew weary of his fears man developed a courageous creature who was not afraid to take his life in his hand, to go out and see; one who would be satisfied with nothing but the truth, who would not stop till he knew it. He went out upon his mission and came back and reported that these things are inevitable results of natural law—dangerous but not malignant. Having begun, he can not stop, for the will of the race is that he must go on. We call him the scientist; his reports are called scientific facts; but scientific fact is the statement of the operation of natural law and natural law must be obeyed in art as well as in life.

Learning to Draw.—If any one turns to these pages in the hope that he will find a suggestion how to proceed, let him remember that, like the primitive artist, he has already in childhood scratched the uncertain image upon a slate. Let him take as his model the labour of the artist from that remote primitive time until he attained to his greatest stature.

First he learned to draw a figure; then he strove to make that figure beautiful; then, expressive. He laboured with nature to learn the laws of composition. He came into the lamplight and went out into the sunshine to know about light and shade. He studied atmosphere and the moods of nature. He learned to present an individual with his characteristic possessions and the psychology of his relations with others. He mastered these things thoroughly—then dismissed the troubles of ignorance and painted his picture. This impersonation of all artists lived for many centuries through all the turmoil of the great march of mankind. He is immortal. We are part of him. Without the understanding which came through his long life we can do little. His life has left its record. Learn to know it.

The laws of composition are written down. Learn them. The scientist has sought till he found the laws of light; he has arranged the simple formula of perspective; these are material means which nature provides and imposes. We must know them.

The artist has always told a story of some sort; let it be the simple statement that "Silver is Beautiful with Blue." That is theme enough for a masterpiece of colour. Perhaps it may be that "A Tree against Clouds is a Beautiful Design." That is theme enough for a masterpiece in black and white.

The Work of the Illustrator.—If stories are told in words, however skillfully elaborated and explained, one must refer to one's own observation and experience to perceive the motive of the author. That reference to the writer's observation, conveyed in words of one's own experience and vision, is generic illustration. Many persons have had no opportunity for parallel experiences with the author. Many have not the power of original observation. But the majority can associate the two when someone shows them how. That is the work of the illustrator.

No modern illustrator worthy of the name fails to realize that he is working for the people who buy that medium of distribution of story and picture which we call a "magazine." He is paid by so small a fraction of the amount expended that his work is bought for virtually nothing. He is under command of the whim of no one man. But he is under command. So were his forbears. They were under command of the whim of power. One of the greatest, a *sculptor*, was commanded by peremptory authority to *paint* the ceiling of the Sistine chapel. He spent three years lying on his back to work upon it and eased his bruises by writing plaintive sonnets and querulous letters to his father complaining that the work was vile and would not be accepted.

We of the present are under command only of the necessity imposed by a vast organization of which we voluntarily form a part. That the story and picture may reach the millions who wait upon a certain day, a great, complicated organization of men and machines must work constantly and without interruption. The illustrator becomes a part of that organization when he accepts a commission. He does not have to accept it; he may refuse; but once undertaken it must be done within a given time that all the processes may function at their best and the printed work delivered where and when it is expected. This is not arbitrary; it is inevitable.

Consider the editorship of the grand epoch of art. The labour of years was unveiled—the cold churchman stalked before it seeking heresy. The partisan peered into its corners for offence. Woe to the poor artist if either was found! The editor of to-day is all concern in his attitude toward the artist, providing a chair and kindly words; this is found to be more humane than the accusation of heresy and a cell under the leads.

The work of an illustrator is of the present, now. Art is of its

own time, looking forward. It derives its knowledge and power of comparison from the past, but its real inspiration from its own time. It is a sad thing to find an artist to-day so possessed with admiration of one of the great of the past that he endeavours to depict his own times, not as the dead genius might do now, but as he did then: whispering an unintelligible echo of stalwart tones reverberating with the meaning of the past. Times have changed. Little of the expression of the past applies to the present. There is no motive now, in any one direction, to impel a living pictorial art.

Mankind is making machines, discovering new laws and forces, applying them to his entertainment. Art, too, is an impulse of nature and it also is being used for entertainment. Born of the multitude, the artist must serve the multitude; if it so commands, he serves by leading it. And if it should have a great dream he must present it pictorially. If the public desires tawdry decorations, he will be bullied or cajoled into making them. If it demand entertainment he must help provide it. Increasingly specialized, used for meagre ends, he has therefore almost ceased to be—sleeping, perhaps, to be awakened at the call of a new need. Buildings go up and are torn down after such brief existence that mural paintings are but vaguely used—the easel picture has little reason to be—it is too heavy for our temporary walls. The exhibition gallery continues to house for its appointed time the dwindling work of the journeyman-apprentice. The real place for pictures seems to be the page of the magazine. The times demand it; it appears inevitable. Possibly this is only a phase.

It is the illustrator's business to give his best. The public will not help him, because it cannot. It behooves the illustrator to become a scholar; to know; to put all he is and has into his work; to study his story, not merely read it. He must do it alone, for himself; no one cares. If his work is up to publishing standards in craftsmanship it will be used. Editors will not help him with drastic criticism, or demand his best. He must work alone and for himself—that is what "art for art's sake" means now. It is true he will be paid a handsome sum; but it is also true he will be paid just as much for work not his best. Here is a spiritual problem. He must do his best, for himself, alone, rejoicing if three persons in the million realize it. He must be a strong man.

The Illustrator's Problems.—To-day the conditions are utterly different from any hitherto confronting the artist. Instead of some single motive he has many. Wide spread democracy encourages everyone to get for himself whatever he most desires. Universally that is wealth. Everyone works for wealth and in his leisure seeks amusement, entertainment, demanding of the arts that they provide it.

If a universal motive is a compelling theme for the artist then this universal struggle for wealth should surely supply it. If it is, then it appears to have developed, by almost equally universal patronage, a new art: the motion picture. It may be significant that the most popular, and therefore successful, motion pictures dwell lavishly upon great wealth, the effort to gain it—within or without the law—or else upon broad comedy. The motion picture might be regarded as illustration in its most elaborate form; but it is not. It is an art alone, and like all arts, best when it tells its own story in its own terms, borrowing from no other.

In the life of to-day there is another new thing. We are conscious of enormous forces that can be made to obey. We are aware of tremendous machines developing an energy equal to an army division, to several army divisions! We have ceased to fear the forces of nature and we have learned that if we obey natural law we may use the unlimited power nature's forces supply. These huge machines move in simple rhythm; ponderous creatures, impersonal, obedient, whose soulless grandeur has given a character to the times. Their significance is power. Some of us shudder at it, some exult, and it moves deeply the emotions of others.

In the presence of these new beings, made by the hands of men, traditional beauty of graceful curves, with the delicate harmony of colour, becomes a cloying sweetness, out of key. The painter has made an effort to express his sense of all this. Therefore we have had a procession of "schools": the cubists, the futurists and many others have made efforts to get into tune with the age. The painter tried geometrical forms; he tried brutal evasions of actuality of form and colour. He sought desperate means indeed. He sought to express the thing he felt—he did not seek to find some new thing to sell. For the painter has tried to stand firm upon integrity and to be faithful to traditions.

Whenever an individual perceives a new and real thing and tells about it, immediately he is surrounded by followers, enthusiasts, incapable of, or lacking the courage of original vision, but quite able to see when shown, and courageous enough to follow. *They* are sincere. *They*, in turn, are followed by imitators. The imitator sees only the thing that has been done and he sees it but superficially, copying the mannerism more often than the manner and never apprehending the underlying motive at all. Nor does he care. His purpose is to sell what he can while the public interest in the original remains. He it is who destroys that public interest, for his stature is soon apparent, and his stuff is rejected. The pity of it is that he brings about a misunderstanding of the whole effort; a few see the work of the original while the many are informed of it only through meaningless imitations.

Modern Tendencies.—The foregoing is a bare outline of the history of illustrative art, from the first intimation scratched on stone to the present difficult situation. A few centuries ago a knowledge of the history of art was not so important to the artist. His work had to do only with his own people, people who believed as he did, thought as he did and only desired to have these things shown to them. No one knew or cared how the Jew in Palestine dressed and lived in Biblical times, so the Italian painter arrayed the Biblical characters in the Italian costume of his day. To-day we have another state of affairs altogether.

The camera has gone into every corner of the world and has brought back cold, precise facts. The reporter and the investigator have gone wherever the camera has gone; they have come home with more facts, and with explanations of the camera's pictures. This is knowledge; the newspapers and magazines send it to everybody. The important question to the artist, no matter whether he paint pictures for the galleries or make them for the magazines, is: what have this wide spread knowledge and the countless photographs got to do with *him?* Shall he go into competition with the camera? The camera in the hands of an artist-photographer is a formidable opponent. Can he meet it on its own terms, on its own ground? He cannot. In a fraction of a second it will defeat his labour of weeks.

The taste of the world demands pictures. It demands paintings, illustrations, photographs; it has seemed to declare definitely when and where it desires to see one or another. It would appear, then, that the painting and illustration has something the photograph lacks. On the other hand when people desire to see in a picture what is lacking in painting or illustration they turn to the photograph. The camera can only report what is before it; it can report with exceeding beauty, at times, but it can only report. The artist can create and he can select from the manifold beauties of nature what he will, to incorporate with his creation. To the artist then, it would seem that the deliberate message of the world appears to be that *he* is expected to create and to let the camera report.

Those artists (called inventors) having knowledge of the findings of scientists, have responded superbly to this demand and have created marvellous works. The creations of the inventors have absorbed the attention and the interest of the world almost to the exclusion of pictorial arts except where these contribute as luxurious accessories, or means of entertainment and amusement. Illustrations are seen by both the "classes" and "masses." They are seen by those capable of discrimination and of appreciation. It behooves the illustrator to respect his "audience."

Illustration may become a great art, but to become a great art it must be creative. It cannot hope to compete with the camera in the reporting of facts. It has no business with the outer shell of things at all. It deals with the spirit. Dealing with the psychological aspects is a great opportunity and a serious handicap. Presupposing a pictorial presentation of the relations of people, the

telling of the story is inevitable. A great and simple story, akin to truth, or a poor and trivial one, akin to meagre facts, may be told of the same incident—depending upon the insight, the vision of the artist. The nature of the story portrayed is the measure of the artist who portrays it. It makes no difference that he may be most accomplished in his craft. Though he may draw with marvellous skill, though his composition be perfect, though his detail be faultless, if his conception is trivial and his thought upon it slight, then his technical excellences betray him the more and his work is a mere virtuosity, empty and meaningless.

The outward form given to an inward vision depends upon composition. Technical skill merely develops that outward form and is governed by composition which, in its character, must possess the emotional meaning of the vision and speak directly to the emotions. It has been said that the artist struggled with nature to learn the laws of composition, and after that he devised rules for it. One should know, then, the fundamental natural law so that he may, at need, disregard the rules.

The meaning of emotional character of form in composition may be illustrated by referring directly to human experience. Mankind has looked with awe upon the mountains for countless generations. The effort to cross them taxes his utmost powers and has cost much in pain and death. The vast pyramidal forms of mountains stand in his imagination as a sign of majesty. In composition the pyramidal form is used sparingly, only when the emotion of majesty, of grandeur, is to be conveyed. Man has long looked upon tall trees with respect and has endowed them with personalities; he has bowed low before temples stately with tall columns. Tall lines in composition are used to express dignity. The sombre greys of storm clouds, full of thunder, have terrified us since the infancy of the race. Cloud forms, subtly introduced into a composition, suggest impending evil. Primal man was probably colour-blind; he learned to see colour slowly. Perhaps he recognized red first, his own blood, seen in pain in the midst of fierce passions of rage and fear. Feeling this to be true, would it not seem strangely out of harmony to paint a sweet and motherly woman in a scarlet gown?

If the illustrator has not parallel experience with the writer he cannot march beside him, but must follow, presenting inconsequential, quasi-photographic, external repetitions—a faint accompaniment, indeed—of what the author has written. The illustrator must be a person of wide knowledge, that he may have understanding; of wide sympathy, that he may know the people whom he is to picture; of creative imagination that the story may be real in his vision. To maintain such an ideal in the face of the difficulties which confront him is almost impossible, and necessitates a rare devotion to his work.

A magazine has been defined as a medium for the distribution of story and picture. It is sold at a trifling price. The publication of it at this trifling price involves a vast organization having contact with innumerable interests and bound by contracts written and implied. It *must* appear on the day when it is due to appear, otherwise these contracts are broken. Some contracts are with advertisers. Were it not for the advertisements carried in its pages the single number, to the single subscriber, would cost a hundred times or more the amount he now must pay. It is the money paid by the advertiser which makes it possible for the person of small means to have the work of the ablest writers and artists presented to him every month or week. To combine the labour of so many brains and hands that this punctuality may be maintained occupies most of the waking consciousness of publisher, editor, writer and artist. There is no eight-hour day for them.

In the necessity for such punctuality lies the exhausting handicap for the illustrator. Difficult situations must be met. Fair play sometimes forbids him from exercising his right to decline work in which he is not deeply interested. This has been called "commercializing" art, but it is not; it is complying with a need. In the lives of the old masters there were parallel instances. To return to the incident of the Sistine chapel, Michelangelo, who painted the decorations for it, was commanded by the whim of a powerful old man, and he was obliged to obey. The illustrator of to-day is commanded by a necessity involving countless individuals over the whole country. To obey such demands requires knowledge so completely in mind that it can be set forth at once—either that or evasion. To be obliged to work far into the night, day after day, is no unusual experience. "Overtime" is a word unknown to the illustrator, the writer, the editor. Few of them can be bribed by money to the exhausting work which their love of it, for its own sake, makes them gladly do.

The illustrator's first obligation to himself and to his public is a complete understanding of the story for which he is to make illustrations. One reading of it is rarely enough. If there are any allusions to things he does not know, he must learn them. Often such allusions, if understood, suggest an entirely new conception of the story. Material inaccuracies are of slight importance. The spirit and the meaning of the story are the important things. What the author thinks about it does not matter to the artist, nor does it matter what the editor and the public think about it. What the artist himself thinks about it is all-important to him and to the public. To depict that is his reason for being. (*See* also DRAWING; PEN DRAWINGS; PAINTING; ART TEACHING.)

(F. R. G.)

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ILLUSTRES, the Latin name given to the highest magistrates of the later Roman empire. The designation was at first informal, and not strictly differentiated from other marks of honour. From the time of Valentinian I. it became an official title of the consuls, the chief praefecti or ministers, and of the commanders-in-chief of the army. Its usage was eventually extended to lower grades of the imperial service, and to pensionaries from the order of the *spectabiles*. The Illustres were privileged to be tried in criminal cases by none but the emperor or his deputy, and to delegate procuratores to represent them in the courts.

See T. Hodgkin, *Italy and her Invaders* (1892), i. 603–617; and O. Hirschfeld in *Sitzungsberichte der Berliner Akademie* (1901).

ILLYRIA, part of the Balkan Peninsula extending along the eastern shore of the Adriatic from Fiume to Durazzo, and inland as far as the Danube and the Serbian Morava. It comprises modern Dalmatia, Bosnia and Hercegovina, and Montenegro, with the southern half of Croatia-Slavonia, part of western Serbia, the sanjak of Novibazar, and the extreme north of Albania. Its landward boundaries were never clearly defined. The name was an ethnological rather than a geographical term; the older Greek historians usually wrote of "the Illyrians" (οἱ Ἰλλύριοι), while the names Illyris (Ἰλλυρίς) or less commonly Illyria (Ἰλλυρία) were subsequently used of the indeterminate area inhabited by the Illyrian tribes, *i.e.*, a region extending eastward from the Adriatic between Liburnia on the north and Epirus on the south. The Latin name Illyricum was not synonymous with Illyria; it was a political name applied to various divisions of the Roman empire, the boundaries of which were frequently changed and often included an area far larger than Illyria properly so called.

Ethnology.—Herodotus and other Greek historians represent the Illyrians as a barbarous people, who resembled the ruder tribes of Thrace. Both are described as tattooing their persons and offering human sacrifices to their gods. The women of Illyria seem to have occupied a high position socially and even to have

exercised political power. Queens are mentioned among their rulers. Fuller and more trustworthy information can be obtained from archaeological evidence. In Bosnia the lake-dwellings at Butmir, the cemeteries of Jezerine and Glasinac and other sites have yielded stone and horn implements, iron and bronze ornaments, weapons, etc., and objects of more recent date fashioned in silver, tin, amber and even glass. These illustrate various stages in the development of primitive Illyrian civilization, from the neolithic age onward. The Hallstatt and La Tène cultures are especially well represented. Similar discoveries have been made in Dalmatia, as among the tumuli on the Sabbioncello promontory, and in Croatia-Slavonia. In Dalmatia there appears to have been a large Celtic element, and Celtic place-names are common. The ancient Illyrian languages fall into two groups, the northern, closely connected with Venetic, and the southern, perhaps allied to Messapian and now probably represented by Albanian. (*See* ALBANIA.)

History.—Greek colonization on the Illyrian seaboard probably began late in the 7th century B.C. or early in the 6th century. The most important settlements were Epidamnus (Durazzo) and Salona (near Spalato). Researches at Salona (*see* SPALATO) have brought to light Greek inscriptions, Greek pottery, etc., dating from 600 B.C. But Greek influence seems never to have penetrated far into the interior, and even on the coast it was rapidly superseded by Latin civilization after the 3rd century B.C. Until then the Illyrian tribes appear to have lived in a state of intermittent warfare with their neighbours and one another. They are said by Herodotus (ix. 43) to have attacked the temple of Delphi. Brasidas with his small army of Spartans was assaulted by them on his march (424 B.C.) across Thessaly and Macedonia to attack the Athenian colonies in Thrace. The earlier history of the Macedonian kings is one constant struggle against the Illyrian tribes. The migrations of the Celts at the beginning of the 4th century disturbed the country between the Danube and the Adriatic. The necessities of defence seem to have united the Illyrians under a chief Bardylis (about 383 B.C.) and his son Clitus, but the great Philip crushed the Illyrians completely, and annexed part of their country. During the next century we hear of them as pirates. Issuing from the secluded harbours of the coast, they ravaged the shores of Italy and Greece, and preyed on the commerce of the Adriatic. The Greeks applied to Rome for help. Teuta, the Illyrian queen, rejected the Roman demands for redress, and murdered the ambassadors; but the two Illyrian wars (229 and 219 B.C.) ended in the submission of the Illyrians, a considerable part of their territory being annexed by the conquerors. Illyria, however, remained a powerful kingdom with its capital of Scodra (Scutari in Albania), until 180 B.C., when the Dalmatians declared themselves independent. In 168 the Romans conquered and annexed the country. Dalmatia was invaded by a Roman army under Gaius Marcius Figulus in 156, but Figulus was driven back to the Roman frontier, and in Dalmatia the Illyrians were not finally subdued until 165 years afterwards. In 119 L. Caecilius Metellus overran the country and received a triumph and the surname *Dalmaticus*. But in 51 a Dalmatian raid on Liburnia led to a renewal of hostilities; the Roman armies were often worsted, and though in 39 Asinius Pollio gained some successes it was not until Octavian took the field in person that the Dalmatians submitted in 33. They again revolted in 16 and 11, and in A.D. 6–9 joined the rebel Pannonians. In A.D. 9, however, Tiberius entirely subjugated them, and Dalmatia, Iapydia and Liburnia were united as the province of Illyricum.

Latin civilization spread rapidly, the cultivation of the vine was introduced, gold-mining was carried on in Bosnia, and commercial cities arose along the coast. Illyria became one of the best recruiting grounds for the Roman legions; and in troubled times Illyrian soldiers fought their way up from the ranks to the imperial purple. Claudius, Aurelian, Probus, Diocletian and Maximian were all sons of Illyrian peasants. The importance of Illyricum caused its name to be extended to many neighbouring districts; in the 2nd century A.D. *Illyricus Limes* included Noricum, Pannonia, Moesia, Dacia and Thrace. The Via Egnatia, the great line of road which connected Rome with Constantinople and the East, led across Illyricum from Dyrrachium to Thessalonica. Either Diocletian or Constantine made Illyricum one of the four prefectures, each governed by a *praefectus praetorio,* into which the empire was divided. This prefecture included Pannonia, Noricum, Crete and the entire Balkan peninsula except Thrace, which was attached by Constantine to the prefecture of the East. From the partition of the empire in 285 until 379 Illyricum was included in the western empire, but thenceforward eastern Illyricum was annexed to the eastern empire; its frontier was almost identical with the line of demarcation between Latin-speaking and Greek-speaking peoples, and roughly corresponded to the boundary which now severs Latin from Greek Christianity in the Balkan peninsula.

In 441 and 447 the country was ravaged by the Huns. In 481 Dalmatia was added to the Ostrogothic kingdom, which already included the more northerly parts of Illyricum. Bands of Slavonic invaders gradually established themselves in Illyria, where, unlike the earlier barbarian conquerors, they formed permanent settlements. Between 600 and 650 the main body of the immigrants (Croats and Serbs) occupied Illyria (*see* SERBIA: *History;* and SLAVS). The Croats settled in the western half of Illyria, the Serbs in the eastern; thus the former came under the influence of Italy and Roman Catholicism, the latter under the influence of Byzantium and the Greek Church. Hence the distinction between them became a marked difference of civilization and creed, which has always tended to keep the Illyrian Slavs politically disunited.

The Croats and Serbs rapidly absorbed most of the Latinized Illyrians. But the wealthy and powerful city-states on the coast were strong enough to maintain their independence and their distinctively Italian character. Other Roman provincials took refuge in the mountains of the interior; some Illyrian tribes remained unconquered among the mountains of Albania and were never Slavonized. With these exceptions Illyria became entirely Serbo-Croatian in population, language and culture. The name of Illyria disappeared from history, but was revived in the "Illyrian Provinces" of 1809 and the "Kingdom of Illyria" of 1816–49. For the political propaganda known as Illyrism, *see* CROATIA-SLAVONIA: *History*.

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ILMENAU, a town and summer resort of Germany, in the republic of Thuringia, at the north of the Thuringian Forest, on the river Ilm, 30 m. by rail south of Erfurt. Pop. (1925) 13,905. Formerly a part of the county of Henneberg, Ilmenau came in 1631 into the possession of electoral Saxony, afterwards passing to Saxe-Weimar. It was a favourite resort of Goethe, who wrote here his *Iphigenie.* It manufactures glass, porcelain, toys, chemicals, surgical instruments and turnery.

ILMENITE or **TITANIC IRON-ORE,** an iron-black mineral resembling haematite in form and habit and formerly regarded as a titaniferous haematite $(FeTi)_2O_3$. It is now considered to be an iron titanate, $FeTiO_3$, isomorphous with *pyrophanite* ($MnTiO_3$) and geikielite, $MgTiO_3$. The composition indicated by the formula is $FeO=47{\cdot}4$ and $TiO_2=52{\cdot}6\%$; but analyses show wide variations due to the presence of an excess of ferric oxide and, in some varieties, magnesia. Ilmenite crystallizes in the hexagonal system with rhombohedral symmetry. Well-formed crystals are rare. The mineral is distinguished from haematite by its black streak and slight magnetism. It is, however, not polar, like magnetite. Hardness, 5. Sp. G., 4·8. Colour, black. Lustre, submetallic. Opaque. The name is derived from the Ilmen mountains in the southern Urals.

Ilmenite occurs in association with magnetite in gneisses and schists, often in beds of considerable size, but of little economic value. It is a frequent constituent of the more basic igneous rocks, as magnetite is of the more acid types. Some of the black sands

derived from these rocks consist largely of grains of ilmenite. For *titano-magnetite* see under MAGNETITE. (F. H. HA.)

ILOILO, a municipality (with administration centre and 16 *barrios* or districts), the most important port of the western Bisayan group and the principal sugar port of the archipelago, capital of the province of Iloilo, Panay, Philippine Islands, about 258 m. from Manila. It is a terminal of the Panay railway which runs to Capiz. Pop. (1918) 49,114, of whom 24,898 were males and 382 white, including a considerable percentage of Basques. Iloilo boasts an intelligent, wealthy and cultured mestizo population. It is built on low, sandy ground and is irregularly laid out. In Iloilo (or nearby) are several private and religious schools, as well as a public high school and other public schools. The harbour is well protected by the island of Guimaras which lies opposite Iloilo, and ocean-going vessels can lie in the channel. The surrounding country, which has excellent motor roads leading in various directions, is fertile and well cultivated, producing sugar, tobacco and rice in abundance. It is the fourth centre in point of population in the Philippines, and is the great commercial rival of Cebu. Various hardwoods grow nearby. Coco-nut oil, lime, vinegar and various articles made from palmwood are among the manufactures. In 1918, it had 67 manufacturing establishments, with output valued at 2,463,000 pesos; and 1,295 household industry establishments with output valued at 364,900 pesos; as well as three rice-mills with output valued at 902,800 pesos. A meteorological station is established here. Of the 30 schools, 17 were public. The language is a dialect of Bisayan. Much of Iloilo was burned by the Filipino insurgents soon after its capture by the troops of the United States in Feb. 1899.

ILSENBURG, a village and health resort of Germany, in Prussian Saxony, situated under the north foot of the Harz mountains, at the entrance to the Ilsethal, 6 m. N.W. from Wernigerode by the railway to Goslar. Pop. (1925) 5,224. It manufactures metal wares.

The old castle, Schloss Ilsenburg, lying on a high crag above the town, was originally an imperial stronghold probably built by the German king Henry I.

IMAGE, SELWYN (1849–), English illustrator and designer, was born at Bodiam, Sussex. He was educated at Marlborough, and New college, Oxford, and received his art training at the Slade school, Oxford, under Ruskin. In 1872 he was ordained deacon and in 1878 priest, having been a curate at All Hallows, Tottenham, in 1875 and at St. Anne's Soho, from 1876 to 1880. In 1900 he became master of the Art Workers' guild and from 1916 he was Slade professor at Oxford. Among his published lectures are: *Art, Morals and the War* (1914) and a treatise on preparing cartoons for stained glass and *grisaille* work, which is included in Gleeson White's *Practical Designing* (1894). He designed the west window of St. Luke's church, Camberwell, and the Four Archangels in Morthoe church, Devon. His *Poems and Carols* were published in 1894.

IMAGE, in general, a copy, representation, exact counterpart of something else. Thus the reflection of a person in a mirror is called an image. For the worship of images *see* IDOLATRY and ICONOCLASTS.

IMAGE WORSHIP: *see* IDOLATRY.

IMAGINARY NUMBER: *see* COMPLEX NUMBER.

IMAGINATION, in general, the power or process of producing mental pictures or ideas. The term is technically used in psychology for the process of reviving in the mind percepts of objects formerly given in sense perception. Since this use of the term conflicts with that of ordinary language, some psychologists have preferred to describe this process as "imaging" or "imagery" or to speak of it as "reproductive" as opposed to "productive" or "constructive" imagination (*see* PSYCHOLOGY).

IMAGO, a term used of the sexually mature stage of an insect (*q.v.*), in contradistinction to its immature or larval stages.

IMĀM (Arabic, "leader" in the sense of a "pattern whose example is followed"). In the Qur'ān it is used several times of leaders and (ii. 118) of Abraham, "Lo, I make thee a pattern for mankind." *Imām* thus became the name of the head of the Muslim community. His duty is to be the lieutenant, the Caliph (*q.v.*) of the Prophet, to guard the faith and maintain the government of the state. Round the origin and basis of his office all controversies as to the Muslim state centre. The Sunnites hold that it is for men to appoint; the Shī'ites in general, that the appointment lies with God, through the Prophet or otherwise, and that He always has appointed. The Khārijites recognize no absolute need of an Imām; he is convenient and allowable. Another distinction between the Sunnites and the Shī'ites is that the Sunnites regard the Imām as liable to err, and to be obeyed even though he personally sins, provided he maintains the ordinances of Islām. But the Shī'ites believe that the divinely appointed Imām is also divinely illumined and preserved (*ma'ṣūm*) from sin. The above is called the greater Imāmate. The lesser Imāmate is the leadership in the Friday prayers. This was originally performed by the Imām in the first sense, who not only led in prayers but delivered a sermon (*khuṭba*); but with the growth of the Muslim empire and the retirement of the caliph from public life, it was necessarily given over to deputies, who in Turkey were servants of the state, each in charge of his own parish; they performed the rites of circumcision, marriage and burial. In Persia among Shī'ites their position is more purely spiritual, and they are independent of the state. A few of their leaders are called *Mujtahids, i.e.* capable of giving an independent opinion on questions of religion and canon law. A third use of the term Imām is as an honorary title. It is thus applied to leading theologians, *e.g.* to Abu Ḥanīfa, ash-Shāfi'ī, Malik ibn Anas, Aḥmad ibn Ḥanbal (these are called "the four Imāms"), Ghazāli.

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IMBECILE, weak or feeble, particularly in mind. The term "imbecility" is used conventionally of a condition of mental degeneration less profound than "idiocy" (*see* INSANITY).

IMBREX, in architecture, one of the raised, covering tiles, placed over the joints between the flat or pan tiles in an ancient Greek or Roman roof. The pan tiles were laid with the joints in each course, or row, exactly in line with the joints above and below, so that the imbrex tiles formed continuous ridges. In the simpler types, the imbrex was approximately semi-circular, but in more monumental examples, especially where the roof tiles were in marble, the imbrex had straight sides and an angular top. At the lower end of each row of imbrex tiles was an ante fix (*q.v.*) or decorative terminal.

IMBROS, an island in the Aegean belonging to Turkey, at the southern end of the Thracian Chersonese peninsula. Herodotus (v. 26) mentions it as an abode of the historic Pelasgians (*q.v.*). It was, like Samothrace, a seat of the worship of the Cabeiri (*q.v.*). There is much volcanic rock and parts of the island are very fertile. Wheat, oats, barley, olives and fruit are grown. The island was occupied by Greece during and after the World War. It was also an important base for the British and Allied operations in the Eastern Mediterranean at the same time. It was returned to Turkey by the Treaty of Lausanne (1923). Its population is about 9,000.

IMHOTEP, a famous physician and sage of ancient Egypt, who afterwards became the god of medicine.

Egyptian texts speak of Imhotep as a minister who lived in the reign of the Pharaoh Zoser of the third dynasty (*c.* 3980 B.C.). He acquired a great reputation for his wisdom and learning and became, first a demi-god, and, under the Ptolemies, the Egyptian god of medicine. By the Greeks Imhotep was called Imouthes, and by them was identified with Asklepios, the god of healing. Although certain Egyptologists have regarded Imhotep as legendary, and have doubted that he lived as an actual man in the reign of Zoser, recent discoveries have converted into certainty what was ever a probability. There can no longer be the slightest doubt that Imhotep is a historical personage, and that in common with other Egyptian nobles, he held civil as well as religious offices. He was vizier, architect, chief ritualist, sage and scribe under the powerful king who built the celebrated "step pyramid" of Sakkara. There is no contemporary evidence that Imhotep

was a physician, but his priestly duties were intimately concerned with magic, and in Egypt magic and medicine were inseparably related. Imhotep is referred to in certain literary texts as a sage of great renown, and he was born in the neighbourhood of Memphis, his parents being Kanufer and Khreduonkh. Under the Ptolemaic dynasties he was invested with all the attributes of deity and was regarded as the son of the Memphite god Ptah, whose name is substituted for that of his earthly father Kanufer. Imhotep had shrines as well as temples of his own in various parts of Egypt and of Nubia. It was believed that miraculous cures could be effected by his divine intervention, and his temples were thronged with sufferers many of whom have left records of their gratitude. Statues and figurines of Imhotep as god of medicine have been found in considerable numbers, and these attest his widespread popularity. The evidence afforded by Egyptian and Greek texts supports the view that Imhotep's reputation was respected in very early times, and that he became at least a demigod not long after his death. His prestige increased with the lapse of centuries, and his temples in Greek times were the centres of medical teaching. His posthumous deification is paralleled by that of another Egyptian sage, Amenophis the son of Hapu, who lived in the eighteenth dynasty and held civil and religious offices in the reign of Amenophis III., and was deified under the Ptolemies and closely associated with Imhotep and with medicine. (*See* W. R. Dawson, "Amenophis the son of Hapu," *Aegyptus,* vol. vii., pp. 113–138, 1926.) Imhotep and Amenophis as deified mortals stand almost alone in Egyptian history, and both, during their lives, must have been men of outstanding merit to have earned such signal posthumous recognition.

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IMIDAZOLES AND IMINAZOLES: *see* GLYOXALINES.

IMITATION, reproduction or repetition of an action or thought as observed in another person or in oneself, or the construction of one object in the likeness of another. By some writers (*e.g.,* Preyer and Lloyd Morgan) the term "imitation" is limited to cases in which one person copies the action or thought of another; others have preferred a wider use of the term (*i.e.,* including "self-imitation"), and have attempted to classify imitative action into various groupings, *e.g.,* as cases of "conscious imitation," "imitative suggestion," "plastic imitation" (as when the members of a crowd subconsciously reproduce one another's modes of thought and action), and the like. The main distinction is that which takes into account the question of attention (*q.v.*). In *conscious* imitation, the attention is fixed on the act and its reproduction; in *unconscious* imitation the reproduction is entirely mechanical and the agent does not "attend" to the action or thought which he is copying; in *subconscious* imitation the action is not deliberate, though the necessary train of thought would immediately follow if the attention were turned upon it under normal conditions. Imitation plays an extremely important part in human and animal development, and a clear understanding of its character is important both for the study of primitive peoples, and also in the theories of education, art and sociology. The child's early development is in large measure imitative; thus the first articulate sounds and the first movements are mainly reproductions of the words and actions of parents, and even in the later stages that teacher is likely to achieve the best results who himself gives examples of how a word should be pronounced or an action done. The impulse to imitate is, however, not confined to children; there is among the majority of adults a tendency to assimilate themselves either to their society or to those whom they especially admire or respect; this tendency to shun the eccentric is rooted deeply in human psychology. Moreover, even among highly developed persons the imitative impulse frequently overrides the reason, as when an audience, a crowd, or even practically a whole community is carried away by a panic for which no adequate ground has been given, or when a cough or a yawn is imitated by a company of people. Such cases may be compared with those of persons in mesmeric trances who mechanically copy a series of movements made by the mesmerist. The universality of the imitative impulse has led many psychologists to regard it as an instinct (so William James, *Principles of Psychology,* ii. 408; *cf.* INSTINCT), and in that large class of imitative actions which have no obvious ulterior purpose the impulse certainly appears to be instinctive in character. On the other hand where the imitator recognizes the particular effect of a process and imitates with the deliberate intention of producing the same effect, his action can scarcely be classed as instinctive. A considerable number of psychologists have distinguished imitative from instinctive actions (*e.g.,* Baldwin, and Sully). According to Darwin the imitative impulse begins in infants at the age of four months. It is to be noted, however, that the child imitates, not every action indiscriminately, but especially those towards which it has a congenital tendency. The same is true of animals; though different kinds of animals may live in close proximity, the young of each kind imitate primarily the actions of their own parents.

Among primitive men imitation plays a very important part. The savage believes that he can bring about events by imitating them. He makes, for instance, an image of his enemy and pierces it with darts or burns it, believing that by so doing he will cause his enemy's death; similarly sailors would whistle, or farmers would pour water on the ground, in the hope of producing wind or rain. This form of imitation is known as sympathetic magic (*see* MAGIC). The sociological importance of imitation is elaborately investigated by Gabriel Tarde (*Les Lois de l'imitation,* 2nd ed., 1895), who bases all social evolution on the imitative impulse. He distinguishes "custom imitations," *i.e.,* imitations of ancient or even forgotten actions, and "mode imitations," *i.e.,* imitations of current fashions. New discoveries are, in his scheme, the product of the conflict of imitations. This theory, though of great value, seems to neglect original natural similarities which, by the law of causation, produce similar consequences, where imitation is geographically or chronologically impossible.

The term "imitation" has also the following special uses:—

1. *In Art-theory.*—According to Plato all artistic production is a form of imitation (μίμησις). That which really exists is the idea or type created by God; of this type all concrete objects are representations, while the painter, the tragedian, the musician are merely imitators, thrice removed from the truth (*Rep.* x. 596 *seq.*). Such persons are represented by Plato as a menace to the moral fibre of the community (*Rep.* iii.), as performing no useful function, drawing men away from reality and pandering to the irrational side of the soul. All art should aim at moral improvement. Plato clearly intends by "imitation" more than is connoted by the modern word; though in general he associates with it all that is bad and second-rate, he in some passages admits the value of the imitation of that which is good, and thus assigns to it a certain symbolic significance. Aristotle, likewise regarding art as imitation, emphasizes its purely artistic value as purging the emotions (κάθαρσις), and producing beautiful things as such (*see* AESTHETICS, CATHARSIS and FINE ARTS).

2. *In Biology,* the term is sometimes applied to the assimilation by one species of certain external characteristics (especially colour) which enable them to escape the notice of other species which would otherwise prey upon them. It is a form of protective resemblance and is generally known as mimicry (*q.v.*; *see* also COLOURS OF ANIMALS).

3. *In Music,* the term "imitation" is applied in contrapuntal composition to the repetition of a passage in one or more of the other voices or parts of a composition. When the repetition is note for note with all the intervals the same, the imitation is called "strict" and becomes a canon (*q.v.*); if not it is called "free," the latter being much the more common. There are many varieties of imitation, known as imitation "by inversion," "by inversion and reversion," "by augmentation," "by diminution" (*see* Grove's *Dictionary of Music,* s.v., and text-books of musical theory).

IMITATION OF CHRIST, THE (*Imitatio Christi*), the title of a famous mediaeval Christian devotional work, much used still by both Catholics and Protestants and usually ascribed to Thomas à Kempis. The prolonged controversy over the author-

ship of the work has at the present time been narrowed down to the issue, "either Thomas à Kempis, or an unknown author."

The following is a statement of the facts that may be received as certain:—

1. It is the verdict of the most competent modern expert opinion that there is no palaeographical reason for suspecting that any known ms. of the *Imitation* (or any part of it) is earlier than the first quarter of the 15th century. The earliest dated ms. is of Bk. I. only (1424).

2. A Latin letter of a Dutch canon regular, named Johann van Schoonhoven, exhibits such a close connection with Bk. I. that plagiarism on the one side or the other is the only possible explanation. It is capable of demonstration that the author of the *Imitation* was the borrower, and that the opposite hypothesis is inadmissible. Now, this letter can be shown to have been written after 1382. Therefore Bk. I. was beyond controversy written between the years 1382 and 1424.

3. It is not here assumed that the four parts of the work formed a single work, or even that they are all by the same author; and the date of the other three books cannot be fixed with the same certainty. But, on the one hand, before the beginning of the 15th century there is no trace whatever of their existence—a strong argument that they did not yet exist; and on the other hand, after 1424 nearly each year produces its quota of mss. and other signs of the existence of these books become frequent. Moreover, as a matter of fact, the four treatises did commonly circulate together. The presumption is strong that Bks. II., III., IV., like Bk. I., were composed shortly before they were put into circulation.

It may then be taken as proved that the *Imitation* was composed between 1380 and 1425, and probably towards the end rather than the beginning of that period. Having ascertained the date, we must consider the birthplace.

4. A number of idioms and turns of expression throughout the book show that its author belonged to some branch of the Teutonic race.

5. Of the 400 mss. of the *Imitation* 340 come from the Teutonic countries—another argument in favour of its Teutonic origin. Again, 100 of them, including the earliest, come from the Netherlands. This number is quite disproportionate to the relative size of the Netherlands, and so points to Holland as the country in which the *Imitation* was first most widely circulated and presumably composed.

6. There is a considerable body of early evidence, traceable before 1450, that the author was a canon regular.

7. Several of the mss. were written in houses belonging to the Windesheim Congregation of canons regular, or in close touch with it. Moreover, there is a specially intimate literary and spiritual relationship between the *Imitation* and writings that emanated from what has been called the "Windesheim Circle."

8. There can be no question that in the Windesheim Congregation itself there was already, during Thomas à Kempis's lifetime, a fixed tradition that he was the author of the *Imitation*. The most important witness to this tradition is Johann Busch, who passed a great part of his life in Windesheim, only a few miles from Mount St. Agnes, the mônastery of which Thomas was an inmate. It would be hard to find a more authentic witness. Another witness is Hermann Rhyd, a German member of the Windesheim Congregation, who also had personally known Thomas. Moreover, the tradition existed in Thomas à Kempis's own monastery shortly after his death; for John Mauburne became a canon in Mount St. Agnes within a few years of Thomas's death, and he states more than once that Thomas wrote the *Imitation*.

9. The earliest biographer of Thomas à Kempis was an anonymous contemporary: the *Life* was printed in 1494, but it exists in a ms. of 1488. The biographer says he got his information from the brethren at Mount St. Agnes, and he states in passing that Bk. III. was written by Thomas. Moreover, he appends a list of Thomas's writings, 38 in number, and 5–8 are the four books of the *Imitation*.

Internal arguments have been urged against Thomas's authorship. It has been said that his certainly authentic writings are so inferior that the *Imitation* could not have been written by the same author. It may be granted that Thomas was a prolific writer, that his writings vary very much in quality and that the *Imitation* surpasses all the rest, and that some are on a level very far below it; still, when at their best, some of the other works are not unworthy of the author of the *Imitation*.

It has been said that the *Imitation of Christ* has had a wider religious influence than any book except the Bible, and if the statement be limited to Christendom, it is probably true. The *Imitation* has been translated into over fifty languages, and is said to have run through more than 6,000 editions. The other statement, often made, that it sums up all that is best of earlier Western mysticism—that in it "was gathered and concentered all that was elevating, passionate, profoundly pious in all the older mystics" (Milman) is an exaggeration. It depreciates unduly the elder mystics and fails to do justice to the originality of the *Imitation*. For its spiritual teaching is different from the mysticism of Augustine in the *Confessions*, or of Bernard in the *Sermons on the Song of Songs*; from the scholastic mysticism of the St. Victors or Bonaventura; and from the mysticism of the German school of Eckhart, Suso, Tauler and Ruysbroek. Again, it is different from the later school of St. Teresa and St. John of the Cross, and from the introspective methods of what may be called the modern school of spirituality. The *Imitation* stands apart, unique, as the principal and most representative utterance of a special phase of religious thought—non-scholastic, non-platonic, positive and merely religious in its scope—herein reflecting faithfully the spirit of the movement initiated by Gerhard Groot (*q.v.*), and carried forward by the circles in which Thomas à Kempis lived. In contrast with many mystical writings it is of limpid clearness, every sentence being easily understandable by all whose spiritual sense is in any degree awakened. No doubt it owes its universal power to this simplicity, to its freedom from intellectualism and its direct appeal to the religious sense and to the extraordinary religious genius of its author.

BIBLIOGRAPHY.—The best account in English of the Controversy is that given by F. R. Cruise in his *Thomas à Kempis* (1887). Works produced before 1880 are in general, with the exception of those of Eusebius Amort, superannuated, and deal in large measure with points no longer of any living interest. A pamphlet by Cruise, *Who was the Author of the Imitation?* (1898) contains sufficient information on the subject for all ordinary needs; it has been translated into French and German, and may be regarded as the standard handbook.

The best Latin edition of the *Imitation* is that of Hirsche (1874), which follows closely the autograph of 1441 and reproduces the rhythmical character of the book. Of English translations the most interesting is that by John Wesley, under the title *The Christian's Pattern* (1735). (E. C. B.; X.)

IMITATION RUBBER: *see* RUBBER: *Synthetic*.

IMMACULATE CONCEPTION, THE. This dogma of the Roman Catholic Church was defined as "of faith" by Pope Pius IX. in the Bull *Ineffabilis Deus* (Dec. 8, 1854) in the following terms: "The doctrine which holds that the Blessed Virgin Mary, from the first instant of her conception, was, by a most singular grace and privilege of Almighty God, in view of the merits of Jesus Christ, the Redeemer of the human race, preserved from all stain of Original Sin, is a doctrine revealed by God, and therefore to be firmly and steadfastly believed by all the faithful." These words presuppose the distinction between original, or racial, and actual, or personally incurred sin. There is no dispute that the Church has always held the Blessed Virgin to be sinless, in the sense of actual or personal sin. The question of the Immaculate Conception regards original or racial sin only. It is admitted that the doctrine as defined by Pius IX. was not explicitly mooted before the 12th century. But it is claimed that it is implicitly contained in the teaching of the Fathers. Their expressions on the subject of the sinlessness of Mary are, it is pointed out, so ample and so absolute that they must be taken to include original sin as well as actual. Controversy on the subject was forbidden by the Council of Trent, pending further action on the part of the Holy See; but the doctrine was widely taught in the Roman Catholic Church long before the middle of the 19th century when bishops of various countries began to press for a definition. Pius IX. ap-

pointed commissions to investigate the subject, and was advised that the doctrine was one which could be defined and that the time for definition was opportune. On Dec. 8, 1854, in a great assembly of bishops at St. Peter's, Rome, he promulgated the Bull *Ineffabilis Deus,* in which the history of the doctrine is summarily traced, and which contains the definition given above.

The chief répertoire of Patristic passages, both on the doctrine and on the festival, is C. Passaglia's great collection, entitled *De immaculato Deiparae semper Virginis conceptu commentarius* (3 vols., Rome, 1854–55). The state of Catholic belief in the middle of the 19th century is well brought out in *La Croyance générale et constante de l'Église touchant l'immaculée conception de la bienheureuse Vierge Marie,* published in 1855 by T. M. J. Gousset (1792–1866). For English readers the doctrine, and the history of its definition, is clearly stated by Archbishop Ullathorne in *The Immaculate Conception of the Mother of God* (2nd ed., London, 1904), and with many references, by F. C. Holweck, art. "Immaculate Conception" in the *Catholic Encyclopaedia,* and (from a different point of view) in the article, "Immaculate Conception" in Hastings' *Encyclopaedia of Religion and Ethics.*

IMMANENCE, in philosophy and theology a term applied, in contradistinction to "transcendence," to the fact or condition of being entirely within something (from Lat. *in-manere,* to dwell in, remain). Its most important use is for the theological conception of God as existing in and throughout the created world, as opposed, for example, to Deism (*q.v.*), which conceives Him as separate from and above the universe. This conception has been expressed in a great variety of forms (*see* THEISM, PANTHEISM).

IMMANUEL BEN SOLOMON (*c.* 1265–*c.* 1330), Hebrew poet, was born in Rome. He was a contemporary and friend of Dante, and his verse shows the influence of the "divine poet." Immanuel's fame chiefly rests on his poems, especially the collection (in the manner of Ḥarizi, *q.v.*) entitled *Mehabberoth,* a series of 27 good-natured satires on Jewish life. Most popular is an additional section numbered 28 (often printed by itself) called *Hell and Paradise* (*ha-Tophet veha-Eden*).

See J. Chotzner, *Hebrew Humour* (1905), pp. 82–102.

IMMERMANN, KARL LEBERECHT (1796–1840), German dramatist and novelist, was born on April 24, 1796 at Magdeburg, the son of a government official. His legal studies at Halle were interrupted by the call to arms and by the campaign of 1815, after which he returned to the university. He was *Referendar* in Magdeburg, and in 1819 *Assessor* at Münster in Westphalia. Here he made the acquaintance of Elise von Lützow, Countess von Ahlefeldt, wife of the leader of the famous "free corps" (*see* LÜTZOW), and their relationship is reflected in several dramas written about this time. In 1823 Immermann was appointed judge at Magdeburg, and in 1827 was transferred to Düsseldorf as *Landgerichtsrat* or district judge. Thither the countess, whose marriage had in the meantime been dissolved, followed him, and, though refusing his hand, shared his home until his marriage in 1839. In 1834 Immermann became manager of the Düsseldorf theatre where he accomplished great things in spite of lack of adequate funds. In 1836 he returned to his official duties. He died at Düsseldorf on Aug. 25, 1840.

Immermann's early plays are imitations, partly of Kotzebue's, partly of the Romantic dramas of Tieck and Müllner, and are now forgotten. In 1826, however, appeared *Cardenio und Celinde,* a love tragedy ridiculed by Platen in his wittiest satire, *Der romantische Oedipus.* Between 1827 and 1832 Immermann wrote a series of historical tragedies, *Das Trauerspiel in Tirol* (1827), *Kaiser Friedrich II.* (1828) and a trilogy from Russian history, *Alexis* (1832). His masterpiece is the poetic mystery, *Merlin* (1831), which, like its model, *Faust,* deals with the problems of spiritual life. Immermann's important dramaturgic experiments in Düsseldorf are described in detail in *Düsseldörfer Anfänge* (1840). As a novelist he clearly stands on the boundary line between Romanticism and modern literature; his *Epigonen* (1836) might be described as one of the last Romantic imitations of Goethe's *Wilhelm Meister,* while the satirical picture of contemporary life in his second novel, *Münchhausen* (1838), forms a full break with the older literature. In *Münchhausen* is embedded the admirable story of village life, *Der Oberhof.* His last work was an unfinished epic, *Tristan und Isolde* (1840).

Immermann's *Gesammelte Schriften* were published in 14 vols. in 1835–43; a new edition, with biography and introduction by R. Boxberger, in 20 vols. (Berlin, 1883); selected works, edited by M. Koch (4 vols., 1887–88) and F. Muncker (6 vols., 1897). *See* G. zu Putlitz, *Karl Immermann, sein Leben und seine Werke* (2 vols., 1870); F. Freiligrath, *Karl Immermann, Blätter der Erinnerung an ihn* (1842); H. Mayne, *Immermann, Der Mann und sein Werk* (Munich, 1921).

IMMERSION, the act of being plunged into a fluid, or being overwhelmed by anything; in astronomy, the disappearance of a heavenly body in the shadow of another, especially of a satellite in the shadow of its primary.

IMMIGRATION, the movement of population, other than that of casual visitors or travellers, *into* one country *from* another. *See* MIGRATION; POPULATION.

IMMINGHAM, seaport, Lincolnshire, England, on the south shore of the Humber estuary, 9 m. S.E. of Hull and 5 m. N.W. of Grimsby. The docks belong to the L.N.E. railway company and consist of a square basin and two long arms (including a graving dock), of a total area of 45 ac., with 5,400 ft. of quayage; and 47 to 43 ft. depth of water. This port was built (1906–12) here because the deep water channel of the Humber leads right to the dock gates and vessels can enter and leave unaided at all states of the tide. A new town, which has grown up round the docks, is connected by electric tramway and light railway with Grimsby. Pop. (1921) 2,150.

IMMOLATION, the ceremonial rites performed in the preparation of victims for sacrificial purposes. The human sacrifice or *sati* (suttee) of India consists of the immolation of a widow on the funeral pyre of her husband and the Khond sacrifice of the Meriah; the days preceding the sacrifice being devoted to increasing the sanctity of the victim by various processes of anointing and other ceremonies. *See* SACRIFICE.

IMMORTALITY, the condition or quality of being exempt from death or annihilation. The belief in human immortality in some form is almost universal; even in early animistic cults the germ of the idea is present, and in all the higher religions it is an important feature. This article is confined to summarizing the philosophical or scientific arguments for and against the doctrine of the persistence of the human soul after death. For the Christian doctrine, *see* ESCHATOLOGY; and for other religions, *see* the separate articles.

The opinion of Socrates is uncertain. In the *Apology* he is represented as sure that "no evil can happen to a good man, either in life or after death," but as not sure of what man's future lot will be. In the *Phaedo* a confident expectation is ascribed to him. Only his body will be buried; he will go away to the happiness of the blessed. The silence of the *Memorabilia* of Xenophon must be admitted as an argument to the contrary; but the probability seems to be that Plato in the *Phaedo* did not altogether misrepresent the master. In Plato's own thought the belief held a prominent position. "It is noteworthy," says D. G. Ritchie, "that, in the various dialogues in which Plato speaks of immortality, the arguments seem to be of different kinds, and most of them quite unconnected with one another." (*Plato* p. 146.) The estimate to be formed of his reasoning has been well stated by A. M. Fairbairn, "Plato's arguments for immortality, isolated, modernized, may be feeble, even valueless, but allowed to stand where and as he himself puts them, they have an altogether different worth. The ratiocinative parts of the *Phaedo* thrown into syllogisms may be easily demolished by a hostile logician; but in the dialogue as a whole there is a subtle spirit and cumulative force which logic can neither seize nor answer" (*Studies in the Philosophy of Religion,* p. 226 [1876]).

Aristotle held that only *νοῦς,* or the active intellect, in man is immortal. His views are conditioned by his psychology, body and soul being a complete whole, in which the elements are inseparably united. Soul cannot exist disembodied. Yet he makes a reservation in favour of the highest element in man: this indeed is immortal, but apparently not in an individual form. He seems not to have believed what could be called personal immortality. The Stoics were not agreed upon the question. Cleanthes is said to have held that all survive until the great conflagration which closes the cycle; Chrysippus that only the wise will do so. Marcus

Aurelius teaches that even if the spirit survives for a time it is at last "absorbed in the generative principle of the universe." Epicureanism thought that "the wise man fears not death, before which most men tremble; for, if we are, it is not; if it is, we are not." Augustine adopts a Platonic thought when he teaches that the immortality of the soul follows from its participation in the eternal truths. The Apologists themselves welcomed, and commended to others, the Christian revelation as affording a certainty of immortality such as reason could not give. The Aristotelian school in Islam did not speak with one voice upon the question; Avicenna declared the soul immortal, but Averroes assumed only the eternity of the universal intellect. Albertus Magnus argued that the soul is immortal, as *ex se ipsa causa*, and as independent of the body. Pietro Pomponazzi, like Duns Scotus, maintained that the soul's immortality could be neither proved nor disproved by reason. Spinoza, consistently with his pantheism denying personal immortality, affirms that "the human mind cannot be absolutely destroyed with the body, but there remains of it something which is eternal" (*Eth.* v. prop. xxiii). The reason he gives is that, as this something "appertains to the essence of the mind," it is "conceived by a certain eternal necessity through the very essence of God."

Leibniz, in accord with the distinctive principle of his philosophy, affirmed the absolute independence of mind and body as distinct monads, the parallelism of their functions in life being due to a pre-established harmony. For the soul, by its nature as a single monad indestructible and, therefore, immortal, death meant only the loss of the monads constituting the body, and the return of the soul to the pre-existent state. The argument of Ernst Platner (*Philos. Aphor.* i. 1174, 1178) is similar. He adds a reason that recalls one of Plato's: "As manifestly as the human soul is by means of the senses linked to the present life, so manifestly it attaches itself by reason, and the conceptions, conclusions, anticipations and efforts to which reason leads it, to God and eternity."

Against the first kind of argument, as formulated by Moses Mendelssohn, Kant advances the objection that, although we may deny the soul extensive quantity and divisibility into parts, we cannot refuse to it intensive quantity, degrees of reality; and consequently its existence may be terminated not by decomposition, but by gradual diminution of its powers. This denial of any reasonable ground for belief in immortality in the *Critique of Pure Reason* (*Transcendental Dialectic*, bk. ii. ch. i.) is, however, not his last word on the subject. In the *Critique of the Practical Reason* (*Dialectic*, ch. i. sec. iv.) the immortality of the soul is shown to be a postulate. Holiness, "the perfect accordance of the will with the moral law," demands an endless progress; and "this endless progress is only possible on the supposition of an endless duration of the existence and personality of the same rational being (which is called the immortality of the soul)." Not demonstrable as a theoretical proposition, the immortality of the soul "is an inseparable result of an unconditional *a priori* practical law." The moral interest, which is so decisive on this question in the case of Kant, dominates Bishop Butler also. A future life for him is important, because our happiness in it may depend on our present conduct; and, therefore, our action here should take into account the reward or punishment that it may bring to us hereafter. As he maintains that probability may and ought to be our guide in life, he is content with proving in the first chapter of the *Analogy* that "a future life is probable from similar changes (as death) already undergone in ourselves and in others, and from our present powers, which are likely to continue unless death destroys them . . . but there is no proof that it will, either from the nature of death," of the effect of which on our powers we are altogether ignorant, "or from the analogy of nature, which shows only that the sensible proof of our powers (not the powers themselves) may be destroyed." (Analysis of chapter I. in Angus's edition of *The Analogy*.) Butler recognizes that "reason did, as it well might, conclude that it should finally, and upon the whole, be well with the righteous and ill with the wicked," but only "revelation teaches us that the next state of things after the present is appointed for the execution of this justice" (ch. ii. note 10). He does not use this general anticipation of future judgment, as he might have done, as a positive argument for immortality.

Adam Ferguson (*Institutes of Moral Philosophy*, p. 119, new ed., 1800), argues that the desire for immortality itself as an instinct is an indication of the Creator's intention. From the standpoint of modern science John Fiske confirms the validity of such an argument; for what he affirms in regard to belief in the divine is equally applicable to this belief in a future life. "If the relation thus established, in the morning twilight of man's existence, between the human soul and a world invisible and immaterial is a relation of which only the subjective term is real and the objective term is non-existent; then I say it is something utterly without precedent in the whole history of creation" (*Through Nature to God*, 1899, p. 188, 189). Whatever may have been Hegel's belief in regard to personal immortality, the logical issue of his absolute idealism would seem to be a rejection of the continuance of finite personality. F. D. Schleiermacher applies the phrase "the immortality of religion" to the religious emotion of oneness, amid finitude, with the infinite and, amid time, with the eternal. He denies any necessary connection between the belief in the continuance of personal existence and the consciousness of God, and bases his faith in immortality on Christ's promise of living fellowship with His followers, as presupposing their as well as His personal immortality. A. Schopenhauer assigns immortality to the universal will to live; and Feuerbach declares spirit or consciousness, eternal, but not any individual subject. R. H. Lotze lays down the broad principle, "All that has once come to be will eternally continue if it has an unchangeable value for the organic unity of the world, but it will obviously again cease to be, when that is not the case." (*Gr. der Psych.*, p. 74.)

Objections to the belief in immortality have been advanced from the standpoints of materialism, naturalism, pessimism and pantheism. Materialism argues that, as life depends on a material organism, thought is a function of the brain, and the soul is but the sum of mental processes dependent upon physical changes; therefore, the dissolution of the body carries with it necessarily the cessation of consciousness. That mind is correlated with brain and life with body must be conceded, but that they cease to be when their organs are destroyed has not been scientifically demonstrated. Indeed the following considerations may be advanced: (1) Man does distinguish himself from his body (in the primitive philosophy of animism the soul is already distinguished from the body); (2) he is conscious of his personal identity throughout all the changes of his body, and the fuller his personal development the more independent is his inner life of the outer; (3) in the exercise of his will he thinks himself as not controlled by but controlling his body, and the testimony of man's conscience to his liberty and responsibility is an ultimate datum of his consciousness. The theory of psychophysical parallelism has been subjected to a rigorous examination in James Ward's *Naturalism and Agnosticism*, part iii., and the argument that mind cannot be derived from matter convincingly presented. Sir Oliver Lodge in reply to E. Haeckel's *Riddle of the Universe* maintains that "life may be something not only ultra-terrestrial, but even immaterial, something outside our present categories of matter and energy; as real as they are, but different, and utilizing them for its own purpose" (*Life and Matter*, 1906, p. 198). He rejects the attempt to explain human personality as "generated by the material molecular aggregate of its own unaided latent power," and affirms that the "universe where the human spirit is more at home than it is among these temporary collocations of matter" is "a universe capable of infinite development, of noble contemplation, and of lofty joy, long after this planet—nay the whole solar system—shall have fulfilled its present spire of destiny, and retired cold and lifeless upon its endless way" (pp. 199–200).

In his lecture on *Human Immortality* (3rd ed., 1906), William James deals with "two supposed objections to the doctrine." The first is "the law that thought is a function of the brain." Accepting the law he distinguishes productive from permissive

or transmissive function (p. 32); and, rejecting the view that brain produces thought, he recognizes that in our present condition brain transmits thought, thought needs brain for its organ of expression; but this does not exclude the possibility of a condition in which thought will be no longer so dependent on brain. Against materialism three general objections can be offered: (1) the categories and the methods of physiology cannot solve the problems of psychology; (2) if physical energy is being transmuted into mental without any recovery, then the principle of the transmutation of energy is not universally applicable; (3) mind as the subject of knowledge cannot be derived from one of its objects, the very conception of which is a mental construction to account for some of the content of consciousness. Further arguments in the same direction are derived from the modern school of psychical research (*see* especially F. W. H. Myers' *Human Personality*, 1903).

Another objection is advanced from the standpoint of naturalism, which, whether it issues in materialism or not, seeks to explain man as but a product of the process of nature. The universe is so immeasurably vast in extension and duration, and man is so small, his home but a speck in space, and his history a span in time, that it seems an arrogant assumption for him to claim exemption from the universal law of evolution and dissolution. This view overlooks the facts that man has ideals of absolute value, truth, beauty and goodness, that he consciously communes with the God who is in all, and through all, and over all, that his mind recognizes the vastness of the universe and its universal law, and that such a mind, which perceives and conceives, must be greater than the object of its thought.

Pessimism suggests a third objection. The present life is so little worth living that its continuance is not to be desired. We cannot, however, admit that the history of mankind justifies this conclusion; for the great majority of men life is a good, and its continuance an object of hope. This philosophy when sincere, is often due to natural disposition, or to unfortunate circumstances, and in some cases is even a mental pose, a disguise of personal failure or disappointment.

For pantheism personal immortality appears a lesser good than reabsorption into the universal life. But against this objection we may confidently maintain that worthier of God and more blessed for man is the hope of a conscious communion in an eternal life of the Father of all with His whole family. Why should the infinite reality differentiate itself in finite personality if there is no permanent result; and why should finite personality be subjected to the often painful discipline of "self-knowledge, self-reverence and self-control," if no self-will be allowed to survive?

Lastly positivism teaches a corporate instead of an individual immortality; man should desire to live on as a beneficent influence in the race. But these possibilities are not mutually exclusive. A man may live on in the world by his teaching and example as a power for good, and he may also be continuing and completing his course under conditions still more favourable to all most worthy in him. Consciously to participate as a person in the progress of the race is surely a worthier hope than unconsciously to contribute to it as an influence; ultimately to share the triumph as well as the struggle is a more inspiring anticipation.

In stating constructively the doctrine of immortality we must assign secondary importance to the metaphysical arguments from the nature of the soul. It is sufficient to show, as has already been done, that the soul is not so absolutely dependent on the body that the dissolution of the one necessarily involves the cessation of the other. Such arguments as the indivisibility of the soul and its persistence can at most indicate the possibility of immortality. The argument for personal immortality must be based on some rational, moral, social or spiritual value which would be discredited if death ended all.

The juridical argument has some force; the present life does not show the harmony of condition and character which our sense of justice leads us to expect; the wicked prosper and the righteous suffer; there is ground for the expectation that in the future life the anomalies of this life will be corrected. Although this argument has the support of such great names as Butler and Kant, yet it will repel many minds as an appeal to the motive of self-interest.

The ethical argument has greater value. The more lofty man's aims, the more worthy his labours, the more incomplete his life appears to be. The man who lives for fame, wealth, power, may be satisfied now; but he who lives for the ideals of truth, beauty and goodness, lives not for time but for eternity, and his life cannot be fulfilled on this side of the grave. Unless these ideals are mocking visions, man has a right to expect the continuance of his life for its completion. This is the line of argument developed by Hugo Münsterberg in his lecture on *The Eternal Life* (1905).

More general in its appeal is the argument from the affections, which has been beautifully developed in Tennyson's *In Memoriam*. The heart protests against the severance of death, and claims the continuance of love's communion after death; and as man feels that love is what is most godlike in his nature, love's claim has supreme authority.

There is a religious argument for immortality. A difference of opinion exists among scholars regarding the indications of a hope of immortality based on the consciousness of fellowship with God in the Old Testament (*see* article on ESCHATOLOGY). The proof offered by Jesus Himself when He declares God to be the God of the living and not of the dead (Matt. xxii. 32) is this: God has entered into personal relations with man, and as He is the Eternal, He will preserve in life with Himself those who are thus in communion with Him. The infinite value of every individual soul (Luke, xv.) to God as Father is an assurance that He will not suffer the loss in death of any of His children. Josiah Royce in his lecture on *The Conception of Immortality*, 1900, (pp. 145–146), combines this argument of the soul's union with God with the argument of the incompleteness of man's life. It must be pointed out, however, that these arguments, based on personal values, do not afford a proof of natural immortality, but of what has been called conditional. Those will survive who deserve to survive. As adaptation to environment is the condition of the survival of any organism, so human personality can attain immortality only as it adapts itself to God, the eternal environment. This is the argument developed by J. G. Simpson in his two books, *Man and the Attainment of Immortality* (1922) and *The Spiritual Interpretation of Nature* (1912).

R. W. Emerson declares that "the impulse to seek proof of immortality is itself the strongest proof of all." We expect immortality not merely because we desire it; but because the desire itself arises from all that is best and truest and worthiest in ourselves. The desire is reasonable, moral, social, religious; it has the same worth as the loftiest ideals, and worthiest aspirations of the soul of man. The loss of the belief casts a dark shadow over the present life, a potent moral influence is gone. "The day," says Ernest Renan, "in which the belief in an after-life shall vanish from the earth will witness a terrific moral and spiritual decadence. Some of us perhaps might do without it, provided only that others held fast. But there is no lever capable of raising an entire people if once they have lost their faith in the immortality of the soul" (quoted by A. W. Momerie, *Immortality*, p. 9). To this belief, many and good as are the arguments which can be advanced for it, a confident assurance is given by Christian faith in the Risen Lord, and the life and immortality which He has brought to light in His Gospel.

BIBLIOGRAPHY.—In addition to the works referred to above, *see* J. Fiske, *The Destiny of Man, viewed in the Light of his Origin* (1884); E. Petavel, *The Problem of Immortality* (Eng. trans. by F. A. Freer, 1892); G. A. Gordon, *Immortality and the New Theodicy* (1897); R. H. Charles, *A Critical History of the Doctrine of a Future Life in Israel, In Judaism and in Christianity* (1899); R. K. Gaye, *The Platonic Conception of Immortality and its Connexion with the Theory of Ideas* (1904); H. Buckle, *The After Life* (1907); F. von Hügel, *Eternal Life* (1912); A. S. Pringle-Pattison, *The Idea of Immortality* (1922). (A. E. G.)

IMMUNITY (*see* also BACTERIA AND DISEASE). The term "immunity" is used in science in the technical sense. An animal is described as *naturally immune* against the microbe of a disease if the microbe in question cannot establish itself in the organism

and as *artificially immune* if it was naturally susceptible and has been rendered insusceptible. Similarly, an animal is described as *naturally immune* against a poison if its organism is naturally proof, and as *artificially immune* if its organism has been rendered proof against the poison.

Natural Immunity.—A few words may be said first with respect to natural immunity against infection. We may attribute the fact that the body normally remains free from microbic infection to a conjunction of causes:—(*i.*) to the fact that its external and internal coatings furnish mechanical protections against infection (this point need not be further considered here); (*ii.*) to the fact that the body is equipped with special machinery for the destruction of microbes (the nature of this machinery will be discussed below in connection with acquired immunity); (*iii.*) to the fact that certain of the conditions which normally prevail in the animal organism are inimical to the growth of microbes as a whole or at any rate to the growth of certain classes of microbes. Of the conditions here in question two which are of quite dominant importance were discovered in the course of researches on wounds carried out in the World War.

Antitrypsin.—The first and more generally important is the antitryptic power of the blood fluids. Such antitryptic power will in every case hamper, and in the ordinary case completely inhibit, bacterial growth. It will achieve this by neutralizing, in part or completely, the digestive ferments of the microbes which would otherwise convert the unassimilable native albumens of the blood-fluids and serous discharges into assimilable nutrient materials. Antitrypsin in the blood fluids will therefore mean for the microbes therein implanted, either a restriction of their food supply, or complete starvation. The facts, as far as known, all comport with this inference.

Only a few species of microbes (the staphylococcus, streptococcus, pneumococcus and perhaps the microbes of all genuinely septicaemic diseases) can proliferate in antitryptic blood fluids. Further, these microbes (*serophytic* microbes) produce when grown in plasma (generalizing from observations made with staphylococcus and streptococcus) trypsin which quenches the antitryptic power of the surrounding blood fluids and then digests vacuoles in the surrounding clot. Again, all serophytic microbes grow very much more vigorously (the streptococcus for example very many thousand times more vigorously) in the blood fluids when these microbes have, by an artificial addition of trypsin, been relieved from the task of themselves producing enough trypsin to quench the antitryptic power of the surrounding medium. And finally, all those kinds of microbes which are unable to grow in antitryptic blood fluids begin to pullulate there the moment trypsin is added—and let it be noted here that a spontaneous addition of trypsin occurs regularly in wounds as soon as the emigrated leucocytes are broken down under the influence of bacterial growth and unfavourable external influences.

Effect of Alkaline Reaction.—Again—and here the second of the restraints on microbic growth spoken of above comes into question—in the course of research work on wound infections conducted in the course of the war, it was established, in connection with the microbe of gas gangrene, that the proliferation of this bacillus in the blood fluids and serous effusions is inhibited not only by the antitryptic power but also by the normal alkaline reaction of these media. Proof of this is furnished by the fact that as soon as the alkaline reaction in question is blunted off by the ante- or post-mortem formation of lactic acid in muscles deprived of their blood supply, or more directly by an infusion of any acid into the blood, the bacillus of gangrene multiplies without restraint.

Natural Susceptibility.—The problem as to why a particular animal is naturally susceptible to particular poisons is likewise a chemical problem, but a chemical problem of a different order. Formulated in the technical terms which were introduced by Ehrlich the problem is that as to why the tissues of the insusceptible animal contain no *receptors* for the poison, that is to say, no organic substratum upon which that poison can anchor itself. This is a question of the aboriginal chemical constitution of the body—a question as to why a particular species of animal was constructed of one kind of elements rather than of another.

Acquired Immunity.—The problem presented by acquired immunity to infections or poisons differs in important respects from that presented by natural immunity. With respect to such reinforcement of the natural resistance it will be well to note at the outset (*a*) that it can be achieved apart from any violent physiological commotion; (*b*) that acquired immunity does not betray itself in any altered habit of body; and (*c*) that the condition may in many cases be presented to-day and gone to-morrow. All these facts indicate that the acquired immunity cannot involve anything in the nature of a revolutionary physiological upheaval such, for example, as a fundamental alteration in the blood elements, or a cutting out of receptor elements from cells.

Anticipating, we may say that later it will be shown with regard to acquired immunity to infections that this depends upon the development of (*a*) increased antibacterial substances in the blood fluid, (*b*) increased efficiency in the leucocytes and (*c*) increased capacity for producing antibacterial substances in response to infection. Similarly it will be shown with regard to acquired immunity to poisons that this depends upon the appearance of neutralizing elements (so-called antitoxins) in the blood coupled with the acquirement of increased capacity for elaborating these elements in response to an incorporation of the corresponding poisons.

Confining ourselves to the problem as to how the bacterial infections are combated in the organism, we may begin by considering the two chief opposing doctrines which were promulgated, when, under the prompting of Pasteur's practical achievements in the field of prophylaxis, problems of immunity began to be first seriously considered. These theories included natural as well as acquired immunity.

Humoral Theory.—In the theory which goes by the name of the humoral theory, natural immunity is attributed to the bactericidal substances contained in the normal blood fluids, and acquired resistance to the acquisition or increase of such bactericidal power. The general thesis, at any rate, of this theory stands secure. Where microbes are killed otherwise than by physical agencies or by inanition, their destruction must inevitably result from some form of chemical action. So, too, the acquisition of greater power of destruction must of necessity be imputed to the achievement of more potent chemical powers. On the other hand, it cannot of course be certain *a priori* that the antibacterial elements concerned in the destruction of microbes will be found in the blood fluids and only in these. That the blood fluids do, in point of fact, possess bactericidal power was demonstrated by Fodor and Nuttall, and it was at first thought, though a careful study of Nuttall's results should have prevented this, that such bactericidal action was exercised upon microbes without distinction of kind. Later research has, however, shown that the blood fluids are directly poisonous only for certain species of microbes such, for example, as the typhoid bacillus and the cholera vibrio. Certain other species of microbes, and in particular the microbes of specifically septicaemic diseases are, as we have seen, serophytic—the number that grow out in serum being as great as the number which grow out in the best artificial nutrient medium. Thus, the so-called humoral theory, though it would account for the organism possessing considerable resistance to typhoid and cholera, leaves unexplained the fact of the normal organism offering very considerable resistance to serophytic microbes.

What applies to natural, applies also to acquired immunity. There is nothing to show that increased resistance to serophytic microbes and septic infections generally is accompanied by the development of any bactericidal power in the blood fluids.

Phagocytic Theory.—An entirely different conception of immunity is that familiarly known as Mechnikov's *theory of phagocytosis*. In the humoral theory the problem of immunity is envisaged from the point of view of the bacteriological specialist and to some extent also from the standpoint of the chemist. Mechnikov for his part approached the problem from that of the morphologist who takes the whole field of animal life as his province. His theory of immunity therefore starts with the generalization that the Protozoa feed upon the lower forms of life such as

microbes. It further regards the fact that the higher animals have been evolved out of colonial aggregations of Protozoa. In every such colonial aggregation certain of the associated cells instead of becoming specialized persist in the condition of wandering cells.

With regard to these free-living members of the protozoal colony Mechnikov divined that they function as defensive cells. And he showed in connection with sponges and other invertebrates that these wandering cells collect round invading microbes and other foreign intrusions and that they thereafter proceed to ingest and digest them or to aid otherwise in their elimination. Lastly Mechnikov pointed out that the leucocytes of the vertebrate were homologous to those wandering cells and performed exactly the same defensive offices. In particular when leucocytes emigrate from the capillaries into a focus of bacterial infection, in the normal case, they follow this up by ingesting the intruding micro-organisms, and killing them intracellularly. *Natural* or *native immunity* was thus, in the conception of Mechnikov, due to efficient leucocytic functioning; and *acquired immunity* to the leucocytes having by a *process of training* (as he called it) acquired a power of more effectively confronting, ingesting and destroying microbes.

Eclectic Theory.—The central tenet of the Mechnikov theory—the tenet that the leucocytes play a very important rôle in the defence of the body against infection—has now found universal acceptance, but at the same time the doctrine that resistance to infection depends in every case on the action of the leucocytes has proved untenable. In connection with the defence of the organism we must distinguish between (1) defence against infection by serophytic microbes, that is against microbes which like the streptococcus and staphylococcus proliferate in the normal serum; (2) defence against infection by microbes incapable of multiplying in the antitryptic normal serum but not directly killed by it, and (3) defence against microbes directly killed by the serum.

In connection with the first kind of microbe the fact that although they grow freely in the serum and plasma, these are killed in large numbers in the blood and in the serum, when living leucocytes are added, shows that the cellular elements of the blood here do the work of destruction.

In connection with the successful killing of these microbes, the leucocytes must, however, in all cases have free mechanical access to the microbes. There would for example be default in this respect if, as would happen in dealing with infected defibrinated or infected centrifuged blood *in vitro*, the leucocytes settled to the bottom and the microbes were buoyed up out of their reach in the serum. The same would of course happen *in vivo* in all serous effusions.

In connection with those microbes which are not directly poisoned but fail to proliferate in the serum, the most important restraining influence is the native antitryptic power of the blood, but once the antitryptic inhibitory action of the blood fluids and serous effusions has been neutralized the leucocytes, even when everything else favours them, will be impotent to inhibit microbic growth. On the contrary as soon as the leucocytes degenerate they will furnish a further quantum of trypsin and in this way directly conduce to the pullulation of all manner of microbes.

Lastly, the leucocytes do not seem to contribute to the defence of the organism against those microbes which, like the typhoid bacillus and the cholera vibrio, are directly poisoned by the serum. When we implant such microbes into defibrinated blood and then incubate and make microscopic preparations those microbes which are quickly ingested are found intact within the phagocytes while those which are left exposed to the action of the serum are distorted and dissolved. And again, when living emigrated leucocytes are brought to bear upon typhoid bacilli it would seem that few of the microbes are killed. Precisely similar results are obtained with extracts made from leucocytes. It was shown by Schattenfroh that such extracts exert bactericidal action upon the staphylococcus and streptococcus while they exert no such action upon the typhoid bacillus and the cholera vibrio. And again it was shown by Colebrook that the products of inflammation derived from foci of inflammation set up by incorporating into rabbits lint soaked in typhoid vaccine are powerfully bactericidal for the staphylococcus and streptococcus while for the microbes of typhoid and cholera they are not more bactericidal than ordinary serum.

This review of the facts shows that only in the case of serophytic microbes does the defence of the body depend upon the leucocytes and that when it is a question of defence against the other two classes of microbes (those whose growth is entirely inhibited and those which are directly poisoned by the serum) the leucocytes are either impotent or directly harmful.

Leucocytes Concerned in Immunization.—Mechnikov originally taught that the leucocytes were attracted to microbes and induced to phagocytose them by the toxin secreted by the microbes; and that there was here only an interaction between leucocytes and microbes and that the blood fluids could be left entirely out of the story. That that doctrine cannot be sustained can be demonstrated by a simple experiment.

We begin by receiving a sample of blood taken direct from the vessels into normal salt solution. We then centrifuge and recentrifuge in further volumes of this normal salt solution so as to wash the cellular elements free from all traces of the blood fluids. We then make two so-called *phagocytic mixtures* combining in the one case (*a*) one volume of a bacterial suspension with (*b*) one volume of washed leucocytes and (*c*) one volume of 0·85% *salt solution;* and in the other case (*a*) one volume of washed leucocytes, (*b*) one volume of the same bacterial suspension and (*c*) one volume of *normal serum.* These mixtures are then placed in the incubator and after a suitable lapse of time a sample of each is examined under the microscope. In the first phagocytic mixture—that in which no serum was employed—the leucocytes have failed to ingest any microbes. In the specimen in which serum has been employed, the microbes have been plentifully ingested. This result depends not upon any stimulating effect exerted upon the leucocytes, but upon the fact that the serum has effected a chemical change—a so-called *opsonic change*—in the microbes. That this opsonic change does not in any sense affect the vitality of the microbe is shown in the case of serophytic microbes by the fact that the serum that exerts an opsonic effect furnished culture medium in which the affected microbes will all grow out into colonies. The blood fluids intervene further in the destruction of microbes in the interior of the phagocyte by combining with them in such a way as to favour their intracellular digestion. This action, which was first described by Douglas, is known as the protryptic action of the blood fluids.

The living leucocyte can also kill microbes apart from phagocytosis. The following experiment is instructive. A shallow receptacle is filled with a solid nutrient medium whose surface has been uniformly implanted with staphylococcus or streptococcus. The centre portions of the three cover glasses are thickly carpeted with living leucocytes obtained direct from the blood. We now, after different treatment, impose these cover glasses side by side upon the implanted nutrient surface. In the case of the first cover glass the adhering leucocytes are brought into application in conjunction with the adhering serum; in the case of the second they have been washed free from every trace of serum; and in the case of the third cover glass the adhering leucocytes, instead of being employed living, have been killed by drying.

The whole preparation is now incubated at blood heat for 12 hours or more. The microbes will then be found to have grown out forming an uninterrupted sheet of colonies over the whole surface of the nutrient medium except under those areas of cover glasses 1 and 2 which are carpeted with living leucocytes. Here the implanted microbes have not proliferated, and microscopic examination of the cover glasses shows that where the leucocytes came into action in conjunction with serum the microbes are all lying intracellularly; while where the leucocytes were washed free from serum, the microbes are all lying extracellularly. The experiment thus shows that microbes can be killed by leucocytes both intra- and extra-cellularly, *i.e.*, both by phagocytosis and also apart from phagocytosis. This holds true both under the conditions obtaining in this particular experiment, and also in numerous other conditions. That destruction of microbes by leucocytes without the

intervention of phagocytosis occurs also very frequently *in vivo* is practically certain.

Results of Experiments.—Research has thus shown that the destruction of microbes in the body does not proceed only along the lines laid down in the humoral and phagocytic theories. Instead of there being, as was assumed in those theories, only one physiological device by which microbes without distinction are killed in the organism, nature would appear to provide different distinctive devices for different microbes. Some pathogenetic microbes are combated by the bactericidal action of the serum unassisted by the leucocytes, others again are prevented from proliferating by special agencies, such for example as the antitryptic power of the blood; and again a third description of microbe, the serophytic microbes, are destroyed intracellularly and extracellularly by the leucocytes aided, or unaided, by the blood fluids.

The above deals only with the normal protective machinery of the body as distinguished from that which comes into play in artificial immunity. In connection with the latter Metchnikov, as will be remembered, taught that acquired resistance was due not to any changes in the blood fluids, but to the leucocytes having been subjected to a process of training which gave to them a greater capacity for confronting and ingesting microbes. This doctrine had to go by the board when it was shown in numberless cases that increased phagocytosis goes hand in hand with increasing opsonic power in the blood fluids.

From this it was incautiously assumed—though this tenet was never definitely formulated—that the leucocytes constitute in artificial immunity an invariable, and the blood fluids the only variable, factor. That the phagocytic efficiency of the leucocytes was also a variable factor was first shown by Shattock and Dudgeon, who observed that the phagocytic efficiency of the patient's leucocytes is in many cases of pyrexial infection greater than that of the normal man. The phagocytic efficiency of a patient's leucocytes may also, as was further shown by Shattock and Dudgeon, be less than normal.

These observations have a direct bearing upon Metchnikov's doctrine with respect to acquired immunity, since, in all infections associated with constitutional disturbances, antigens from the foci of infection are being brought into operation—in other words the organism is experiencing and is reacting to *auto-inoculations*. It follows that, conformably with the doctrine of Metchnikov, the leucocytes should in every case of pyrexial infection be conducted by successive degrees to a condition of continually increased phagocytic efficiency. Instead of that these cellular elements are, sometimes in localised infections, and practically always in streptococcus septicaemia, reduced to a condition of diminished efficiency.

Artificial Immunization.—We have to consider next how to increase the effectiveness of the antibacterial machinery, *i.e.*, how to produce artificial immunization against infection. The original point of departure was the observation that those patients who had contracted and recovered from an infectious disease were thereby rendered proof against reinfection. That observation led, in connection with smallpox, to the adoption of a procedure for the warding off of the disease. The procedure adopted in various parts of the world and introduced to Europe from Turkey, consisted in the implantation into the susceptible individual of material obtained from a patient suffering from smallpox. This procedure, which was denoted inoculation because it resembled the grafting of an *eye* or *bud* into a new stock, is in reality the parent from which all other procedures of artificial immunization are derived. What required still to be done was to purge inoculation of its dangers and to regulate the immunizing stimulus. This was successfully done in Jennerian vaccination. But the achievement of Jenner was in point of fact purely empirical.

Pasteur's Work.—After Jenner came Pasteur and with Pasteur scientific methods are for the first time brought into application in connection with prophylactic inoculation. His initial achievement was to recognise that the essential in Jennerian vaccination was that for a virulent infective organism obtained from actual cases of smallpox there has been substituted an infective organism which by the operations of nature—to wit by transfer to the cow—had been attenuated in such a manner as to render it non-lethal for man. By the exploitation of that general principle, by the employment of pure culture and by a technique of artificial attenuation adapted with infinite resource to each separate case, the whole series of Pasteurian successes in the field of artificial immunization were one after another achieved. Artificial immunization was not, however, purged from all its risks by the procedures of Pasteur.

It had not yet been transformed into a scientifically regulated procedure. The Pasteurian vaccines were in point of fact standardized only thus far that recourse to attenuation placed in each case a certain limit upon the proliferation of the vaccinating material in the organism of a normally resistant man or animal.

Standardization.—A great step in advance was taken when it was established in connection with anti-typhoid inoculation that the antigen required for the setting in motion of the machinery of immunization can be furnished by the incorporation of sterilized microbic cultures. And further, important steps to the achievement of a standardization of bacterial vaccines were made when a technique for the enumeration of the microbes in bacterial suspensions was devised, and when it was recognized that weighed quanta of desiccated and powdered bacterial substance could be employed in cases where, owing to the felting together of the microbes, enumeration of the microbial suspension was impracticable. The counting of the microbes or the weighing of the bacterial substance is, however, only a means to an end—the standardization of a vaccine, *i.e.*, the determination of the doses which will give the best "curve of immunization."

The Curve of Immunization.—The expression *curve of immunization* calls attention to certain fundamentally important points in connection with the reaction of the body to the incorporation of vaccines. In the pre-Pasteurian and Pasteurian periods, when ideas about the nature of immunizing response were still vague, it was assumed with regard to vaccines that they produced their effects only after a certain incubation period (ordinarily only after ten days). And it was further taken for granted that the curve of immunization would from the beginning move always in the upward direction. When, however, immunization curves came to be constructed (and this was done first in connection with anti-typhoid inoculation) unanticipated features revealed themselves and in connection with these also time-relations which did not conform with expectation.

Negative and Positive Phases.—In what may be called the normal case—*i.e.*, in the case where the dose of vaccine inoculated is sufficient to produce an appreciable constitutional disturbance, a bi-phasic curve of immunization is obtained. For 24 or more hours after the inoculation the antibacterial power of the blood is reduced. This—the so-called negative phase—is followed by a phase of increased antibacterial power—the so-called positive phase—which may last for one or two or a number of days as the case may be. After this the antibacterial power falls away gradually to a level only slightly higher than the original normal. But despite this there would seem to persist in the organism (and this would seem to be the chief profit from inoculation) a power of making more rapid and more ample immunizing response to any subsequent incorporation of antigen whether in the form of a subsequent inoculation of a similar vaccine, or actual infection.

When, instead of a quantum of vaccine which produces a constitutional disturbance, a smaller dose is inoculated, the negative phase is elided and a positive phase is well developed already 24 hours after the incorporation of the vaccine. And, finally, when excessive doses of vaccine, such as produce very severe constitutional disturbances, are incorporated, the negative phase may be correspondingly intense and may persist for many weeks. These facts have an important bearing upon prophylactic operations; they must also, as reflection will show, have an importance in connection with the immunization procedure to which horses are subjected with a view to their producing antibacterial and antitoxic sera. Again substantially the same relations as between the quantum of vaccine inoculated and the type of response elicited, obtain in the case where vaccines are inoculated into patients who

are the subjects of infection. But in that case the conditions are so far different that we have to consider in each case two quanta of antigen: that administered in the vaccine, and that already contained in the patient's organism. Where a patient is the subject of only a minimal infection, we may employ doses of vaccine nearly as great as those employed for the prophylaxis of healthy men. Where a patient is heavily infected, we are restricted to the employment of minimal doses, and finally, when the patient is already labouring under an excessive infection, the injection of vaccines can only do harm.

The principle that the kind of response, and the amplitude of the reaction, and the time-relations of the phases are in each case a function of the quantum of antigen brought into application is found to apply also to the case where the vaccine is added to the extravascular blood. We obtain *in vitro* every variety of effect according to the dose of vaccine brought into application and the time for which it operates upon the blood—the effects varying from an instantaneous increase of bactericidal power to a loss of most of that destructive power. And further different effects are obtained according as we select now one and now another method of testing. We obtain for example one result when we measure the bactericidal power of the whole blood; another when we measure the opsonic power of the serum; a third when we measure the phagocytic efficiency of the leucocytes.

The lessons which can be drawn from immunization curves may now be summarised. The first of these is that excessive doses of vaccine may delay and possibly interfere with the prophylactic response, and further that such excessive doses of vaccine administered to patients suffering from an infection may definitely aggravate their condition. Other important lessons are that when appropriate doses of vaccine (*i.e.*, doses which are not followed by a negative phase) are administered, prophylactic effects may be obtained almost immediately after inoculation. And further it should be possible to arrest a general infection by inoculating in the incubation period and then employing a reduced dose of vaccine.

Considerable evidence showing that immunization develops very rapidly after the inoculation of an antigen is furnished in the work of Pirquet. If a first implantation of vaccinia is followed by similar implantations on successive days, the response to these latter differs from the response made to the first. This altered clinical response—which would appear to indicate a more rapid destruction of the later implanted infective material—was described under the name of *allergy*. It was further shown by Pirquet in connection with the inoculation of foreign serum that the supervening clinical reaction—which appears to indicate the throwing out of that foreign serum from the blood—is accelerated when the injection of serum is made into an organism which has been before subjected to that procedure. The interval between the injection of the foreign serum and the clinical manifestations associated with its elimination from the blood (normally 10–14 days) may be reduced to a very few minutes.

A series of further questions in relation to artificial immunity have to be considered (1) Are there agencies other than vaccines proper—in other words, other than living or dead microbes or substances derived from the bodies of microbes—which will affect the bactericidal power of the blood and leucocytes? (2) Again, are the antibacterial substances in the serum specific in the sense of operating only upon one particular variety of microbe or are they non-specific? (3) Further, will leucocytes which have acquired increased phagocytic efficiency, ingest more actively only one particular species of microbe, or all microbes without distinction? (4) Finally, what are the cells in the body which elaborate the anti-bacterial substances? All these questions are intimately linked up.

Non-bacterial Vaccine.—In connection with the question as to whether there are agencies other than vaccines proper which can increase or, as the case may be, diminish the bactericidal power of the blood, it has been shown that the infliction of burns increases the bactericidal power of the serum for the anthrax bacillus. This increased bactericidal power is no doubt referable to an absorption into the blood of disintegration products derived from the burnt tissues. Again, it has recently been ascertained that increased bactericidal power can be developed in the blood *in vitro* by adding to it foreign sera and also non-foreign sera artificially altered by heating to 60° C. Lastly, it has been shown in connection with the irradiation of the skin with ultra-violet light, the light of the electric arc and sunlight, that by these agencies also the bactericidal power of the blood is increased, such increased bactericidal power depending upon an increased phagocytic power of the leucocytes and also an increased antibacterial power in the serum (*see* HELIOTHERAPY and PUBLIC HEALTH). It is not yet known how irradiation produces these results, but the consideration that radiations such as are here in question are much more likely to act by breaking down than by building up albuminous substances, taken together with the fact that increased bactericidal power is achieved only with a certain quantum of irradiation and that the blood suffers deterioration when larger doses are employed, would seem to point to the conclusion that we are here, in each case, dealing with effects produced by the absorption into the blood of an antigen in the form of disintegration products generated by the irradiation.

Specificity.—The non-bacterial antigens which have been under discussion above occupy at present a position apart in the respect that it would generally be held with regard to these that they might quite likely evoke a non-specific immunizing response; whereas it would be generally held that bacterial vaccines would produce only specific immunizing response. But against this there is conclusive evidence to show that bacterial vaccines also evoke non-specific immunizing response in the form of increased bactericidal power in the blood, increased phagocytic efficiency in the leucocytes and sometimes also increased antibacterial power in the serum. Thus, for example, by the incorporation of staphylococcus the blood can be rendered more bactericidal for streptococcus. This can be achieved also by the addition of staphylococcus vaccine to the blood *in vitro*. Similarly an addition of tuberculin to the extravascular blood will increase the bactericidal power of the blood to staphylococcus, increasing at the same time the phagocytic efficiency of the leucocytes.

These laboratory experiments are in consonance with the statistical results obtained in connection with anti-pneumonococcus inoculations at the Premier Mine in the Transvaal. Here in 1912, in addition to a striking reduction in the incidence and death-rate of pneumonia, there was achieved a striking reduction in the incidence and death-rate from "other diseases."

Derivation of Immunization Product.—The discussion of the deeper problems as to where antibacterial substances are elaborated in the body, and as to how their production is to be explained, may be deferred for a moment. For the facts relating to immunization against bacterial toxins must first be taken into consideration by bringing out the following points: (1) The machinery of immunization is in reality a machinery for neutralizing or otherwise disposing of poisonous substances—poisonous substances being by definition those which enter into crippling or lethal chemical combination with the blood fluids and tissues. (2) The machinery of immunization achieves its ends by furnishing substances which enter into neutralizing or precipitating or destructive union with the poisonous substances above spoken of. (3) The machinery of immunization is brought into operation only by a particular class of poisons—to wit, by those which enter into crippling but not immediately lethal chemical combination with the cellular protoplasm—those which, to use the expressions of Ehrlich, intrude themselves into the "side-chains" and not into the "vital ring" of that protoplasm. Of such poisons four kinds specially invite attention. These are: (*a*) the poisonous constituents of the bacterial protoplasm, (*b*) the albuminous substances contained in foreign sera and certain other foreign albuminous substances, (*c*) bacterial toxins such as those which can be filtered off from cultures of diphtheria and tetanus and (*d*) vegetable and animal toxalbumens such as abrin, ricin and the various snake venoms. With respect to the first the body responds to their inoculation by a production of *bacterio-tropic substances, i.e.*, substances which enter into detrimental or lethal chemical combination with bacteria. The inoculation of sera is followed

by the elaboration and delivery into the blood of *sero-tropic substances* which neutralize and precipitate these sera. The inoculation of bacterial toxins in like manner—this discovery was made by Behring—leads to the production and delivery into the blood of toxitropic substances. These, known as bacterial *anti-toxins*, neutralize and precipitate the corresponding toxins. And, finally, the inoculation of toxalbumens is followed by an elaboration and delivery into the blood of the appropriate neutralizing substances.

Practical Results.—The discovery of bacterial antitoxins had led to important practical applications in connection with the treatment and prophylaxis of, in particular, diphtheria (*see* INFECTIOUS FEVERS) and tetanus (*q.v.*). By virtue of the fact that toxins and antitoxins lend themselves to accurate quantitative study, it has contributed much to our knowledge of the machinery of immunization. It was through the study of the curves of immunizing response made to the inoculation of tetanus toxin that the negative phase first became known. Again, it was by the study of antitoxin production that it was for the first time unequivocally established that the organism which has made previous response to even a minimal quantum of a toxin is thereafter capable of responding to any further quantum of that poison with a prompter and ampler elaboration of antitoxins.

Further, by the study of the antitoxin content of the blood in its relation to diphtheria toxin, it has been shown that the presence of even a small quantum of antitoxin in the blood protects against infection, and that the insusceptibility of the majority of adults to diphtheritic infection is correlated with the possession of a minute quantum of antitoxin derived, as it would seem, from repeated minimal diphtheritic infections contracted in their earlier life. The same would appear to hold also of the scarlet fever streptococcus. We have here, as reflection will show, facts which illuminate the epidemiology of diphtheria and scarlatina and show that it is possible and may under circumstances be advisable to substitute for a prophylactic inoculation of a bacterial vaccine, an injection of antitoxin, or alternatively an injection of such quantum of toxin as will evoke an antitoxic response.

Two further points about antitoxins have important bearings upon the problem as to where and how products of immunization are produced in the organism. (1) Antitoxins are quite rigidly specific—each antitoxin neutralizing only the particular kind of toxin in response to which it was engendered. (2) After a first inoculation of toxins antitoxins are only very slowly produced. Ordinarily an interval of ten to 20 days elapses before they make their appearance in the blood.

These properties are not, let it be noted, differential properties of antitoxins; they characterize also certain kinds of bacteriotropic substances. Specificity and comparatively tardy appearance in the blood characterize for example agglutinins, and the so-called "thermostable immune bodies."

Since there are two kinds of products of immunization: one kind that are eminently non-specific and are produced immediately (and can, as we have seen, be produced in the blood *in vitro*); and another kind which are rigidly specific and are elaborated only after a considerable lapse of time and are so far as appears produced only *in vivo;* we may now seek for an answer to the problem as to how and where these various products of immunization are engendered. Since it may be taken as certain that these two kinds cannot well originate in the same cells and be engendered by the same kind of metabolic operation, we may divide up the problem and consider first by what cells and by what kind of metabolic operation the non-specific anti-bacterial substances are produced and then take up the question as to where and how antitoxins and such antibacterial substances as are specific are generated.

Non-specific Antibacterial Substances.—The former question presents no difficulty. The facts set forth above make it clear that non-specific antibacterial substances are elaborated by the leucocytes. And further the facts suggest that the leucocytes produce these substances as ordinary secretion incited by the chemical products derived from bacterial and cellular disintegration products applied in suitable concentration.

Further the facts comport with the idea that leucocytes which have elaborated antibacterial secretions but have not as yet excreted these into the environing blood fluids will, by virtue of their increased content in antibacterial substances, possess increased antibacterial efficiency, while the blood fluids will not have gained anything in antibacterial power.

Conversely leucocytes that have excreted their antibacterial substances will exhibit diminished antibacterial power and the blood fluids which have received these secretions will have received an accretion of antibacterial power.

Specific Products of Immunization.—The problem as to how these products of immunization which indenture chemically with only one counterpart substance are engendered in the body, is of quite another order of difficulty, and it is one of the memorable achievements of Ehrlich to have conceived how the furnishing of such specific products of immunization could be accounted for. The problem presented itself to Ehrlich's mind in the following vivid manner: "If," it was thus that Ehrlich communed with himself, "If I take a guinea-pig—that is to say, a creature whose country of origin is Southern America—and administer to it abrin—a poison derived exclusively from Africa (and thus one which neither the tame guinea-pig nor its ancestry can ever have encountered) and if I now find that my guinea-pig furnishes me with an antidotal substance which indentures with the abrin as does a key with the wards of the lock for which it is made, is there then for me any way of escape from the conclusion that the organism of my guinea-pig has specially constructed an antidotal substance to fit the particular kind of poison I have administered—performing in this a feat of chemical analysis and synthesis which would balk the ablest chemist?" From the intellectual *impasse* into which this interrogatory seemed to lead there was, Ehrlich discerned, a possible way of escape. He reflected that there must of necessity exist in the organism of any animal which is affected by a given poison a counterpart substance (or to use his technical term) a *receptor* which enters into chemical combination with that poison. In other words, there must exist already preformed in the organism of susceptible animals, substances which have a chemical constitution such as would admit of their functioning as antitoxins.

At the same time these counterpart substances differ fundamentally from the non-specific antibacterial substances which were considered above. First of all they are not, as are the substances last mentioned, available in the form of secretory products produced only with a view to their being ejected from the cell. Instead of that, specific counterpart substances are integral elements of the cellular protoplasm, and elements of which it may be assumed with certainty that they subserve special functions in the internal economy of the cells of which they are constituents. Further the specific counterpart substances we are here considering differ from the non-specific antibacterial substances in the respect that while these latter are elaborated only in one particular variety of cell (to wit, in the leucocyte) the former are widely distributed in the organism, being located in each case in a different assortment of cells. Thus, for example, the counterpart substances to which the diphtheritic toxin would anchor itself would be located in a different assortment of cells than the counterpart substances with which the tetanus toxin would combine. And again the counterpart substances which would combine with abrin would be different. This would hold true also of the counterpart substances which would unite with the poisons derived from each particular variety of bacterial protoplasm.

So far it has been shown only that susceptible animals must by the very nature of things contain in their cell-protoplasm constituent elements which are the exact chemical counterparts of poisons. We are still very far from the solution of the mystery (*a*) of the organism furnishing antitoxins in the circulating blood; (*b*) of its furnishing antitoxins only to special classes of poisons; and (*c*) of its furnishing these in quantities far in excess of the quantum of counterpart substances originally contained in the organism. Ehrlich, in exploring for some way of exit from the labyrinth constituted by these questions oriented himself by the

aid of a ground-plan, in which there was set out his general conception of the stereo-chemistry of protoplasm. In the plan in question the protoplasm is a structure made up of side-chains assembled round a central ring—the continued life of the protoplasm depending upon the integrity of the central (or as we may call it *vital*) ring; while the side-chains consist of elements which are integrated into the protoplasm for its nourishing and vital functioning. To this original ground plan there was now added by Ehrlich a new feature. The conception which he now added was that the side-chains of the protoplasm would, as soon as they became redundant, be cast forth from the cell into the circulating blood, forming there what he called *free receptors*.

Interpreted in the light of this so-called *side-chain* theory, the incorporation of poisons which make a chemical attack upon the vital ring of the cell protoplasm would abrogate the life of the cell and would therefore be incompatible with an elaboration of antitoxins. The situation is entirely different when the poison, instead of directing its attack to the vital ring, anchors itself on to one of the side-chains. After a temporary putting out of action of those functions which are discharged by the particular side-chains in question, this would lead to the replacement of the crippled side-chains, and thereafter to a hyper-replacement and to such redundancy of these in the protoplasm as would involve casting forth these side-chain receptors into the circulating blood. This theory, which is quite as applicable to the production of specific antibacterial substances as to the production of antitoxins —would seem to lie open to critical assault in that the hyper-replacement of side-chains does not necessarily conduct to an excretion of these into the circulating blood. In point of fact in the case of muscle, on which Ehrlich here relies, it leads to something very different, to a hypertrophy of this tissue.

Finally, the side-chain theory has met with hostile criticism more especially on the ground that it would compel us to believe that the noble tissues, such as those of the central nervous tissue which are poisoned by the toxins of diphtheria and tetanus, can be converted into secretory organs so prolific as to furnish in the blood tens and hundreds of thousands of units of the corresponding antitoxins. The side-chain theory does not in any way require us to believe this. It would do so only if it had been established that poisons such as diphtheria and tetanus toxins attack only the central nervous system. But in point of fact Ehrlich assumed that the poisons which are responded to by a production of antitoxins are all *polytropic*—in other words they turn towards and combine chemically with a number of different tissues. So far therefore as the side-chain theory is concerned, we are thus authorised to assume that, not the cells of the central nervous system, but all or any of the other and less noble tissues which are affected by the toxins, are those which produce the harvest of antitoxins.

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IMMUNITY, in law, a term for exemption from liability, principally used in the legal sense in connection with exterritoriality (*q.v.*).

IMOLA, a town and episcopal see of Emilia, Italy (anc. *Forum Cornelii*), province of Bologna, 21 m. southeast of that town by rail, 140 ft. above sea-level. Pop. (1921) 15,497 (town); 37,293 (commune). The cathedral of S. Cassiano possesses interesting reliquaries, and contains the tomb of Petrus Chrysologus, archbishop of Ravenna (d. 449), a native of Imola. S. Domenico has a fine Gothic portal and S. Maria in Regola an old campanile. The town also contains some fine palaces. The communal library has some mss., including a psalter with miniatures, that once belonged to Sir Thomas More (1304). The citadel is square with round towers at the angles. Imola has two large lunatic asylums with over 1,800 inmates. The Madonna del Piratello, 2 m. outside the town to the north-west, is in the early Renaissance style (1488); the campanile was probably built from Bramante's plans in 1506.

See L. Orsini, *Imola* (Bergamo, Arti Grafiche, 1907) well illustrated.

IMP, originally a shoot of a plant or tree used for grafting (O.E. *impa*, a graft, shoot). The verb "to imp" was especially used of the grafting of feathers on to the wing of a falcon or hawk to replace broken plumage, and is frequently used metaphorically. Like "scion," "imp" was, till the 17th century, used of a member of a family, especially of high rank, hence often used as equivalent to "child."

IMPALA, a South African antelope. *See* PALLA.

IMPATIENS, in botany, a genus (family Balsaminaceae) of annual or biennial herbs, sometimes becoming shrubby, comprising some 350 or more species, chiefly natives of the mountains of tropical Asia and Africa, but also found widely distributed in the north temperate zone and in South Africa. The flowers, which are purple, yellow, pink or white and often showy, are spurred and irregular in form and borne in the leaf-axils. The name is derived from the fact that the seed-pod when ripe discharges the seeds by the elastic separation and coiling of the valves. *Impatiens Noli-tangere*, touch-me-not, an annual succulent herb with yellow flowers, is probably wild in moist mountainous districts in north Wales, Lancashire and Westmorland. *I. Roylei*, a tall hardy succulent annual with rose-purple flowers, a Himalayan species, is common in England as a self-sown garden plant or garden escape. In North America there are five native species, of which the spotted touch-me-not or jewel-weed (*I. biflora*), with orange-yellow flowers, mottled with brown, and the pale touch-me-not or jewel-weed (*I. pallida*), with pale yellow flowers, are widely distributed across the continent. *I. Balsamina*, the common balsam of gardens, a well-known annual, is a native of India; it is one of the showiest of summer and autumn flowers and of comparatively easy cultivation. *I. Sultani*, a handsome plant, with scarlet flowers, a native of Zanzibar, is easily grown in a greenhouse throughout the summer, but requires warmth in winter.

IMPEACHMENT, the English form of judicial parliamentary procedure against criminals, in which the House of Commons are the prosecutors and the House of Lords the judges. It differs from bills of attainder (*q.v.*) in being strictly judicial. When the House of Commons has accepted a motion for impeachment, the mover is ordered to proceed to the bar of the House of Lords, and there impeach the accused "in the name of the House of Commons, and of all the Commons of the United Kingdom." The charges are formulated in articles, to each of which the accused may deliver a written answer. The Commons appoint managers to conduct the prosecution, but the whole House in committee attends the trial. The defendant may appear by counsel. The president of the House of Lords is the lord high steward in the case of peers impeached for high treason; in other cases the lord chancellor. The hearing takes place as in an ordinary trial, the defence being allowed to call witnesses if necessary, and the prosecution having a right of reply. At the end of the case the president "puts to each peer, beginning with the junior baron, the questions upon the first article, whether the accused be guilty of the crimes charged therein. Each article is proceeded with separately in the same manner, the lord high steward giving his own opinion the last" (May's *Parliamentary Practice*, c. xxiii.). Should the accused be found guilty, judgment follows if the Commons move for it, but not otherwise. The Commons thus retain the power of pardon in their own hands, and this right they have in several cases expressly claimed by resolution, declaring that it is not parliamentary for their lordships to give judgment "until the same be first demanded by this House." Spiritual peers occupy an anomalous position in the trial of peers, as not being themselves ennobled in blood; it is customary for them to withdraw before judgment is given, entering a protest "saving to themselves and their successors all such rights in judicature as they have by law, and by right ought to have." An impeachment, unlike other parliamentary proceedings, is not interrupted by prorogation, nor even by dissolution. Proceedings in the House of Commons preliminary to an impeachment are sub-

ject to the ordinary rules, and in the Warren Hastings case an act was passed to prevent the preliminary proceedings from discontinuance by prorogation and dissolution. A royal pardon cannot be pleaded in bar of an impeachment, though it is within the royal prerogative to pardon after the lords have pronounced judgment. The point was raised in the case of the earl of Danby in 1679, and the rule was finally settled by the Act of Settlement. Persons found guilty on impeachment may be reprieved or pardoned like other convicts. Impeachment will lie against all kinds of crimes and misdemeanours, and against offenders of all ranks. In the case of Simon de Beresford, tried before the House of Lords in 1330, the House declared "that the judgment be not drawn into example or consequence in time to come, whereby the said peers may be charged hereafter to judge others than their peers," from which Blackstone and others have inferred that "a commoner cannot be impeached before the Lords for any capital offence, but only for high misdemeanours." In the case of Edward Fitzharris in 1681, the House of Commons in answer to a resolution of the Lords suspending the impeachment, declared it to be their undoubted right "to impeach any peer or commoner for treason or any other crime or misdemeanour." And the House of Lords has in practice recognized the right of the Commons to impeach whomsoever they will. The procedure has, however, been reserved for great political offenders whom the ordinary powers of the law might fail to reach. It has now fallen into desuetude. The last impeachments were those of Warren Hastings (1788–1795) and Lord Melville (1806), but an unsuccessful attempt was made by Thomas C. Anstey to impeach Lord Palmerston in 1848.

United States.—In the United States the procedure of impeachment both in the national and in almost all of the state governments is very similar to that described above. The national constitution prescribes that the House of Representatives "shall have the sole power of impeachment" and that "the Senate shall have the sole power to try all impeachments." The House appoints managers to conduct the prosecution at the bar of the Senate, and the vote of the Senate is taken by putting the question separately to each member, who, during the trial, must be on oath or affirmation. In ordinary cases the president or president *pro tempore* of the Senate presides, but when the president of the United States is on trial the presiding officer must be the chief justice of the United States Supreme Court. A two-thirds vote is necessary for conviction. The president, vice-president or any civil officer of the United States may be impeached for "treason, bribery or other high crimes and misdemeanours," and if convicted, is removed from office and may be disqualified for holding any office under the government in future. The officer after removal is also "liable and subject to indictment, trial, judgment and punishment, according to law." The term "civil officers of the United States" has been construed as being inapplicable to members of the Senate and the House of Representatives. The president's pardoning power does not extend to officers convicted, on impeachment, of offences against the United States. Since the organization of the Federal government there have been only nine impeachment trials before the United States Senate, and of these only two resulted in convictions. The two most famous cases are those of Justice Samuel Chase of the United States Supreme Court in 1805, and of President Andrew Johnson, in 1868.

See English constitutional histories generally (Maitland etc.); also, for U.S.A., W. A. Estrich "20 *Cases and Comment* 454," etc. *Harvard Law Review*, 684 etc.

IMPERIA, a city of Liguria, Italy, the capital of the province of Imperia, on the coast of the Ligurian Sea, 46 m. by rail east of Nice and 70 m. south-west of Genoa, 115 ft. above sea-level. Pop. (1921) 15,497 (town), 25,013 (commune). It consists of a picturesque old town on the heights and a modern town of villas on the lower slopes. The principal church is a large structure of 1780 with dome rebuilt in 1821. A few remains of the old city walls may be seen. About 2 m. to the north-east on the same bay is Oneglia, with a fine church, S. Giovanni Battista, designed by Gaetano Amoretti, a hospital (1785) and a large prison. It suffered considerably from the earthquake of 1887. Both have small but safe harbours, both are frequented for sea-bathing, and both are embowered amid olive groves; and the district is famous for the quality of its oil.

Imperia, formerly Porto Maurizio, appears as *Portus Maurici* in the Maritime Itinerary. After being subject to the marquises of Turin (11th century) and of Clavesana, it was sold by Boniface of Clavesana in 1288 to Genoa in return for a yearly payment; in 1354 it became the seat of the Genoese vicar of the western Riviera, and thenceforth shared the fortunes of Genoa.

IMPERIAL CHAMBER (*Reichskammergericht*), the supreme judicial court of the Holy Roman empire, during the period between 1495 and the dissolution of the empire in 1806. From the early middle ages there had been a supreme court of justice for the empire—the *Hofgericht*, in which the emperor himself presided and a body of assessors found the judgments. The Hofgericht was connected with the person of the emperor; it ceased to act when he was abroad; it died with his death. Upon him it depended for its efficiency; and when, in the 15th century, the emperor ceased to command respect, his court lost the confidence of his subjects, and after 1450 it ceased to sit. Its place was taken by the *Kammergericht*, which appeared side by side with the Hofgericht from 1415, and after 1450 replaced it altogether. The king (or his deputy) still presided in the Kammergericht and it was still his personal court; but the members of the new "chamber" were all officials—the *consiliarii* of the imperial *aula* or *Kammer*, whence the name of the court). It was generally the legal members of the council who sat in the Kammergericht (*see* under AULIC COUNCIL); and as they were generally doctors of civil law, the court which they composed tended to act according to that law, and thus contributed to the "reception" of Roman law into Germany towards the end of the 15th century. Even the Kammergericht, however, fell into disuse in the later years of the reign of Frederick III.; and the creation of a new and efficient court became a matter of pressing necessity, and was one of the most urgent of the reforms which were mooted in the reign of Maximilian I.

This new court was eventually created in 1495; and it bore the name of *Reichskammergericht*, or Imperial Chamber. It was distinguished from the old Kammergericht by the essential fact that it was not the personal court of the emperor, but the official court of the empire (or Reich—whence its name). The emperor appointed the president; the empire nominated the rest of the judges. There were originally 16 judges (afterwards, as a rule, 18): half of these were to be doctors of Roman law, and half were to be knights; but after 1555 it became necessary that the latter should be learned in Roman law, even if they had not actually taken their doctorate.

Thus the empire at last was possessed of a court, a court resting on the enactment of the diet, and not on the emperor's will; a court paid by the empire, and not by the emperor; a court resident in a fixed place (until 1693, Spires, and afterwards, from 1693 to 1806, Wetzlar), and not attached to the emperor's person. The great result which in the issue it served to achieve was the final "reception" of Roman law as the common law of Germany. That the Imperial Chamber should itself administer Roman law was an inevitable result of its composition; and it was equally inevitable that the composition and procedure of the supreme imperial court should be imitated in the various States which composed the empire, and that Roman law should thus become the local, as it was already the central, law of the land.

The province of the Imperial Chamber, as it came to be gradually defined by statute and use, extended to breaches of the public peace, cases of arbitrary distraint or imprisonment, pleas which concerned the treasury, violations of the emperor's decrees or of laws passed by the diet, and a variety of other matters. It had also cognizance in cases of refusal to do justice, and it acted as a court of appeal from territorial courts in civil and, to a small extent, in criminal cases; but it had no authority in territories which enjoyed a *privilegium de non appellando* (such as, *e.g.*, the territories of the electors). The business of the court was, however, badly done. Delay was interminable, thanks, in large measure, to want of funds, which prevented the maintenance of a proper number of judges. In all its business it suffered

from the competition of the Aulic Council; for that body, having lost all executive competence after the 16th century, had also devoted itself to judicial work. Composed of the personal advisers of the emperor, the Aulic Council did justice on his behalf (the erection of a court to do justice for the empire having left the emperor still possessed of the right to do justice for himself through his *consiliarii*); and it may thus be said to be the descendant of the old Kammergericht. The competition between the Aulic Council and the Imperial Chamber was finally regulated by the treaty of Westphalia, which laid it down that the court which first dealt with a case should alone have competence to pursue it.

See J. N. Harpprecht, *Staatsarchiv des Reichskammergerichts* (1757–85); G. Stobbe, *Reichshofgericht und Reichskammergericht* (Leipzig, 1878); R. Schröder, *Lehrbuch der deutschen Rechtsgeschichte* (Leipzig, 1904). (E. B.)

IMPERIAL CHEMICAL INDUSTRIES LIMITED. This British joint stock company, which has an authorized share capital of £65,000,000, came into being through a discussion on board the "Aquitania" in Oct. 1926 between Sir Alfred Mond and Sir Harry McGowan, the chairmen respectively of Brunner Mond and Co., Ltd., and Nobel Industries, Ltd. A merger of the British chemical and allied industries within two months was the result. A brief account follows of the participating companies and their productions.

Brunner Mond and Co., Ltd.—The history of this group dates back to the partnership of John Brunner and Ludwig Mond in 1872 to manufacture alkali by the Solvay ammonia soda process. The small works begun at Winnington in 1874 made such progress that a company was formed in 1881 whose capital had been increased from time to time until (1926) it stood at £15,000,000. In 1924 the output was 32 times that of 1881.

United Alkali Co., Ltd.—The alkali industry was established in Great Britain in 1823. Its founder, James Muspratt, seized the opportunity afforded by the repeal of the salt tax to exploit the chemical process invented by the French scientist, Nicolas Le Blanc. After 1875 the production of alkali exceeded the world demand, and prices fell. This coupled with the introduction of the ammonia soda process by Brunner Mond in 1881 caused all the older works to close down. It was out of the situation so created that the United Alkali company was formed in 1890 by the chief Le Blanc process manufacturers.

British Dyestuffs Corporation, Ltd.—The synthetic dyestuffs industry in Britain had its origin in the discovery of aniline mauve by W. H. Perkin in 1856, but through lack of research in the United Kingdom the potentialities of the discovery were not realized, and Germany developed it into one of the greatest undertakings in the world. In the United Kingdom the industry was kept alive with varying degrees of vigour by Levinstein, Read Holliday and company and Claus and company. Through Claus and company the British Dyestuffs corporation can trace its descent from Brooke, Simpson and Spiller, who bought, in 1874, the firm of Perkin and sons, the first synthetic dyestuffs manufacturers.

Read Holliday and company of Huddersfield were founded as chemical manufacturers in 1830, and in 1860 they began to manufacture intermediate products and dyes. Levinstein (founded in 1865 by Ivan Levinstein) and Read Holliday and company at the outbreak of the war were manufacturing a number of dyestuffs from raw materials and many others from intermediates purchased abroad. In 1917 Levinstein, Ltd., took over the indigo works at Ellesmere Port built by Messrs. Meister, Lucius and Bruning, and synthetic indigo is produced there on a large scale. Levinstein, Ltd., purchased Claus and company in 1917. Read Holliday and company had been reorganized with Government assistance, and given the name of British Dyes, Ltd., in 1915. In 1918 British Dyes amalgamated with Levinstein under the style of the British Dyestuffs corporation. A controlling interest was purchased in Scottish Dyes, Ltd., by the British Dyestuffs corporation in 1926.

Nobel Industries, Limited.—This company was a fusion of the principal British makers of explosives, blackpowder, safety-fuses, ammunition and germane products; it takes its name from Alfred Nobel, pioneer of the high explosives industry. The sales of high explosives in Great Britain alone have risen from 255 tons per annum about 30 years ago to about 15,000 tons annually for industrial purposes. (L. C. M.)

IMPERIAL CITIES or **TOWNS** is the usual English translation of *Reichsstädte,* an expression of frequent occurrence in German history. These were cities and towns subject to no authority except that of the emperor, or German king, in other words they were immediate; the earliest of them stood on the demesne land of their sovereign, and they often grew up around his palaces. A distinction was thus made between a *Reichsstadt* and a *Landstadt,* the latter being dependent upon some prince, not upon the emperor direct. (*See* COMMUNE, MEDIAEVAL.)

IMPERIAL ECONOMIC COMMITTEE. This is a British imperial body, which owes its authority to resolutions adopted at the Imperial Conference. It continues from one Imperial Conference to the next; it is constituted of members appointed by the several Governments of the British empire; it deals with subjects remitted to it by agreement among those Governments; and it addresses its reports thereon to the Governments of the empire.

The proposal to appoint such a committee received much support at the Imperial Economic Conference of 1923, but agreement on the terms of reference was only reached in 1924, when Mr. Baldwin, as prime minister, announced its appointment for the following purpose:

"To consider the possibility of improving the methods of preparing for market and marketing in the United Kingdom the food products of the overseas parts of the empire with a view to increasing the consumption of such products in the United Kingdom in preference to imports from foreign countries and to promote the interests both of producer and consumer."

In addition, the committee was to be asked to advise on the expenditure of a £1,000,000 fund which it was proposed to devote to furthering empire trade.

The first subjects remitted to the committee were meat and fruit. The general reference was understood to imply that precedence should be given in the United Kingdom market in the following order: United Kingdom produce, produce from the oversea empire, foreign produce.

The imperial economic committee first met in March 1925 and, by the next meeting of the Imperial Conference in 1926, had issued four reports. The Imperial Conference endorsed the work so far done, and in continuing the committee till the next Imperial Conference extended the scope of its operations thus:

"(i.) to complete the series of investigations into the marketing of empire foodstuffs in Great Britain, and, while this work is proceeding,

(ii.) to put forward for the consideration of the various Governments concerned (*a*) a list of raw materials for possible further marketing enquiries, and (*b*) suggestions for the preparation and circulation of brief preliminary surveys, as suggested by the general economic sub-committee of the Conference of any branch of empire trade and marketing, such preliminary surveys, if the Governments concerned so desire, to be followed up by further enquiries."

The committee consists of a chairman and representatives nominated by the various Governments of the empire as follows: Four by the United Kingdom, two by each dominion, two by India, one by Southern Rhodesia and two by the secretary of State for the Colonies.

In its first or general report the committee stated the case for voluntary preference, that the consumption of empire produce could be stimulated by education and publicity, by increased facilities for indicating the country of origin on goods exposed for sale, and by sustained research, scientific and economic, into specific disabilities under which empire produce might labour. It, however, emphasized that such a policy would fail without supplies, adequate and regular in quantity, of the quality desired by consumers, and sold at competitive prices.

The development of such a policy demanded executive action

beyond the scope of a committee appointed for advisory purposes, and the committee recommended that so far as the United Kingdom was concerned such executive work should be entrusted to an executive commission financed out of the proposed new fund and responsible to parliament through a minister of the Crown. This recommendation was accepted. The task was entrusted to the secretary of State for the colonies, assisted by a body known as the Empire Marketing Board (*q.v.*). The relationship between the imperial economic committee and the Empire Marketing Board is close, yet the two bodies differ radically in functions and in constitution.

In its various reports numerous recommendations unconnected with voluntary preference have been made. These cover trade practices and scientific research, and are directed to securing larger and better supplies of empire products under strictly competitive conditions. By March 1928 eight reports had been issued. Two of these—the first report already referred to and the eighth setting forth the functions and work of the committee—are of a general character, the remaining six deal with meat, fruit, dairy produce, fish, poultry and eggs and honey. The Governments of the empire have directed the committee to conduct similar enquiries into tobacco, pig products, timber and hides and skins, and to prepare preliminary trade surveys of agricultural machinery and rubber goods. The committee was engaged on this work throughout 1928. (D. C.)

IMPERIAL PREFERENCE. This consists in the charging, by States belonging to the British empire, of lower import duties on goods coming from another State of the empire than on like goods coming from countries outside the empire, or in exempting empire goods from duty altogether.

Until after the middle of the 19th century, colonial products enjoyed a preference in the customs tariff of Great Britain, and British goods in the tariffs of the colonies. Preferences in both directions disappeared about the same time. But while Great Britain removed tariff restrictions equally from all imports, from whatever source, the colonies—now obtaining responsible government, and looking upon customs as the only available source of public revenue—proceeded to impose equal duties on all imports, from whatever source. The British Government in vain protested in 1859 against the imposition of duties by Canada on British goods. The Government of Canada insisted on "the right of the people of Canada to decide for themselves both as to the mode and extent to which taxation shall be imposed." The principle of tariff autonomy was henceforward acquiesced in by the British Government and acted upon by the self-governing colonies.

This was the situation for almost 40 years, in the course of which colonial tariffs became distinctly heavier. So great, however, was the reliance in Great Britain on the most favoured nation clause in her commercial treaties with European countries, that by her treaty with Belgium in 1862 and with the German Zollverein in 1865 she actually bound her colonies, without consulting them, to grant as favourable treatment to the products of the treaty country as to those of the mother country; *i.e.*, to grant no preference to Britain.

Changed Sentiment.—A new stage in intra-imperial trade relations was opened in 1897. In that year Canada granted tariff concessions to all countries treating her on equally favourable terms. In effect this was a preference to British goods; and in 1898 the Canadian Tariff Act was converted from one of general reciprocity to one avowedly of British preference. The Imperial Government had already in 1897 given notice to terminate the treaties with Belgium and the Zollverein.

In 1902 the policy of Canada became the policy of the dominions. At the colonial conference of that year in London the following resolution was passed:—

"That . . . it is desirable that those colonies which have not already adopted such a policy should, as far as their circumstances permit, give substantial preferential treatment to the products and manufactures of the United Kingdom. That the prime ministers of the colonies respectfully urge on His Majesty's Government the expediency of granting in the United Kingdom preferential treatment to the products and manufactures of the colonies, either by exemption from or reduction of duties now or hereafter imposed."

Effect was given to this resolution by New Zealand and South Africa in 1903 and by Australia in 1906.

Tariff Reform.—Meanwhile in England the re-imposition for revenue purposes in 1902 of the old registration duty of one shilling a quarter on imported wheat had raised hopes of preference in Canada which were defeated by the abolition of the duty next year. The episode completed the conversion of Joseph Chamberlain to the principle of preference; and imperial preference was a prominent element in the policy of "tariff reform" which he laid before the country in 1903. The movement, however, failed at the time to receive sufficient popular support in Great Britain. At the next colonial conference in 1907, though the resolutions of 1902 were re-affirmed by the colonial representatives, the British Government put in a definite reservation that they could not assent in so far as the resolutions implied that it was necessary or expedient that the fiscal system of the United Kingdom should be altered.

Progress During the War.—The World War and the generous support which the dominions gave the mother country had considerable effect on public sentiment in Great Britain. Early in 1917 the important committee appointed by the Government to consider commercial policy after the war (presided over by Lord Balfour of Burleigh) recommended:—

. "That His Majesty's Government should now declare their adherence to the principle that preference should be accorded to the products and manufactures of the British overseas dominions in respect of any customs duties now or hereafter to be imposed on imports into the United Kingdom."

A few weeks later the Imperial War Conference expressed itself in favour of "the principle that each part of the empire, having due regard to the interests of our allies, shall give specially favourable treatment and facilities to the produce and manufactures of other parts of the empire": a resolution now passed unanimously by the representatives no longer of the dominions alone but also of Great Britain. In April 1917 Lloyd George and Bonar Law on behalf of the Coalition Government, announced their acceptance of the principle of preference, making it clear that this did not involve the taxation of food. In Sept. 1918 the British Government withdrew from the Brussels sugar convention on the express ground that they had "now approved the principle of giving preference to empire sugar." And, finally, in the Finance Act, introduced by Austen Chamberlain as chancellor of the exchequer in April 1919, preferential rebates on imports from the colonies or exemption from surtax were granted on practically all articles dutiable under the existing tariff.

The range of dutiable articles had been increased under stress of war. For many years before 1915 the only duties imposed by Britain were either purely for revenue purposes—those on tea, cocoa, coffee, sugar and tobacco; or for revenue with a certain mixture of ethical motive—those on wines and spirits. But the Finance Act of 1915 had introduced duties also on certain manufactured goods (the "McKenna duties")—cinema films, clocks and watches, motor-cars and musical instruments. These were intended as luxury taxes, but had some protective effect. On these the measure of 1919 was now able to give preference.

Post-War Changes.—The area of preference was still further enlarged by the Safeguarding of Industries Act in 1921. Part of this act provided for the imposition of duties on certain articles produced by "key industries." The list included cameras and optical lenses and a large number of scientific instruments and apparatus, chemicals and special appliances, deemed essential for the safety of the empire; and from these duties empire goods were entirely exempted.

The growth of manufactures in Canada had affected the situation by enlarging the possibility of advantageous preference Great Britain beyond the primary foodstuffs; motor-cars are example. A similar extension of possibilities from Australia was brought about by the growth of fruit farming, largely as the result of the settlement on the land of ex-soldiers. The British Government took the opportunity of the imperial conference of 19

to announce its readiness to enlarge the existing preference on dried fruits, to increase the rebate on empire tobacco and on certain wines, and to take other action of a similar character. Before these promises could be fulfilled, the Baldwin Government fell from power. The MacDonald Ministry which followed declined to carry out the intentions of its predecessors; abolished the McKenna duties; and, though it did not entirely throw over preference in revenue duties, so reduced the tax on sugar, tea and dried fruits as to make the preference of less value.

Preferences Granted by Britain.—On the return to office of Baldwin at the end of 1924, the McKenna duties were restored with the accompanying preferences; and the preference on dried fruits, tobacco, wines and sugar was increased. The range of preference was further widened in two directions. The new Safeguarding of Industries (Customs Duties) Act, 1925, imposed duties on imported cutlery, gloves and incandescent mantles; while the budget of that year introduced duties on silk, natural and artificial. To each of these new duties, empire preference was attached, amounting to one-third of the full duty in the case of the safeguarding duties, and to one-sixth in the case of silk.

By the Finance Act, 1925, the preference on sugar was stabilized at a fixed money value per cwt. for ten years or for so long within that period as the full rate of duty amounts to that figure: if the full rate falls below that figure, empire sugar is to be free of duty. By the Finance Act, 1926, all existing preferences (and that on packing and wrapping paper imposed by that act) were similarly stabilized for ten years from July 1, 1926.

Since the first grant of preference to the mother country by the great dominions, changes have from time to time taken place both in the general rates of duty and in the extent of the preference. In 1923 Canada, having in mind the removal of certain restrictions on the importation of cattle into the British market, undertook to give a discount of 10% on existing duties on British goods coming through Canadian ports. Australia increased its preference to British goods in 1920, and gave assistance to British trade both by anti-dumping legislation and by measures with respect to dyes. In 1927 the New Zealand tariff gave increased empire preference. So, during the last two decades a whole complex of preferences has grown up between the several dominions and colonies, many of them the result of definite treaties, and thus preference within the British commonwealth of nations has already become a considerable factor in the economic and political world situation. (*See* also TARIFF.)

BIBLIOGRAPHY.—The least partisan and most complete history of the whole movement down to 1921 will be found in a *Report* on colonial tariff policies (1922), prepared for the U.S. tariff commission. Much information as to the views of the dominions and as to the volume of trade affected is given in the *Record of Proceedings* of the imperial economic conference of 1923 (Cmd. 2009, 1924). The nature and extent of the preferences accorded to Great Britain, down to March 1925, together with the conditions governing the concessions, will be found in the *Survey of Overseas Markets* (1925) by the committee on industry and trade appointed by the British Government in 1924. That committee reported that "while it is difficult to obtain any exact statistical measure of the benefit to British trade of the preferential treatment, the surveys of British dominion markets and the statistics of distribution of British trade leave no room for doubt that the advantage has been substantial." (W. A.)

IMPERIAL TOBACCO COMPANY LIMITED. This British combine, the full title of which is The Imperial Tobacco Company (of Great Britain and Ireland), Limited, was formed in 1901 to incorporate a number of the leading British tobacco manufacturers, including W. D. and H. O. Wills, Lambert and Butler, John Player and Sons, W. and F. Faulkner, and Ogdens, and 13 other firms and companies. Between them, these firms control 27 factories, producing cigarettes, pipe tobaccos, cigars and snuff.

In 1928 the issued share capital of the company amounted to £42,800,000, upon which the stock markets place a heavy premium. The branches of the company cover a very large area, and it manufactures not only the tobacco sold, but the packing materials. The combine has some 20 factories engaged in the various processes of typographical and colour printing. There is also a factory devoted to the extraction of nicotine from tobacco waste. The total area of the combine's factories and warehouses in the United Kingdom alone exceeds 5,000,000 square feet.

The work of the company extends to many places outside the United Kingdom, there being 35 factories abroad. These foreign factories do not produce manufactured goods, but are concerned only in the handling of natural tobacco and in drying and packing it for shipment to the United Kingdom. The combine employs 40,000 people. (L. C. M.)

IMPERIAL VALLEY, a depressed area in Imperial county, California, and extending into the Mexican territory of Lower California. It is approximately 110 m. long by 40 m. wide, and constitutes a part of what is known as the Colorado desert. That the valley was formed by constructional depression rather than erosion is shown by the fact that the greater part of its area is below sea-level (the bed of Salton Sink being 287 ft. below). The soil is chiefly silt deposited in the inland sea made by the Colorado delta, but in some places there is a large admixture of sand. The climate of the region is known for extremes, the daily range of temperature often exceeding 59° F. The extremes of temperature range from 125° to a minimum of 24°, although the average for the year is 71°. The annual rainfall varies from 1·5 to 3 inches.

Prior to 1893, when the California Development company was organized for the purpose of securing and delivering water to irrigate and reclaim the Imperial valley, the region was waterless, barren and uninhabited. The first water was brought into the valley with the Imperial canal (45 m. long), which curved below the international boundary into Mexico, in March 1902. Difficulties occasioned by the silting up of the California intake led to the opening of new intakes in Lower California in 1903 and 1904. Insufficient control gates allowed the Colorado river to widen the third intake during 1905–06 until its waters poured through the valley into Salton Sink. The situation became so alarming that President Roosevelt called on the Southern Pacific railway to assist in controlling the flood, and as a result the breach was closed on Nov. 7, 1906. High water soon caused another break and by Dec. 7, 1906 the entire flow of the river was again going back to Salton Sink, but this break was finally closed on Feb. 11, 1907. Levees were subsequently built to protect the region from further flood dangers. The main canal, over 50 m. in length, brought in a water-supply which, in 1919, irrigated 415,304 ac. and was capable of watering an additional 42,500 acres. The chief crops are alfalfa, cotton, cantaloupes, watermelons, asparagus, vegetables for winter markets, grapes and fruits. Cotton is the chief crop on the Mexican side of the border. The population of Imperial county increased from 13,591 in 1910 to 43,453 in 1920, or a gain of 219·7%. According to local estimates made in 1928 the population then exceeded 60,000. The chief centres of population are Calexico, El Centro, Brawley, Imperial and Holtville.

IMPEY, SIR ELIJAH (1732–1809), chief justice of Bengal, was born on June 13, 1732, and educated at Westminster with Warren Hastings, who was his intimate friend throughout life. In 1773 he was appointed the first chief justice of the new supreme court at Calcutta, and in 1775 presided at the trial of Nuncomar (*q.v.*) for forgery, with which his name has been chiefly connected in history. His impeachment was unsuccessfully attempted in the House of Commons in 1787, and he is accused by Macaulay of conspiring with Hastings to commit a judicial murder.

See E. B. Impey, *Sir Elijah Impey* (1846); and Sir James Stephen, *The Story of Nuncomar and the Impeachment of Sir Elijah Impey* (1885).

IMPLEMENT, a term used in the plural of weapons and tools, and hence of the necessary outfit of a trade. In its original Latin sense of "filling up" the term survives in Scots law, meaning full performance of or "fulfilment of" a contract or agreement; "to implement" is thus, in Scots law, to carry out, perform.

IMPLUVIUM, in the classic Roman house, the basin, or depressed portion of the floor in the centre of the atrium (*q.v.*) immediately beneath the compluvium or hole in the roof. It was generally of marble, and drained to a cistern.

IMPORT DUTIES: *see* CUSTOM DUTIES.

IMPORTING: IN PRACTICE. Imports can be divided into those sent forward "on consignment" and those arriving "against orders."

In either case the British importer's duty is to superintend the reception, clearance and delivery of goods, either on his own behalf or in the service of a principal. He must receive and negotiate certain documents, and prepare others. His duties fall under three heads: those required of him by (1) the government (as represented by the Board of Trade and the Customs officials); (2) the shipowner in whose vessel the goods have been carried; (3) the port authority or wharf owners responsible for berthing the vessel and (perhaps) landing the goods.

Customs Formalities.—The government requires accurate records of all goods that enter or leave the country. The importer has to complete a *Customs Entry* giving full particulars of his goods and of the importing vessel. Net quantities must be given, and the value required is the c.i.f. value or, if goods are consigned for sale, the latest sale value. Importers may by law be called upon to verify their entries and are liable to penalties for inaccuracies.

Duty-free goods are entered on a form which must be lodged at the Custom House. One copy of this form (termed the "bill") is kept by the officials and a second copy (the "warrant") is sent to the examining officer at the place where the vessel is discharging so that the goods can be compared with the owner's statement. The third copy, or "duplicate warrant" is returned to the importer.

If imported goods are dutiable (and the Customs tariff is the source of information as to what goods are dutiable) three courses are open to the importer. (*a*) By paying duty forthwith, the goods may be cleared for removal as soon as required: or, to postpone payment of duty, storage may be arranged either (*b*) at the port of importation, or (*c*) elsewhere, subject to H.M. Customs approval. In the former case a form is prepared and presented at the Custom House. Should an importer wish to defer payment of duty he can have goods stored in a bonded warehouse by special arrangement. When it is desired to remove goods from a bonded warehouse into consumption the entry formalities are completed by the preparation of a warehouse warrant of the appropriate kind, and the payment of duty.

Goods of Empire origin entitled to enter the country at the preferential rates of duty, have to be vouched for by a certificate of origin bearing the signature of the British consul at the port of shipment or place of production. This certificate, with such further evidence by way of invoices, bills of lading, etc., as may be specially required, must be tendered when the entry is lodged at the Custom House. If a claim to preference cannot at once be substantiated, the goods can be secured by depositing duty at the full rate pending production of satisfactory evidence.

British returned goods which, but for their British origin, would be dutiable, are entered by bill of store in addition to the appropriate entry form. Supporting commercial documents must also be produced. This procedure only holds when goods are reimported within five years of exportation.

Special forms govern the entry of goods by *bill of sight* (in the absence of proper details for an entry), by *baggage sufferance* (passengers' baggage and household effects of a miscellaneous nature), statutory declaration for plate imported for private use, key industry entry (for goods subject to ad valorem duty under the Safeguarding of Industries act, 1921) and goods which may be intended to qualify for drawback upon re-export.

Satisfying the Shipowner.—The shipowner's chief anxiety is to get his vessel discharged promptly and to secure payment of his *freight* charge, if not prepaid. The importer will have received from his shipper, either direct or through a bank, a set of *Bills of Lading* which, on being presented to the shipowner properly endorsed, will substantiate the importer's claim to the goods. The inward freight clerk in the shipowner's office, to whom the bills must be presented, will satisfy himself as to the validity of the endorsement, check the details of the goods as shown by the bill of lading with those furnished on his *manifest* (*i.e.*, the list of cargo prepared at the starting port by the ship's representatives) and as to the payment, or security for, the freight charge, and will then grant a *freight release* or *ship's delivery order*.

In the temporary absence of bills of lading, some shipowners will permit delivery of goods when the importer has signed and lodged a *banker's guarantee*. Other lines allow delivery overside to craft to commence upon the lodgment of a provisional release, so long as the craft is not moved away from the ship until the proper *release* has been obtained and presented.

The Dock or Wharf.—Before removing goods one must also satisfy the dock or wharf officials that delivery is being made to the rightful owner, and must also pay or guarantee their charges. For this purpose the bill of lading, properly endorsed and released, or the equivalent documents (freight release, provisional release, or ship's delivery order) must be produced at the dock office, as must the customs entry unless clearance from customs has already been arranged. An applicant other than the original importer of goods will need to be provided with a transfer order, delivery order or sub-order, or possibly several such, showing between them a correct chain of instructions from the original importer to the actual applicant. (J. A. D.)

UNITED STATES

Consular Invoice.—The initial requirement for the importation of merchandise into the United States, if valued over $100, is the presentation of an invoice for certification, to the U.S. Consular officer for the district in which the merchandise was manufactured or purchased. This must show the time when, the place where, the person by whom and the person to whom the merchandise is sold or agreed to be sold; or if secured otherwise than by purchase, the place from which shipped, the time when and the person to whom and the person by whom shipped; and other necessary information. Such invoice to be signed by the seller or shipper, or the agent of either. One copy of the certified invoice, which is made in triplicate, or in quadruplicate for merchandise intended for immediate transportation, is forwarded with the bill of lading to the consignee in the United States.

Entry.—Upon the arrival of merchandise the consignee is required to prepare and present an entry at the Custom House within 48 hours. Entry may be made for immediate consumption, warehouse or for immediate transportation without appraisement to another port. After the entry is lodged, a preliminary estimate of the duties based upon the statements contained in the entry, is made and the amount of duty thus ascertained is paid by the importer and a permit is issued to him, which releases the merchandise with the exception of the packages designated for examination by the appraiser. The appraiser is the officer authorized by law to ascertain the dutiable value of imported merchandise for the guidance of the collector in assessing and collecting the correct amount of duty of ad valorem merchandise. He may advance the entered value of merchandise to a point representing, in his opinion, the market value in the country from which the merchandise is shipped. He also describes the merchandise in order that the collector may determine the final rate to be applied. The surveyor of customs weighs, gauges and measures merchandise subject to specific rates of duty before delivering to the importer; and, in the case of goods entered for warehouse, before the transfer to the designated to a bonded warehouse. A report is made to the collector as a basis for the final assessment of duty in liquidation.

Warehousing.—If the importer desires the merchandise may remain in a bonded warehouse designated by the importer for a period not exceeding three years from date of importation without payment of duty. All goods with the exception of perishable or dangerous articles or those free of duty may be stored in a bonded warehouse. Any time during the three year period the importer may withdraw any portion of the merchandise, not less than an entire package, and pay the duty upon such portion withdrawn. Merchandise imported for which no entry is made is sent to a General Order warehouse, which is under the jurisdiction of the collector, where it may remain for one year, during which time the importer may claim it and make proper entry. There are also certain requirements of the Department of Agriculture with regard to the importation of meats, food products and drugs, which

the collector of customs is required to enforce before delivery and samples of these articles are required for examination and analysis. There are also similar requirements with regard to the importation of plants, grains and fruits from particular countries.

Passengers' Baggage.—The foregoing procedure relates to merchandise. For articles brought into the United States by passengers in their baggage a declaration form is distributed by the steamship employees to the passengers upon the return voyage. This form covers all articles acquired abroad by gift, purchase or otherwise. *Returning residents* of the United States are permitted to bring in free of duty articles up to but not exceeding $100 acquired abroad for personal or household use, or as souvenirs, if not intended for sale or purchased on commission for other persons. All *Non-residents* of the United States will be treated for customs purposes as non-residents and are entitled to bring in free of duty all personal effects, without limitation as to value, which were actually owned by them and in their possession abroad at the time of or prior to their departure from a foreign country, which are necessary and proper for their wear and use, provided they are not intended for other persons or for sale. The dutiable effects are appraised by customs officers and duty, if any, estimated and paid to the collector's representative upon the pier.

Liquidation.—The appraiser, after examination of the merchandise, returns the properly completed invoice to the collector who thereupon determines the proper paragraph of the schedules of the dutiable or free list applicable to the particular articles in question, and thereupon the amount of duty is ascertained. The collector's liquidation of entries of merchandise, subject to a specific duty, is also based upon the report of the surveyor. A notice of additional duty or refund is sent to the importer for the final adjustment of the account—if the liquidation results in an amount different from that found at the time of the preliminary estimate and payment of duty when entry was made.

Customs Court.—A customs court is provided for a review of questions of classification when the importer is dissatisfied with the collector's decision; also for a review of the dutiable value of imported merchandise as determined by the U.S. appraiser. The decisions of the U.S. customs court with regard to questions of law and classification are also reviewable by the U.S. court of customs appeals.

Provisionally Free Merchandise.—There are many classes of merchandise which upon submission of the required proof may be admitted without payment of duty. There are also provisions for the importation of many articles under bond for a limited period in accordance with regulations prescribed by the secretary of the Treasury. (H. C. S.)

IMPORTS. A term used to describe the commodities brought into a country by the operations of commerce. Considered economically, the imports into a country represent payments for services rendered by the importing country. These services may have taken the form of (1) the exportation of goods; (2) services, such as the services of ships, or commercial or financial commissions; or (3) interest on capital previously exported by the importing country. After the World War, another source of imports arose out of the payment of indemnities, Germany being compelled to export to the Allies and thus causing them to receive imports. The repayment of the inter-allied debts set up a cause of imports, consisting of exports made by one ally to another. (*See* TRADE.)

The difference between the imports and exports of a country, as recorded by its customs houses, is called the "balance of trade" (*see* BALANCE OF TRADE). The records made at the custom house can refer, of course, only to material commodities, but a country may at any time be importing services, the value of which cannot and is not recorded in the trade returns. To such imported services the term "invisible imports" is sometimes applied.

The values at which imports are officially recorded by customs houses varies with different nations; in the case of the United Kingdom, the imports are entered at what are called c.i.f., values, that is, values representing the cost, insurance and freight; or when goods are consigned to the United Kingdom for sale, at the latest sale value of such goods. (*See* also EXPORTS.)

IMPORTS, INVISIBLE: *see* BALANCE OF TRADE.

IMPOSITION, in ecclesiastical usage, the "laying on" of hands by a bishop at the services of confirmation and ordination as a sign of a spiritual gift or conferring special service (Lat. *imponere,* to place or lay upon). The word is also used of the levying of a burdensome or unfair tax or duty, and of a penalty; also a trick or deception. In the printing trade the term is used of the arrangement of pages of type in the "forme."

IMPOST, a tax or tribute, and particularly a duty levied on imported or exported merchandise. In architecture, a moulding, series of mouldings, projecting band, carved ornament or projecting block, marking the spring of an arch, and placed at the top of the pier or section of wall that carries the arch. In Byzantine work the block sometimes placed between the capital of a column and the arches which it carries is known as an impost block.

IMPOTENCE: *see* NULLITY OF MARRIAGE.

IMPRESARIO (Ital.), literally one who undertakes any kind of venture or enterprise (*cf.* emprise); hence more specifically one who promotes and manages musical and other entertainments—operas, concerts and so forth. *Entrepreneur* has the same meaning.

IMPRESSIONISM. In music, impressionism has been adopted as a term for compositions of a type analogous to impressionist paintings, in which the outlines are blurred and the expression of a mood or the suggestion of a scene, rather than the purely musical development and treatment of his material, has been the principal aim of the composer. Bach's Chromatic Fantasia might be regarded also as impressionistic. Later, Chopin and Schumann supplied many other instances, clearly forecasting the still more highly-developed methods of Debussy, Delius and other modern practitioners, with whose music, as exemplified in such works as *L'Après-midi d'un Faune* of the one and *In a Summer Garden* of the other, the term has been more especially identified.

IMPRESSIONISM, a term applied to certain anti-academic and anti-romantic tendencies in late 19th century painting, advocated and carried into effect by Edouard Manet, Claude Monet, Auguste Renoir, Camille Pissarro, Edgar Degas, and a number of lesser men who followed the example set by these leaders. Originally the word Impressionism was coined by a journalist as a term for opprobrium in a derisive criticism of a painting by Claude Monet, called "Impressions," the actual subject of which was a sunset. This work was shown in 1863 in a special room known as the *Salon des Refusés,* together with many other paintings by artists who, like Monet, had suffered from the uncompromising hostility of the Salon jury to all originality and experimental enterprise, and who had risen in revolt against the placid self-righteous attitude of the French official Salon. The opening of the Salon des Refusés was due to the direct initiative of the emperor Napoleon III.

As a matter of fact, unlike the English Pre-Raphaelites, who deliberately banded together, chose the name for their association, and formulated a set of theories and a programme, the so-called "Impressionists" of the '60s were a number of individual artists thrown together by force of circumstance, and held together by their spirit of revolt against the tyranny of the school.

If there is any general aim to be traced through the various manifestations that have become known as Impressionism, it is the substitution in art of transitory appearance for permanent fact. The Impressionist paints things as they appear at any given moment and not as they actually *are* according to his knowledge of their permanent form and colour. Thus, if the contour of a figure or object happens to be obliterated or blurred by shadow or distance, he will render the undefined masses of shadow or the blurred silhouette as they are reflected on his retina, and not endeavour to give them the definition which his knowledge tells him lies hidden beneath the momentary appearance. In the same way he will record the modifications of colour caused by intervening atmosphere and by reflection. Green foliage appears blue in the distance, shadows are not neutral greys or browns, but partake of and are modified by the colours of the surroundings; a ridge of mountains against a light sky does not appear as a sharp silhouette, but an interchange of rays produces a radiating zone

connecting the light and dark masses; the rays of the sun on a clear day, setting behind a tree or a hill, seem to eat into the forms behind which the fiery orb is sinking; and, above all, there is in nature a vibrant movement of light, for the rendering of which the Impressionists have tried to develop an adequate formula.

The research work of the scientists Helmholtz and Chevreul, establishing the wave movement of light and sound and the theories of the solar spectrum happened to coincide with the Impressionist experiments and, no doubt, contributed towards the Impressionist technique of "divisionism" or "vibrism," as it came to be called in its later and more scientific phase. It is quite likely that the influence of the scientists upon Monet, the originator of the Impressionist technique, has been overrated, since the beginnings of divisionism can be traced to Watteau and Chardin and Turner. Indeed, there is no question that Monet, who paid repeated and lengthy visits to England, was as deeply impressed by Turner's achievement, as Delacroix, a generation earlier, had been by Constable's, and that he followed his natural impulse rather than scientific theory.

The technique of Impressionism followed the doctrine that colour, as a definite quantity, does not exist, but is only the result of the play of light upon form. Even shadows are deemed to be, not the negation of light, but an altered form of it. By the rigid exclusion from the palette of all but the actual colours contained in the spectrum, and the placing of dabs of alternating colours upon the canvas, instead of mixing the required tones upon the palette, the Impressionists invested their paintings with a degree of luminosity and with a vibrant quality suggestive of atmospheric vibration that had not previously been obtained by any other method. Light thus became the real subject of pictorial art, and anything was deemed worthy of representation so long as it afforded an opportunity for recording the effect of light upon nature. Thus Monet painted his famous series of "Hayricks," noting the appearance of a hay-stack at different hours of the day and in varying conditions of light, changing the canvas from hour to hour, to take it up again when the conditions happened to be identical. In this pursuit of light and atmospheric vibration, substance was in danger of being altogether sacrificed to surface appearance, and design was not always given due attention, although the Impressionists were by no means as haphazard in their manner of composition as they were accused to be by their detractors.

Parallel with this technical innovation came the Impressionists' revolt, led by Manet, against the academic canons of beauty. It was inspired by passionate interest in actuality, that is to say in contemporary life and manners, and was closely akin to the literary movement led by Flaubert, the Goncourts and Zola. Now that the Impressionist battle, which at the time aroused so much bitterness, belongs to past history and can be viewed in right perspective, it is quite clear that the alleged revolutionaries of the '60s and '70s were in reality the champions of the best tradition, and that their art was deeply rooted in the art of the past.

Manet.—The eclectic imitators of types that have become acknowledged standards of excellence are not the upholders of tradition: their art spells decadence. The revolutionary line passes through those who, having assimilated the tradition of the past, continue to build upon it and to bring it into harmony with the age in which they live. But Manet's generation, shocked by the artist's departure from the letter, failed to recognize that he had maintained the spirit of tradition in painting an "Olympia" which was in the direct line of descent, through Valazquez's "Venus with the Mirror" and Goya's "Maja desnuda," from Giorgione's and Titian's "Reclining Venus." The picture, now in the Louvre, caused as furious a storm of indignation as the same artist's "Déjeuner sur l'herbe," which his revilers claimed to be painted in defiance of all principles of design—a charge that would scarcely have been brought against the artist, had his revilers known that the design was practically traced, line by line, from a Marcantonio engraving after a painting of "Neptune and Nymphs" by Raphael.

Degas.—Degas, although his technique had little or nothing in common with Impressionism, is generally claimed with that group, because he was linked with them by the tie of friendship, took part in their exhibitions, and shared with them their keen interest in contemporary life. It was his love of actuality, of the momentary impression, that made him discard all conventional methods of composition and gave his pictures frequently an air of the accidental and unpremeditated, somewhat like a snapshot photograph. Yet behind this apparent neglect of rule lies a highly developed sense of balanced arrangement and rhythmic flow of compositional line; for Degas, too, had made a profound study of the old masters, and devoted much time to copying the primitives. His draughtsmanship, in particular, has a classical perfection rivalled only by Ingres.

Renoir.—Renoir, who connects the art of his time with the French 18th century, adopted for a lengthy period the Impressionist technique and vision, but later in life abandoned the search after the visual truth of ephemeral effects in favour of a more permanent plasticity of form, achieved by the concentration of light on projections and of shade on recessions—a kind of modelling by means of an arbitrarily placed source of illumination for which Nature offers no parallel.

Pissaro, Sisley, Whistler and Sickert.—Less personal, though of considerable distinction, was the contribution made to the movement by Camille Pissaro and Alfred Sisley. The minor adherents to Impressionism need not here be recorded. By the close of the 19th century, Impressionism had fought through to recognition not only in France, but had gained adherence and changed the entire current of art throughout Europe. Whistler was connected with the movement from its very birth. Wilson Steer and Walter Sickert, by their example, spread the new artistic gospel in England, Leibermann and Kuehl in Germany, Segantini in Italy, Van Rysselberghe and Claus in Belgium, Sorolla in Spain, Thaulow and Kröyer in Scandinavia; whilst among the American painters Sargent, Harrison and Alexander were profoundly influenced by the movement.

Impressionism may be regarded as the final chapter in the gradual conquest of representational truth, which began with Giotto's vitalization by Byzantine rigidity, and proceeded step by step through the discovery of the law of perspective by the 15th century Florentines, the use of light and shade for the suggestion of relief by Leonardo da Vinci, the application of colour as an integral part of pictorial structure by the great Venetians, and the accurate registration of tone values by Velazquez. With Impressionism this search for truthful representation of appearances had reached a point where further advance in the same direction had become impossible. Painters had succeeded in capturing the most transient effects of surface glitter and tremulous atmosphere and, in the doing, had come dangerously near to losing their grip on form and substance.

The futility of any attempt to carry the Impressionist principles beyond the stage reached by the great initiators is demonstrated by the Neo-Impressionists, or pointillists, Sigorac and Seurat, who tried to give a scientific basis to Monet's system of divisionism by the mechanical use of rounded dabs of pure colours of equal size, divided by regular intervals of pure white. Theoretically, these dabs of spectral colours were intended to blend into luminous tones of the desired intensity when viewed from the right distance. In reality, they remained isolated dabs of colour, and the pictures thus produced bore an exasperatingly mechanical aspect.

Seurat, however, soon abandoned his rigid adherence to this method and adopted a less pronounced style of pointillism. His great importance in the history of 19th century art lies, however, in his practical protest against the disintegration of form which was the natural consequence of Monet's innovation. His later work marks a return to expressive pattern and sculptural form, and bears witness to the profundity of his outlook and to his ability to combine with his mosaic-like treatment a respect for orderly rhythm and solid volumes. Seurat thus became one of the chief connecting links between Impressionism and the modern tendencies which are embraced in the term "Post-Impressionism." (*See* POST-IMPRESSIONISM, PAINTING.)

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BY COURTESY OF (1) THE REID AND LEFEVRE GALLERY, FROM THE COLLECTION OF MR. AND MRS. S. COURTAULD, (2) COLLECTION ARCHIVES PHOTOGRAPHIQUES, (3, 5) COPR. H. BONNAIRE, (4) THE FREER GALLERY OF ART, (6) THE HISPANIC SOCIETY OF AMERICA

FRENCH, AMERICAN, AND SPANISH IMPRESSIONISTS

1. "Le Pont de Courbevoie," by Georges-Pierre Seurat (1859–91), French; one of the connecting links between Impressionism and Post-Impressionism. The Seine, one of Seurat's favourite subjects, is here painted in pointillist manner, with rounded dabs of colour divided at regular intervals by pure white. 2. "Olympia," by Edouard Manet (1833–83), French, leader of that revolt against academic canons of beauty which later came to be called Impressionism. This picture, now in the Louvre, raised a storm of protest in academic art circles when first exhibited in 1865. As a transition work, it is a landmark in the evolution of French art. 3. "Vue de Landres (effet de neige)," by Camille Pissarro (1830–1903), French, one of the most notable exponents of Impressionism. Pissarro's landscapes illustrate his ability to blend Classicism and Impressionism. 4. "Nocturne, Blue and Silver, Battersea Reach," by James A. McNeill Whistler (1834–1903), an American painter who lived in England, and was connected with Impressionism from its birth. His "Nocturnes" (painted about 1877) usually represented moonlight effects on water, with lights on the banks shining through mists. These studies in subtle colour and atmosphere aroused furious criticism at first, but eventually exerted a strong influence on the world of modern painting. 5. "Lavacourt," a landscape by Claude Monet (1840–1926), French. Monet was the originator of the technique which, because of its emphasis upon the transitory appearance rather than the permanent quality of objects, was dubbed "Impressionism" by academic critics. 6. "Tunny fishing on the waterfront of Ayamonte," by Joaquin Sorolla y Bastida (1862–1923), Spanish; one of a series of fourteen mural paintings in the Hispanic Museum, New York, representing the provincial life of Spain and showing a broad impressionistic technique

Camille Mauclair, *The French Impressionists;* T. Duret, *Manet and the French Impressionists* (1910); P. Signar, *D'Eugene Delacroix au Neo-Impressionisme* (Paris, 1911); Max Drey, *Die Malerei im XIX. Jahrhundert* (Berlin, 1919); M. Raphael, *Von Monet zu Picasso* (Munich).
(P. G. K.)

IMPRESSMENT, the name given in English to the exercise of the authority of the State to "press" or compel the service of the subject for the defence of the realm. Every sovereign State must claim and at times exercise this power. All the monarchical, or republican Governments of Europe have employed the press at one time or another. All forms of conscription, including the English ballot for the militia, are based on this sovereign right. In England impressment may be looked upon as an erratic, and often oppressive, way of enforcing the common obligation to serve in "the host" or in the *posse comitatus* (power of the county). In Scotland, where the feudal organization was very complete in the Lowlands, and the tribal organization no less complete in the Highlands, and where the State was weak, impressment was originally little known. After the union of the two parliaments in 1707, no distinction was made between the two divisions of Great Britain. In England the kings of the Plantagenet dynasty caused Welshmen to be pressed by the lords marchers, and Irish kerns to be pressed by the lords deputy, for their wars in France. Complaints were made by parliament of the oppressive use of this power as early as the reign of Edward III., but it continued to be exercised. A small sum called imprest-money, or coat and conduct money, was given to the men when pressed to enable them to reach the appointed rendezvous. Soldiers were secured in this way by Queen Elizabeth, by Charles I. and by the parliament itself in the Civil War. The famous New Model Army of Cromwell was largely raised by impressment. Parliament ordered the various county committees to select recruits of "years meet for their employment and well clothed." After the revolution of 1688 parliament occasionally made use of this resource. In 1779 a general press of all rogues and vagabonds in London to be drafted into the regiments was ordered. It is said that all who were not too lame to run away or too destitute to bribe the parish constable were swept into the net. As they were encouraged to desert by the undisguised connivance of the officers and men who were disgusted with their company, no further attempt to use the press for the army was made.

The impressment of sailors was regarded as a prerogative of the Crown. From an act of Philip and Mary (1556) it appears that the watermen of the Thames claimed exemption from the press as a privileged body. They were declared liable, and the liability was clearly meant to extend to service as a soldier on shore. In the fifth year of Elizabeth (1563) an act was passed to define the liability of the sailors. It is known as "an act touching politick considerations for the maintenance of the navy." By its term all fishermen and mariners were protected from being compelled "to serve as any soldiers upon the land or upon the sea, otherwise than as a mariner, except it shall be to serve under any captain of some ship or vessel, for landing to do some special exploit which mariners have been used to do." The operation of the act was limited to ten years, but it was renewed repeatedly, and was at last indefinitely prolonged in the 16th year of the reign of Charles I. (1631). The justices of the peace in the coast districts, who were often themselves concerned in the shipping trade, were not always zealous in enforcing the press. The pressed sailors often deserted with the "imprest money" given them. Loud complaints were made by the naval officers of the bad quality of the men sent up to serve in the king's ships. On the other hand, the press gangs were accused of extorting money, and of making illegal arrests. In the reign of Queen Anne (1703) an act gave parish authorities power to apprentice boys to the sea, and exempted such apprentices from the press for three years, and until the age of 18. It especially reaffirmed the part of the Vagrancy Act of 1597 which left rogues and vagabonds subject to be pressed for the sea service. By the act of 1740, all men over 55 were exempted from the press, together with lads under 18, foreigners serving in British ships (always numerous in war time), and landsmen who had gone to sea during their first two years. The act for "the better supplying of the cities of London and Westminster with fish" gave exemption to all masters of fishing-boats, to four apprentices and one mariner to each boat, and all landsmen for two years, except in case of actual invasion.

Subject to such limitations as these, all seafaring men, and watermen on rivers, were liable to be pressed between the ages of 18 and 55, and might be pressed repeatedly for so long as their liability lasted. The rogue and vagabond element were at the mercy of the justices of the peace. The frightful epidemics of fever which desolated the navy till late in the 18th century were largely due to the infection brought by the prisoners drafted from the ill-kept jails of the time. Even merchant ships were stopped at sea and the sailors taken out. On one occasion, in 1802, an East Indiaman on her way home was deprived of so many of her crew by a man of war in the Bay of Biscay that she was unable to resist a small French privateer, and was carried off as a prize with a valuable cargo. In 1795 it was found necessary to impose on the counties the obligation to provide "a quota" of men, at their own expense. The local authorities provided the recruits by offering high bounties, often to debtors confined in the prisons. These desperate men were a very bad element in the navy. In 1797 they combined with the United Irishmen, of whom large numbers had been drafted into the fleet as vagabonds, to give a very dangerous political character to the mutinies at the Nore and in the south of Ireland. The pressing of sailors alleged to be British from American vessels was one of the causes of the war between Great Britain and the United States in 1812. After the conclusion of the great Napoleonic wars in 1815 the power of the press was not again exercised. In 1835 an act was passed during Sir James Graham's tenure of office as first lord of the admiralty, by which men who had once been pressed and had served for a period of five years were to be exempt from impressment in future. Sir James, however, emphatically reaffirmed the right of the Crown to impress seamen. The introduction of engagements for a term of five years in 1853, and then of long service produced so large a body of voluntary recruits, and service in the navy became so popular, that the question had no longer any interest save an historical one. But in the World War compulsory service, both in the navy and army, once more became necessary and was enforced under the Military Service Acts of 1915 and 1916.

BIBLIOGRAPHY.—For the general subject of impressment *see* F. Grose, *Military Antiquities* (1812), vol. ii., p. 73 *et seq.* S. R. Gardiner gives many details in his history of James I. and Charles I., and in *The Civil War* (1886–91). The acts relating to the navy are quoted in *A Collection of the Statutes relating to the Admiralty,* etc., published in 1810. Some curious information is in the papers relating to the Brest Blockade edited by John Leyland for the Navy Record Society.
(D. H.)

IMPRISONMENT, as a legal term imprisonment denotes any involuntary restraint of the liberty of an individual whether he be confined within bounds, as in a jail or prison, or merely subjected to arrest and detention in his home or even in a public place. Such detention, if not warranted by law, constitutes the crime of *false imprisonment,* punishable as such and also by an action for damages prosecuted by the injured party.

As a legal process the primary object of imprisonment is to enforce obedience to an order of a court or to assure the presence of an alleged or convicted offender for questioning or for such disposition of him as may be deemed necessary, whether his indictment or trial or the execution of the judgment that may be pronounced against him. The wide range of the judicial power of commitment to prison is illustrated by the fact that in many cases not only persons under suspicion of criminal misconduct, but necessary witnesses whose presence cannot otherwise be assured, defaulting debtors and children brought into court for their protection and safe-keeping may be thus confined. It is only in recent years, little more than a century, that, with the gradual abolition of the death penalty, of branding, mutilation and other methods of corporal punishment as the usual penalties for crime, imprisonment has come, in itself, to be employed as a punishment. It is now, in the several countries of western Europe as well as in the United States, the common penalty for criminal misconduct of every description. From this point of view,

imprisonment presents itself as an important phase in the slow development of humanitarian sentiment in the Western world. But its story, as related elsewhere (*see* PRISON), creates the hope that it is not the last word in society's treatment of the offender. Certain it is that the convict prison has betrayed the humanitarian impulse to which it owes its existence.

In this latter phase of its development, imprisonment may be said to have a double object; first, that of inflicting upon the offender the suffering that he has earned by his crime and, second, that of protecting the community from further depredations by his close confinement. To secure the former of these aims the life of the prisoner was made as hard and revolting as he could endure; to secure the latter he was immured in stone or steel cells behind bars and formidable walls, in structures of the bastille type, under the constant observation of armed guards. It can be said that, upon the whole, these two objectives of penal imprisonment have been adequately secured. A third aim of the system, which has incongruously mingled with its more immediate purposes, is that of reforming the character of the prisoner. This purpose has, however, been completely defeated by the sordid and demoralizing conditions of prison life.

The principal object of prison reformers from John Howard down to the present time has been to ameliorate these conditions and the last few years have witnessed several hopeful experiments —notably that of Thomas Mott Osborne at Auburn and Sing Sing prisons in the United States—to make the term of imprisonment a period of schooling in character and citizenship. This is, indeed, the avowed aim of many if not of most of the correctional institutions for children, as well as of the State reformatories for youthful offenders in the United States and of the Borstal institutions in England. If the system of imprisonment is ultimately to justify itself, it can be only through the successful outcome of these efforts.

The period of imprisonment imposed, as a penalty for delinquency, varies from a few days in the case of commitments for trifling offences to the life of the offender in the case of wilful murder and sometimes of other crimes of the graver sort. In a few instances the penalty is definitely prescribed by law, but in all but a few cases the term to be served rests in the discretion of the court in which the judgment of conviction was given within minimum and maximum limits fixed by statute. As an incentive to good conduct on the part of the prisoner most of the American States have adopted some form of indeterminate sentence, the date of release being determined by the prison authorities or by an independent board of parole within limits prescribed by law or by the sentencing court. After such release on parole and up to the expiration of his maximum sentence the parolee is still a quasi prisoner, being at large under the supervision of the prison authorities and subject to be recalled by them to finish his term in confinement. *See* CONVICT; PAROLE; PUNISHMENT.

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(G. W. KI.)

IMPROMPTU, a short literary composition which has not been, or is not supposed to have been, prepared beforehand, but gains its merit from the ready skill which produces it without premeditation. The word seems to have been introduced from the French language in the middle of the 17th century. Poets have, from earliest ages, made impromptus, and the very art of poetry, in its lyric form, is a modified improvisation. Many of the epigrams of the Greeks, and still more probably those of the Roman satirists, particularly Martial, were delivered on the moment, and gained a great part of their success from the evidence which they gave of rapidity of invention. But it must have been difficult then, as it has been since, to be convinced of the value of that evidence. Who is to be sure that the impromptu-writer has not, like Mascarille in *Les Précieuses ridicules*, employed his leisure in sharpening his arrows? Voltaire was celebrated for the savage wit of his impromptus, and was himself the subject of a famous one by Young. Less well known but more extemporaneous is the couplet by the last-mentioned poet, who being asked to put something amusing in an album, and being obliged to borrow from Lord Chesterfield a pencil for the purpose, wrote:—

> Accept a miracle instead of wit,
> See two dull lines with Stanhope's pencil writ.

The word "impromptu" is sometimes used to designate a short dramatic sketch, the type of which is Molière's famous *Impromptu de Versailles* (1663), a miniature comedy in prose.

In music any extemporised composition might be regarded as an impromptu, but in actual usage the name is applied only to written compositions of an indeterminate and, as it were, improvisatory character. The finest and most famous are those of Chopin, four in number.

IMPROVISATION: *see* EXTEMPORIZATION.

IMPROVISATORE (Ital. *improvvisatore*), a word for a poet who recites verses which he composes on the spur of the moment. It became recognized as an English word in the middle of the 18th century, and is used by Smollett in his *Travels* (1766). In speaking of a woman, the feminine *improvisatrice* is used.

IMPULSE, a conation or conative tendency acting by itself and apart from the whole system of motives which constitute the character of the agent. *See* VOLITION; WILL; PSYCHOLOGY, and the bibliographies given there.

INAUDI, JACQUES (1867–), Italian calculating prodigy, was born at Onorato, Piedmont, on the 15th of October, 1867. When between seven and eight years old, at which time he was employed in herding sheep, he already exhibited an extraordinary aptitude for mental calculation. His powers attracted the notice of various showmen, and he began to give exhibitions. He was carefully examined by leading French scientists, including Charcot, from the physiological, psychological and mathematical point of view. The secret of his arithmetical powers appeared to reside in his extraordinary memory, improved by continuous practice. It appeared to depend upon hearing rather than sight, more remarkable results being achieved when figures were read out than when they were written.

INBREEDING is the term used to define any system of breeding which involves the mating of relatives. It has been deliberately used by animal breeders ever since the modern breeds of livestock were created: it is the sole method of reproduction of many self-fertilised plants, *e.g.*, beans, barley, oats and peas, and it has been used extensively by plant breeders in order to "fix" varieties of certain naturally cross-fertilised species such as maize. Exceptionally it has been practised by man, as for example in the ancient royal families of Egypt. In spite of the evidence provided by experience, however, there has been and still is great diversity of opinion concerning the average results of this system of mating. It has been shown on the one hand that inbreeding in a population in which it is not the rule commonly leads to the production of offspring which exhibit a diminution in size, lowered powers of resistance and fertility, that in fact markedly defective types appear among the progeny of an inbred strain. On the other hand it is abundantly clear that inbreeding can and does promote uniformity of type amongst the individuals exposed to its action and to an increase in prepotency when an individual of an inbred line is mated with unrelated stocks. Among plants the self-fertilised forms show no signs of being less vigorous than the normally cross-fertilised. It is not surprising therefore that a disagreement as to the effects and value of inbreeding exists. In different human societies there are to be found laws forbidding marriage save between relatives and laws forbidding the marriage of relatives altogether. Laws and practices vary because inbreeding has not always yielded the same results.

But during recent years it has been shown that the results of inbreeding, diverse as they are in different cases, can readily and consistently be explained by an appeal to the Mendelian theory. (*See* HEREDITY: *Breeds and Breeding.*) It has been demonstrated that the chief effect of inbreeding, the continued mating of close relatives, is to increase genetic purity or the proportion of homo-

zygous individuals or, conversely, to decrease heterozygosis among the progeny. To take an example; a recessive strain, such as that of dwarf peas, is crossed with a corresponding dominant strain, such as that of tall peas. All the first (filial) generation are hybrid (heterozygous) but show only the dominant character tallness. If these are allowed to become self-fertilised, ¼ of the resulting generation are pure (homozygous) dwarfs, ½ are heterozygous talls and ¼ are homozygous talls. (*See* HEREDITY.) If all these plants are allowed in their turn to become self-fertilised the homozygous classes will continue to breed true while the heterozygous class will again break up into 25% homozygous dwarfs, 50% heterozygous talls and 25% homozygous talls. If self-fertilisation of all individuals is continued generation after generation, the proportion of the heterozygous individuals becomes steadily reduced (being halved in each generation) and the proportion of the homozygous types steadily increases because these remain homozygous and are augmented in each self-fertilised generation. This progressive reduction in heterozygosis (the condition of being heterozygous or hybrid for one or more Mendelian characters) occurs automatically in all Mendelian factor-pairs, regardless of the number involved. The rate of reduction is determined by the intensity of the inbreeding practised. Reduction is most rapid in cases of self-fertilisation; theoretically it is calculated that for all practical purposes complete homozygosis (the condition of being homozygous for all characters the individual exhibits) should be attained in the 10th generation in such cases. Reduction is less rapid in cases of continued brother and sister mating: it is estimated that starting with heterozygous individuals the proportion of heterozygosis after ten generations becomes reduced from 50% to about 5%. This theoretical expectation is not likely to be realised in practice for the reason that the theory requires that mating shall be at random whereas in practice there is bound to be some certain selection, either natural or artificial, and this is more likely to preserve the heterozygous than the homozygous. The matings of relatives beyond the first cousin degree reduces heterozygosis so slightly they cannot really be considered as cases of inbreeding.

In breeding practice a system of mating commonly adopted is that of using a male upon a number of his half-sisters, these being half-sisters to each other. Such a system requires five generations to reduce the proportion of heterozygosis to about half the original value. Even after fifteen generations the proportion is 8·5%, and this system, therefore, is to be commended for all general purposes in cases in which a breeder wishes to avoid the dangers of too narrow inbreeding, to preserve the advantages of inbreeding and to keep wholly within his own stock. In the case of those breeds of livestock of which a study has been made, Shorthorn cattle, for example, it has been shown that the breeders who have contributed most notably to the advancement of the breeds have been those who used the system of inbreeding. They did so in most cases because they possessed males of such superior merit as sires that they wished to perpetuate and to concentrate the blood of these. Their methods earn the endorsement of science, for if it is desired to fix a type, the best guarantee that the animals shall not only look alike but also be alike in hereditary constitution is close relationship.

Critical experimental analysis of the effects of inbreeding has shown that its action takes the form of isolating a number of types each homozygous for the characters it displays and differing one from the other in respect of hereditary constitution. If, as is often the case, some of the recessive factors carried in the original stock are deleterious in their effects, some of the homozygous lines produced by inbreeding will be weakly or even incapable of life. Others, however, will have become purified of all harmful recessives and these will continue to flourish. But even these may show some decrease in general vigour, size and fertility; by crossing the best of these inbred stocks the effects of hybrid vigour (*see* HYBRIDISM) can be brought into play and a purified stock of equal, or better, performance than the original will be produced.

In the case of man, as in that of his domesticated animals, consanguinity in marriage is not dangerous in itself, it is only dangerous for the reason that human stocks are heavily laden with undesirable recessives, hidden in the heterozygous hybrid. These are most frequently revealed in the children when closely related individuals marry. Inbreeding exerts its effects solely through the medium of inheritance and not through the blood-relationship of the individuals concerned. Incest—inbreeding of the narrowest kind—is not harmful *per se* but only because of the recessives it may bring to light. It is usually more common among the biologically inferior: it is not surprising therefore that the offspring of such are themselves biologically unworthy, but this does not mean that incest itself is pernicious but only that it should be forbidden in the cases of unsound stock. There is no biological objection to the marriage of a man to his deceased wife's sister; there is some endorsement for the social attitude concerning the marriage of uncle and niece and of first cousins. If it can be shown that there is nothing but good in the pedigrees then cousinship is no barrier to marriage. This applies not only to first cousins but also to the case of the marriage of non-related individuals, for if in the pedigrees of such there appear records of the same disadvantageous character then on biological grounds marriage is undesirable, assuming of course that marriage implies parentage. It is because pedigrees have not been and still are not kept that in all cases of prospective marriage of related individuals. it is necessary to advocate caution—it has to be assumed that *all* such marriages are fraught with danger.

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INCA, a Peruvian tribe, speaking the Quichua dialect, who, at the time of the Spanish expedition under Pizarro, in 1533, exercised paramount rule over a region extending, west of the Atlantic slope of South America, between Quito in Ecuador and the River Maule in Chile. They were a highland people and organized a renaissance of the earlier "civilization," characterized by megalithic, polygonal structures of stone, which appears to have prevailed in the uplands of Bolivia and Peru at an anterior date (known as the Tiahuanaco period). (*See* SOUTH AMERICA: *Archaeology.*) The earliest traditional records of the people are mythological. The ancestors of the tribe are supposed to have emerged from certain caverns in a hill (*Tampu-tocco,* "House of Windows"), in a region known as *Paccari-tampu* ("House of the Dawn"), under the leadership of four brothers, all bearing the title of *Ayar.* The chief was the eldest brother, named Manco, who was the high-priest of the tribal god, the Sun, whose emblem was a fetish in the form of a bird, kept concealed in a basket. This fetish possessed oracular powers, and directed the migrations of its votaries. The other brothers were named Cachi (Salt), Uchu (Pepper), and Auca (Pleasure). Their sister-wives, who bore the title of Mama ("Mother"), were named respectively, Occlo, Huaco, Cura and Raua. These eight personalities were regarded as divine in origin, being descendants of the Sun god.

Under the direction of an oracle, these leaders conducted the tribe northward in search of empire. The leader, Manco, was equipped with a golden rod, which, according to the prophecy, would sink into the ground when the predestined home was attained. In the course of the migration, the three younger brothers perished. Cachi was persuaded to return for certain fetishes which had been left behind in a sacred cave; but when he had entered the sanctuary, his escort rolled a great rock against the entrance. Uchu, in the attempt to seize a mysterious stone statue, encountered on the journey, was himself turned to stone. The locality, known in later times as Huanacauri, was one of the most sacred spots in Peru, and was the scene of the Huarachicu ceremony. (*See* SOUTH AMERICA: *Archaeology.*) Auca, who was winged, was asked by Manco to fly to the top of a distant hill (afterwards the site of the great Sun-temple in Cuzco), but he, on completing the feat, was transformed to stone. Nevertheless the tribe followed, the test of the golden rod was applied, and Cuzco, the seat of the later Inca empire, was founded.

Most traditions give Manco's immediate successor as Sinchi Rocca, but one account interpolates a long list of rulers between the two. It is probable that Manco is in the main a legendary character, dating back, possibly to the Tiahuanaco period. Rocca appears to have been the first ruler bearing the royal title of *Sapa Inca* (Only Inca), and it is probable that his accession heralded the epoch associated with Inca domination. In fact he may be regarded as the first Inca "historical" ruler. The evolution of the Inca tribe into a ruling caste has brought about a certain confusion in the use of the word "Inca." Originally tribal, it became a term of rank, as applied to the members of the official hierarchy (invariably members of the paramount tribe). And, at the same time, the phrase "The Inca" is commonly used in connection with the supreme ruler, regarded as a god on earth and the descendant of the old tribal god, the Sun (obviously the translation of one of his titles, *Sapa Inca,* or "Only Inca"). The development of the peculiar form of state-socialism, controlled by a bureaucracy wielding religious authority, is described in the article, SOUTH AMERICA, *Archaeology,* with an account of the stone-work, pottery, and other industrial arts as compared with those of their predecessors and their tributaries. *See* the bibliography appended to that article. (T. A. J.)

INCANTATION, the use of words, spoken, sung or chanted, usually as a set formula, for the purpose of obtaining a result by their supposed magical power (Lat. *incantare,* to chant a magical formula). *See* MAGIC; SPELL.

INCE, WILLIAM, English 18th century furniture designer and cabinetmaker. He was one of the most successful imitators of Chippendale, although his work was lighter. It came between the massive and often florid style of Chippendale and the more boudoir-like forms of Hepplewhite. He was for many years in partnership with Thomas Mayhew, with whom he published a folio volume of 95 plates, under the title of *The Universal System of Household Furniture* (undated, but probably *c.* 1762).

INCE-IN-MAKERFIELD, urban district, Ince parliamentary division, Lancashire, England, adjoining the borough of Wigan. Pop. (1921) 22,855. Served by the Leeds and Liverpool canal, it contains large collieries, iron works, forges and cotton mills. The Old Hall is a beautiful example of half timbered architecture.

INCENDIARISM: *see* ARSON.

INCENDIARY MIXTURES are required for the destruction of buildings or material by fire. They are of two types: (1) mixtures of inflammable materials, such as pitch or resin, with oxidizing agents such as potassium nitrate, which on ignition produce much flame of long duration; (2) mixtures of the thermit type in which molten products at a very high temperature are scattered by a mild bursting charge. These mixtures contain aluminium and iron oxide, which on ignition form iron and aluminium oxide and produce a temperature of about 2,500° C. (W. R. Ho.)

INCENSE, the perfume (fumigation) arising from certain resins and gum-resins, barks, woods, dried flowers, fruits and seeds, when burnt, and also the substances so burnt. In its literal meaning the word "incense" is one with the word "perfume," the aroma given off with the smoke (*per fumum*) of any odoriferous substance when burnt. But, in use, while the meaning of the word "perfume" has been extended so as to include everything sweet in smell, from smoking incense to the invisible fresh fragrance of fruits and exquisite scent of flowers, that of the word "incense," in all the languages of modern Europe in which it occurs, has, by an opposite process of limitation, been gradually restricted almost exclusively to frankincense. (*See* FRANKINCENSE.)

Probably nowhere can the actual historical progress from the primitive use of animal sacrifices to the later refinement of burning incense be more clearly traced than in the pages of the Old Testament; but in the monuments of ancient Egypt the authentic traces of the use of incense that still exist carry us back to a much earlier date. From Meroe to Memphis the commonest subject carved or painted in the interiors of the temples is that of some contemporary Phrah or Pharaoh worshipping the presiding deity with oblations of gold and silver vessels, rich vestments, gems, the firstlings of the flock and herd, cakes, fruits, flowers, wine, anointing oil and incense. One of the best known of these representations is that carved on the memorial stone placed by Tethmosis (Thothmes) IV. (1533 B.C.) on the breast of the Sphinx at Gizeh. The tablet represents Tethmosis before his guardian deity, the sun-god Rê, pouring a libation of wine on one side and offering incense on the other. The ancient Egyptians used various substances as incense, but in course of time frankincense was specially consecrated to the worship of the gods.

In the authorized version of the Bible, the word "incense" translates two wholly distinct Hebrew words. In various passages in the latter portion of Isaiah (xl.–lxvi.), in Jeremiah and in Chronicles, it represents the Hebrew *lebonah,* more usually rendered "frankincense"; elsewhere the original word is *ketoreth* (Exod. xxx. 8, 9; Lev. x. 1; Num. vii. 14, etc.), a derivative of the verb *kitter* (Pi.) or *hiktir* (Hiph.), which verb is used, not only in Exod. xxx. 7, but also in Lev. i. 9, iii. 11, ix. 13, and many other passages, to denote the process by which the "savour of satisfaction" in any burnt-offering, whether of flesh or of incense, is produced. Sometimes in the authorized version (as in 1 Ki. iii. 3; 1 Sam. ii. 28) it is incorrectly made to mean the burning of incense. The expression "incense (*ketoreth*) of rams" in Ps. lxvi. 15 and the allusion in Ps. cxli. 2 ought both to be understood, most probably, of ordinary burnt-offerings. The "incense" (*ketoreth*), or "incense of sweet scents" (*ketoreth sammim*), called, in Exod. xxx. 35, "a confection after the art of the apothecary," or rather "a perfume after the art of the perfumer," which was to be regarded as most holy, and the imitation of which was prohibited under the severest penalties, was compounded of four "sweet scents" (*sammim*), namely stacte (*nataph*), onycha (*sheheleth*), galbanum (*helbenah*) and "pure" or "fine" frankincense (*lebonah zaccah*), pounded together in equal proportions, with (perhaps) an admixture of salt (*memullah*). It was then to be "put before the testimony" in the "tent of meeting" (a transference of late ceremonial back to the years of sojourn in "the wilderness"). It was burnt on the altar of incense by the priest every morning when the lamps were trimmed in the Holy Place, and every evening when they were lighted or "set up" (Exod. xxx. 7, 8). A handful of it was also burnt once a year in the Holy of Holies by the high priest on a pan of burning coals taken from the altar of burnt-offering (Lev. xvi. 12, 13). Pure frankincense (*lebonah*) formed part of the meat-offering (Lev. ii. 16, vi. 15), and was also presented along with the shew bread (Lev. xxiv. 7) every Sabbath day (probably on two golden saucers; *see* Josh. *Ant.* iii. 10, 7). The religious significance of the use of incense, or at least of its use in the Holy of Holies, is distinctly set forth in Lev. xvi. 12, 13.

The introduction of incense took place late in the history of the Jewish ritual (*see* Wellhausen, *Geschichte Israels,* i. 75 *seq.*); but evidently the idea that the odour of a burnt-offering (*cf.* the κνίσης ἡδὺς ἀὴτμή of Od. xii. 369) is pleasing to the deity, being at least the vehicle by which the sacrifice can be successfully conveyed to its destination, was a survival of a very early belief, and underlies the biblical phrase "a savour of satisfaction" (Gen. viii. 21; Lev. i. 9 and elsewhere; *cf.* Eph. v. 2). It is probable that the development of a sensuous appreciation of pleasant perfumes, and knowledge of the sources from which these could be derived, expressed itself not only in domestic habits, sanitation, etc., but also in religious ceremonial, so that the custom of adding some kind of incense to animal sacrifices naturally arose. The final stage (not reached in the Levitical ritual) was the offering of incense pure and simple.

The "marbles" of Nineveh furnish frequent examples of the offering of incense to the sun-god and his consort (2 Ki. xxiii. 5). The kings of Assyria united in themselves the royal and priestly offices, and on the monuments they erected they are generally represented as offering incense and pouring out wine to the Tree of Life. According to Herodotus (i. 183), frankincense to the amount of 1,000 talents' weight was offered every year, during the feast of Bel, on the great altar of his temple in Babylon.

The monuments of Persepolis and the coins of the Sassanians

show that the religious use of incense was as common in ancient Persia as in Babylonia and Assyria. Five times a day the priests of the Persians (Zoroastrians) burnt incense on their sacred fire altars. Herodotus (iii. 97) states that the Arabs brought every year to Darius as tribute 1,000 talents of frankincense. The Parsees still preserve in western India the pure tradition of the ritual of incense as followed by their race from probably the most ancient times.

The *Ramayana* and *Mahabharata* afford evidence of the employment of incense by the Hindus, in the worship of the gods and the burning of the dead, from the remotest antiquity. Its use was obviously continued by the Buddhists during the prevalence of their religion in India, for it is still used by them in Nepal, Tibet, Ceylon, Burma, China and Japan. These countries all received Buddhism from India, and a large proportion of the porcelain and earthenware articles imported from China and Japan into Europe consists of innumerable forms of censers. The Jains all over India burn sticks of incense before their Jina. The commonest incense in ancient India was probably frankincense. The Indian frankincense tree is found chiefly where the Buddhist religion prevailed in ancient times, in Bihar and along the foot of the Himalayas and in western India, where it particularly flourishes in the neighbourhood of the Buddhist caves at Ajanta. Now, however, the incense in commonest use in India is benzoin. But the consumption of all manner of odoriferous resins, gum resins, roots, woods, dried leaves, flowers, fruits and seeds in India, in social as well as religious observances, is enormous. The incense sticks and pastils made at the Mohammedan city of Bijapur in the Mahratta country are celebrated all over western India.

As to the *θύεα* mentioned in Homer (*Il.* ix. 499, and elsewhere) and in Hesiod (*Works and Days*, 338), there is some uncertainty whether they were incense offerings at all, and if so, whether they were ever offered alone, and not always in conjunction with animal sacrifices. That the domestic use, however, of the fragrant wood *θύον* (*Arbor vitae*) was known in the Homeric age, is shown by the case of Calypso (*Od.* v. 60), and the very similarity of the word *θύον* to *θύος* may be taken as almost conclusively proving that by that time the same wood was also employed for religious purposes. It is not probable that the sweet-smelling gums and resins of the countries of the Indian ocean began to be introduced into Greece before the 8th or 7th century B.C., and doubtless *λίβανος* or *λιβανωτός* first became an article of extensive commerce only after the Mediterranean trade with the East had been opened up by the Egyptian king Psammetichus (*c.* 664–610 B.C.). The new Oriental word is frequently employed by Herodotus; and there are abundant references to the use of the thing among the writers of the golden age of Attic literature (*see*, for example, Aristophanes, *Plut.* 1,114; *Frogs*, 871, 888; *Clouds*, 426; *Wasps*, 96, 861). Frankincense, however, though the most common, never became the only kind of incense offered to the gods among the Greeks. Thus the Orphic hymns are careful to specify, in connection with the several deities celebrated, a great variety of substances appropriate to the service of each; in the case of many of these the selection seems to have been determined not at all by their fragrance but by some occult considerations which it is now difficult to divine.

Among the Romans the use of religious fumigations long preceded the introduction of foreign substances for the purpose (*see* for example, Ovid, *Fast.* i. 337 *seq.*, *Et non exiguo laurus adusta sono*). Latterly the use of frankincense (*mascula thura*, Virg., *Ecl.* viii. 65) became very prevalent, not only in religious ceremonials, but also on various state occasions, such as in triumphs (Ovid, *Trist.* iv. 2, 4), and also in connection with certain occurrences of domestic life. In private it was daily offered by the devout to the *Lar familiaris* (Plaut. *Aulul.* prol. 23); and in public sacrifices it was not only sprinkled on the head of the victim by the pontifex before its slaughter, and afterwards mingled with its blood, but was also thrown upon the flames over which it was roasted.

No perfectly satisfactory traces can be found of the use of incense in the ritual of the Christian Church during the first four centuries. (Compare Duchesne, *Christian Worship* [Eng., trans., 1904], ch. ii., "The Mass in the East," v. "The Books of the Latin Rite," and xii. "The Dedication of Churches.") Its use was foreign to the synagogue services on which the worship of the primitive Christians is known to have been originally modelled; and its associations with heathen solemnities, and with the evil repute of those who were known as "thurificati," would still further militate against its employment. Various authors of the ante-Nicene period have expressed themselves as distinctly unfavourable to its religious, though not, of course, to its domestic, use. Thus Tertullian, while (*De Cor. Mil.* 10) ready to acknowledge its utility in counteracting unpleasant smells ("si me odor alicujus loci offenderit, Arabiae aliquid incendo"), is careful to say that he scorns to offer it as an accompaniment to his heartfelt prayers (*Apol.* 30; *cf.* 42). Athenagoras also (*Legat.* 13) gives distinct expression to his sense of the needlessness of any such ritual ("the Creator and Father of the universe does not require blood, nor smoke, nor even the sweet smell of flowers and incense"); and Arnobius (*Adv. Gent.* vii. 26) seeks to justify the Christian neglect of it by the fact, for which he vouches, that among the Romans themselves incense was unknown in the time of Numa, while the Etruscans had always continued to be strangers to it. Cyril of Jerusalem, Augustine and the Apostolic Constitutions make no reference to any such feature either in the public or private worship of the Christians of that time. But in the Apostolic Canons (can. 3), the *θυμίαμα* is spoken of as one of the requisites of the eucharistic service. It is easy to perceive how it should inevitably have come in along with the whole circle of ideas involved in such words as "temple," "altar," "priest," which about this time came to be so generally applied in ecclesiastical connections. At a later date Roman Catholic theologians treated it as symbolically typifying the prayers of the faithful and the virtues of the saints. Ultimately the word incense was sometimes used symbolically of prayer; a usage anticipated in Rev. v. 8, viii. 3, 4 (*cf.* Origen, *Contra Celsum*, viii. 17, 20).

Incense in the Church of England.—The Missal of the Roman Church, however, enjoins incensation before the introit, at the gospel and again at the offertory, and at the elevation, in every high mass; the use of incense also occurs at the exposition of the sacrament, at consecrations of churches and the like, in processions, in the office for the burial of the dead and at the exhibition of relics. On high festivals the altar is censed at vespers and lauds. There is reason to believe that notwithstanding the order for the use of incense at every celebration, it was used in British churches only on high festivals, and then only in rich churches down to the period of the Reformation, and that the ritual of the mass remained unchanged until the death of Henry VIII. (Jan. 28, 1547). On Whitsunday 1549 the first Prayer Book of Edward VI. came into use under the first Act of Uniformity (2 and 3 Ed. VI. ch. 1) which required its exclusive use in public worship so as to supersede all other forms of service. Another Act (3 and 4 Ed. VI. ch. 10) required the old service books to be delivered up to be destroyed. The first Prayer Book does not contain any direction to use or any mention of incense. It is a controverted question whether incense did or did not continue to be in ceremonial use under the first Prayer Book or during the rest of Edward VI.'s reign. No evidence has hitherto been discovered which justifies us in answering this question in the affirmative. The second Prayer Book of Edward VI. (1552), published under the authority of the second Act of Uniformity (5 and 6 Ed. VI. ch. 1), contains no reference to incense. Edward VI. died July 6, 1553. Queen Mary by statute (1 Mary, sess. 2, ch. 2) abolished the Prayer Book, repealed the Acts of Uniformity and restored "divine service and administration of sacraments as were most commonly used in England in the last year of Henry VIII." The ceremonial use of incense thus became again an undoubted part of the communion service in the Church of England. A proclamation issued (Dec. 6, 1553) directed the churchwardens to obtain the proper ornaments for the churches; and the bishops in their visitations inquired whether censers had been furnished for use. Mary died Nov. 17, 1558. On June 24, 1559, the second Prayer Book of Edward VI. (with a few alterations having no reference to incense) was again established, under the

authority of the third Act of Uniformity (1 Eliz. ch. 2), as the exclusive service book for public service. There is no evidence of the ceremonial use of incense under Elizabeth's Prayer Book, or under the present Prayer Book of 1662 (established by the fourth Act of Uniformity, 13 and 14 Charles II., ch. 4) until the middle of the 19th century; and there is no doubt that as a ceremony of divine worship, whether at the Holy Communion or at other services, it was entirely disused. There are a good many instances recorded of what has been called a fumigatory use of frankincense in churches, but this use of incense—which was utilitarian and not symbolical—must be carefully distinguished from its ceremonial use. In the general revival of Church ceremonial which accompanied and followed the Oxford Movement incense was not forgotten, and its ceremonial use in the pre-Reformation method has been adopted in a number of churches since 1850. Its use has been condemned as an illegal ceremony by the ecclesiastical courts. In 1868 Sir Robert Phillimore (Dean of the Arches) pronounced the ceremonial use of incense to be illegal in the suit of *Martin* v. *Mackonochie* (2 A. and E.L.R. 116). The case was carried to the Privy Council on appeal, but there was no appeal on the question of incense. Again, in 1870, the ceremonial use of incense was condemned by Sir Robert Phillimore in the suit of *Sumner* v. *Wix* (3 A. and E.L.R. 58).

Notwithstanding these decisions, it was insisted by those who defended the revival of the ceremonial use of incense that it was a legal custom of the Church of England. The question was once more elaborately argued in May 1899 before an informal tribunal consisting of the archbishop of Canterbury (Dr. Temple) and the archbishop of York (Dr. Maclagan), at Lambeth Palace. On July 31, 1899, the archbishops decided that the liturgical use of incense was illegal. The Lambeth "opinion," as it was called, failed to convince the clergy against whom it was directed any better than the judgments of the ecclesiastical courts, but at first a considerable degree of obedience to the archbishops' view was shown. Various expedients were adopted, as, *e.g.*, the use of incense just before the beginning of service, by which it was sought to retain incense without infringing the law as laid down by the archbishops. There remained, nevertheless, a tendency on the part of the clergy who used incense, or desired to do so, to revert to the position they occupied before the Lambeth hearing—that is, to insist on the ceremonial use of incense as a part of the Catholic practice of the Church of England which it is the duty of the clergy to maintain, notwithstanding the decisions of ecclesiastical judges or the opinions of archbishops to the contrary.

BIBLIOGRAPHY.—*See* art. "Incense," *Encyclopaedia Biblica*; P. Morrisroe, art. "Incense" in the *Catholic Encyclopaedia* (from the modern Roman Catholic point of view); J. A. MacCulloch, art. "Incense," in Hastings, *Encyclopaedia of Religion and Ethics* (with many refs.); E. G. Atchley, *History of the Use of Incense in Divine Worship* (1909). *See* also PERFUMES.

INCENSE CEDAR (*Libocedrus decurrens*), a handsome North American tree of the pine family (Pinaceae), called also white cedar, native to high mountains from Oregon and Nevada to Lower California. It is a valuable timber tree, with cinnamon-red bark, frequently attaining a height of 150 ft., and sometimes a trunk diameter of 7 feet. The slender branches, with much flattened branchlets and lustrous, cypress-like leaves, form a beautiful crown. The soft, durable, straight-grained, fragrant, resinous wood is utilized for fence posts, telephone poles and lumber. The incense cedar is planted for ornament, as is also the smaller South American species (*L. chilensis*). Besides the foregoing, six other species of incense cedar are found, one each in Chile, New Caledonia, China and Japan, and two in New Zealand. Of these, *L. tetragona*, of Chile, and *L. Doniana*, of New Zealand, are valuable timber trees.

INCEST, sexual intercourse between persons so related by kindred or affinity that legal marriage cannot take place between them (*see* MARRIAGE, especially the section *Canon Law*). In England incest formerly was not generally treated as a crime, although, along with other offences against morals, it was made punishable by death in 1650. Since the Restoration it had, to use Blackstone's phrase, been left to the "feeble coercion of the spiritual courts," but bills to make it a criminal offence have at various times been unsuccessfully introduced in parliament. In 1908, however, an act (The Punishment of Incest Act 1908) was passed, under which sexual intercourse of a male with his grand-daughter, daughter, sister or mother is made punishable with penal servitude for not less than 3 or more than 7 years, or with imprisonment for not more than 2 years with or without hard labour. It is immaterial that the sexual intercourse was had with the consent of the female; indeed, by s. 2 a female who consents is on conviction liable to the same punishment as the male. The act also makes an attempt to commit the offence of incest a misdemeanor, punishable by imprisonment for not more than two years with or without hard labour. The terms "brother" and "sister" include half-brother and half-sister, whether the relationship is or is not traced through lawful wedlock. Formerly all proceedings under the act were held *in camera* (s. 5), but this provision was repealed by the Criminal Law Amendment Act 1922. In *Rex* v. *Ball* (22 Cx, C.C. 366) it was held by the House of Lords that evidence of previous intercourse was admissible to establish guilty passion and rebut innocent association. In the law of Scotland, it was, until the Criminal Procedure (Scotland) Act 1887, a crime nominally punishable with death, but the penalty usually inflicted was penal servitude for life. This sentence was actually pronounced on a man in 1855. In the United States incest, though not an indictable offence at common law, has, generally speaking, been made a felony by statute and punishable by fine or imprisonment or both. It is also a punishable offence in some European countries, notably Germany, Austria and Italy. (W. DE B. H.)

INCH, the twelfth part of a linear foot (O.Eng. *ynce* from Lat. *uncia*, a twelfth part; *see* OUNCE and AS). As a measure of rainfall an "inch of rain" is equivalent to a fall of a gallon of water spread over a surface of about 2 sq.ft., or 100 tons to an acre.

INCHBALD, ELIZABETH (1753–1821), English novelist, playwright and actress, was born on Oct. 15, 1753, the daughter of a farmer, Joseph Simpson. She left home in April 1772 to seek her fortune on the London stage; two months later she married Joseph Inchbald, an actor, and in September made her début at Bristol as Cordelia to his Lear. In the next seven years she played with him in the provinces, taking important leading parts. Elizabeth Inchbald had great beauty, but was debarred from rising to the top of her profession by an impediment in her speech. After her husband's death she continued to appear on the stage until 1789, producing at the same time many adaptations of plays, and writing some farces of her own. Among her most successful adaptations were *Wives as They Were and Maids as They Are* (1797). But her fame rests on the two novels: *A Simple Story* (1791) and *Nature and Art* (1796), which have become standard works and cannot be neglected by any student of the 18th century novel.

See J. Boaden, *Memoirs of Mrs. Inchbald* (2 vols., 1833); Fanny Kemble, *Records of a Girlhood* (1878); W. Bell Scott, preface to *A Simple Story* (1880); S. R. Littlewood, *Elizabeth Inchbald and her Circle 1753–1821* (1921).

INCHCAPE, JAMES LYLE MACKAY, 1ST VISCOUNT (1852–), British shipowner, was born at Arbroath, Forfarshire, on Sept. 11, 1852, and educated there and at Elgin. In 1874 he went to India to join the firm of Messrs. Mackinnon, Mackenzie & Company, Calcutta, of which he ultimately became senior partner; he was a member of the legislative council of the Viceroy (1891–93) and a member of the Council of India from 1897 to 1911. In 1902, consequent upon the Boxer rebellion, Mackay negotiated a commercial treaty with China. In 1911 he was raised to the peerage as Baron Inchcape of Strathnaver. As a representative of the shipping industry Inchcape took a leading part in all its affairs both during the World War and after, being president of the Chamber of Shipping of the United Kingdom (1893, 1918, 1919) and president of the Shipping Federation (1926). He served on most of the Government commissions of inquiry both in India and England. He was a member of the Geddes committee on national expenditure (1921), and chairman of the Indian retrenchment committee (1922). In 1924 he was created viscount and G.C.S.I. The positions of chairman of the

P. and O. Steam Navigation Company and director of the National Provincial Bank and Suez Canal Company were other important positions which he occupied. In 1928 Lord Inchcape lost his daughter, Miss Elsie Mackay, in an attempted trans-Atlantic flight.

INCHIQUIN, MURROUGH O'BRIEN, 1ST EARL OF (*c.* 1614–1674), Irish soldier and statesman, was the son of Dermod O'Brien, 5th Baron Inchiquin (d. 1624). He belonged to a great family which traced its descent to Brian Boroimhe, king of Ireland, members of which were always to the forefront in Irish public life. The first baron of Inchiquin was another Murrough O'Brien (d. 1551) who, after having made his submission to Henry VIII., was created baron of Inchiquin and earl of Thomond in 1543. When Murrough died in November 1551 his earldom passed to his nephew Donogh, son of Conor O'Brien (d. 1539), the last independent prince of Thomond (*see* THOMOND, EARLS OF), leaving only his barony to be inherited by his son Dermod (d. 1557), the ancestor of the later barons of Inchiquin.

Murrough O'Brien, who became 6th baron of Inchiquin in 1624, took an active part in suppressing the Irish rebellion which broke out in 1643, and during the Civil War the English parliament made him president of Munster. Early in 1648, however, he declared for Charles I., and for about two years he sought to uphold the royalist cause in Ireland. He then emigrated. In 1654 Charles II. made him an earl. He died on Sept. 9, 1674.

His son, WILLIAM, THE 2ND EARL (*c.* 1638–1692), served under his father in France and Spain, and for six years was governor of Tangier. He was a partisan of William III. in Ireland, and in 1690 he became governor of Jamaica where he died in January 1692. In 1800 his descendant Murrough, the 5th earl (d. 1808), was created marquess of Thomond, but on the death of James, the 3rd marquess, in July 1855 both the marquessate and the earldom became extinct.

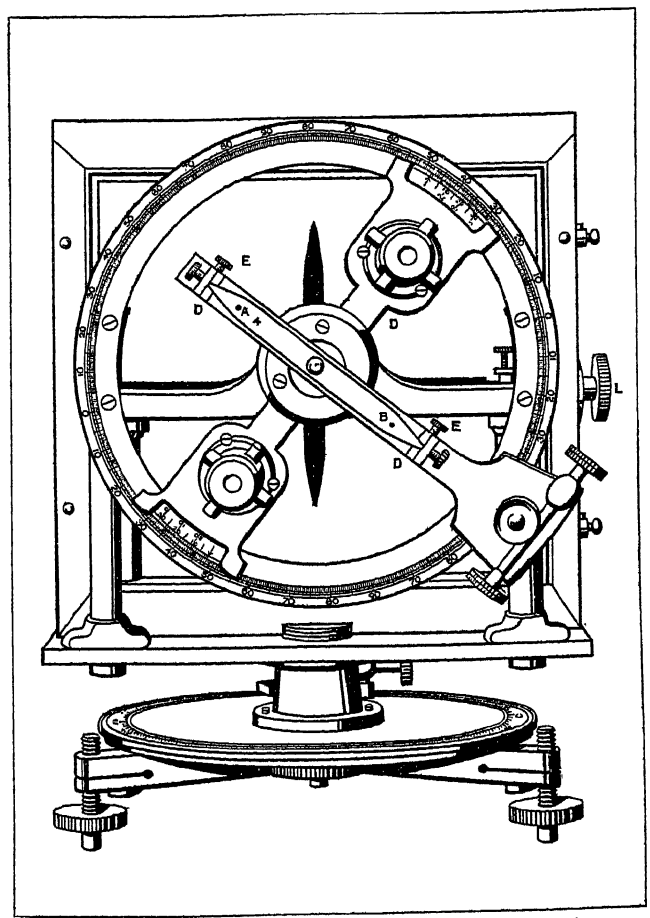
INCIDENTAL MUSIC, otherwise music designed to accompany and support the action of a spoken play or other dramatic performance. Very fine music has been written in this form, such as that of Beethoven for Goethe's *Egmont,* and Mendelssohn's famous *Midsummer Night's Dream.*

INCINERATOR: *see* DESTRUCTORS.

INCLEDON, CHARLES BENJAMIN (1763–1826), English singer, son of a doctor in Cornwall, was the principal English tenor of his day. He sang both in opera and in oratorio, but his chief popularity lay in his delivery of ballads, such as "Sally in our Alley," "Black-eyed Susan," "The Arethusa," and others of a similarly bold and manly type. On retiring in 1822 from the operatic stage, he travelled through the provinces with an entertainment called "The Wandering Melodist." He died at Worcester on Feb. 11, 1826.

INCLINOMETER, an instrument used for measuring the dip or inclination of the dipping needle to the horizontal (*see* MAGNETISM, TERRESTRIAL). Inclinometers are of two distinct classes, viz., dip circles and induction inclinometers, often called earth inductors.

Dip Circle.—The instrument shown in the fig. is intended for the determination of total force as well as dip. With this instrument four needles are provided. Two are seen in the illustration. One of these, No. 4, held between the clips DD, is a total force needle, but we may suppose it non-existent, as it is not represented in the ordinary dip circle. In modern circles of the pattern shown, the needle is a flat lozenge-shaped piece of steel, about 9 cm. long and 0·1 cm. thick. The axle, which is made of hard steel, projects on either side of the needle, and where in contact with the agate knife-edges in which it rolls has a diameter of about 0·05 cm. The two ends of the needle are marked A and B for purposes of distinction. When in position inside the box the axle of the needle is on the axis of the vertical divided circle. The needle shown in the background of the illustration happens to be vertical. When a dip observation is being made the needle takes up the appropriate inclination, and the positions of its ends are observed with the two reading microscopes, carried by the same movable piece as the two diametrically opposite verniers. The circle is divided to 0·5°, and the vernier, divided from 0 to 30, enables minutes of arc to be read off. The reading should always be taken with a slight swing on the needle, the adjustment being made with the tangent screw until the wire in the reading microscope seems to bisect the (small) arc of vibration. Suppose the inclination observed when the plane in which the needle swings—which is necessarily parallel to the vertical circle—is inclined at an angle α to the magnetic meridian, the observed dip, I_1, and the true dip



DIP CIRCLE, WITH TOTAL FORCE NEEDLES, FOR MEASURING (A) THE INCLINATION OF THE EARTH'S MAGNETIC FIELD TO THE HORIZONTAL AND (B) THE TOTAL FORCE

I in the magnetic meridian are connected by the relation $\cot I_1 = \cos \alpha \cot I$. If then I_2 be the dip obtained when observing in a plane perpendicular to the first one, we similarly get $\cot I_2 = \sin\alpha \cot I_1 \alpha \cot I$. Hence for all values of α, *i.e.,* for any pair of orthogonal planes, we have $\cot^2 I = \cot^2 I_1 + \cot^2 I_2$.

It follows that no plane can give a smaller dip than the magnetic meridian, and in the plane perpendicular to the meridian the dip is 90°, *i.e.,* the needle is vertical. Circumstances may arise in which observing out of the meridian in two perpendicular planes has advantages but the usual practice is to observe only in the meridian. The meridian is sometimes obtained with the aid of an auxiliary compass needle, but it is usually determined by means of the result that the needle becomes vertical in the plane perpendicular to the meridian. The position where this occurs is read off on the horizontal circle, which is similarly divided to the vertical circle. Rotating the instrument through a right angle, as shown on the horizontal circle, we bring the vertical circle into the desired meridian, and by the use of a stop, not shown in the figure, can recover this position when desired. Rotating the instrument backwards 180° from this position we again bring the vertical circle into the magnetic meridian, and secure the recovery of this position by a second stop. At a fixed observatory one determination of the magnetic meridian may serve for months.

A satisfactory dip observation involves a number of readings. Calling the flat surface of the needle bearing the letters A and B

the face, and that side of the box containing the needle which is next the vertical circle the face of the instrument, we take the following readings with A dipping, at least two readings being taken of each end:

Instrument facing east, face of needle to face of instrument
" " west, " " " " " " "
" " west, " " " " back " "
" " east, " " " " " " "

We then repeat these observations with B dipping, the reversal of the magnetization of the needle having been effected with the aid of bar magnets or a coil. The object of the reversal is to eliminate the effects of a possible gravitating couple due to the C.G. of the needle not coinciding with its axle. The object of reading both ends of the needle is to eliminate any error of centring. The object of changing the positions of the circle and of the needle is to eliminate error in the zero graduation on the vertical circle, and departure of the magnetic axis of the needle from the straight line joining its two ends. Prior to each reading, the needle is lifted off and restored to the knife-edge by a lifter, actuated by the knot *I*. It is well to do this several times before actually taking a reading. If the position of equilibrium about which the needle swings alters, or if the needle swings jerkily, its axle should be cleaned with the pith provided for the purpose. In damp weather frequent use of the pith may be necessary.

Total Force.—The needle marked 4 in the figure is stouter than the others and has a small hole in which can be screwed one of several weights provided. The total force observation consists of two experiments, both in the magnetic meridian. In the first we observe the inclination η to the horizon of needle No. 4 carrying one of its weights, and the difference μ between η and the true dip as given by an unweighted needle. In the second experiment we determine the angle μ' through which an auxiliary needle No. 3—which resembles the ordinary reversible needles Nos. 1 and 2—swinging freely on the agate edges, is deflected by No. 4 from its natural dipping position. No. 4 when deflecting is in the position shown in the figure, but is protected from the observer's breath by a cover. No. 3 in its deflected position is necessarily orthogonal to No. 4, because No. 4 is so supported that its long axis is perpendicular to the line joining the lines of vision of the two reading microscopes by which the ends of No. 3 are read. There are two such deflected positions on opposite sides of the position that No. 3 would assume if undeflected. Half the difference between the two readings is taken as the deflection angle μ'. The value of the total force F is given by $F^2 = C\cos\eta/\sin\mu\sin\mu'$, where C is a constant for a particular weight, provided the distribution of magnetism in needles Nos. 3 and 4 remains unaltered. To this end these two magnets, unlike the others Nos. 1 and 2, never have their magnetism reversed. The constant C is determined from observations at a base station where F is known. In reality C varies slightly with the local value of gravity, but hardly to an extent that matters.

The dip circle can be adapted for use at sea by having the ends of the axle of the needle carried in jewelled holes. The instrument, of course, is carried on gimbals. A modification of the original sea pattern instrument, devised by Robert Were Fox, to which its inventor, Captain E. W. Creak, R.N., assigned the name of the Lloyd-Creak, has been a good deal used. To get rid of friction, a knob on the top of the box is rubbed with a corrugated ivory disc. A distance between the deflecting and deflected needles suitable for higher latitudes may be too small near the equator, where the total force is relatively small. This difficulty has been surmounted in the sea dip circles used by the Carnegie Institution by mounting the deflecting needle eccentrically in a metal box, which is attachable to the frame of the dip circle, with the side to which the deflecting needle is nearest either adjacent to or remote from the deflected needle. This gives a choice between two deflection distances.

Induction Inclinometer.—If a coil of insulated wire is spun about a diameter, an alternating current is induced unless the diameter is parallel to the lines of force of the earth's magnetic field. Hence if the axis about which the coil spins is adjusted until there is no deflection in a sensitive galvanometer, connected to the coil through a commutator by which the alternating current is converted into direct current, then the axis must be parallel to the lines of force of the earth's field. The inclination of the axis to the horizon is then the dip. The introduction and improvement of the induction inclinometer were largely the work of H. Wild, but modifications have been subsequently made by others, especially M. Eschenhagen. Wild's form of instrument for field observations consists of a coil 10 cm. in diameter containing about 1,000 turns of silk-covered copper wire, with a resistance of about 40 ohms. The coil is pivoted inside a metal ring which can be rotated about a horizontal axle in its own plane, this axle being orthogonal to that about which the coil can rotate. Attached to the axle of the ring is a divided circle with two reading microscopes by means of which readings can be taken of the inclination of the coil's axis of rotation to the horizontal. The bearings which support the horizontal axle of the ring are mounted on a horizontal annulus, which can be rotated in a groove attached to the base of the instrument, so as to allow the adjustment of the azimuth of the axle of the ring, and hence also that of the plane in which the axis of the coil can move. The coil is rotated by means of a flexible shaft, worked by a small cranked handle and a train of gear wheels. The terminals of the coil are taken to a two-part commutator of the ordinary pattern, on which rest two copper brushes, which are connected by flexible leads to a sensitive galvanometer. The inclination of the axis of the coil can be roughly adjusted by hand by rotating the supporting ring. The final adjustment is made by means of a micrometer screw.

The first thing when making an observation is to set the azimuth circle horizontal, checking this by a striding level placed on the trunnions which carry the ring. The striding level is then placed on the axle which carries the coil, and when the bubble is at the centre of the scale the microscopes are adjusted to the zeros of the vertical circle. A box containing a long compass needle, and having two feet with inverted V's, is placed so as to rest in the axle of the coil, and the instrument is turned in azimuth until the compass needle points to a lubber line on the box. By this means the axis of the coil is brought into the magnetic meridian. The coil is then rotated, and the ring adjusted until the galvanometer needle is undeflected. The reading on the vertical circle then gives the dip. Slight faults in the adjustment are eliminated by a scheme of reversals analogous to that with the dip circle. The degree of accuracy claimed for the final value of the dip is $\pm 1'$, but a good deal depends on the judgment of the observer.

In the form of Wild inductor intended for observatory use the coil consists of a drum-wound armature, the length of which is about thrice the diameter. This armature has its axle mounted in a frame attached to the sloping side of a stone pillar, so that the axis of rotation is approximately parallel to the lines of force of the earth's field. The inclination of the axis to the magnetic meridian and to the horizontal can be adjusted by two micrometer screws. The armature is fitted with a commutator and a system of gear wheels by means of which it can be rapidly rotated. The upper end of the axle carries a plane mirror, the normal to which is adjusted parallel to the axis of rotation of the armature. A theodolite is placed on the top of the pillar, and the telescope is turned so that the image of the cross wires, seen by reflection in the mirror, coincides with the wires themselves. In this way the axis of the theodolite telescope is placed parallel to the axis of the armature, and hence the dip can be read off on the altitude scale of the theodolite.

A modified pattern of earth inductor with a suitable type of galvanometer has been devised by the department of terrestrial magnetism of the Carnegie Institution for taking dip observations at sea.

The primary object of dip observations at an observatory is to assist in determining the base value of the vertical force curves. Suppose a dip I has been observed with a dip circle or inductor at a certain time. The corresponding value of H is then derived by measuring the ordinate of the H curve, standardized by absolute measurements with the unifilar magnetometer V being simply H tan I is then known. Subtracting the force equivalent of the

corresponding ordinate of the V curve from the value thus found for V, we have the base line value. If now Δ denote a small change in a magnetic element, we easily find $\Delta I = \frac{1}{2} \sin 2I \{(\Delta V/V) - (\Delta H/H)\}$. This shows that in high magnetic latitudes where $2I$ approaches 180°, and V is very large, a dip circle or inductor is an insensitive instrument to changes in V. It takes a very large change indeed in V to produce a change of even 0'.1 in I. This has suggested the importance of devising coil instruments to measure V directly. Instruments accomplishing this in two different ways have been devised by D. la Cour of Copenhagen and D. W. Dye of the National Physical Laboratory, Teddington. The method followed by the latter is to reduce to zero the earth's vertical field by means of an artificial field produced by a current in a horizontal coil. The measurement of the current gives the strength of the artificial field, the coil constants being known, and hence the earth's vertical force.

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(C. CHR.)

INCLOSURE or **ENCLOSURE:** *see* COMMONS.

IN COENA DOMINI, a papal bull, so called from its opening words, first issued in 1363 and republished annually about Eastertide. It was a statement of ecclesiastical censure against heresies, schisms, sacrilege, infringement of papal and ecclesiastical privileges, attacks on person and property, piracy, forgery and other crimes. Owing to the opposition of the sovereigns of Europe both Protestant and Catholic, who regarded the bull as an infringement of their rights, its publication was discontinued by Pope Clement XIV. in 1770. It is considered to have been formally abrogated by Pius IX. in the constitution *Apostolicae Sedis.* It received its final form from Pope Urban VIII. in 1627.

See J. Prior, art. "In Coena Domini," in the *Catholic Encyclopaedia;* M. O'Riordan, art. "Apostolicae Sedis," *ibid.*

INCOME: ECONOMIC DEFINITION. Income has been defined as:—(1) "The wealth measured in money which is at the disposal of an individual or a community, per year or other unit of time"; (2) "The inflow of satisfactions from economic goods, estimated in money" (Seligman); (3) "Those incomings which are in the form of money, including 'payments in kind.'"

These definitions have some ambiguity. In general, the term is confined to those "satisfactions which are capable of being parted with, or are usually parted with, for money." For example, the satisfaction or economic value derived from living in one's own house is commonly expressible as an annual rental, and this is usually included in income, but an analogous satisfaction from contemplating one's pictures or using one's furniture is not. Again, periodicity is essential, and a year is the common basis, though the flow may be quite uneven, in fact, and even accruing unevenly over the year. Services performed for oneself which, if performed for others, would bring in an income are not usually included, *e.g.,* painting one's own house, or a wife's domestic services. This is extended to exclude other mutual services within a group; *e.g.,* a club or co-operative society. There is a field of difficult distinction from capital; *e.g.,* a series of profits from transactions which, taken singly, are regarded as capital transactions (sales of houses, lands or securities) may constitute an income in certain circumstances. And "net income" involves considerations of long period wastage in the producing agent—a coal-mine, or 99 years' lease, or a building. The term "national income" is subject to numerous special conventions.

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(J. S.)

INCOME BONDS, bonds bearing a stipulated interest rate but upon which no interest is paid unless there is sufficient income for this purpose after all other fixed charges have been met. The non-payment of interest on an income bond when the earnings are not sufficient for this purpose does not constitute a default and does not give the bondholder the right to sue. Income bonds are almost invariably brought about during reorganizations of businesses, whereupon they may be accepted by holders of old defaulted bonds or offered for sale to the general public to raise cash. Income bonds may be secured as to principal by a mortgage, in which case the mortgage would be junior to the others; or by collateral; or may be strictly of the debenture type. The interest may be either cumulative or non-cumulative. It is usually the practice to use available income to pay a portion of the interest if there is not enough to pay the full rate. Owing to the uncertainty of interest payments income bonds generally rank very low as investments and are usually regarded as just above the preferred stock of the corporation. They are often bought at a low price by unprincipled persons and sold at par or above to uninformed buyers upon the false representation that the name "income bonds" means bonds upon which an income is guaranteed, than which nothing could be further from the truth.

INCOME TAX: ECONOMIC ASPECT. The most important economic aspect of income taxation is naturally its effect upon the capacity and psychology of the taxpayer, for these may affect his willingness to work and to save, and thus have important reactions upon national production. Any general discussions about the economic effects of a particular tax are usually idle unless a comparison is made with the effects of alternative forms of taxation, designed to raise a given sum. Again, discussions of the effects of taxation in whatever form to a particular amount, are of only limited value unless the effects are brought into contrast with the effects of the expenditure of the money upon the individual and the community. It may be, for example, that the expenditure of a certain fund derived from taxation has, in its general application to the improved organization of society, an aggregate value of additional production or economic satisfaction in improved social relationships, or in peacefulness and law and order, or in industrial organization measured by an amount 2x. Examination of the effects of the taxation to produce this sum may indicate a depressing effect upon producing agents measured by an amount x. The taxation as a whole may, therefore, yield a net profit to the community, but whereas the burden is often obvious and vocal, the benefits are generally diffused, intangible and silent, so that most discussions upon the burdens of taxation which deal only with the one side are inconclusive as a contribution to its economic aspects. But it must not be supposed that a mere quantitative surplus of benefits over burdens is a sufficient test, if the burden falls entirely upon one section and the benefits go entirely to another. Redistribution of wealth *per se* by way of taxation, lies rather beyond the field of economic science, and in that of politics. Three aspects have to be present then in discussing the economics of taxation. What is the alternative? How great is the benefit? Who gets it?

Income Tax and Prices.—With these reservations in mind, the most important economic aspect of income tax to be considered is its effect upon prices. The common business view is that an increase in income taxation tends to increase prices and vice versa. The generally accepted view of the economist is that income tax does not enter into prices. A tax on every barrel of beer enters into price, a tax upon the profits on beer does not. There is a distinction between the "incidence" of taxation and the "effects," the most recent and exhaustive examination of which was made by the Colwyn committee in their report on national debt and taxation: "In general usage the term 'incidence' covers not only the initial burden of a tax, but also the whole range of consequential effects. Economists, however, have given it a narrower meaning. For them 'incidence' is only concerned with the question on whom the more immediate burden of the tax as a tax rests. This is the first thing to be decided about any tax. It is to be distinguished from the question of further effects, which may be exceedingly important. For instance, the burden of

a tax may rest upon an employer, and in consequence he may cut down his staff; in such a case the effects of the tax may be more serious to the employees than to anyone else, but the incidence of the tax is not said to be upon them." In a full examination of the two current views, according to one of which a general income tax cannot be shifted by the person on whom it is laid, while according to the other it "can be shifted, and is in fact shifted, in the form of an addition to price," the committee concluded that "if and so far as the latter view is correct, the income tax must abandon part of its chief claim to virtue as a method of taxation. However carefully graduated, it can no longer be said to satisfy the canon of ability to pay, if the burden is indiscriminately shifted; if this happens, no one can tell how much tax he really suffers. This implication is usually not developed by those who advocate the view that income tax is added to price. They more often pursue the argument that income tax is responsible for raising prices, and is therefore a potent factor in depressing trade."

The committee's final conclusion was that the broad economic argument was true over practically the whole field and over practically the whole of the time, any exceptions being local or temporary and insufficient to invalidate it. The main feature of the doctrine is that where there is no profit there is no tax; the tax comes out of the margin of profit, and does not enter into cost. At the point at which, in economic parlance, the demand price meets the supply price, the supply price only covers costs in that part of the supply which it is just worth while to maintain. At the same time it is agreed that the "effects" as distinct from incidence of income tax, may, on balance, be repressive to production. But whether production so diminished results in a higher price level with a gold standard is a matter of rather refined economic analysis, which is not capable of ultimate solution. In the first instance there is the effect upon enterprise. One view is that a high rate of taxation lessens the willingness to work for a diminished reward, and also lessens the willingness to take risks. It is probable that there is some truth in this point of view for short period changes, but there is no absolute relation between the amount of work the average man is prepared to do and the amount of the real reward that he enjoys. For there have been very wide variations as between different countries in the reward, without any corresponding variation in the amount of effort given, and in a particular country, England, for example, it cannot be said that willingness to work has varied directly with the real reward for effort, which has multiplied fourfold in the last 100 years. Indeed, strong counter tendencies are always in operation and high taxation may often lead to greater effort in order to maintain the net standard of living at the original point. It is probable that sudden *changes* in taxation do affect the willingness to take risk directly, but "tolerance" sets in rapidly.

Income Tax and Saving.—In regard to the effect upon savings, it is obvious that a large sum taken in taxation diminishes the fund *out of which* saving takes place. It may be that the whole of the taxation is drawn from money that would otherwise be spent, and that savings are kept intact, but there is strong evidence for the view that taxation trenches upon both saving and spending, though in different proportions, according to the psychology of the individual. It has to be remembered that there is no single simple motive for all saving of all kinds and that a high net rate of interest for certain classes of saving can diminish the effort that is being made, inasmuch as a given total sum can be more easily reached. On balance, however, when consideration is given both to scope and to incentive, high taxation diminishes savings.

Whether high income taxation is worse in this respect than other forms of taxation for an equivalent amount is a nice point dependent upon the industrial habits and the psychological character of the people. So far we have considered the effect upon individuals acting on their personal volition, but a large part of modern industry is conducted by corporate bodies actuated by rather different motives. In this instance, income tax which is levied upon the whole profits is said to diminish the amount put to reserve, and, therefore, the funds available for further extensions. Probably this is the case, but there is no corresponding effect on incentive, for income tax, whether high or low, is passed on as a deduction from dividends, and the conscious effort of profit-making by the management is not usually touched by its amount. Income tax in a particular country has important economic influences upon other countries, inasmuch as the income of its people is never entirely self-contained; it draws income from beyond its borders to its nationals living within them, and it makes income within its borders which goes to people living beyond them. Two separate income tax systems in two countries having economic relations of this kind have most important reactions of an economic character. The problem of double taxation is so far only partly solved. It acts as a kind of artificial barrier in the international flow of capital, inasmuch as funds are prevented from flowing *from* the point where they are most abundant *to* the point where they are most needed. Contrary to popular impression, the real burden of double taxation is on the borrowing country, and not upon the lender, although the latter often appears to suffer it.

In elaborating methods of income taxation, the pursuit of ideals connected with justice as between individuals with widely different incomes may have to be reconciled with disadvantages of a social or industrial character. Thus, highly progressive rates may be "fair," but they may also be socially inexpedient, especially where they trench upon the fund for savings, and the population with smaller incomes, who reap the benefits of the progression, are not prepared to make good the deficiency, or are unaware of its existence. A fall in the national fund of savings must ensue, with economic reactions upon total productivity.

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INCOME TAX: IN PRACTICE. War provides a fertile soil for the roots of taxation. Perhaps the earliest income tax in England is to be found in the old land tax. After the Revolution the war with France led to a considerable sum of revenue being raised on the land. The land tax imposed in 1692 continued to draw supplies from this source, but in addition it imposed a tax of "4 sh. in the £ according to the true yearly value" of any "estate in goods, wares, merchandise, or other chattels, or personal estate whatsoever within this realm." In addition, it imposed a similar tax upon the profits and salaries of all persons having any office or employment of profit, except naval and military officers. It is not known how the duty on personal estate was levied, or what was its proportion in the quotas of the total land tax raised. All that is known is that over the course of years the yield of the tax on personalty dwindled almost to nothing.

Pitt's Income Tax, 1799.—A century later the financial necessities of the further wars with France, the Napoleonic Wars, led to the return to the income tax as a financial instrument. Ignoring an attempt to link the old assessed taxes on carriages, horses, menservants, etc., to the amount of the taxpayer's income in the form of duties, which were called the "triple assessment," a regular income tax was imposed in Great Britain in 1799 by William Pitt. The taxpayer was asked to state his income from all sources but incomes under £60 were exempt. The general rate of tax was 10%, which was applied to all incomes of £200 and upwards. For incomes between £60 and £200 the rate was graduated, while certain deductions were allowed for children and repairs to property. Some of these refinements of taxation proved, however, to be before their time. Abused by the taxpayer they were erased from the statute book and revived only in modern times. After the Treaty of Amiens in May 1802 this early statute was repealed.

When war was resumed in 1803 a new income tax act was enacted, framed on lines which were so soundly based as to remain, in essence, the framework of the modern law. Not only were the sources of income divided into the five great classes which

remain with us to-day as schedules A, B, C, D and E, but the principle of collection of the tax at the source was introduced. The former statements of total income were abandoned; in their place were required statements of income from particular sources. So potent was the new principle of collection at the source that the yield of the tax, notwithstanding the reduction of the rate from the 10% of 1799 to a rate of 5%, was almost equal to that under the earlier act. During the century and a quarter that has since elapsed, this principle has continued to be the mainstay of the productivity of the tax.

Peel's Income Tax, 1842.—After Waterloo the tax was repealed, but it was revived again by Sir Robert Peel in 1842 as part of his scheme of the reorganization of the national finances. Peel's act of 1842 levied the duties under the five familiar schedules, and the tax in its general structure, principles and scheme of administration closely resembled Pitt's act of 1803 as modified by an act of 1806, in which the deductions for children and the allowances in respect of repairs to property were withdrawn.

Apart from the exclusion of Ireland from the scope of the tax, an omission which was rectified in 1857, the tax as set out in Peel's act was not seriously modified until quite modern times. In 1842 the exemption limit was raised to £150, but when in 1853 the tax was made effective throughout the United Kingdom it was reduced to £100. In 1876 the old limit of £150 was restored and increased in 1894 to £160, at which figure it remained until the outbreak of the World War led to its reduction in 1915 to £130. The rate of tax has varied greatly. At the date of its repeal in 1815 it was 2s. in the pound. In the second half of the 19th century its general level may be said to have been from 6d. to 8d., although it was as low as 2d. in 1874 and 1875. The South African War brought the rate beyond the one shilling mark, while the World War pushed it up to a maximum of six shillings. Ten years of peace have brought it back to four shillings.

Graduation.—Graduation in some degree or other has almost always been a characteristic of the tax. During its earlier years it was of little effect, inasmuch as its application was restricted to the lower incomes, more or less as a practical necessity. A proposal to extend it to the higher incomes evoked from Lord Brougham the opinion that such a system would be a gross and revolting absurdity. Harcourt in 1894 effected a slight extension of the graduation but he could not be induced to proceed beyond incomes of £500. A similar attitude was adopted throughout the 19th century towards the principle of differentiation, that is, the principle of charging earned income at a lower rate than that applied to investment income. Select committees in 1851 and 1861 were hopelessly divided in their views upon this method of relief. It was left to Asquith to appoint the select committee of 1906 to consider the practicability of both graduation and differentiation. Upon the recommendations of this committee both principles found a final acceptance.

Graduation and Differentiation, 1907.—The Finance Act of 1907 gave earned income in the enjoyment of a taxpayer whose total income did not exceed £2,000 immediate relief of one-quarter of the normal rate of one shilling. Later acts have so refined upon the principle that it is now firmly embedded in the British income tax system. The principle of graduation came into its own in the same act of 1907 through the introduction of a super-tax upon incomes over £5,000, which was imposed as an additional tax of 6d. in the £ on the amount by which the income exceeded £3,000. Here also later acts have changed the weight and range of the graduation but have left the principle inviolate.

In 1918 all the numerous income tax enactments were consolidated into one statute in the Income Tax Act, 1918, which came into force on April 6, 1919. A comprehensive examination of the whole income tax system was conducted by the Royal Commission on the Income Tax in 1920. Following its recommendations changes were made in the method of granting the differentiation relief and in applying the principle of graduation. The relief introduced in 1916 in respect of double taxation, so far as it arose from dominion income taxes, was put upon a permanent footing. The commission also made recommendations in a number of minor matters, some of which have been duly incorporated into the law and others of which, including a resolute attempt to deal with the evils of evasion, still remain to be fully implemented.

THE UNITED KINGDOM

The British tax has been developed gradually in detail, reflecting at various stages in its history the growth of opinion, equality and justice, until to-day it is a financial instrument of great intricacy, subtlety and power. None the less the broad scheme of the law has remained unchanged in many essential characteristics for nearly a century. Flexibility is provided by the annual re-enactment of the whole income tax code through the medium of the continuation clauses in the yearly Finance Act, which serves also as the medium for amendments, extensions and declarations of the construction of the law.

The salient characteristics of the tax may be grouped under nine heads.

Scope.—The tax extends, broadly speaking, to all income arising in the United Kingdom by whomsoever it may be enjoyed, and to all income accruing to persons residing in the United Kingdom without regard to the place where it may arise. The tax walks, so to speak, upon the two legs of origin and residence. It therefore leads to the problems of double taxation. Provisions for relief against this defect, resting upon the principle of division of the total tax between the two taxing jurisdictions, exist as respects income liable both to United Kingdom tax and tax in any of the British dominions overseas, except in the case of the Irish Free State, where the relief is based upon the principle of charging tax only in the country of residence. Further provisions for double taxation relief also exist as respects profits on shipping. One code of laws applies, generally speaking, to individuals, partnerships, companies and other bodies of persons. In the main the tax is a tax on the incomes of individuals, nearly 90% of the total actual income brought into charge being distributed among individuals who are actually resident in the United Kingdom.

Administratively, the tax is levied under five separate categories or schedules of income. But this is a matter of machinery only, and the tax borne by individuals is in reality only one tax on the total income of the individual, and not, as is often thought, a series of taxes on the separate sources of his income.

Definition of Income.—In respect of the ownership of lands, houses, etc., in the United Kingdom (schedule A) the measure of income is the annual value, which means broadly the rent at which the property is let, or is worth to be let by the year (the tenant bearing his usual rates and taxes), less certain statutory deductions for repairs. Relief may also be obtained on an average cost of additional expenditure on repairs, maintenance, insurance and management. Annual value is determined periodically.

In respect of the profits on occupation of land in the United Kingdom (schedule B), the measure of profit is made on a conventional basis, which assumes profits bearing, in the case of land used mainly for the purposes of husbandry, a fixed relation of equality to the annual value of the land occupied. In other cases it is a relation of one-third of the annual value.

No definition is necessary in the case of interest on public funds (schedule C). Income (schedule D) from dominion and foreign securities (other than public debts) or from foreign and dominion stocks, shares and rents is normally liable on the full amount of the income, less charges which must necessarily be met abroad.

There remain the two main classes: income from trades or professions (schedule D) and income from employments (schedule E). Here the broad rule is that the income to be charged is the excess of the gross receipts over the expenses incurred wholly, necessarily and exclusively in earning the profits or income in question.

The British income tax, in the words of one of the judges, "is a tax on income," and this is strictly construed by the exclusion from the scope of the tax of profits which are in the nature of capital gains; in this respect the British system is strikingly different from that in force in the United States of America. In consequence, the law prohibits, in arriving at profits for income tax purposes, any deductions in respect of capital charges, lost

income or losses unconnected with the business. Provision is, however, made for a deduction from the statutory profits liable to tax of an allowance in respect of the depreciation of machinery or plant.

Computation of the Statutory Income.—Subject to certain exceptions, the statutory income liable to be taxed *for* any year of assessment (a year running from April 6 to the following April 5) is—in the case of the variable incomes derived from trades, manufactures, professions and employments (except those of wage earners), and also in the case of income from investments (other than property in the United Kingdom) received without deduction of tax—the actual income of the preceding year. In the case of business profits, the trading year usually replaces the fiscal year. Income from property (schedule A), from the occupation of lands (schedule B), from interest on public funds (schedule C), from wages, and all income taxed by deduction under the principle of collection at the source (*vide* Collection of the Tax) is computed, when ascertaining the statutory income of the year of assessment, at the amount of the income assessed for, or earned, or taxed by deduction (as the case may be) in that year.

Computation of the Tax.—For the year 1928–29 income tax is charged at a standard rate, and, in the case of an individual whose income exceeds £2,000, at a rate or rates exceeding the standard rate in respect of fixed sections of income above that amount. For 1927–28, the scale of these rates, known up to 1927–28 as rates of super-tax, but after that year as rates of sur-tax, is set out under rates and yield of tax.

Differentiation.—This is the principle of granting a relief from the full weight of the tax on earned income. Introduced in 1907, by means of a reduction of the normal rate of income tax, and changed in 1920 to the method of deducting from the earned income of an allowance of part of that income, subject to a maximum, the method in force from 1928–29 is as follows. From the tax computed at the standard rate is deducted an allowance of tax, at that rate, on one-sixth of the amount of the earned income, subject to a maximum deduction of the tax on £250.

Graduation.—This is the principle of charging a heavier rate of tax upon large incomes than upon small. From the inception of the tax, graduation in some form or other has been among its characteristics. From 1920–21 to 1927–28 inclusive, after deducting from the total of the statutory income from various sources the allowance in respect of earned income (*vide* Differentiation), there was deducted from the balance, called the assessable income, an aggregate of various personal allowances and deductions (*e.g.*, for self or self and wife, children, housekeeper, dependant relatives, etc.), leaving a balance called the taxable income. The first £225 of this taxable income was charged at half the standard rate, and the balance, if any, at the full standard rate. From 1928, the reliefs are granted in terms of tax, instead of in terms of income. In other words, from the total tax calculated at the standard rate on the aggregate statutory income is deducted tax, calculated at the standard rate, on the personal allowances and deductions. Further deductions of tax are made of (a) half the tax remaining chargeable, or half the tax at the standard rate on £225, whichever is the less, and (b) tax at certain defined rates on the amount of life insurance premiums, within fixed limits, and on the amount of income which has already borne dominion income tax.

If the system of graduation stopped at this point, the relevant curve would rise steeply until incomes in the neighbourhood of £2,000 were reached, but after that point it would flatten rapidly. To continue the graduation, rates of sur-tax (before 1928–29 the name was super-tax) are charged on sections of income above £2,000 in the case of individuals. Sur-tax is expressed to be a deferred instalment of income tax. It is normally payable on or before Jan. 1 following the end of the year of assessment for which it is payable. For administrative reasons, sur-tax is assessed and collected, under the aegis of the special commissioners of income tax, separately from the income tax. The effect of this system as a whole is to levy an effective rate of tax on each £ of the total statutory income of an individual, rising gradually from a fraction of a penny in the £ until the rate closely approaches a maximum rate represented by the sum of the standard rate of income tax and the highest rate of sur-tax.

The following table of the amount of income tax and super-tax and the effective rate of tax per £ of income on specimen incomes clearly illustrates the graduation of the tax in the case of married couples without children for the year 1927–28. It shows how the effective rate rises in the case of earned income from 2d. in the £ for a total income of £300 by gradual stages up to 9s. 7½d. in the £ on an earned income of £150,000. The rate for investment income rises from 2½d. for an income of £250 to 9s. 7½d. for one of £150,000. Plotted on a graph, these effective rates fall upon a very smooth line unbroken by any abrupt jumps.

GREAT BRITAIN: *Income Tax and Super tax. Married Couples Without Children, 1927–28*

Total income	If income all "earned" income		If income all "investment" income	
	Income tax (including super tax, if any)	Effective rate	Income tax (including super tax, if any)	Effective rate
£	£ s. d.	s. d.	£ s. d.	s. d.
250	..	..	2 10 0	2½
300	2 10 0	2	7 10 0	6
350	6 13 4	4½	12 10 0	8½
400	10 16 8	6½	17 10 0	10½
500	19 3 4	9	32 10 0	1 3½
600	32 10 0	1 1	52 10 0	1 9
700	40 3 4	1 5	72 10 0	2 1
800	65 16 8	1 7½	92 10 0	2 4
900	82 10 0	1 10	112 10 0	2 6
1,000	90 3 4	2 0	132 10 0	2 8
1,250	140 16 8	2 3	182 10 0	2 11
1,500	182 10 0	2 5	232 10 0	3 1
2,000	282 10 0	2 10	332 10 0	3 4
2,500	401 5 0	3 2½	451 5 0	3 7½
3,000	520 5 0	3 6	570 5 0	3 10
4,000	801 5 0	4 0	851 5 0	4 3
5,000	1,113 15 0	4 5½	1,163 15 0	4 8
6,000	1,463 15 0	4 10½	1,513 15 0	5 0½
7,000	1,838 15 0	5 3	1,888 15 0	5 5
8,000	2,213 15 0	5 6½	2,263 15 0	5 8
9,000	2,613 15 0	5 9½	2,663 15 0	5 11
10,000	3,013 15 0	6 0½	3,063 15 0	6 1½
15,000	5,138 15 0	6 10	5,188 15 0	6 11
20,000	7,388 15 0	7 4½	7,438 15 0	7 5½
25,000	9,763 15 0	7 9½	9,813 15 0	7 10
30,000	12,138 15 0	8 1	12,188 15 0	8 1½
40,000	17,138 15 0	8 7	17,188 15 0	8 7
50,000	22,138 15 0	8 10½	22,188 15 0	8 10½
100,000	47,138 15 0	9 5	47,188 15 0	9 5½
150,000	72,138 15 0	9 7½	72,188 15 0	9 7½

Collection at the Source.—Perhaps the most famous characteristic of the British tax is the principle of collection at the source. Under this principle the tax is obtained, whenever it is possible to do so, by deducting it before the income reaches the person to whom it belongs. The formal assessment is accordingly laid, wherever this course is possible, on each source of income by itself and on persons who are debtors in respect of income belonging to other persons. Power is given to the payer of income to deduct the appropriate tax from the payments made to the ultimate proprietors of that income. For instance, a limited liability company is assessed to tax at the standard rate on the whole of its profits, without reference to their ultimate destination. On paying interest to its debenture holders, or dividends to its shareholders, the company is entitled to deduct and retain tax at the standard rate on the interest paid or dividends distributed, and the investor thus receives his interest or dividend subject to this deduction of tax. It is estimated that approximately two-thirds of the net yield of the tax is collected at the source.

With the exception of tax collected at the source on interest on public debts, and on income from foreign dividends, etc., which is paid at or shortly after the time of payment of the income from which the tax is deducted, income tax contained in the main assessments for the year is due and payable on or before

Jan. 1 in the year of assessment; tax contained in additional assessments signed after that date is payable on the day after the date of signature. To this general rule there are, however, some other important exceptions. The tax charged on any individual or firm in respect of lands occupied for husbandry, or in respect of a trade, profession or vocation, and of most employments, is payable in two equal instalments, the first on or before Jan. 1 in the year of assessment and the second on or before the following July 1. Manual wage earners assessed half-yearly pay tax in respect of each half-year. Tax in respect of employments under the Crown is deducted (usually quarterly) at the source.

Administration.—The responsibility for assessment and collection of a very large part of the tax is laid upon local bodies of commissioners possessing certain property or other qualifications, which are appointed for certain cities and boroughs and for parts or all of a geographical county. The commissioners are independent of official control; they appoint their clerk, and (except in respect of certain areas or functions) assessors of taxes and collectors of taxes; on them falls the statutory duty of signing and allowing assessments made either by the assessor or the additional commissioners (the name given to those who make assessments on trade profits) and of hearing and determining appeals against such assessments. Fitted into this scheme is the officer of the Crown, known as H.M. inspector of taxes. In law his part is primarily to safeguard the interests of the revenue with strictly defined rights of intervention and objection at various stages of the formal procedure laid down by the statutes.

This broad scheme is honeycombed with exceptions. There are the special commissioners of income tax, each of whom, still independent of the revenue authority, is appointed by the Treasury. Then there are commissioners for the various public departments of State. The Bank of England and the National Debt Commissioners also act as commissioners. Again, all assessments on manual weekly wage earners which are for a half year only are made by H.M. inspector of taxes. The taxpayer normally charged by the district commissioners may, if he wishes, elect to be dealt with by the special commissioners, and even if he allows his assessment to be made by the district commissioners he may take an appeal against that assessment to the special commissioners.

During the past 50 years income tax has grown so much in importance and complexity that its efficient administration has compelled a considerable development of the methods of administration. In practice, the inspector of taxes carries out, with the full concurrence of the various bodies of commissioners, most of the duties that are vitally essential to the smooth-working efficiency of the machinery of administration. Nevertheless, the key functions of the district commissioners have been preserved throughout. In the absence of any detailed accounts or other evidence, it is the additional commissioners who determine the amount of the assessment upon business profits; even more important, the general commissioners retain their appellate functions and so stand in an independent and impartial position between the taxpayer and the representative of the revenue.

Rates and Yield of Tax.—In 1920–21 a new system of differentiation and graduation was introduced in accordance with the recommendations of the Royal Commission on the Income Tax of 1920. In 1927–28 the effective exemption limit was £135 of assessable income, or £162 in terms of earned income. For married persons these figures change to £225 and £270. The total number of individuals within the scope of the tax in 1925–26 was estimated at 4,600,000.

The standard rate of tax for the three years 1925–26 to 1927–28 was four shillings in the pound. For 1925–26 the total statutory income of persons liable to the tax for the new United Kingdom of Great Britain and Northern Ireland was estimated at £2,375,000,000. In 1926–27 the Exchequer receipt was £234,717,000 and it was estimated that the collection in 1927–28 would amount to £247,000,000.

The preceding figures relate to income tax alone and do not include the yield of the super-tax. The point at which liability to this tax commences is £2,000. The scale of rates of tax in force since 1925–26 is given below. In 1925–26 the number of individuals to be charged was estimated at 97,000, with a total income of £558,000,000. The estimated net super-tax payable for that year was £58,000,000.

Scale of Rates of Super-tax	*Rate in the £* s	d
On the first £2,000 of the income	nil	
On the next £500 (to £2,500)		9
On the next £500 (to £3,000)	1	0
On the next £1,000 (to £4,000)	1	6
On the next £1,000 (to £5,000)	2	3
On the next £1,000 (to £6,000)	3	0
On the next £1,000 (to £7,000)	3	6
On the next £1,000 (to £8,000)	3	6
On the next £2,000 (to £10,000)	4	0
On the next £5,000 (to £15,000)	4	6
On the next £5,000 (to £20,000)	5	0
On the next £10,000 (to £30,000)	5	6
On the remainder (above £30,000)	6	0

BRITISH DOMINIONS

Taxation according to faculty, that is, direct taxation, based upon the principle of ability to pay, so early established in Great Britain, was naturally carried overseas to the various British possessions. It is not therefore surprising to find income taxes firmly established to-day in South Africa, in the provinces and protectorates there as well as in the Union, in Canada, where also there are provincial income taxes as well as the Dominion tax, Australia, where a similar widespread use of the tax is made, New Zealand, India and in most of the West Indies. Naturally also there is a strong family resemblance between the various income tax systems, most of them having been strongly influenced by British law. Income is usually defined broadly but comprehensively, but there is a general absence of the schedular arrangement of the British tax. Broadly speaking, the year preceding the year of assessment is favoured as the basis of computation of the income to be charged. The minimum amount of income exempted from tax varies, but personal allowances to the taxpayer, his wife and children are general. Graduation of the tax is a common feature, and the device of an additional tax, or super-tax, is freely adopted. In some dominions, graduation is extended *also* to companies. The methods of graduation range from simplicity to formulae of great complexity. Differentiation in favour of earned income is found, but is not widely favoured. Taxation at the source is a frequent feature, especially in respect of dividends paid by companies. The rates of tax vary widely, as may be expected from the range of budget requirements of communities of different populations and varying degrees of wealth. As a rule, the income tax in the British dominions overseas is one tax levied upon the base of the total income, irrespective of the nature of the components of that income. In this respect, the British tradition is followed.

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INCOME TAXES IN EUROPE

Income taxes of various kinds have been adopted by all the European States except Switzerland (where, however, several cantons levy such taxes). The following is a brief outline for 1928 of those imposed by France, Germany and Italy.

France.—France levies seven subsidiary income taxes (on individuals and companies, generally on income arising in France) and a general income tax (on the aggregate income of individual residents). The income year is, in general, the preceding calendar (or business) year.

(1) *Industrial and Commercial Profits Tax* (*Impôt sur les bénéfices industriels et commerciaux*) (excluding mining profits, *see* [7]), with special treatment for insurance and financial under-

takings. Rates—for profits up to 50,000 fr. lump sums are payable, ranging from 22·50 fr. (profit under 800 fr.) to 6,750 fr. (profit between 45,000 fr. and 50,000 fr.); for profits exceeding 50,000 fr., 15%; insurance and financial undertakings, 20%.

(2) *Agricultural Profits Tax* (*Impôt sur les bénéfices de l'exploitation agricole*), on rental value, increased by 75% and multiplied by 3 (or 2·5 for wheat-lands, or 5 for market-gardens, etc., and woodlands worked commercially), or on the preceding year's profit, if less. Exemption limit, and abatement, 2,500 fr., with partial abatements for the income between 2,500 fr. and 8,000 fr. Rate, 12%.

(3) *Salaries, etc., Pensions and Annuities Tax* (*Impôt sur les traitements, etc., salaires, pensions et rentes viagères*). Exemption limit, and abatement, 7,000 fr., with allowances for wife, children and dependants and partial abatements for the income between 7,000 fr. and 40,000 fr. Rate, 12%.

(4) *Non-commercial Professional Profits Tax* (*Impôt sur les bénéfices des professions non-commerciales*). Exemption limit, abatements and rate, in general, as in (3).

(5) *Immovable-property Tax* (*Impôt foncier*), comprising: (*a*) *Buildings Tax* (*Contribution foncière des propriétés bâties*), on rental value, less allowance for maintenance and depreciation—rate, 18%; (*b*) *Land Tax* (*Contribution foncière des propriétés non bâties*), on rental value (less allowance for upkeep and exhaustion) increased by 75%—rate, 18%.

(6) *Dividend and Interest, etc., Tax* (*Impôt sur les revenus des valeurs et capitaux mobiliers*), comprising: (*a*) *Taxe sur le revenu des valeurs mobilières, sur les primes de remboursement et les lots*, on dividends, debenture interest, premiums, etc., payable by French companies and municipalities—rate, 18%; (*b*) *Taxe sur les valeurs étrangères*, on income from foreign shares, etc., and from foreign Government securities—rate (if the shares, etc., are introduced *into* France by the issuing companies, etc.), 18% (if the securities are of foreign Governments, or are introduced into France by individuals and not by the companies, etc., concerned), 25%; and (*c*) *Taxe sur le revenu des créances, dépôts et cautionnements*, in general on deposit and mortgage interest—rate, 18%.

(7) *Mine Levy* (*Redevance proportionnelle des mines*), in general on all mines (except salt mines) in France, in respect of (*a*) their area and (*b*) proceeds from the winning and exploitation of coal and minerals. Assessment in (*b*), for a joint-stock company, is based on the dividends distributed; for other cases, on the net profit. Rates, 1·8 fr. per hectare (about 2½ ac.) and 25% on the dividends or profit assessed.

(8) *General* (*or Supplementary*) *Income Tax* (*Impôt général sur le revenu*), including, besides income chargeable under (1) to (7), that from French Government securities and from abroad. (Foreigners with habitual residence in France are assessed upon *seven times its rental value*, unless their income from French property, business or profession exceeds that amount.) Exemption limit, and abatement, 7,000 fr., with allowances for wife, children and dependants. Rates range, in a scale of 25 "steps," from 1·20% on the portion of income between 7,000 fr. and 20,000 fr. to 30% on the portion above 550,000 francs. (Tax so computed is increased by 25% if the taxpayer is over 30 years old and unmarried or divorced, without a child or dependant; or by 10% if over 30 years old and at least two years married, without a child or dependant.)

In (1) to (5) and (8), in addition to the income allowances for children and dependants already mentioned, further allowances under those heads are made as deductions from the tax computed.

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Germany.—Since 1920 the taxation of income has been reserved to the Reich, which levies:

(1) *Income Tax* (*Einkommensteuer*) (on individuals, including members of ordinary partnerships), assessed on the aggregate income of residents in Germany and on the German income of non-residents. The income year is, in general, the preceding calendar (or business) year. Changes during the income year in the value of business buildings and movable property are taken into account in computing income. Wages are taxed through deduction by the employer. Exemption limit, in general, R.M. 1,300, with additions for wife and children; abatement, R.M. 720 (restricted to incomes up to R.M. 10,000), with allowances for wife and children. Rates—incomes up to R.M. 8,000, and all wages, 10%, less 15% reduction (not to exceed R.M. 24); incomes over R.M. 8,000, from 10% on the first R.M. 8,000 to 40% on excess over R.M. 80,000; non-residents' income, if not from agriculture, business or profession, 10%. (If total income does not exceed R.M. 20,000, a partial set-off of income tax is made for dividends, etc., from companies liable to corporation tax.)

(2) *Corporation Tax* (*Körperschaftsteuer*) (on joint-stock concerns), in general with the same scope, income year and treatment of changes during the income year in the value of business buildings and movable property, as the income tax. Rates—in general, 20%; for certain banks, co-operative societies, etc., 10%; for private limited companies and co-operative societies, with capital or assets not exceeding R.M. 50,000, from 10% on the first R.M. 8,000 income to 30% on excess over R.M. 28,000 (but the maximum rate on their total income is 20%).

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Italy.—Italy levies three subsidiary income taxes (on individuals and companies) and a general income tax (on individuals), with a bachelors' tax (partly an income tax).

(1) *Land Tax* (*Imposta sui terreni, Imposta fondiaria*), distinct from the agricultural profits tax (*see* [3], *Class B*) and assessed on rental value. Rate, 7½%.

(2) *Buildings Tax* (*Imposta sui fabbricati*), on rental value (less allowance for repairs, etc.), except of buildings used industrially, the income from these being dealt with in (3), *Class B*. Rate, 7½%.

(3) *Movable Property Income Tax* (*Imposta sui redditi di ricchezza mobile*), on income not charged to (1) or (2), arising in Italy or accruing abroad to an Italian resident (foreign dividends and interest, and interest on certain loans contracted abroad since 1922 by Italian companies and public authorities, being exempt). The income year is, in general, the preceding year to June 30 or preceding business year. Investment incomes and salaries, etc., are taxed by deduction. The tax comprises five classes:

Class A, investment income—rate, 20%. *Class B*, business, mining and agricultural income—exemption limit (total income from *all* sources): (1928) 1,000 l.; (1929 *et seq.*) 2,000 l.—abatement: (1928) 400 l. (incomes up to 3,000 l.); (1929 *et seq.*) from 1,000 l. (incomes between 2,000 l. and 2,100 l.) to 200 l. (incomes between 2,400 l. and 2,500 l.)—rate (1928) 16%; (1929 *et seq.*) 14% (agricultural income is charged *half* these rates). *Class C*, income from professions or arts—exemption limit and abatement, as in *B*—rate (1928) 14%; (1929 *et seq.*) 12%. *Class C2*, salaries, pensions, annuities, etc. (other than as included in *D*)—exemption limit, as in *B*—abatement: (1928) 240 l. (incomes between 1,000 l. and 1,120 l.) or 160 l. (incomes between 1,120 l. and 1,280 l.); (1929 *et seq.*) as in *B*—rate, 9%. *Class D*, salaries, pensions, etc., from the State and certain public bodies—exemption limit, as in *B*—abatement; (1928) 100 l. (incomes up to 2,000 l.); (1929 *et seq.*) as in *B*—rate (1928) 9%; (1929 *et seq.*) 8%—in the case of wages of *workmen* employed by the State and certain public bodies the rate is 4%.

(4) *General* (*or Supplementary*) *Income Tax* (*Imposta complementare globale progressiva sul reddito*), on residents (including foreigners living in Italy for at least one year), for all Italian income and the portion of their foreign income enjoyed (*goduto*)

in Italy—and on all residents abroad, for all Italian income. The income year is in general as in (3). Five per cent (limited to 3,000 l.) is deducted for each child or dependant (excluding wife). Exemption limit, 6,000 l. (before allowing for children, etc.) or 3,000 l. (after allowing for them). Rates generally range, in a much subdivided scale, from 1% on incomes between 3,000 l. and 3,025 l. to 10% on incomes exceeding 995,000 l.

(5) *Bachelors' Tax* (*Imposta personale progressiva sui celibi*), on bachelors (except, *inter alia*, foreigners and Catholic clergymen) between 25 and 65 years old, is in general a lump sum (35 l., 50 l., or 25 l., where the ages are between 25 and 35, 35 and 50, 50 and 65 respectively) plus one-fourth of the general income tax (*see* [4]) due by the taxpayer.

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UNITED STATES

Although taxes on gains and profits derived from personal ability as distinguished from property—so-called "faculty" taxes—were employed in the American colonies before the middle of the 17th

	1913	1916	1918	1921	1923	1925	1926
Personal income tax							
Total number of returns*	357,598	437,036	4,425,114	6,662,176	7,698,321	4,171,051	4,138,092
Per cent of population making returns	0·37	0·43	4·27	6·28	6·94	3·60	3·52
Total net income returned*	$3,900,000,000	$6,298,577,620	$15,924,639,355	$19,577,212,528	$24,840,137,364	$21,804,576,403	$21,958,505,649
Total tax returned	28,253,535	173,386,694	1,127,721,835	719,387,106	663,651,505	734,555,183	732,470,790
Average tax per individual	$79.01	$396.73	$254.85	$107.98	$86.21	$176.11	$177.01
Average rate of tax:							
Incomes							
$1,000-$2,000	..	..	1·19%	0·81%	0·49%	0·096%	0·10%
$5,000 $10,000	..	0·61%	4·34%	2·90%	2·04%	0·552%	0·52%
$25,000 $50,000	..	1·41%	13·32%	11·53%	7·67%	5·94%	5·77%
$100,000 $150,000	..	3·48%	33·68%	32·00%	10·85%	13·87%	13·66%
$1,000,000 and over	..	11·09%	64·65%	63·50%	23·53%	15·83%	16·56%
All classes	0·725%	2·75%	7·08%	3·67%	2·67%	3·35%	3·34%
Normal rate:							
Under $4,000	1%	2%	6%	4%	4%	1½%	1½%
$4,000 $8,000	1%	2%	12%	8%	8%	3 %	3 %
Over $8,000	1%	2%	12%	8%	8%	5 %	5 %
Maximum surtax rate	6%	13%	65%	65%	50%	20 %	20 %
Incomes under $5,000:							
Total returns %	..	36·60	89·17	92·10	91·87	80·18	78·37
„ net income returned %	..	9·92	59·00	67·50	66·29	41·64	39·77
„ tax %	..	0·45	12·84	12·90	12·21	1·89	1·81
Incomes over $100,000:							
Total returns %	..	1·54	0·10	0·035	0·056	0·23	0·234
„ net income returned %	..	29·47	6·22	2·37	3·67	10·59	10·86
„ tax %	..	73·11	41·66	28·11	31·76	48·84	50·87
Personal exemptions:							
To individual	$3,000	$3,000	$1,000	$1,000	$1,000	$1,500	$1,500
„ "head of family"	4,000	4,000	2,000	2,500**	2,500**	3,500	3,500
For each dependent	..	..	200	400	400	400	400
Corporation tax							
Total number of returns	316,909	341,253	317,579	356,397	398,933	430,072	455,320
Returns showing taxable income	188,866	206,984	202,061	171,239	233,339	252,334	258,134
Returns showing no taxable income	128,043	134,269	115,518	185,158	165,594	177,738	197,186
Total net income reported†	$4,714,000,000	$8,765,908,984	$8,361,511,249	$4,336,047,813	$8,321,529,134	$9,583,683,697	$9,673,402,889
Rate of tax	1%	2%	12%	10%	12½%	13%	13½%
Total tax returned	$43,127,740	$171,805,150	$653,198,483	$366,443,621	$937,106,798	$1,170,331,206	$1,229,797,243
War and excess-profits tax returned	..	..	2,505,565,939	335,131,811	..	..	..
Total corporation taxes	$43,127,740	$171,805,150	$3,158,764,422	$701,575,432	$937,106,798	$1,170,331,206	$1,229,797,243
Grand total—individuals and corporations	$71,381,275	$345,191,844	$4,286,486,257	$1,420,962,538	$1,600,758,303	$1,904,886,389	$1,962,268,033

*Including non-taxable returns; *i.e.*, returns showing personal exemptions in excess of net income. The number of non-taxable returns and the net income shown on such returns for each year were:

Year	*Number of Returns*	*Net Income*
1916	74,066	$ 261,344,646
1918	1,032,251	2,031,863,365
1921	3,072,191	6,167,527,958
1923	3,428,200	7,342,753,945
1925	1,669,885	4,403,357,041
1926	1,667,102	4,535,873,077

†Without deduction for deficits shown on returns of corporations reporting no net income.
**For net incomes of $5,000 and over, this exemption was reduced to $2,000.

century, no successful use of the general income tax was made in the United States until the Civil War; and the income taxes then adopted were soon thereafter repealed, or fell into practical disuse. The demand for effective income taxation, however, showed great vitality. It kept moribund income tax laws on the statute books in several States; led to abortive experiments with the tax, particularly in the '40s and '90s; and finally in 1909 resulted in the adoption of a Federal excise tax "with respect to the carrying on or doing business" by corporations, equivalent to 1% of the annual net income over and above $5,000. This proved to be in substance an effective income tax.

State Income Taxes.—In 1911 the State of Wisconsin adopted a general income tax law applicable to individuals, partnerships and corporations. The practical success of this tax encouraged other States to adopt similar laws or to vitalize the administration of unsuccessful income tax laws already on the statute books; and although a few States either repealed or rejected the tax, in 1927 14 States had income taxes. Of these States, nine taxed the income of both individuals and corporations; three taxed the income of corporations only; and three taxed only personal incomes. The adoption of income taxes by the States has been largely for the purpose of replacing the unsatisfactory personal-property tax (particularly on intangible personal property) and the so-called corporation franchise tax. The newer State income taxes are generally administered by State or central authority, but provide for the return of a substantial portion of the tax to the county or local governments. There is an increasing tendency to assess the tax on the basis of the Federal income tax return and an effort is made by apportionment devices to exempt in whole or in part business or corporation income derived from property located and business transacted outside the State. Jurisdictional questions and multiple taxation thus constitute fundamental problems. The various State income taxes differ considerably in their exemptions and rates, but in general the rates are much lower than in the Federal tax, the highest rates—in North Dakota—ranging from 1% to 6% on incomes in excess of $10,000. However, the combined Federal and State taxes represent a serious burden on the larger incomes.

Federal Income Tax.—The foundation for the Federal system of income taxation was laid by the ratification, on Feb. 25, 1913, of the 16th amendment to the Constitution, which provides:—

> That Congress shall have power to lay and collect taxes on incomes, from whatever source derived without apportionment among the several States, and without regard to any census or enumeration.

The development of the Federal income tax is suggested in the accompanying tabular statement. Under the Revenue Act of 1928 the income tax carries exemptions of $1,500 for single individuals, $3,500 for heads of families and $3,000 for corporations with net income below $25,000. Under the personal income tax there is a further specific exemption of $400 for each child under 18 years and for every dependent incapable of self-support. Individuals are subject to a split normal tax of 1½% on the first $4,000 of taxable income, 3% on the next $4,000 and 5% on the remainder; and to a surtax ranging from 1% of the net income between $10,000 and $14,000, to 20% on the net income in excess of $100,000. Corporations are subject to a flat rate of 12%. Earned income (to the extent of $30,000) is taxed 25% less than unearned income, all incomes of $5,000 or less being considered as earned. Net income is defined as all income and gains "from whatever source derived," excluding certain specific classes of income and less certain specific deductions.

The most important characteristic of the Federal income tax is its striking productivity, the elasticity of which is illustrated in the table. The present exemptions are high compared with similar exemptions allowed in other countries, and only a small proportion of the population is directly affected by the tax. A large proportion of the tax is collected in the industrial or urban States and is thus marked by some unfortunate class and sectional characteristics. Compared with similar taxes of other countries, the rates on small and moderate incomes are low, while the rates on the larger incomes were, until the year 1925, unusually high. From the technical standpoint, the striking characteristics of the Federal tax are: The high ratio of surtax to normal tax; the marked difference in the normal tax applicable to individuals and corporations respectively; its failure, largely because of constitutional limitations, to reach interest on municipal bonds and other tax-free securities; the small use of "stoppage-at-source" (whereby the normal tax is withheld and paid direct to the Government by payers out of payments due to corresponding payees); and the credit accorded for income and profits taxes paid to foreign countries on income derived from sources therein. The American tax reveals a gradual approach to the British position on capital gains and losses, which are taken into account at a special rate of 12½%.

The complexity of the tax has, in the past, led to great delay in the settlement of the larger tax cases; and there was, in 1928, a disturbing congestion of appeals pending before the Board of Tax Appeals (a joint administrative and judicial tribunal, created in 1924, whose decision is final unless modified on appeal by the higher Federal courts). A continuing agency, the Joint Committee on Internal Revenue Taxation, was instituted by the Revenue Act of 1926 for the purpose of scrutinizing the application of the tax, checking refunds and devising methods of simplifying the income tax and of improving its administration. The committee concluded that a net income tax, applicable to the complex conditions of modern business, cannot be made "simple"; but, as a result of its investigations and the effective co-operation of the Treasury Department, the work of assessment has been greatly speeded up, final and conclusive settlements are being reached in a larger proportion of cases, the technical and administrative provisions of the law have been made more certain and the entire law re-arranged and clarified in the Revenue Act of 1928. While hundreds of the old "war cases" still remain to be settled by the Board of Tax Appeals or the courts, they are being rapidly cleaned up, and the income tax has now plainly entered the post-World War period of development.

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INCONVERTIBLE PAPER CURRENCY, the name given to paper money not exchangeable for gold at the demand of the holder, and therefore possessing no title of intrinsic validity. When a bank-note is exchangeable on demand for gold, as for example is the case with a Bank of England note, it is in effect a gold certificate and is therefore accepted by anyone, anywhere, at its face value. When a Government prints paper money, and refuses to honour it by converting it on demand into metallic money, the inconvertibility of such currency makes it unacceptable as good money, and it falls below face value to a point determined by the quantity issued. For a discussion of the important issues involved *see* BANKING AND CREDIT; CURRENCY; MONEY; PAPER MONEY.

INCORPORATION, in law, the embodying or formation of a legal corporation, brought about either by a general rule contained in such laws, *e.g.*, as the Companies Acts, or by a special act of sovereign power, *e.g.*, an incorporating statute or charter. The word is used also in the sense of uniting; *e.g.*, a will may incorporate by reference other papers, which may be then taken as part of the will, as much as if they were set out at length in it. This term is used similarly in the United States.

INCREASING RETURNS. In economics, a term used to describe a condition of production in which the application of additional capital and labour produces a greater proportionate return. Alfred Marshall, in his *Principles of Economics*, points out that while the part which nature plays in production shows a tendency to diminishing returns, the part which man plays shows a tendency to increasing returns. This leads to the following definition of the law of increasing return: "An increase of capital and labour leads

generally to an improved organization, which increases the efficiency of the work of capital and labour." Therefore, "in those industries which are not engaged in raising raw produce an increase of capital and labour generally gives a return increased more than in proportion." *See* ECONOMICS; DIMINISHING RETURNS.

INCREMENT VALUE DUTY. A duty called by this name was first imposed by the Parliament of the United Kingdom in 1910, the tax being one of the highly controversial measures contained in the Finance Act 1909–10. The rate of duty was one pound for every complete five pounds of the "increment value" of any land accruing (a) on a sale, or on a lease (other than a mining lease, and other than a lease for a term not exceeding 14 years); (b) on a succession on the death of the owner; (c) on a valuation made every 15th year in the case of land held by permanent corporations. Increment value was defined as the amount by which the site value of the land as defined in the Act should exceed the original site value as ascertained under the provisions of the Act as to valuation. The administration of the tax was entrusted to the Commissioners of Inland Revenue, who were directed "as soon as may be after the passing of the Act" to cause a valuation to be made of all land in the United Kingdom, showing (a) the "site value," and (b) the total value, of the land. The "site value" was to be the value of the land exclusive of buildings and other improvements, which were taken into account in estimating the total value. The "original site value" was the value of the land without improvements on April 30, 1909. The duty was not imposed in respect of agricultural land while the land had no higher value than its market value for agricultural purposes; or in respect of houses of a limited annual value when occupied by the owner; or in the case of agricultural land not exceeding 50 acres in area and £75 per acre in value, when cultivated by the owner. One half of the proceeds of the duty was appropriated for the benefit of local authorities in the United Kingdom in such manner as Parliament might determine. The increment value duty did not fulfil the hopes of the promoters of the legislation, and was, together with the other "land values duties," *i.e.*, the reversion duty and the undeveloped land duty, repealed by Section 57 of the Finance Act 1920. (*See* also LAND TAXES; UNEARNED INCREMENT.) (J. S. S.)

INCUBATORS. Boxes or rooms of special construction designed for the maintenance of a constant internal temperature, usually blood heat or room temperature. The commonest uses of such contrivances are in bacteriology, in the poultry industry and for the rearing of prematurely-born infants.

BACTERIOLOGICAL INCUBATORS

An incubator which will remain with 0·5° C of the adjusted temperature gives sufficiently accurate heat regulation for all ordinary bacteriological purposes. Bacteriological incubators, unlike bird incubators, do not require a continuous circulation of air nor is it necessary to provide any arrangement to moisten the contained air. The type in ordinary use is in the form of a rectangular box fitted with a double door in front and surrounded on all the other sides by a water-jacket; one or more shelves are fitted for the accommodation of flasks, racks of tubes, etc.

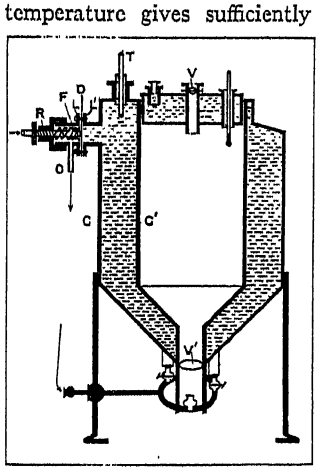


FIG. 1.—D'ARSONVAL INCUBATOR

D'Arsonval Incubator.—Some of the older incubators were cylindrical in form, that of d'Arsonval being the best known. This apparatus (fig. 1) consisted essentially of a cylindrical water-jacketed chamber c'. The water-jacket was heated by gas and there was a gas regulator controlled by the expansion of the water in the jacket. The water expanding by heat rose in the tube T; this increased head of pressure acted upon a rubber diaphragm D which was forced outwards thus obstructing the gas flow into the regulator. A great disadvantage of the cylindrical incubator was its inconvenient shape; there was also difficulty of access to the contents as compared with the modern types.

Hearson Incubators.—The incubators in use in most bacteriological laboratories at the present time are of the types shown in figs. 2 and 3; they may be heated by either an oil lamp or a gas burner or by electricity. The machines illustrated are made by Chas. Hearson and Co., Ltd., London.

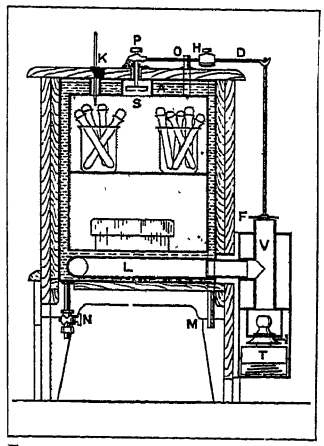
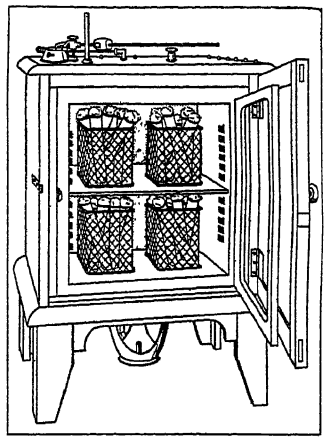


FIG. 2.—HEARSON'S BACTERIOLOGICAL INCUBATOR (HEATED BY A PETROLEUM LAMP)


FIG. 3.—HEARSON'S BACTERIOLOGICAL INCUBATOR (HEATED BY A GAS FLAME)

In the form heated by a lamp, for which, however, gas can be substituted, the incubation chamber is surrounded by a water-tank (fig. 2, A) and the lowest part of this is traversed by an in-going (L) and an out-going flue. The mode of regulation of the temperature is by means of a thermostatic capsule which operates the movements of a cap (F) over the main flue (V), and it is identical in its chief features with the method employed in the chicken incubator. The capsule (S) is situated in the upper part of the incubation chamber.

In the other form (fig. 3) for which gas is used exclusively, there are no flues traversing the water-tank. This latter is heated from its conical floor by a burner beneath the incubator. The heat regulation is controlled by a thermostat of the same nature as in the form of incubator just described, but instead of operating by lowering or raising a cap over a main flue, so as to direct the heated gases either through the water-tank if the temperature is falling, or through the main flue directly to the exterior if it is rising, it actuates a gas-governor, so that the flame itself is increased or diminished in size according to the needs of the incubator. The gas-governor (fig. 4) is fixed to the roof of the incubator. The horizontal arm (D) is the same that raises the cap (fig. 2, F) over the flue in the other form of incubator, but in this case it simply acts as the bearer of the sliding weight. Beyond its fulcrum (fig. 4, G) it is continued into a detent-like spur (B) which pushes down upon a button attached to a rubber diaphragm, when the thermostat within the incubator is expanded by a rise in temperature. The button thus forced down, more or less completely closes the inlet gas aperture, and so reduces or cuts off the gas supply to the flame. There is a by-pass to prevent the flame from going out completely, and the size of this can be adjusted by the screw (S).

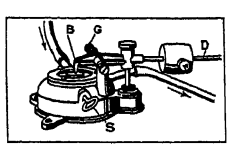


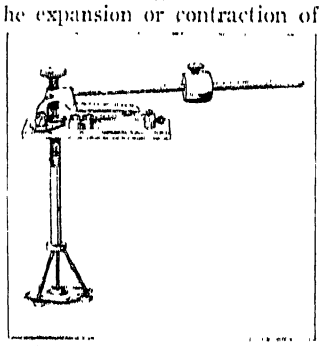
FIG. 4.—GAS GOVERNOR

In electrically-heated incubators the regulating mechanism is similar to that shown in fig. 2 except that the arm D is not connected to a cap F but is fixed to the upper member of a pair of electrical contacts as in fig. 5. Electrical heating units either heat a water jacket or are arranged as a series of resistance wires enclosed in a metal case occupying the position of the water jacket.

In bacteriological laboratories there are two standards of temperature, one chiefly for the culture of non-pathogenic organisms and the other for the pathogenic forms. The first standard of

temperature lies between 18° and 20° C, and the second between 35° and 38° C. But in hot countries, and even in temperate regions during the summer, the external temperature is much higher than the former of these two standards, with the result that many cultures, especially the gelatine ones, are spoiled. The difficulty is often partially overcome by running cold water through the incubator.

Hearson, however, has constructed a "cool biological incubator," in which by an ingenious device the expansion or contraction of the thermostatic capsule deflects a horizontal pipe (C) on the roof (fig. 6), through which runs cold water from an ordinary tap, in one of two directions. If it is deflected so as to open into the tube (D), the cold water passes into the tank (F), where it is warmed by a gas flame, and thence it passes into the water-jacket of the incubator. If it is deflected so as to open into the pipe (E), it then runs through the ice tank (B), containing broken ice, before passing through the water-jacket of the incubator. If it pours into neither of these pipes it then simply passes out through the pipe (H) to the waste pipe (N). By this device the temperature of the incubator can be kept constant at any desired point, even though it may be some 30° to 40° C below that of the external air.



BY COURTESY OF HEARSON & CO.

FIG. 5.—DIAGRAM ILLUSTRATING CONTACTS AND REGULATOR OF ELECTRIC INCUBATORS

Incubator Rooms.—In large laboratories where a considerable incubator accommodation is required incubator rooms are employed. These are small rooms lined by insulating material and fitted with shelves. The simplest and most satisfactory method of heating is by electricity. A series of electrical heating units are distributed about the room and may be conveniently controlled by a thermostatic capsule. The current consumption is too great for a direct platinum contact as in the electrically-heated incubators; the capsule therefore is made to control a circuit of comparatively low current consumption which in turn operates an electrically controlled switch.

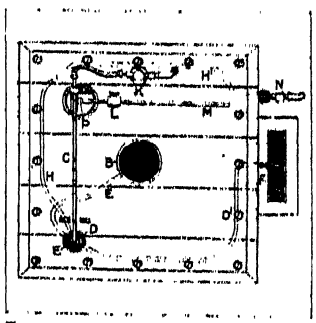


FIG. 6.—HEARSON'S COOL BIOLOGICAL INCUBATOR

INFANT INCUBATORS

Tarnier's Incubator.—The first incubator designed for rearing children who are too weak to survive under normal conditions, or who are prematurely born, was that of Dr. Tarnier. It was constructed in 1880 and was first used at the Paris Maternity Hospital. Its form is that of a rectangular box measuring 65 × 30 × 50 centimetres (fig. 7). It is divided into an upper and lower chamber; the former contains the infant, while the latter serves as a heating chamber, and in reality is simply a modified water-tank. The partition (P) which divides the incubator into two chambers does not extend the whole length of it, so that the upper and lower chambers are in communication with each other at one end of the apparatus. It is through this passage that the heated air from the lower chamber passes into the upper one containing the infant. The narrow bottom chamber (C) serves to prevent loss of heat from the base of the water-bottles. The outside air is admitted into the lower chamber at the opposite end, through an aperture (A), and passing over a series of bottles (B) containing warm water, becomes heated. The air is rendered adequately moist by means of a wetted sponge (S) which is placed at the entrance of the lower chamber into the upper. The warmed and moistened air is determined in its direction by the position of the outlet aperture (O), which is situated above and just behind the head of the infant. It contains a helix valve (H) and the rotation of this is an indication that the air is circulating within the incubator.

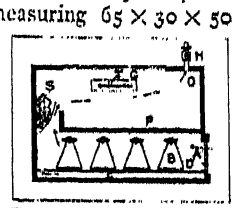


FIG. 7.—TARNIER'S INCUBATOR

The child is kept under observation by means of a sliding glass door (G) situated in the upper or roof wall of the incubator. Immediately beneath this, and attached to one of the side walls, is a thermometer (T) which records the temperature of the air in the infant-chamber. The temperature should be maintained at 31° to 32° C. The precise limit of temperature must of course be determined by the condition of the child; the smaller and weaker it is, the higher the temperature must be.

The warm water vessels contain three-quarters of a pint of water and four of them are sufficient to maintain the required temperature, provided that the external air does not fall below 16° C. The vessels are withdrawn and replaced through an entrance to the lower chamber, which can be opened or closed by a sliding door (D). The walls of the incubator, with the exception of the glass sliding door, are made of wood 25 millimetres thick. Child incubators heated by hot water bottles on the same lines as Tarnier's are still used but need constant attention and have been superseded by machines of the type to be described.

Hearson's Thermostatic Nurse.—This consists fundamentally of an application of the arrangements for heating and moistening the air and for regulating the temperature of Hearson's chick incubator to Dr. Tarnier's human incubator. As in this latter form, there are two chambers (fig. 8), an upper (A) and a lower (B), connected with each other in the same way as in Tarnier's apparatus. The upper chamber contains the infant, but the lower is not a heating but a moistening chamber. Through apertures (M) in the bottom of the lower chamber, the external air passes through, and as in the chick incubator it then passes through perforations in the inner cylinder of a water tray (O) and thence over the surface of the water in the tray, through a sheet of wet canvas, to the chamber itself. Hence it passes to the infant chamber and ultimately leaves this through a series of perforations round the top. The air in both chambers is heated by a warm-water tank. This tank forms the partition which divides the incubator into upper and lower chambers and is made of metal. Through the water contained in it, an incoming (R) and an outgoing (R to the left) flue, continuous with each other, pass. These two flues are related to each other as in the chick incubator (*see* POULTRY AND POULTRY FARMING), the inlet flue similarly heating and the outlet flue similarly discharging. The heat-regulating apparatus is identical with that in the chick incubator, and the thermostatic capsule (S) is placed in the upper chamber, near the head of the infant.

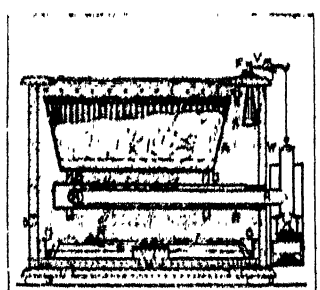


FIG. 8.—HEARSON'S "THERMOSTATIC NURSE"

The child is placed in a basket which has perforated walls, and is open above. The basket rests upon two shallow supports (D) situated on the upper surface of the water-tank partition. The child is kept under observation through a glass door in the upper or roof-wall of the incubator.

A similar but somewhat improved type of apparatus electrically heated is now manufactured by Messrs. Hearson & Co.

THERMO-REGULATORS OR THERMOSTATS

Certain special forms of thermo-regulators, adapted to the requirements of the particular incubators to which they are attached, have already been described. It remains now to describe other forms which are of more general application. Only those kinds will be described which are applicable to incubators. The special forms used for investigations in physical-chemistry are not described. There are various types of thermo-regulators, all of which fall into one of two classes. Either they act through the

expansion of a solid, or through that of a liquid. They are adjusted so that at a certain temperature the expansion of the material chosen either cuts down the gas supply or operates a switch which cuts off the whole or part of the electricity supply to the heating units.

Reichert's Thermo-regulator.—This (fig. 9) is one of the simpler forms of gas regulator in which a column of mercury raised by expansion obstructs the gas flow. The stem (S) of the regulator is enlarged above and receives a hollow **T**-piece (P), the vertical limb of which fits accurately into the enlarged end of the stem, and one end of the cross-limb receives the inlet gas pipe; the other end is closed. The vertical limb of the **T**-piece is narrowed down at its lower extremity and opens by a small aperture. Above this terminal aperture is a lateral one of the smallest size. From the enlarged end of the stem there passes out a lateral arm (A) which is connected with the outlet pipe to the burner, and lower down another arm (L), which is closed at its outer extremity by a screw (R), is also attached. The stem and lower arm are filled with mercury and the bulb of the stem is placed in the incubator chamber, and gas allowed to pass. When the desired temperature is reached, the mercury in the stem is forced upwards until it closes the aperture of the **T**-piece, by screwing in the screw (R) of the lower lateral arm (L).

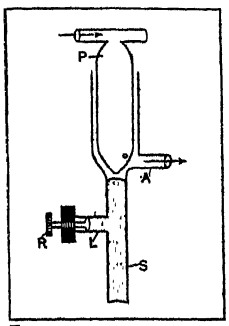
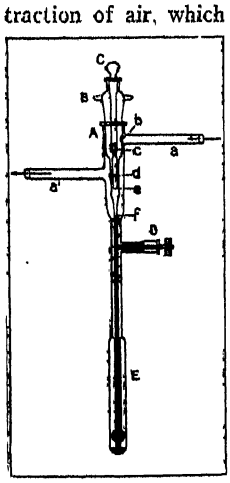


FIG. 9.—REICHERT'S THERMO-REGULATOR

There are several modifications of Reichert's original form. In one of these the screw arrangement in the lower arm is replaced by a piston rod working in a narrow bore of a vertically bent limb of the arm. In another form, the other end of the cross bar of the **T**-piece is open and leads through a stopcock to a third arm, which opens into the enlarged upper end of the stem opposite to the outlet arm (A); this modification acts as an adjustable by-pass and replaces the minute aperture in the side of the vertical limb of the **T**-piece.

Other Types.—There have been many modifications of this apparatus employing essentially the same method of regulation and differing only in minor details of construction.

Bunsen's, Kemp's and Münke's regulators are in reality of the nature of air-thermometers, and act by the expansion and contraction of air, which raises or lowers respectively a column of mercury; this in its turn results in the occlusion or opening of the gas aperture. Such forms, however, are subject to the influence of barometric pressure and an alteration of 0·5 in. of the barometer column may result in the variation of the temperature to as much as 2°.



BY COURTESY OF GREINER & FRIEDRICHS

FIG. 10.—NOVY'S THERMO-REGULATOR

Lothar Meyer's regulator is described in the *Berichte of the German Chemical Society*, 1883, p. 1089. It is essentially a liquid thermometer, the mercury column being raised by the expansion of a liquid of low boiling-point. The liquid replaces the air in Bunsen's and other similar forms. The boiling-point of this liquid must be below the temperature required as constant.

Toluol-mercury Thermo-regulators.—Novy's thermo-regulator, which is an apparatus of this type, is shown in fig. 10. The bulb (E) is full of toluol which by its expansion forces up the mercury column thus occluding the opening (f). Toluol is used on account of its high coefficient of expansion. Apart from the use of toluol instead of mercury in the bulb the principles of the apparatus are essentially the same as Reichert's. The two ground stoppers (B) and (C) with openings (b, c) and (d) may be rotated so as to regulate both the volume of gas entering the apparatus and the quantity flowing through the by-pass.

Regulators Controlling Electrical Heaters.—Instruments like the above-described, which incorporate a varying column of mercury, are easily modified to control electrically-heated incubators or water-baths. A platinum wire is fused through the glass so as to make contact with the lower part of the mercury column and the gas inlet tube (f, fig. 10) is replaced by a platinum wire contact. The rising mercury column completes a circuit which operates a small electromagnetic switch breaking the circuit to the heating units. To ensure the satisfactory working of such contacts as these it is necessary to avoid sparking and this may be effected by inserting a condenser (1 microfarad) across the terminals of the spark gap.

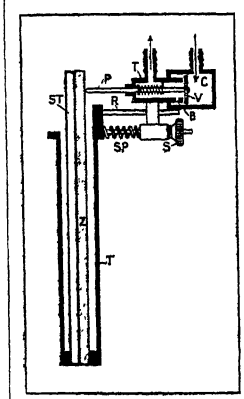


FIG. 11.—DR. ROUX'S THERMOSTAT (STRAIGHT BAR)

Metallic Thermo-regulators.—The solid forms of thermostats are constructed upon the same principle as the compensation balance of a watch or the compensating pendulum of a clock. This depends on the fact that the coefficient of expansion is different for different metals. It therefore results that if two bars of different metals are fastened together along their lengths (fig. 11, Z and ST) with the same rise of temperature one of these will expand or lengthen more than the other. And since both are fastened together and must therefore accommodate themselves within the same linear area, it follows that the compound rod must bend into a curved form, in order that the bar of greater expansion may occupy the surface of greater length, *i.e.* the convex one. Conversely, when the temperature falls, the greater degree of contraction will be in the same bar, and the surface occupied by it will tend to become the concave one. If, then, one end of this compound rod be fixed and the other free, the latter end will describe a backward and forward movement through the arc of a circle, which will correspond with the oscillations of temperature. This movement can be utilized by means of simple mechanical arrangements, to open or close the stopcock of a gas supply pipe.

In the construction of this type of thermostat it is obvious that the greater the difference in the coefficient of expansion of the two metals used, the larger will be the amplitude of the movement obtained. Steel and zinc are two metals which satisfy this condition. The coefficient of steel is the lowest of all metals and is comparable in its degree with that of glass. Substances which are not metals, such as vulcanite and porcelain, are sometimes used to replace steel, as the substance of low coefficient of expansion.

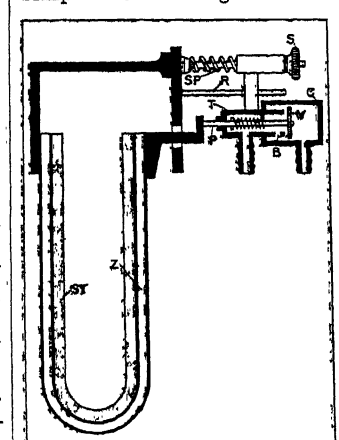


FIG. 12.—DR. ROUX'S THERMOSTAT (U-SHAPED BAR)

Roux Thermostat.—The bimetallic thermostat most commonly employed is one of the two forms designed by Dr. Roux. In one of these forms the compound bar is straight (fig. 11) and in the other it is **U**-shaped (fig. 12). In the former type the bar itself is enclosed in a tube (T) of metal, the wall of which is perforated. Towards the open end of this tube the gas box or case (C) is fixed. In the **U**-shaped form it is attached to the outer surface (zinc) of one limb of the bar. The gas box is capable of adjustment with respect to its distance from the bar, by means of a screw (S) and a spiral spring (SP), which moves the box outwards or inwards along a rod (R). This adjustment enables the degree of temperature at which it is desired that the gas shall be cut off to be fixed accurately, and within a certain more or less extended range. The inlet and the outlet pipe are disconnected from each other in the gas box by means of a piston-like rod (P) and valve (V), which slides backwards and forwards in the tubular

part (T) of the box, from which the outlet pipe emerges. When the valve (V) rests upon the edge of this box, the gas is completely cut off from passing through the outlet pipe, with the exception of that which passes through an exceedingly small aperture (B), serving as a by-pass. This is just large enough to allow sufficient gas to pass to maintain a small flame. The piston-like rod and valve, when free, is kept pressed outwards by means of a spiral spring. This ensures that the valve shall follow the movements of the compound bar. When this bar bends towards the gas box owing to a fall of temperature, the valve is pushed back away from the orifice and gas in increasing quantity passes through. The temperature of the incubator begins then to rise, and the zinc bar (Z) expanding more than the steel one (ST), the bar bends outwards and the valve once more cuts off the gas supply.

Gas-pressure Regulators.—In order to ensure the accurate working of a thermo-regulator controlling a gas supply it may be necessary to regulate the gas pressure which is sometimes very variable in the mains. Various forms of these regulators are on the market and descriptions of these may be found in catalogues of makers of scientific instruments. It will suffice here if we describe a simple form of regulator (that of R. A. Buddicom) which can be made from material available in most laboratories.

In this regulator (fig. 13) the inlet (I) and outlet (O) gas pipe open into a metal bell (B), the lower and open end of which is immersed beneath water contained in a metal tray (T). The bell is suspended upon the arm of a balance (B) and the other arm is poised by a weight (W). This weight may be made of any convenient material. In the original apparatus a test-tube partially filled with mercury was used. The weight dips into one limb of a **U**-shaped glass tube (U), which contains mercury. Into the other limb of this tube the gas from the meter enters through a glass tube (G) which is held in position by a well-fitting cork. The internal aperture of the tube (G) is very oblique, and it rests just above the level of the mercury when the instrument is finally adjusted. This adjustment is better made in the morning when the gas pressure in the main is at its lowest. Just above the internal aperture of the tube (G), a lateral tube (L) passes out from the limb of the U and is connected with the inlet pipe (I) of the bell. If the gas pressure rises, the bell (B) is raised and the counter-poising weight (W) is proportionately lowered. This forces the mercury up in the other limb of the **U**-tube and consequently diminishes the size of the oblique orifice in the tube (G). Some of the gas is thus cut off and the pressure maintained constant. Should the pressure fall, the reverse processes occur, and more gas passes through the orifice of G and consequently to the burner by the outlet tube (O). (For incubators for poultry *see* POULTRY AND POULTRY FARMING.)

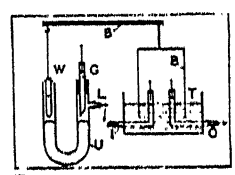


FIG. 13.—BUDDICOM'S GAS REGULATOR

BIBLIOGRAPHY.—Charles A. Cyphers, *Incubation and its Natural Laws* (1776); J. H. Barlow, *The Art and Method of Hatching and Rearing all Kinds of Domestic Poultry and Game Birds by Steam* (London, 1827); and *Daily Progress of the Chick in the Egg during Hatching in Steam Apparatus* (London, 1824); Walthew, *Artificial Incubation* (London, 1824); William Bucknell, *The Eccaleobin. A Treatise on Artificial Incubation*, in 2 parts (published by the author, London, 1839); T. Christy, Jr., *Hydro-Incubation* (London, 1877); L. Wright, *The Book of Poultry* (2nd ed. London, 1893); A. Forget, *L'Aviculture et l'incubation artificielle* (Paris, 1896); J. H. Sutcliffe, *Incubators and their Management* (London, 1896); H. H. Stoddard, *The New Egg Farm* (New York, 1900); Edward Brown, *Poultry Keeping as an Industry* (5th ed., 1904); F. J. M. Page, "A Simple Form of Gas Regulator, *Journ. Chem. Soc.* i. 24 (London, 1876); V. Babes, "Über einige Apparate zur Bactericnuntersuchung," *Centralblatt für Bacteriologie*, iv. (1888); T. Hüppe, *Methoden der Bacterienforschungen* (Berlin, 1889). For further details of bacteriological incubators and accessories *see* catalogues of Gallenkamp, Baird & Tatlock, Hearson of London, and of the Cambridge Scientific Instrument Company, Cambridge; of P. Lequeux of Paris; and of F. & M. Lautenschläger of Berlin. Those of Lequeux and of the Cambridge Company are particularly useful, as in many instances they give a scientific explanation of the principles upon which the construction of the various pieces of apparatus is based. (G. P. M.; S. L. B.)

INCUBUS, the name given in the middle ages to a male demon which was supposed to haunt women in their sleep, and to whose visits the birth of witches and demons was attributed. The word is a late Latin derivation (Augustine, *Civ. Dei*, 15. 23) of the classical *incubare*, to lie upon. The female counterparts of these demons, whose temptation of monks and other males bulked so large in the legends of the 11th and 12th centuries, were known as *succubae*. In modern times the word has come to be generally used of an oppressive person or thing.

INCUMBENT, a general term for the holder (rector, vicar, curate in charge) of an ecclesiastical benefice (*see* BENEFICE). In Scotland the title is generally confined to clergy of the Episcopal Church.

INCUNABULA, a Latin neuter-plural meaning "swaddling-clothes," a "cradle," "birthplace," and so the beginning of anything, now curiously specialized to denote books printed in the 15th century. Its use in this sense may have originated with the title of the first separately published list of 15th century books, Cornelius a Beughem's *Incunabula typographiae* (Amsterdam, 1688). The word is generally recognized all over Europe and has produced vernacular forms such as the French *incunables*, German *Inkunabeln* (Wiegendrucke), Italian *incunaboli*, and the anglicized form incunables is now frequently used. Despite the rapid development of printing in some centres as compared with others, the attractions of a round date have caused the word to be applied to all books produced before the close of the year 1500 and to these alone. The earliest important catalogues of them were (i.) Panzer's *Annales typographici ab artis inventae origine ad annum MD.*, printed in five volumes at Nuremberg in 1703 and subsequently in 1803 carried on to 1536 in six additional volumes; (ii.) Hain's *Repertorium bibliographicum in quo libri omnes ab arte typographica inventa usque ad annum MD. typis expressi ordine alphabetico vel simpliciter enumerantur vel adcuratius, recensentur* (Stuttgart, 1826–38). In Panzer's *Annales* the first principle of division is that of the alphabetical order of the Latin names of towns in which incunabula were printed, the books being arranged under the towns by the years of publication. In Hain's *Repertorium* the books are arranged under their authors' names, and in 1891 an invaluable index of printers was added by Konrad Burger. In 1898 Robert Proctor published an *Index to the Early Printed Books in the British Museum: from the invention of printing to the year MD., with notes of those in the Bodleian Library.* In this work the books were arranged as far as possible chronologically under their printers, the printers chronologically under the towns in which they worked, and the towns and countries chronologically in the order in which printing was introduced into them, the total number of books registered being nearly 10,000. After Proctor's premature death in 1903, the trustees of the British Museum ordered a full dress catalogue of its incunabula to be prepared, and of this five volumes have been issued, comprising Germany (including Austria and German speaking Switzerland), Rome and Venice. In France Mlle. Pellechet in 1897 began a *Catalogue général des incunables des bibliothèques publiques de France*, which was continued by M. Louis Polain but stopped in the middle of G. In Germany after 21 years of preparation the first volume of a *Gesamtkatalog der Wiegendrucke* was published in 1925.

In any attempt to estimate the extent to which the incunabula still in existence represent the total output of the 15th century presses a sharp distinction must be drawn between the weightier and the more ephemeral literature. Owing to the great religious and intellectual upheaval in the 16th century much of the literature previously current went out of date, while the cumbrous early editions of books still read were superseded by handier ones. Before this happened the heavier works had found their way into countless libraries and here they reposed peacefully, only sharing the fate of the libraries themselves when these were pillaged, or, by a happier fortune, amalgamated with other collections in a larger library. The considerable number of copies of many books for whose preservation no special reason can be found encourages a belief that the proportion of serious works now completely lost is remarkably low, except in the case of books of devotion whose honourable destiny was to be worn to pieces by devout fingers. On the other hand, of the lighter literature in book-form, the cheap romances and catchpenny literature of all kinds, the destruction

has been very great. Most of the broadsides and single sheets generally which have escaped have done so only by virtue of the 16th century custom of using waste of this kind as a substitute for wooden boards to stiffen bindings. Excluding these broadsides, etc., the total output of the 15th century presses in book form is not likely to have exceeded 40,000 editions. As to the size of the editions we know that the earliest printers at Rome favoured 225 copies, those at Venice 300. By the end of the century these numbers had increased, but the soft metal in use then for types probably wore badly enough to keep down the size of editions, and an average of 500 copies, giving a possible total of 20 million books put on the European market during the 15th century, is probably as near an estimate as can be made.

Types as Evidence.—Very many incunabula contain no information as to when, where or by whom they were printed, but the individuality of most of the early types as compared with modern ones has enabled typographical detectives (of whom Robert Proctor, who died in 1903, was by far the greatest) to track most of them down. To facilitate this work many volumes of facsimiles have been published, the most important being K. Burger's *Monumenta Germaniae et Italiae Typographica* (1892, etc.), J. W. Holtrop's *Monuments typographiques des Pays-Bas* (1868), O. Thierry-Poux's *Premiers monuments de l'imprimerie en France au XVe siècle* (1890), K. Haebler's *Typographie ibérique du quinzième siècle* (1901) and Gordon Duff's *Early English Printing* (1896), the publications of the Type Facsimile Society (1700, etc.) and the *Woolley Facsimiles*, a collection of 500 photographs, privately printed by George Dunn.

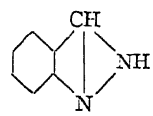
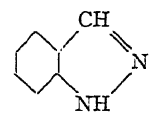
In his *Index to the Early Printed Books at the British Museum* Proctor enumerated and described all the known types used by each printer, and his descriptions have been usefully extended and made more precise by Dr. Haebler in his *Typenrepertorium der Wiegendrucke* (1905, etc.). With the aid of these descriptions and of the facsimiles already mentioned it is usually possible to assign a newly discovered book with some certainty to the press from which it was issued and to fix within narrow limits the date at which it was finished.

The total number still extant of incunabula printed in England is about 360, of which Caxton produced nearly 100. Of the 10,000 different incunabula which the British Museum and Bodleian Library owned between them in 1898, about 4,100 are Italian, 3,400 German, 1,000 French, 700 from the Netherlands, 400 from Switzerland, 150 from Spain and Portugal, 50 from other parts of the continent of Europe and 200 English, the proportion of these last to the total known being about doubled by the special zeal for collecting them. The celebration in 1640 of the second centenary (as it was considered) of the invention of printing may be taken as the date from which incunabula began to be collected for their own sake, apart from their literary interest, and the publication of Beughem's *Incunabula typographiae* in 1688 marks the increased attention paid to them. But up to the end of the 17th century Caxton's could still be bought for a few shillings. The third centenary of the invention of printing in 1740 again stimulated enthusiasm, and by the end of the 18th century the really early books were eagerly competed for. Interest in books of the last 10 or 15 years of the century is a much more modern development, but with the considerable literature which has grown up round the subject is not likely to be easily checked.

The chief collections of incunabula are those of the Bibliothèque Nationale at Paris, Royal library, Munich, and British Museum, London, the number of separate editions in each library exceeding 9,000 with numerous duplicates. The number of separate editions at the Bodleian Library is about 5,000. Other important collections are at the University library, Cambridge, and the John Rylands library, Manchester, the latter being based on the famous Althorp library formed by Earl Spencer (*see* BOOK-COLLECTING). A census of 15th-century books owned in America, compiled by a committee of the Bibliographical Society of America, published in 1919, enumerated over 13,200 copies of some 6,640 different editions. The chief collections are in the Pierpont Morgan library, New York, the Annmary Brown Memorial, Providence, R.I., the Henry Huntington library, San Gabriel, Calif., and the library of Congress at Washington. (A. W. P.)

INDABA, a Zulu-Bantu word, formed from the inflexional prefix *in* and *daba*, business, news, for an important conference held by the "indunas" or principal men of the Kafir (Zulu-Xosa) tribes of South Africa.

INDAZOLES (BENZOPYRAZOLES), in chemistry, are crystalline, feebly basic organic compounds. Indazole itself has formula (I.) and is prepared by warming an aqueous solution of *o*-toluenediazonium chloride (*see* DIAZO COMPOUNDS). It

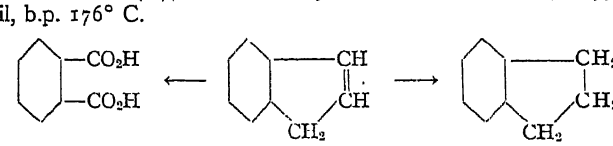
(I.)  (II.) 

is a crystalline solid melting at 146° C (boiling point, 270° C). This ring formation is exhibited only by diazonium salts having a methyl group adjacent to the diazo-radical. A series of isomeric compounds, *isoindazoles*, is known; the acetyl derivative of the simplest member (formula II.) is made by warming *o*-aminobenzaldoxime with acetic anhydride (*see* PYRAZOLES).

INDEMNITY, in law, an undertaking, either express or implied, to compensate another for loss or damage, or for trouble or expense incurred; also the sum so paid (*see* COMPENSATION; CONTRACT; and INSURANCE: *Marine*). An act of indemnity is a statute passed for the purpose either of relieving persons from disabilities and penalties to which they have rendered themselves liable or to make legal transactions which, when they took place, were illegal. An act or bill of indemnity used to be passed every session by the English parliament for the relief of those who had unwittingly neglected to qualify themselves in certain respects for the holding of offices, etc., as, for example, justices, without taking the necessary oaths. The Promissory Oaths Act 1868 rendered this unnecessary. Acts are frequently passed to provide for meeting unforeseen but necessary expenditure incurred in emergencies in the service of the State.

In the United States acts of Congress and of the state legislatures and municipal councils generally, compensating corporations or individuals for damages or expenses incurred for the benefit of the public or the government, are generally termed acts of "relief."

INDENE, a hydrocarbon found in the fraction of the coal tar distillate (*see* COAL TAR) boiling between 176° and 182° C and isolated from this material by means of the picrate (m.p. 98° C). It is a colourless mobile liquid boiling at 179·5–180·5° C with a specific gravity 1·04 at 15° C. Its chemical formula is C_9H_8, and its constitution (II.) may be deduced from its behaviour on oxidation and reduction. The former process gives phthalic acid (I.), the latter hydrindene or indane (III.), an oil, b.p. 176° C.



(I.) (II.) (III.)

Indene rapidly absorbs oxygen from air, and polymerizes to a resin utilizable in lacquers and varnishes.

INDENT, in commerce, an order for goods. The derivation is from Lat. *indentare*, to bite a bit out, hole, to notch. The term is more usually employed in foreign than in home trade. An indent is fully detailed to prevent error, and gives full instructions as to quality, pattern or design, price, exchange, packing, marks and shipment.

INDENTURE, a law term for a special form of deed executed between two or more parties, and having counterparts or copies equal to the number of parties. These copies were all drawn on one piece of vellum or paper divided by a toothed or "indented" line. The copies when separated along this waved line could then be identified as "tallies" when brought together. Deeds executed by one party only had a smooth or "polled" edge, whence the name "deed poll." By the Real Property Act 1845, s. 5, all deeds purporting to be "indentures" have the

effect of an "indenture," even though the indented line be absent. The name "chirograph" was also early applied to such a form of deed, and the word itself was often written along the indented line (*see* further DEED). The term "indenture" is now used generally of any sealed agreement between two or more parties, and specifically of a contract of apprenticeship, whence the phrase "to take up one's indentures," on completion of the term, and also of a contract by labourers to serve in a foreign country or colony (*see* COOLIE). In the United States indenture is used generally as a term meaning a conveyance.

INDEPENDENCE, a city in the coal, oil and gas belt of south-eastern Kansas, U.S.A., on the Verdigris river; the county seat of Montgomery county. It is on Federal highway 75, and is served by the Missouri Pacific and the Santa Fe railways. The population was 10,900 in 1925 (State census), and was estimated locally at 15,000 in 1928. It is the supply and shipping point for a rich agricultural district, and for the oil and gas fields near by, and is the headquarters of leading oil companies of the mid-continent field. Its manufactures include flour, sash and doors, oil-field machinery, revolving doors and vitrified and pressed brick. The city was founded and incorporated in 1869.

INDEPENDENCE, a city of Missouri, U.S.A., 10m. E. of Kansas City and 3m. S. of the Missouri river, at an altitude of 1,000ft.; the county seat of Jackson county. It is served by the Chicago and Alton, the Kansas City Southern and the Missouri Pacific railways. The population was 11,686 in 1920 (88% native white) and was estimated at 12,720 in 1925. There are various manufacturing industries, with an output in 1925 valued at $4,231,807. Independence was laid out and chosen as the county seat in 1827, and was chartered as a city in 1849. In 1831 Joseph Smith selected a tract here to be the site of the New Jerusalem, and was followed in 1832 by some 1,500 Mormons from Ohio, but they were not welcome to the "Gentile" inhabitants, and in 1833 they were driven out. In 1867–69 a few families belonging to the Reorganized Church of Jesus Christ of Latter Day Saints (monogamists) settled here, and by 1881 they had built a church. In 1907 a number of Mormons from Utah came to Independence, moving the headquarters of the "Central States' Mission" from Kansas City, and establishing a publication office. After 1831, until its river landing was destroyed by flood in 1844, Independence was headquarters of the wagon-trains starting west over the Santa Fe, the Old Salt Lake and the Oregon trails.

INDEPENDENCE, DECLARATION OF: *see* DECLARATION OF INDEPENDENCE.

INDEPENDENTS, in religion, a name used in the 17th century for those holding to the autonomy of each several church or congregation, hence otherwise known as Congregationalists. (*See* CONGREGATIONALISM.)

INDETERMINATE EQUATIONS: *see* DIOPHANTINE EQUATIONS.

INDEX, a word that may be understood either as a table of references to a book or, generally, as an indicator of the position of information on any given subject. The classical Latin word *index* denoted a discoverer or informer, a catalogue, an inscription or a book-title, and the fore or index-finger. Cicero also used the word for the table of contents. So also Shakespeare (*Troilus and Cressida,* i. 3). Table was the usual English word, and index was not thoroughly naturalized until the beginning of the 17th century.

In making an index the headings that the reader is most likely to seek must be selected; cross references should not be spared. The index should not be broken up into several alphabets (though this is often done, as into indexes of places, of persons and of subjects). The arrangement may be chronological, alphabetical or classified, but confusion will be caused by combining the three systems. The alphabetical arrangement is so simple, that it has largely superseded other systems. Every endeavour should be made to print an index clearly. In old indexes the indexed word was not brought to the front, but was left in its place in the sentence; but in modern times there has been a great advance in indexing, especially since the foundation in 1877 in England of the Index Society; and the growth of great libraries has given a stimulus to this aid to research. Not only has it become almost a *sine qua non* that any good book must have its own index, but the art of indexing has been applied to great composite works such as the *Encyclopædia Britannica,* to scientific periodicals or groups of periodicals (as in *Index Medicus*), to a great newspaper like the London *Times,* and to the cataloguing of great libraries themselves, indexing and cataloguing being closely allied. One of the largest and best book-indexes is that to E. T. Cook's ed. of the works of Ruskin. The work in these more elaborate cases has been enormously facilitated by the modern card-indexes, of American origin. The subject indexes of the Library of Congress, of the British Museum and of the London library have much advanced the art. The Association of Special Libraries and Information Bureaux proposes to form a panel of indexers of scientific periodicals; while a similar but more general panel is also under discussion. (*See* also BIBLIOGRAPHY.)

There are numerous books on indexing, but the best for any one who wants to get a general idea are H. B. Wheatley, *How to make an Index* (1902), and A. L. Clarke, *Manual of Practical Indexing* (1905).

INDEX LIBRORUM PROHIBITORUM, the title of the official list of those books which on doctrinal or moral grounds the Roman Catholic Church authoritatively forbids the members of its communion to read or to possess, irrespective of works forbidden by the general rules on the subject. The earliest known instance of a list of proscribed books being issued with the authority of a bishop of Rome is the *Notitia librorum apocryphorum qui non recipiuntur,* the first redaction of which, by Pope Gelasius (494), was subsequently amplified on several occasions. The document is for the most part an enumeration of apocryphal gospels and acts. One of the functions of the Inquisition when it was established was to exercise a rigid censorship over books put in circulation. The majority of the condemnations were at that time of a specially theological character. With the discovery of the art of printing, and the wide and cheap diffusion of all sorts of books which ensued, the need for new precautions against heresy and immorality in literature made itself felt; more than one pope (Sixtus IV. in 1479 and Alexander VI. in 1501) gave special directions regarding the growing freedom of the printing press, and in 1515 the Lateran council attempted to forbid the printing of any book without previous examination by the ecclesiastical authority. The Council of Trent in its fourth session, April 1546, forbade the sale or possession of any anonymous religious book which had not previously been seen and approved by the ordinary; in the same year the university of Louvain, at the command of Charles V., prepared an "Index" of pernicious and forbidden books, a second edition of which appeared in 1550. In 1557, and again in 1559, Pope Paul IV., through the Inquisition at Rome, published what may be regarded as the first Roman *Index* in the modern ecclesiastical use of that term (*Index auctorum et librorum qui tanquam hæretici aut suspecti aut perversi ab Officio S. R. Inquisitionis reprobantur et in universa Christiana republica interdicuntur*). In this we find the three classes which were to be maintained in the Trent Index: authors condemned with all their writings; prohibited books, the authors of which are known; pernicious books by anonymous authors. At the 18th session of the Council of Trent (February 1562), in consideration of the great increase in the number of suspect and pernicious books, and also of the inefficacy of the many previous "censures" which had proceeded from the provinces and from Rome itself, a commission was appointed to inquire into these "censures," and to consider what ought to be done in the circumstances. The result of its labours was handed over to the pope to deal with as he should think proper. In the following March accordingly were published, with papal approval, the *Index librorum prohibitorum,* which continued to be reprinted and brought down to date, and the "Ten Rules" which regulated the matter until the pontificate of Leo XIII. (1897). The business of condemning pernicious books and of correcting the Index to date has been since the time of Pope Sixtus V. in the hands of the "Congregation of the Index," which consists of several cardinals, and more or less numerous "consultors" and "examiners of books."

With the alteration of social conditions, however, the Rules of Trent ceased to be entirely applicable. Their application to publications which had no concern with morals or religion was no longer conceivable; and, finally, the penalties called for modification. Already, at the Vatican Council, several bishops had submitted requests for a reform of the Index, but the Council was not able to deal with the question. The reform was accomplished by Leo XIII., who, on the 25th of January 1897, published the constitution *Officiorum*, in 49 articles. In this constitution, although the writings of heretics in support of heresy are condemned as before, those of their books which contain nothing against Catholic doctrine or which treat other subjects are permitted. Editions of the text of the Scriptures are permitted for purposes of study; translations of the Bible into the vulgar tongue have to be approved, while those published by non-Catholics are permitted for the use of scholars. Obscene books are forbidden; the classics, however, are authorized for educational purposes. Books and newspapers which outrage God and sacred things, which propagate magic and superstition, or which are pernicious to society are forbidden. Permissions to read prohibited books are given by the bishop in particular cases, and in the ordinary course by the Congregation of the Index. The constitution then proceeds with the censorship of books. The examination of the books is entrusted to censors, who have to study them without prejudice; if their report is favourable, the bishop gives the *imprimatur*. All books concerned with the religious sciences and with ethics are submitted to preliminary censorship, and in addition to this ecclesiastics have to obtain a personal authorization for all their books and for the acceptance of the editorship of a periodical. The penalty of excommunication *ipso facto* is only maintained for reading books written by heretics or apostates in defence of heresy, or books condemned by name under pain of excommunication by pontifical letters. The constitution also prescribed a revision of the catalogue of the Index. The new Index, which omits works anterior to 1600 as well as a great number of others included in the old catalogue, appeared in 1900. The encyclical *Pascendi* of Pius X. (8th September 1907) made it obligatory for periodicals amenable to the ecclesiastical authority to be submitted to a censor for report.

BIBLIOGRAPHY.—*See* J. Hilgers, art. "Index" in the *Catholic Encyclopaedia*, and *Der Index der verbotenen Bücher*, 1899; T. Hurley, *Commentary on the present Index Legislation*, 1908; H. Reusch, *Der Index der verbotenen Bücher* (1883); A. Arndt, *De Libris prohibitis commentarii* (1895); A. Boudinhon, *La Nouvelle Législation de l'index* (1899).

INDEX NUMBERS. The phrase index number is sometimes applied to any series in which a chosen term is written as 100 and the other terms expressed as percentages of it. The earlier and more general use is, however, consonant with the following definitions: "An index number [is] a number adapted by its variations to indicate the increase or decrease of a magnitude not susceptible of accurate measurement" (Edgeworth, *Economic Journal*, 1925, p. 379); "index numbers are used to measure the change in some quantity which we cannot observe directly, which we know to have a definite influence on many other quantities which we can so observe, tending to increase all or diminish all, while this influence is concealed by the action of many causes affecting the separate quantities in different ways" (Bowley, *Elements of Statistics*, 1920, p. 196). Thus index numbers are applied to the measurement of the *general* movement of prices, cost of living, wages, production, consumption, employment, etc.

The data from which index numbers are formed consist of records of particular quantities at two or more dates or places and information about the relative importance of these quantities in a general measurement. In constructing an index number to measure the movement of any defined magnitude it is necessary to decide on the choice of the separate quantities, on their relative importance, on the period or place to be taken as base, and on the formula of compilation. Thus, in the *Statist* index number the objective is the measurement of the change of wholesale prices in the United Kingdom; 45 commodities are selected and regarded as of equal importance, the period 1867–77 is taken as base, the average price in that period of each commodity is equated to 100, the terms in each series of prices are expressed as percentages of that average ("price-relatives"), and the simple average of the 45 relatives in any year forms the index number for that year.

A distinction is drawn, but not by all writers, between two classes of index numbers: (*a*) where, as in the definitions quoted above, the object is to measure the movements of a magnitude without specific reference to any pre-determined application, *e.g.*, the purchasing power of money in general ("indice monétaire") as conceived by Jevons, *The Variation of Prices and the Value of Currency since 1782* (1865); (*b*) where the measurement is to be applied to a defined group, *e.g.*, the changes in the cost of a quantitative standard, such as is used in a cost of living index ("indice budgétaire"). Many index numbers, however, are intermediate between these classes, and much of the analysis of the form and content of the numbers is appropriate to both. Thus, in all cases of price measurement, only those commodities can be included which are measurable in a defined and unchanged unit, and for which the price can be ascertained, and (unless the geometric mean is used) a base period in which each price is equated to 100 must always be selected.

PURCHASING POWER

(*a*) In the measurement of the purchasing power of money in general it is argued that the prices of all commodities, not subject to regulation or monopoly, are equally significant. Theoretically the problem is one of pure sampling, and the precision of the result in any year is directly proportional to the square root of the number of independent terms included and inversely proportional to the mean dispersion of these terms from their average in that year. In practice, the terms are not completely independent, for the prices of related commodities influence one another, and the precision is thus reduced. Also, the greater the interval from the base year, the greater tends to be the dispersion and the smaller the precision. In periods when prices are changing rapidly, as in the years 1914 to 1923, the dispersion is usually considerable and the measurement loses accuracy.

There are three types of averages applicable to price-relatives: their arithmetic mean as described above for the *Statist* index number; the geometric mean of the same numbers, that is the nth root of their product if there are n commodities; and the harmonic mean, which is the reciprocal of the arithmetic mean of the reciprocals. Thus, for two commodities whose prices were 6d. and 10d. in the base year, and 1s. and 2s. 1d. in any other year, the price-relatives are 200 and 250, their A.M. is 225, their G.M. is $\sqrt{(200\times250)}=223{\cdot}6$, their H.M. is $1\div\frac{1}{2}(\frac{1}{200}+\frac{1}{250})=222{\cdot}2$. If the latter year is taken as 100, the relatives in the original base year are 50 and 40, the A.M. is 45, and $45:100=100:222{\cdot}2$. The H.M. of the "forward" relatives gives the same measurement as the A.M. of the "backward" relatives; or, if the comparison is between two places the H.M. of the relatives when the first is taken as base gives the same measurement as the A.M. when the second is so taken.

A general change in the relation of currency to its use tends to affect all prices in the same proportion, and "if other disturbing causes may be considered proportional to the ratio of change of price they produce in one or more commodities, then all the individual variations of prices will be correctly balanced off against each other in the Geometric Mean" (Jevons, *Investigations in Currency and Finance*, 1884, pp. 121–122; *see* also Bowley, *Economic Journal*, 1921, p. 202). The Geometric Mean is therefore considered appropriate to this problem. It has the advantage that it gives less importance to extreme measurements than does the Arithmetic Mean. It has the further advantage that the comparison by its use of any two years is independent of the choice of the base year (*see* below).

CHANGE IN A FIXED AGGREGATE

(*b*) The method generally used in the more objective problem of measuring the change of cost of a fixed aggregate of goods is as follows: the quantities of defined commodities which are produced or consumed in a year, or exported or imported, or are purchased in a week by a family, are estimated and the prices per unit are

ascertained in a base year or period and also in the year to which the measurement is to refer. This budget of quantities is valued at the base year prices and again at the prices of the year in question; the latter total expressed as a percentage of the first gives the required index number. The computation is often effected by writing down the relative expenditure (quantity × price) on each commodity in the base year, applying to each the percentage that its price in the second year forms of that in the first, and adding the products. This sum (divided by the total of the base year's relative expenditures) gives the same index number as before. Cost of living index numbers are computed by this method. In this form the index number appears as a "weighted average," where the weights are the relative expenditures and the things weighted are the price-relatives. From the theory of weighted averages it is known that considerable roughness in the weights has little effect on the result. It may also be regarded as an average of price-relatives which form a sample of a larger group than that included, and therefore—as under (*a*)—its precision depends on the square root of the number of independent relatives and, inversely, on their dispersion about their average.

The weakness of this method is that, when we make a comparison between two years or two places, the relative expenditures generally differ and each scheme of expenditure appears to have an equal claim to be included. This difficulty may be met theoretically by computing the index twice, first with the expenditures in year or place A and then with those in B and averaging the result. For comparison between places this method is applied; but it is seldom that the necessary "weights" can be obtained for more than one year, and till there is a further census of production or a new collection of working class budgets the double computation cannot be made. Further, if the weights are available for three years or places, A, B and C, the index for B in reference to A multiplied by that for C in reference to B does not by any weighted average formula give that for C in reference to A (÷100), as it should. This so-called "condition transitive" is not satisfied by any formula that is symmetrical with regard to weights. The algebra of the method is as follows:—

Write ${}_aQ_1, {}_aQ_2 \ldots$ and ${}_aP_1, {}_aP_2 \ldots$ for quantities and prices in A, and ${}_bQ_1, {}_bQ_2 \ldots, {}_bP_1, {}_bP_2 \ldots$ in B. The "forward" index number is $I_a = 100\Sigma_a Q_{1\cdot b}P_1 \div \Sigma_a Q_{1\cdot a}P_1$ and the "backward" index number is $I_b = 100\Sigma_b Q_{1\cdot b}P_1 \div \Sigma_b Q_{1\cdot a}P_1$. The Geometric Mean $\sqrt{I_a \times I_b}$ is Prof. Irving Fisher's "Ideal index number" (*The Making of Index Numbers*, 1922, p. 220). The arithmetic average, $\frac{1}{2}(I_a + I_b)$ and the form $I_a = 100\Sigma\frac{1}{2}({}_aQ_1 + {}_bQ_1)\cdot{}_bP_1 \div \Sigma\frac{1}{2}({}_aQ_1 + {}_bQ_1)\cdot{}_aP_1$, may be conveniently used. The three forms of average may be expected to give nearly identical results. I_a, in which the quantities at the two dates are averaged, is perhaps the simplest in idea. Each average lies between I_a and I_b, and is greater than I_a if an increase of prices of a commodity above the general increase from year A to a later year B is correlated with a relative decrease of the quantity purchased, as may be expected if there is a possibility of substitution of one commodity for another without any general change of standard (Bowley, *Statistical Journal*, 1919, pp. 343 *seq.*).

In their measurement of the change of import or export index prices from year A to the consecutive year B, the Board of Trade uses the formula I_b and for comparison with the next year C the formula $100 \times \frac{\Sigma_b Q_{1\cdot b}P_1}{\Sigma_b Q_{1\cdot a}P_1} \times \frac{\Sigma_a Q_{1\cdot c}P_1}{\Sigma_a Q_{1\cdot b}P_1}$ which does not equal $100\,\frac{\Sigma_a Q_{1\cdot c}P_1}{\Sigma_a Q_{1\cdot a}P_1}$ obtained by direct re-valuation of the C quantities by the A prices and, if there is a very rapid change of quantities and prices, may differ considerably from it. This is an example of the "step-by-step" or "chain" method of index numbers. Note that from A to B, $100\,\frac{\Sigma_b Q_{1\cdot a}P_1}{\Sigma_a Q_{1\cdot a}P_1}$ is an index number of quantity of trade (prices constant), and $100\,\frac{\Sigma_b Q_{1\cdot b}P_1}{\Sigma_a Q_{1\cdot a}P_1}$ is the index number of value of trade. The product of these measurements of price and quantity is the index of value (×100).

Since no form of index number satisfies all the conditions which can properly be laid down (see *e.g.*, Gini, in *Metron*, 1924, pp. 81 and 134), we must select in each case the form most suited for the particular purpose in hand (regard being had to the data available) and it follows that we can only expect precision when different relevant forms give approximately the same result, for which the conditions are that the dispersion of prices from their average should be small and the number of constituent elements should be considerable. *See* Cost of Living: Prices.

(A. L. B.)

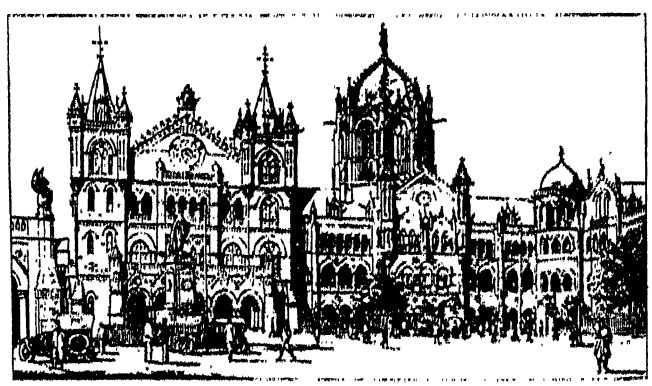
INDEX SYSTEM: *see* Office Appliances.

INDIA, a great country and empire of Asia under British rule, inhabited by a congeries of different races, speaking upwards of 200 different languages. The whole Indian empire, including Burma, has an area of 1,805,000 sq.m., and had in 1928 a population of 319 millions, being about equal to the area and population of the whole of Europe without Russia. Gibbon's estimate for all the races and nations which obeyed imperial Rome was 120 millions.

The Indians can scarcely be said to have a word of their own by which to express their common country. In Sanskrit, it would be called "Bharata-varsha," from Bharata, a legendary monarch of the Lunar line; but Sanskrit is no more the vernacular of India than Latin is of Europe. The name "Hindustan," which was at one time adopted by European geographers, applies properly only to that portion of the peninsula lying north of the Vindhya mountains, or yet more strictly to the upper basin of the Ganges where Hindi is the spoken language. The "East Indies" is an old-fashioned and inaccurate phrase, dating from the dawn of maritime discovery. "India," a word derived through the Greeks from the Persicized form of the Sanskrit *sindhu*, a "river," pre-eminently the Indus, has become familiar since the British acquired the country, and is now officially recognized in the imperial title of the sovereign.

THE COUNTRY

Position and Shape.—India, as thus defined, is the middle of the three irregularly shaped peninsulas which jut out southwards from the mainland of Asia. Its form is that of a great triangle, with its base resting upon the Himalayan range and its apex running far into the ocean. It extends from the 8th to the 37th degree of north latitude; that is to say, from the hottest



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THE VICTORIA TERMINUS OF THE GREAT INDIAN PACIFIC PENINSULA RAILWAY, IN BOMBAY CITY, CAPITAL OF THE BOMBAY PRESIDENCY

regions of the equator to far within the temperate zone. The length of India from north to south, and its greatest breadth from east to west, are both about 1,900 m.; but the triangle tapers with a pear-shaped curve to a point at Cape Comorin, its southern extremity. To this compact dominion the British have added Burma, the strip of country on the eastern shores of the Bay of Bengal. But on the other hand the adjacent island of Ceylon has been administratively severed and placed under the Colonial Office. Two groups of islands in the Bay of Bengal, the Andamans and the Nicobars; one group in the Arabian Sea, the Laccadives; and the outlying station of Aden at the mouth of the Red Sea, with Perim, and protectorates over the island of

Sokotra, along the southern coast of Arabia and in the Persian Gulf, are all politically included within the Indian empire; while on the coast of the peninsula itself, small Portuguese and French settlements break the continuous line of British territory.

Boundaries.—India is shut off from the rest of Asia on the north by a vast mountainous region, known in the aggregate as the Himalayas, amid which lie the independent states of Nepal and Bhutan, with the great table-land of Tibet behind. From the rest of the world it is severed by tropical oceans, except where Burma marches, in a confused succession of little explored ranges, with the kingdom of Siam. The empire included within these boundaries is rich in varieties of scenery and climate, from the highest mountains in the world to vast river deltas raised only a few inches above the level of the sea. It practically forms a continent rather than a country, divisible into three separate and well-defined tracts.

Himalayas.—The first of the three regions is the Himalaya mountains and their offshoots to the southward, comprising a system of stupendous ranges, the loftiest in the world. They extend in the shape of a scimitar, with its edge facing southwards, for a distance of 1,500 m. along the northern frontier of India. At the north-eastern angle of that frontier, the Dihang river, the connecting link between the Tsanpo of Tibet and the Brahmaputra of Assam, bursts through the main axis of the range. At the opposite or north-western angle, the Indus in like manner pierces the Himalayas, and turns southwards on its course through the Punjab. Ancient and well-known trade routes exist, by means of which merchandise from the Punjab finds its way over heights of 18,000 ft. into Eastern Turkestan and Tibet. The Muztagh (Snowy Mountain), the Karakoram (Black Mountain), and the Changchenmo are the most famous of these passes.

The Himalayas not only form a double wall along the north of India, but at both their eastern and western extremities send out ranges to the south, which protect its north-eastern and north-western frontiers. On the north-east, those offshoots form a barrier between the civilized districts of Assam and the wild tribes of Upper Burma. On the opposite or north-western frontier of India, the mountains run down the entire length of the British boundaries from the Himalayas to the sea. As they proceed southwards, their best marked ranges are in turn known as the Safed Koh, the Suliman and the Hala mountains. These massive barriers have peaks of great height, culminating in the Takht-i-Suliman or Throne of Solomon, 11,317 ft. above the level of the sea. But the mountain wall is pierced at the corner where it strikes southwards from the Himalayas by an opening through which the Kabul river flows into India. An adjacent opening, the Khyber Pass, the Kurram Pass to the south of it, the Gomal Pass near Dera Ismail Khan, the Tochi Pass between the two last-named, and the famous Bolan Pass still farther south, furnish the gateways between India and Afghanistan. The Hala, Brahui and Pab mountains, forming the southern hilly offshoots between India and Baluchistan, have a much less elevation.

River Plains.—The wide plains watered by the Himalayan rivers form the second of the three regions of India. They extend from the Bay of Bengal on the east to the Afghan frontier and the Arabian Sea on the west, and contain the richest and most densely crowded provinces of the empire. The vast level tract which thus covers northern India is watered by three distinct river systems. One of these systems takes its rise in the hollow trough beyond the Himalayas, and issues through their western ranges upon the Punjab as the Sutlej and Indus. The second of the three river systems also takes its rise beyond the double wall of the Himalayas, not very far from the sources of the Indus and the Sutlej. It turns, however, almost due east instead of west, enters India at the eastern extremity of the Himalayas, and becomes the Brahmaputra. These rivers collect the drainage of the northern slopes of the Himalayas, and convey it, by long and tortuous although opposite routes, into India. The third river system of northern India receives the drainage of their southern slopes, and eventually unites into the mighty stream of the Ganges.

Southern Table-land.—The third division of India comprises the three-sided table-land which covers the southern or more strictly peninsular portion of India. This tract comprises the Central Provinces and Berar, the presidencies of Madras and Bombay, and also Hyderabad, Mysore and other states.

Its northern side rests on confused ranges, running with a general direction of east to west, and known in the aggregate as the Vindhya mountains. Guarding the flanks of this tumbled mass stand two peaks sacred to the mysteries of the Jain religion, Mount Abu on the extreme west, and Mount Parasnath on the extreme east, with a succession of ranges stretching 800 m. between. The various ranges of the Vindhyas, from 1,500 to over 4,000 ft. high, form, as it were, the northern wall and buttresses which support the central table-land. Though now pierced by road and railway, they stood in former times as a barrier of mountain and jungle between northern and southern India, and formed one of the main obstructions to welding the whole into an empire.

Ghats.—The other two sides of the elevated southern triangle are known as the Eastern and Western Ghats. These start southwards from the extremities of the Vindhya system, and run along the eastern and western coasts of India. The Eastern Ghats stretch in fragmentary spurs and ranges down the Madras presidency, here and there receding inland and leaving broad level tracts between their base and the coast. The Western Ghats form the great sea-wall of the Bombay presidency, with only a narrow strip between them and the shore. The Eastern Ghats have an average elevation of 1,500 feet. The Western Ghats ascend more abruptly from the sea to an average height of about 3,000 ft. with peaks up to 4,700 along the Bombay coast, rising to 7,000 and even 8,760 (Dodabetta Peak) in the upheaved angle which they unite to form with the Eastern Ghats, towards their southern extremity. The inner triangular plateau thus enclosed lies from 1,000 to 3,000 ft. above the level of the sea. But it is dotted with peaks and seamed with ranges exceeding 4,000 ft. in height. Its best known hills are the Nilgiris, with the summer capital of Madras, Ootacamund, 7,000 ft. above the sea.

Eastern Ghats.—On the eastern side of India, the Ghats are traversed by a number of broad and easy passages from the Madras coast. Through these openings the rainfall of the southern half of the inner plateau reaches the sea. The drainage from the northern or Vindhyan edge of the three-sided table-land falls into the Ganges. The Nerbudda and Tapti carry the rainfall of the southern slopes of the Vindhyas and of the Satpura hills, in almost parallel lines, into the Gulf of Cambay. But from Surat to the furthest south, the Western Ghats form a lofty unbroken barrier between the waters of the central plateau and the Indian Ocean. The drainage has therefore to make its way across India to the eastwards, now turning sharply round projecting ranges, now tumbling down ravines, or rushing along the valleys, until it finally falls into the Bay of Bengal. In this way the three great rivers of the Madras Presidency, viz., the Godavari, the Kistna and the Cauvery, rise in the mountains overhanging the western coast, and traverse the whole breadth of the central table-land before they reach the sea on the eastern shores of India.

Of the three regions of India thus briefly surveyed, the first, or the Himalayas, lies for the most part beyond the British frontier, but a knowledge of it supplies the key to the ethnology and history of India. The second region, or the great river plains in the north, formed the theatre of the ancient race-movements which shaped the civilization and the political destinies of the whole Indian peninsula. The third region, or the triangular table-land in the south differs markedly in its population, languages and traditions from either of the other two divisions. (ME.)

GEOLOGY

Geologically, as well as physically, India consists of three distinct elements—the Himalayas, the Peninsula, and the Indo-Gangetic plain. The relations of the Himalayas to the Peninsula and the essential differences between them are dealt with in the article on Asia, and a more detailed description of the geology of the Himalayas is given elsewhere. The following account deals only with the Indo-Gangetic plain and the Peninsula.

Indo-Gangetic Plain.—The Indo-Gangetic depression is the

fore-deep of the Himalayas, lying between the folded belt which forms the mountain range and the rigid foreland constituted by the Peninsula. It bears the same relation to the Himalayas as the Pacific Deeps bear to the island arcs near which they lie, but in these the level is lower and both foreland and fore-deep lie beneath the sea. There can be no doubt, however, that the Himalayan fore-deep itself extends far below sea-level, though since its formation it has been filled up by deposit. In the eastern section of the plain the deposit is chiefly alluvial material brought down from the hills, in the western section wind-blown material plays an important part. Everywhere, except in the neighbourhood of the hills, the deposit is fine-grained, consisting of sands and muds, though *kankar* concretions may sometimes give a pebbly appearance.

No boring has ever reached the base of the alluvium, or has even shown any downward increase in the coarseness of the material. In a boring at Calcutta a bed of peat with wood, about 360 ft. below sea-level, clearly points to subsidence. A boring at Lucknow reached nearly 1,000 ft. below sea-level without any indication of an approach to the bottom of the deposit. Sir Sidney Burrard finds that the deflections of the plumb-line and anomalies of gravity suggest that the loose material filling the Indo-gangetic depression extends to a depth of 40,000 feet. He himself thinks so great a depth is scarcely probable. But the fore-deeps of much less massive mountain arcs reach 20,000 ft. and more, and in comparison with these Sir Sidney Burrard's estimate seems not improbable for the Himalayan fore-deep.

Peninsular India.—The geological history of the Indian Peninsula has been so different from that of Europe that the classification of the strata which is natural in Europe cannot be used in India and an almost entirely different terminology becomes necessary. The grouping, originally proposed by Holland, which is now commonly adopted is as follows:—

Aryan Group	Tertiary and Recent Cretaceous and Deccan Trap Gondwana System
Dravidian Group	(Absent in the Peninsula)
Purana Group	Vindhyan System Cuddapah System
Vedic or Archaean Group	Dharwar System Gneisses and Granites

The term Archaean is here used in the restricted sense in which it is often employed, denoting only the crystalline and schistose rocks of Pre-Cambrian age. The Purana group consists of normal sedimentary deposits which rest unconformably upon the Archaean but which, from the total absence of fossils, are believed to be Pre-Cambrian also, like the Algonkian of North America or the Torridonian of Scotland. The Dravidian group, which is absent in the Peninsula but present in the Himalayas, corresponds approximately with the Palaeozoic up to the Upper Carboniferous. The Gondwana system includes the oldest fossiliferous beds of the Peninsula and ranges from the Upper Carboniferous to the Upper Jurassic.

The Pre-Gondwana rocks (Archaean and Purana groups) form the foundation of the whole Peninsula. Southeast of a line drawn from Goa to Allahabad they occupy most of the surface, the areas covered by the later beds being relatively small. Northwest of this line they are concealed over a wide space by the great outflows of the Deccan Trap, but they reappear at the surface in Bandelkhand and Gujarat. In Southern India appearances suggest that there was an ancient gneissic series, including granitic and other intrusive masses, into which has been infolded a later series of sedimentary and volcanic beds, now for the most part converted into schists. The schistose series is the Dharwar system, which runs in long narrow bands through the gneiss from south-south-east to north-north-west. There has certainly been strong folding in this direction, but the Mysore geologists think that the Dharwar system is the older and that the gneissic rocks have been intruded into it. Farther north, however, where the Dharwar rocks have been less altered and retain their original bedding, they seem to be later than the main body of the gneiss, though intrusions of later date penetrate both. The gneissic series is in fact a complex of various ages and it has not yet been possible to separate it completely into its several parts.

Rocks of Dharwar type and probably of Dharwar age occur also in the Aravalli Hills, in the Central Provinces and in Western Bengal. The famous "marble rocks" of Jabalpur, for example, are referred to this system. It is interesting to note that while in Southern India the trend of the Dharwar folds is from south-south-east to north-north-west, in the Aravalli Hills it is from south-west to north-east.

The Dharwar rocks form the most highly metalliferous system in India. In Southern India all the most productive gold-bearing quartz veins, including those of the Kolar gold-field, lie within it; while in the Central Provinces and Bengal it includes valuable manganiferous deposits. Iron ore of high quality also occurs at several localities, but is usually too distant from the coalfields to be profitably worked.

The rocks of the Purana group have not been subjected to the intense folding which has affected the Dharwar system and have suffered little from metamorphism. They are mostly sedimentary deposits, such as sandstones, shales and limestones, and rest quite unconformably and often horizontally upon the older rocks. But in spite of their unaltered condition no fossils have been found in them and for this reason they are supposed to be Pre-Cambrian in age. In Southern India the group occurs in the Cuddapah basin and between Belgaum and Kaladgi. It covers a wide area in the Central Provinces and it forms most of the northern border of the Peninsular massif overlooking the Indo-gangetic plain. Several unconformities have been recognised in the group and various local subdivisions have been made; but in the absence of fossils the correlation of rocks in widely separated areas is necessarily open to doubt. Two points of general interest may be noted. In the first place, although both the Cuddapah and the Vindhyan systems are often undisturbed, yet in places the former has been strongly folded. Along the eastern margin of the Cuddapah basin, for example, the Cuddapah beds show strong overfolding and overthrusting towards the east, the trend of the folds being from north to south. If these beds are correctly referred to the Pre-Cambrian there were certainly two great periods of mountain-building in Pre-Cambrian times, separated by a long interval, the first one being post-Dharwar and pre-Cuddapah and the second post-Cuddapah and pre-Vindhyan.

The second point of general interest is that all the most famous diamond deposits of India, such as that of Karnul in S. India and of Pannah in Bandelkhand, belong to the upper Vindhyan system. The diamonds usually occur in sandstone or conglomerate, and have evidently been carried by water in the same way as other pebbles. No diamond-bearing igneous rock like that of Kimberley has been found and the original source from which the diamonds have been derived is unknown, though certain igneous rocks have been suspected.

The Gondwana System.—The Gondwana system is the most important and interesting set of beds in India. Outside the Peninsula, for example in Assam, coal is found chiefly in the Eocene, but in the Peninsula all the principal coal-seams lie in the Lower Gondwana series. The Gondwana beds occur in strips which are let into the foundation of older rock by faults. These strips, which may be continuous or broken, show a close connection with the lines of existing rivers, and probably by their comparative softness determined the courses which the rivers took. There is, for example, a series of Gondwana patches along the Damodar and a more continuous strip roughly parallel to the Mahanadi. These two strips unite into a broad triangular area traversed by the Son. Another strip is associated with the Godavari.

The Gondwana system consists chiefly of sandstones, shales and clays, with seams of coal in the lower division. For the most part the deposits are entirely of terrestrial origin, but in Cutch and at several places along the Coromandel coast marine beds are interstratified towards the top. The fossils found in these marine bands are of Upper Jurassic age. In general, however, plants are the predominant fossils, with reptiles, crustacea and freshwater fish locally. The Lower Gondwana is characterised by

ferns of the *Glossopteris* type and by Equisitaceae, the Upper Gondwana by the prevalence of Cycadaceae. The lowest subdivision of the Gondwana system is known as the Talchir series and near its base is a remarkable clay with striated boulders, now universally admitted to be of glacial origin. In its lithology, fauna and flora the Gondwana system of India is remarkably like the Karroo system of South Africa, and it was this resemblance that led Suess and Neumayr to the conception of "Gondwana Land." It should, however, be pointed out in passing that the *Glossopteris* flora has a much wider distribution than was originally supposed and extends into northern Asia and Russia.

The chief interest of the Indian Cretaceous lies in the evidence that it affords for a former connection between India and South Africa. The marine Cretaceous of the Indian Peninsula belongs entirely to the Upper division of the system. A number of detached outcrops occur along the valley of the Narbada from the town of Bagh in Gwalior, past Baroda, to Wadhwan in Kathiawar. In the south of India there is a Cretaceous area of two or three hundred square miles in Trichinopoli district, and smaller patches near Pondicherry and Viruddhachalam. By far the greater number of species which have been obtained from the Narbada Cretaceous occur also in Europe but only about a third of them have been found in southern India. On the other hand only about a sixth of the numerous species which have been found in the South Indian Cretaceous occur in Europe. Moreover, there are Cretaceous beds in Assam and nearly all the species found there are Southern Indian forms. Finally, many of the Assam and South Indian species occur also in South Africa. Hence it has been concluded that in Upper Cretaceous times the Narbada area lay in a northern sea which stretched into Europe, while Assam and the southeast border of India lay in a southern sea which extended to South Africa. Between these seas a land-mass stretched from Africa to India.

The Deccan Trap.—The Deccan Trap is an extensive series of basaltic lava-flows, with a total thickness of several thousand feet, which covers an area of about 250,000 square miles in the north-western quadrant of the Peninsula. Along the west coast it reaches the sea without any diminution in thickness from about 21° N. to 16° N., and since the lavas are certainly subaerial it is clear that at the time of their eruption the land must have extended much farther to the west than it does now. The flat-topped hills and deep-cut valleys characteristic of the Deccan Trap area are well shown on the route to Bombay either from Calcutta or Madras. In spite of the great extent of these lavas there is very little indication of volcanoes, and it is believed that the eruptions took place from fissures, with little explosive action. The duration of the eruptions cannot be determined with certainty. Probably they began during the later part of the Cretaceous period but may have continued into the Eocene.

The Tertiary beds of the Peninsula are insignificant. Near the west coast there are a few small outcrops in Travancore, Gujarat and Kathiawar, and a more complete sequence in Cutch. On the east coast the Cuddalore series, ranging in age from Eocene to Pliocene, occurs in patches from Orissa to the southern extremity of the Peninsula.

The most interesting of the recent deposits in India is Laterite (*q.v.*) which caps many of the hills and plateaux of the Deccan Trap area and is also found extensively at a lower level both upon the western and the eastern border of the Peninsula. It is a surface formation due to a special type of weathering characteristic of regions where temperature and humidity are sufficiently high. It owes its prominence to the fact that it hardens on exposure and after hardening it often resists erosion more strongly than the rocks on which it rests. (P. LA.)

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CLIMATE

1. **Regional.**—The great peninsula of India, with its lofty mountain ranges behind and its extensive seaboard exposed to the first violence of the winds of two oceans, forms an exceptionally valuable field for the study of meteorological phenomena.

From the gorge of the Indus to that of the Brahmaputra, a distance of 1,400 m., the Himalayas form an unbroken watershed. The average elevation of the Himalaya crest may be taken at not less than 19,000 ft., and therefore equal to the height of the lower half of the atmosphere; and indeed few of the passes are under 16,000 or 17,000 ft. Across this mountain barrier there appears to be a constant flow of air, more active in the day-time than at night, northwards to the arid plateau of Tibet.

At the foot of the great mountain barrier, and separating it from the more ancient land which now forms the highlands of the peninsula, a broad plain, for the most part alluvial, stretches from sea to sea. In the mid-west of this plain is a dry region occupied partly by the alluvial deposits of the Indus and its tributaries and the saline swamps of Cutch, partly by the rolling sands and rocky surface of the desert of Jaisalmer and Bikaner, and the more fertile tracts to the eastward watered by the Luni. Over the greater part of this region rain is of rare occurrence; and not infrequently more than a year passes without a drop falling on the parched surface. On its eastern margin, however, in the neighbourhood of the Aravalli hills, and again in the northern Punjab, rain is more frequent, occurring both in the south-west monsoon and also at the opposite season in the cold weather.

The alluvial plain which lies north of the desert area and is traversed by the Indus and its tributaries passes into that of the Gangetic valley without visible interruption. Up or down this plain, at opposite seasons, sweep the rain-bearing monsoon winds, in a direction at right angles to that of their nominal course. Nearly the whole surface of the Gangetic plain is under cultivation, and it ranks among the most productive as well as the most densely populated regions of the world. The rainfall diminishes from 100 in. in its south-east corner to less than 30 in. at Agra and Delhi, and there is an average difference of from 15 to 25 in. between the northern and southern borders of the plain.

From the Bengal delta at its eastern extremity, two alluvial plains stretch up between the hills which connect the Himalayan system with that of Burma. The first, or the valley of Assam and the Brahmaputra, is long and narrow, bordered on the north by the Himalayas, on the south by the lower plateau of the Garo, Khasi and Naga hills. The other, short and broad, and in great part occupied by swamps, separates the Garo, Khasi and Naga hills from those of Tippera and the Lushai country. The climate of these plains is damp and equable, and the rainfall is prolonged and generally heavy, especially on the southern slopes of the hills.

The peninsula area of India, cut off from the encircling ranges by the broad Indo-Gangetic plain, is divided into two unequal parts by the Vindhyas, an amalgam of several hill systems running almost continuously across the country from west by south to east by north, just south of the Tropic of Cancer. The waters to the north of this watershed drain chiefly into the Nerbudda and the Ganges, those to the south into the Tapti, the Mahanadi, the Godavari and some smaller streams. Together with the two parallel valleys of the Nerbudda and Tapti, which drain the flanks of its western half, this mass of hills gives, at opposite seasons of the year, a decided easterly and westerly direction to the winds of this part of India, and condenses a tolerably copious rainfall during the south-west monsoon.

The peninsula south of the Vindhyas consists chiefly of the triangular plateau of the Deccan, terminating abruptly on the west in the Sahyadri range (Western Ghats), and shelving to the east (Eastern Ghats). This plateau is swept by the south-west monsoon, but not until it has surmounted the western barrier of the Ghats; and hence the rainfall is, as a rule, light at Poona and places similarly situated under the lee of the range, and but moderate over the more easterly parts of the plateau. The rains, however, are prolonged some three or four weeks later than in tracts to the north of the Vindhyas, since they are also brought by the easterly winds which blow from the Bay of Bengal in October and the early part of November, when the recurved southerly wind ceases to blow up the Gangetic valley, and sets towards the south-east coast.

At the junction of the Eastern and Western Ghats rises the bold triangular plateau of the Nilgiris, and to the south of them come the Anamalais, the Palnis, and the hills of Travancore. These ranges are separated from the Nilgiris by a broad depression or pass known as the Palghat Gap, some 25 m. wide, the highest point of which is only 1,500 ft. above the sea. This gap affords a passage to the winds which elsewhere are barred by the hills of the Ghat chain. The country to the east of the gap receives the rainfall of the south-west monsoon. In the strip of low country that fringes the peninsula below the Ghats the rainfall is heavy.

2. **The Seasons.**—Within the boundaries of India almost any extreme of climate that is known to the tropics or the temperate zone can be found. It is influenced from outside by two adjoining areas. On the north, the Himalaya range and the plateau of Afghanistan give it a continental climate; on the south the ocean gives it an oceanic climate. The continental type of weather prevails over almost the whole of India from December to May, and the oceanic type from June to November, thus giving rise to the two great divisions of the year, the dry season or north-east monsoon, and the rainy season or south-west monsoon. India thus becomes the type of a tropical monsoon climate.

The Indian year may be divided into four seasons: the cold season, including the months of January and February; the hot season, comprising the months of March, April and May; the south-west monsoon period, including the months of June, July, August, September and October; and the retreating monsoon period, including the months of November and December. The temperature is nearly constant in southern India the whole year round, but in northern India the variation is very large.

In the cold season the mean temperature averages about 30° F lower in the Punjab than in southern India. In the Punjab, the United Provinces, and northern India generally the climate from November to February resembles that of the Riviera, with a brilliant cloudless sky and cool dry weather. This is the time for the tourist to visit India. The hot season begins about the middle of March, when there is a steady rise in temperature, until the break of the rains in June. In May the highest temperatures are found in Upper Sind, north-west Rajputana, and south-west Punjab. At Jacobabad the thermometer sometimes rises to 125° in the shade.

The south-west monsoon currents usually set in during the first fortnight of June on the Bombay and Bengal coasts, though they linger on their way up-country, and give more or less general rain in every part of India during the next three months. But the distribution of the rainfall is very uneven. Overlooking the Bay of Bengal, where the mountains catch the masses of vapour as it rises off the sea, the rainfall is enormous. At Cherrapunji in the Khasi hills it averages upwards of 500 in. a year. The Bombay monsoon leaves with very little rain a strip 100 to 200 m. in width in the western Deccan parallel with the Ghats, and it is this part of the Deccan, together with the Mysore table-land and the Carnatic, that is most subject to drought. Similarly the Bengal monsoon passes by the Coromandel coast and the Carnatic with an occasional shower, taking a larger volume inland, and abundant rain to Assam and Cachar. The same current also supplies with rain the broad band across India, which includes the Vindhyas, Chota Nagpur, the greater part of the Central Provinces and Central India, Orissa and Bengal. Rainfall rapidly diminishes to the north-west from that belt. A branch of the Bombay current blows pretty steadily through Rajputana to the Punjab, carrying some rain to the latter province. But the greater part of north-west India is served as a rule by cyclonic storms between the two currents. In September the force of the monsoon begins rapidly to decline, and in its rear springs up a gentle steady north-east wind, which gradually extends over the Bay of Bengal, and is known as the north-east monsoon. A wind similar in character, but rather more easterly in direction, simultaneously takes possession of the Arabian Sea. The most unhealthy season immediately follows the rains, when malaria is prevalent, especially in northern India. (ME.)

FLORA

British India (including Ceylon and Burma) has not any distinctive botanical features peculiar to itself; its flora is compounded out of those of the adjoining countries. In the mountainous region in the extreme north-west many European and Siberian forms occur, while the north-east displays the influence of Western China. The South of the Peninsula and Ceylon show distinct affinity with Malaya and to a certain extent with East Africa. Burma, while akin to India, has a strong Malayan bias.

The whole area is divisible into three primary botanical sections: Himalayan, Western and Eastern. These, however, are by no means homologous and are susceptible of further subdivision and they are best considered under the following eight main botanical regions.

The Western Himalayan Region.—This region consists of the western portion of the Himalayas from Chitral to Kumaon and covers a vast depth from north to south, embracing a series of parallel snow-clad ranges. Towards the south the valleys are narrow and tortuous; northwards they are more open and tend to form elevated table-lands which merge into the great Tibetan Plateau. The predominant families are: *Gramineae, Leguminosae, Cyperaceae, Labiatae, Ranunculaceae, Orchidaceae, Cruciferae, Rosaceae,* and *Scrophulariaceae,* showing a definite western influence, more especially at the higher levels. In the South subtropical trees and shrubs intrude, such as *Boswellia* and *Holoptelia.* The oaks are few and among them is the European Holm Oak (*Quercus Ilex*). Of conifers we find the *Cedrus Deodara, Pinus longifolia, P. excelsa, Abies Pindrow, Cupressus torulosa, Juniperus macropoda* and in the drier localities *Pinus Gerardiana.*

The Eastern Himalayan Region.—The remainder of the Himalayan range falls into the next region, which is narrower from north to south and has a lower average level. Tropical forms here are more numerous and there is a definite Chinese influence. The dominating families are: *Orchidaceae, Gramineae, Leguminosae, Compositae, Cyperaceae, Urticaceae* (in the wide sense), *Scrophulariaceae, Rosaceae, Rubiaceae* and *Euphorbiaceae.* A number of oaks and *Castanopsis* and a large number of *Rhododendrons* characterize this region as also many species of *Primula* and *Meconopsis.* The Deodar hardly occurs at all and few of the conifers of the last region; they are replaced by *Abies Webbiana, Picea Morinda, Larix Griffithii, Tsuga Brunoniana* and two species of *Juniperus.* Tree Magnolias are conspicuous and the tropical influence is emphasized by the presence of numerous species of *Impatiens* and Orchids.

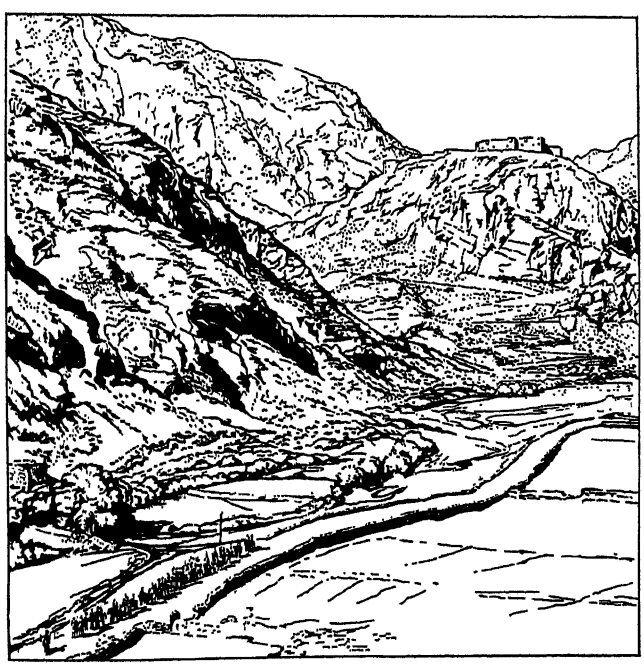
The Indus Plain Region.—The Punjab, Sind, Rajputana west of the Aravalli Hills, Cutch and Northern Guzerat make up this region. Over the greater part arid conditions prevail with a very low rainfall and a scanty vegetation which approaches extinction in the Indian Desert. Tree growth is comparatively rare and stunted; the vegetation is mainly herbaceous and is burnt or dried up in the hot season. Thorny species are conspicuously numerous. The dominant families are: *Gramineae, Leguminosae, Compositae, Cyperaceae, Scrophulariaceae, Labiatae, Boraginaceae, Malvaceae, Euphorbiaceae* and *Convolvulaceae.* Characteristic among the shrubs and undershrubs are *Fagonia arabica,* thorny species of *Capparis* and *Zizyphus* and *Calotropis.* There are two indigenous palms—*Phoenix sylvestris* and *Nanorrhops Ritchieana*—and one bamboo—*Dendrocalamus strictus.*

The Gangetic Plain Region.—Extending from the Aravalli Hills eastwards to the Bay of Bengal, this region comprises all the tract from the Himalayan foothills to the low country of Orissa. There are considerable variations in the vegetation of its different parts, all of which are far more humid than the last region. The dominant families are: *Gramineae, Leguminosae, Cyperaceae, Compositae, Scrophulariaceae, Malvaceae, Acanthaceae, Euphorbiaceae, Convolvulaceae* and *Labiatae.* The deltas of the Ganges and the Brahmaputra consist of a number of islands which support a dense evergreen forest of trees and shrubs in which the mangroves predominate. A valuable timber tree, the Sal (*Shorea robusta*), is almost confined to this region.

The Malabar Region.—This region occupies a wet zone of mountainous country with a narrow strip of low land between it and the west coast running from Guzerat to Travancore. Its highest peaks attain to a little short of 9,000 feet in elevation. The vegetation generally is very luxuriant and mainly evergreen and

approaches the Malayan type. Dense evergreen forests with thick cane (*Calamus*) brakes and bamboo thickets are characteristic. On the higher hills are found wide expanses of grassy downs dotted with patches of evergreen woods, the remnants of former extensive forests left clinging to the sides of ravines and depressions. In the moderately wet areas below 2,000 feet, the teak—*Tectona grandis*—attains to very large dimensions, growing mixed with a number of other large and valuable timber trees—*Dalbergia, Pterocarpus, Terminalia, Lagerstroemia*—and with *Bambusa arundinacea*. In the wetter forests at moderate elevations *Anonaceae, Garcinia, Dipterocarpaceae, Mesua ferrea, Calophyllum, Cullenia*, many Rubiaceous trees, shrubs and herbs, *Euphorbiaceae, Ficus, Artocarpus* and *Zingiberaceae* occur as also a single conifer—*Podocarpus latifolia*—and a number of palms and numerous ferns. In the low-lying swampy localities *Pandanus* and several *Araceae* are noticeable. At higher elevations many Acanthaceous shrubs, particularly of the genus *Strobilanthes*, are prominent and among the trees, species of *Elaeocarpus*, many *Eugenias* and a tree Composite—*Vernonia monosis*. Epiphytic orchids are fairly numerous and tree ferns appear here and there. Among the grasses of the downs at elevations over 6,000 feet are numerous herbs and undershrubs of *Impatiens, Leguminosae, Umbelliferae, Rubiaceae, Compositae*, terrestrial orchids, *Liliaceae, Commelinaceae* and patches of the bracken fern.

The Deccan Region.—The whole of the peninsula south of the Ganges valley and east of the Western Ghats is comprised in this region. With the exception of a belt of dry-evergreen, low jungle along part of the east coast, characterised by species of *Capparis, Pterospermum, Eugenia, Ixora, Mimusops, Diospyros* and *Strychnos*, the vegetation is mainly deciduous and much of it is thorny. *Leguminosae* occupy a conspicuous place; other prominent families, besides the ubiquitous *Gramineae*, are: *Tiliaceae,*



FORT ALI, ON THE KHYBER PASS, WAS ONE OF THE GARRISONS THAT GUARDED THIS IMPORTANT FRONTIER ROAD BETWEEN THE PUNJAB AND AFGHANISTAN

Rhamnaceae, Rubiaceae, Asclepiadaceae, Convolvulaceae and *Euphorbiaceae*, with large areas occupied almost exclusively by one or other of the two common bamboos—*Bambusa arundinacea* and *Dendrocalamus strictus*. On dry rocky hillocks *Givotia rottleriformis, Sterculia urens, Gyrocarpus Jacquinii, Cochlospermum gossypium, Cassia Fistula* and *Euphorbia antiquorum* claim attention. Along the coast and in the semi-desert sandy tract in the extreme South the Palmyra palm—*Borassus flabelliformis*—forms dense groves and thickets; similar aggregations of another palm—*Phoenix sylvestris*—occur inland. The true sandalwood—*Santalum album*—is found in the south central part.

The chief cultivated plants of British India include rice, wheat, many pulses and grains; castor, *Sesamum* and ground-nut oil-seeds; fruit trees such as the mango, citrus fruits, the coco-nut, Palmyra and Areca-nut palms; apples, pears, peaches, apricots, walnuts in the Himalayan valleys; tea plantations cover large areas in the North as well as in the South Indian mountains and in the latter and in Ceylon are also extensive coffee, rubber, cardamom and pepper gardens. Rubber is also grown in Burma. In several damp localities cinchona is successfully grown. (C. E. C. F.)

FAUNA

Mammals.—The lion (*Felis leo*) was not uncommon within historical times in Hindustan proper and the Punjab. A peculiar variety is preserved in the Gir, or rocky hill-desert and forest of Kathiawar, often described incorrectly as maneless.

The tiger (*F. tigris*), is found in every part of the country, from the slopes of the Himalayas to the Sundarbans swamps. The average length of a tiger from nose to tip of tail is 9 ft. to 10 ft. for tigers, and 8 ft. to 9 ft. for tigresses, but a tiger of 12 ft. 4 in. has been shot. The advance of cultivation, even more than the incessant attacks of sportsmen, has reduced numbers but extermination is very unlikely. The malarious *tarâi* fringing the Himalayas, the uninhabitable swamps of the Gangetic delta, and the wide jungles of the central plateau are at present the chief home of the tiger. His favourite food appears to be deer, antelope and wild hog. When these abound he will disregard domestic cattle. Indeed, the natives are disposed to consider him as in some sort their protector, as he saves their crops from destruction by the wild animals on which he feeds. But he may develop a taste for human blood and the confirmed man-eater, generally an old beast disabled from overtaking his usual prey, seems to accumulate victims in sheer cruelty rather than for food. The favourite mode of shooting the tiger is from the back of elephants, or from elevated platforms (*machâns*) of boughs in the jungle.

The leopard or panther (*F. pardus*) is far more common than the tiger in all parts of India, and at least equally destructive to life and property. The greatest length of the leopard is about 7 ft. 6 in. A black variety, as beautiful as it is rare, is sometimes found in the extreme south of the peninsula, and also in Java.

The cheetah or hunting leopard (*Cynaelurus jubatus*), found only on the Deccan, is trained for hunting the antelope. The cheetah's limbs are long, its hair rough, and its claws blunt and only partially retractile. Other Indian cats are the ounce or snow leopard (*F. uncia*), the clouded leopard (*F. nebulosa*), the marbled cat (*F. marmorata*), the jungle cat (*F. chaus*), and the viverrine cat (*F. viverrina*).

Wolves (*Canis lupus*) abound in open country preying on sheep, but are said to run down or ambush antelopes and hares. The Indian wolf has a dingy reddish-white fur, some of the hairs being tipped with black. By some naturalists it is regarded as a distinct species, under the name of *Canis pallipes*. Three distinct varieties, the white, the red and the black wolf, are found in the Tibetan Himalayas. The Indian fox (*Vulpes bengalensis*) is comparatively rare, but the jackal (*C. aureus*) abounds.

The wild dog, or dhole (*Cyon*), is found in all the wilder jungles of India. Its characteristic is that it hunts in packs, sometimes containing thirty dogs, and does not give tongue. A peculiar variety of wild dog exists in the Karen hills of Burma, black and white, as hairy as a Skye terrier, and as large as a medium-size spaniel. Among other dogs of India are the pariah, which is merely a mongrel, run wild and half starved; the poligar dog, an immense creature peculiar to the south; the greyhound, used for coursing; and the mastiff of Tibet and Bhutan. The striped hyaena (*Hyaena striata*) is common, being found wherever the wolf is absent. Like the wolf, it is very destructive.

Of bears, the common black or sloth bear (*Melursus ursinus*) is common throughout India wherever rocky hills and forests occur. It is distinguished by a white horse-shoe mark on its breast. Its food consists of ants, honey and fruit. When disturbed it will attack man, and it is a dangerous antagonist, for it always strikes at the face. The Himalayan or Tibetan sun bear (*Ursus tor-*

quatus) is found along the north, from the Punjab to Assam. During the summer it remains high up in the mountains, near the limit of snow, but in the winter it descends to 5,000 ft. and even lower. Its congener, the Malayan sun bear (*U. malayanus*), is found in Lower Burma.

The elephant (*Elephas indicus*) is now, at any rate, an inhabitant, not of the plains, but of the hills; and even on the hills it is usually found among the higher ridges and plateaus, and not in the valleys. From the peninsula of India the elephant has been gradually exterminated, being only found now in the primeval forests of Coorg, Mysore and Travancore, and in the tributary states of Orissa. It still exists in places along the *tarái* or submontane fringe of the Himalayas. The main source of supply is the north-east transition zone from Assam to Burma. Two varieties are there distinguished, the *gunda* or tusker, and the *makna* or *hine*, which has no tusks. The maximum height is probably 12 ft. The elephant must be hunted on foot. A special law, under the title of "The Elephants Preservation Act" (No. VI. of 1879), regulates the licensing of hunting.

Of the rhinoceros, three distinct varieties are enumerated, two with a single and one with a double horn. The most familiar is the *Rhinoceros unicornis*, commonly found in the Brahmaputra valley. It has but one horn, and is covered with massive folds of naked skin. It sometimes attains a height of 6 ft.; its long horn is much prized by natives for medicinal purposes. The Javan rhinoceros (*R. sondaicus*) is found in the Sundarbans and also in Burma. It also has but one horn, and mainly differs from the foregoing in being smaller, and having less prominent "shields." The Sumatran rhinoceros (*R. sumatrensis*) is found from Chittagong southwards through Burma. It has two horns and a bristly coat.

The wild hog (*Sus cristatus*) is well known. It frequents cultivated situations, and is the most mischievous enemy of the villager. A rare animal, called the pigmy hog (*S. salvanius*), exists in the *tarái* of Nepal and Sikkim, and has been shot in Assam. Its height is only 10 in., and its weight does not exceed 12 lb.

The wild ass (*Equus hemionus*) is confined to the sandy deserts of Sind and Cutch, where it is almost unapproachable.

Many wild species of the sheep and goat tribe are to be found in the Himalayan ranges. The *Ovis ammon* and *O. poli* are Tibetan rather than Indian species. The *urial* and the *shapu* are kindred species of wild sheep (*Ovis vignei*), found respectively in Ladakh and the Suleiman range. The former comes down to 2,000 ft. above the sea, the latter is never seen at altitudes lower than 12,000 ft. The *barhal*, or blue wild sheep (*O. nahura*), and the *markhor* and *tahr* (both wild goats), also inhabit the Himalayas. A variety of the ibex is also found there, as well as in the highest ranges of southern India. The *sarau* (*Nemorhaedus bubalinus*), allied to the chamois, inhabits the mountains of the north.

The antelope tribe is represented by comparatively few species, as compared with the great number peculiar to Africa. The antelope proper (*Antilope*), the "black buck" of sportsmen, is very generally distributed. Its special habitat is salt plains, as on the coast-line of Gujarat and Orissa, where herds of fifty does may be seen, accompanied by a single buck. The doe is of a light fawn colour and has no horns. The colour of the buck is a deep brown-black above, sharply marked off from the white of the belly. His spiral horns, twisted for three or four turns like a corkscrew, often reach the length of 30 in. The flesh is dry and unsavoury, but is permitted meat for Hindus, even of the Brahman caste. The *nílgai* or blue cow (*Boselaphus tragocamelus*) is also widely distributed, but specially abounds in Hindustan Proper and Gujarat. As with the antelope, the male alone has the dark-blue colour. The *nílgai* is held peculiarly sacred by Hindus, from its fancied kinship to the cow. The four-horned antelope (*Tetracerus quadricornis*) and the gazelle (*Gazella bennetti*), the chinkara or "ravine deer" of sportsmen, are also found in India.

The *sámbhar* or *jarau* (*Cervus unicolor*) is found on the forest-clad hills in all parts. It is of a deep-brown colour, with hair on its neck almost like a mane; and it stands nearly 5 ft. high, with spreading antlers nearly 3 ft. in length. Next in size is the swamp deer or *bara-singha*, signifying "twelve points" (*C. duvaucelí*), which is common in Lower Bengal and Assam. The *chital* or spotted deer (*C. axis*) is generally admitted to be the most beautiful inhabitant of the Indian jungles. Other species include the hog deer (*C. porcinus*), the barking deer or muntjac (*Cervulus muntjac*), and the chevrotain or mouse deer (*Tragulus meminna*). The musk deer (*Moschus moschiferus*) is confined to Tibet.

The *gaur* (*Bos gaurus*), the "bison" of sportsmen, is found in the hill jungles, in the Western Ghats, in Central India, also in Assam, and in Burma. This animal sometimes attains a height of 20 hands (close on 7 ft.), measuring from the hump above the shoulder. Its short curved horns and skull are enormously massive. Its colour is dark chestnut, or coffee-brown. From the difficult nature of its habitat, and from the ferocity with which it charges an enemy, the pursuit of the bison is no less dangerous and no less exciting than that of the tiger or the elephant. Akin to the *gaur*, though not identical, are the *gayál*, or *mithun* (*B. frontalis*), confined to the hills of the north-east frontier, where it is domesticated for sacrificial purposes by the aboriginal tribes, and the *tsine* or *banting* (*B. sondaicus*), found in Burma. The wild buffalo (*Bos bubalus*) differs from the tame buffalo only in being larger and more fierce. The finest specimens come from Assam and Burma. The horns of the bull are thicker than those of the cow, but the horns of the cow are larger. A head has been known to measure 13 ft. 6 in. in circumference, and 6 ft. 6 in. between the tips. The greatest height is 6 ft. The colour is a slaty black; the hide is immensely thick, with scanty hairs.

The rat and mouse family is only too numerous. The loathsome bandicoot (*Nesocia bandicota*), which sometimes measures 2 ft. in length, including its tail, and weighs 3 lb., burrows under houses, and is very destructive to plants, fruit and even poultry. More interesting is the tree mouse (*Vandeleusia*), about 7 in. long, which makes its nest in palms and bamboos. The field rats (*Mus mettada*) occasionally multiply so exceedingly as to diminish the out-turn of the local harvest.

Birds.—The ornithology of India is not considered so rich in specimens of gorgeous and variegated plumage as that of other tropical regions. The parrot tribe is the most remarkable for beauty. Four vultures are found, including the common scavengers (*Gyps indicus* and *G. bengalensis*). The eagles comprise many species, but none to surpass the golden eagle of Europe. Of falcons, there are the peregrine (*F. peregrinus*), the *shain* (*F. peregrinator*), and the *lagar* (*F. jugger*), which are all trained by the Indians for hawking; of hawks, the *shikara* (*Astur badius*), the goshawk (*A. palumbarius*), and the sparrow-hawk (*Accipiter nisus*). Kingfishers of various kinds and herons are sought for their plumage. The *maina* (*Acridotheres tristis*), a member of the starling family, lives contentedly in a cage, and talks well. Snipe (*Gallinago coelestis*), pigeons, partridges, quail, plover, duck, teal, sheldrake, widgeon—all of many varieties—make up the list of small game. The red jungle fowl (*Gallus ferrugineus*), supposed to be the ancestor of our own poultry, is not good eating; and the same may be said of the peacock (*Pavo cristatus*).

Reptiles.—Serpents swarm in gardens, and intrude into dwellings, especially in the rainy season. The cobra di capello (*Naia tripudians*)—the name given to it by the Portuguese, from the appearance of a hood produced by the expanded skin about the neck—is the most dreaded. The Russelian snake (*Vipera russellii*), about 4 ft. in length, is of a pale yellowish-brown, beautifully variegated with large oval spots of deep brown, with a white edging. Its bite is extremely fatal. All the salt-water snakes in India are poisonous; the fresh-water forms are innocuous.

The other reptiles include two species of crocodile (*C. porosus* and *C. palustris*) and the ghariyal (*Gavialis gangeticus*). These are more ugly than destructive. Scorpions abound.

Fishes.—Fish are eaten as nearly fresh as may be, for the art of curing them is not generally practised, owing to the exigencies of the salt monopoly. At Goalanda, at the junction of the Brahmaputra with the Ganges, and along the Madras coast many establishments exist for salting fish in bond. Among edible Indian fishes, the *Cyprinidae* or carp family and the *Siluridae* or cat-fishes are best represented. From the angler's point of view, by far the finest fish is the *mahseer* (*Barbustor*), found in all hill streams, whether in Assam, the Punjab or the South. The *mahseer*

is a species of barbel. One of the richest and most delicious of Indian fishes is the *hilsa* (*Clupea ilisha*).

Insects.—Mosquitoes are innumerable, and moths and ants of the most destructive kind, as well as others equally noxious and disagreeable. Amongst those which are useful are the bee, the silk-worm, and the insect that produces lac. Clouds of locusts occasionally appear, which leave no green thing behind them. There are many beautiful butterflies. (X.)

ETHNOLOGY AND RELIGION

Racial Origins and Types.—With a population of 319 millions (one-fifth of the whole human race) such as India possesses, racial origins are incapable of exact definition. It is generally accepted however that, in remote antiquity, India was occupied by a negroid people of low culture, ethnically related to the aborigines of Ceylon, Sumatra and possibly even Australia. At a still pre-historic stage, it is believed that an inflow of what are loosely called Dravidian races made its way through Baluchistan from Western Asia, and slowly penetrated India to the far south. Another pre-historic movement, more restricted in its scope, was an infiltration of Mongoloid races from the north-east. The fusion of these elements with the indigenes had probably gone far when the long series of invasions from outer Asia through the north-west passes began. From that period successive waves, starting with the Indo-Aryans and ending in historical times with the Moslem invasions, have swept through and got largely absorbed among the older inhabitants. Eight racial types can be traced with some confidence and for them, Risley's names are provisionally retained though it is recognised that progress of research has converted some of them into mere labels. Dravidian and Scythian as racial names are used without relation to linguistic or historical facts.

(1) The aboriginal or pre-Dravidian type, surviving in the short, platyrhine men of certain scattered primitive tribes of the



RAJPUT PEASANTS AT A FAIR IN JHALRAPATAN, RAJPUTANA

hills and jungles, such as the Santals and Bhils, and farther south, the Paniyan, Kadir, Kurumba, Irula, Kanihar, etc.

(2) The Dravidian type, now extending from Ceylon, all over the Southern peninsula, up to the Gangetic valley.

(3) The Indo-Aryan type, in Kashmir, tailing off into the Punjab and Rajputana.

(4) The Aryo-Dravidian or Hindustani type in the Gangetic valley, the product of the absorption into a mainly Dravidian population, of colonies from the more definitely Indo-Aryan country farther west.

(5) The Scytho-Dravidian type, running east of the Indus, down through Gujerat and the western part of Bombay, and represented chiefly by the Mahrattas.

(6) The Turko-Iranian type, found west of the Indus on the north-west frontier and adjoining districts.

(7) The Mongoloid type, in Burma, Assam and among the foot-hills of the eastern Himalayas, clearly originating in China and Tibet.

(8) The Mongolo-Dravidian type, probably a blend of Dravidian and Mongoloid elements, with a strain of Indo-Aryan blood in the higher groups, of which the Bengalis are unmistakable representatives.

Religions.—The chief Indian religions, with the numbers of their followers according to the census of 1921 are: Hindu (216,734,586), Mohammedan (68,735,233), Buddhist (11,571,268), Sikh (3,238,803), Jain (1,178,596), Christian (4,754,064), Parsee (101,778), and Animist (9,774,611). The oldest of these religions is Animism (*q.v.*), which represents the beginnings of religion in India, and is still professed by the more primitive tribes, such as Santals, Bhils and Gonds. The transition from this crude form of religion to popular Hinduism is comparatively easy. The most obvious characteristics of the ordinary Hindu are that he worships a plurality of gods, looks upon the cow as a sacred animal, regards certain rivers and pools as holy, and accepts the Brahmanical supremacy and the caste system; and when it is a question whether one of the animistic tribes has or has not entered the fold of Hinduism, these seem to be the proper test to apply. On the other hand there are various offshoots from orthodox Hinduism, the distinguishing feature of which, in their earlier history at least, is the obliteration of caste distinctions and the rejection of the Brahmanical hierarchy. It is doubtful if Buddhism, and still more so if Jainism and Sikhism, all of which are commonly recognized as distinct religions, ever differed from Hinduism to a greater extent than did the tenets of the earlier followers of Chaitanya in Bengal or those of the Lingayats in Mysore; and yet these latter two are regarded only as sects of Hinduism. Considerations of their history and past political importance have led to the elevation of Buddhism, Jainism and Sikhism to the rank of independent religions, while the numerous other schismatic bodies are held to be only sects. But there is a marked tendency both on the part of the sects and of the distinct religions to lapse into the parent religion from which they sprang.

The bewildering diversity of religious beliefs collected under the name of Hinduism has no counterpart amongst the Mohammedans, who are limited as to their main tenets by the teaching of a single book, the Koran. The two main sects are the Sunnis and the Shiahs. In India the Sunnis greatly preponderate, but they usually share with the Shiahs their veneration for Hasan and Husain and strictly observe the Mohurrum.

Muslims.—The Mohammedans of India may be divided into two classes, pure Mohammedans from the Mogul and Pathan conquering races, and Mohammedan converts, who differ very little from the surrounding Hindu population from which they originally sprang. The pure Mohammedans may again be subdivided into four sections: Moguls, or the descendants of the last conquering race, including Persians; Afghans or Pathans, in the Punjab and in the Rohilkhand division of the United Provinces; Saiyads, who claim to be lineally descended from the Prophet; and Sheikhs, which is a name often adopted by converts. The remainder are unspecified. In Bengal the vast majority of the Mohammedans in their devotion to hereditary occupations are scarcely to be distinguished from Hindu castes. In the Punjab, besides the Pathan immigrants from across the frontier, Islam has taken a strong hold of the Jats, Rajputs and Gujars. Bombay possesses three peculiar classes of Mussulmans, each of which is specially devoted to maritime trade—the Memons, chiefly in Sind; the Borahs, mainly in Gujarat; and the Khojahs, of whom half live in the island of Bombay. In southern India are found the two peculiar races of the Moplahs and the Labbays, both of which are seated along the coast and follow a seafaring life. They are descended from the Arab traders who settled there in very early times, and were recruited partly by voluntary adhesions and

partly by forcible conversions during the persecutions of Hyder Ali and Tippoo Sultan. The Moplahs of Malabar are notorious for repeated outbreaks of bloody fanaticism. In proportion to the total population Islam is most strongly represented in the North-West Frontier Province, where it is the religion of 92% of the inhabitants: then follow Kashmir and Sind with about 75% each, Bengal with 54%, the Punjab with 55%, and the United Provinces with 14%. In the great Mohammedan state of Hyderabad the proportion is only 10%.

The Sikh religion is almost entirely confined to the Punjab, its adherents numbering 3,237,449. Buddhism had disappeared from India long before the East India Company gained a foothold in the country, and at the present day there are very few Buddhists in India outside Burma, where they number over 11 millions. More than two-fifths of the Jains in India (1,178,596 in all) are found in Bombay and its states, including Baroda. The Parsees, though influential and wealthy, are a very small community, numbering only 102.000, of whom all but 19,000 are found in Bombay. The remainder are scattered all over India.

Christians.—The Christian community numbers 4,753,937, of whom 4,464,396 are Indians and the remainder Europeans and Anglo-Indians. Of the Indian Christians about two-fifths are Roman Catholics. More than half of the Indian Christians are found in Madras and the adjoining states, a tribute to the labours of St. Francis Xavier and the Protestant missionary Schwarz. The adherents of the Syrian church, known as "Christians of St. Thomas," in Malabar, Travancore and Cochin are the most ancient Christian community in the south. After these come the Roman Catholics, who trace their origin to the teaching of St. Francis Xavier and the Madura Jesuits. The Protestant churches date only from about the beginning of the 19th century, but their progress since that time has been considerable. As is to be expected in the case of a religion with a strong proselytizing agency, the growth of Christianity is far more rapid than that of the general population. Taking Indian Christians alone, their numbers increased from 1,246,288 in 1872 to 4,464,396 in 1921, and the rate of increase was even greater than these figures would show, because they include the Syrian church, whose numbers are practically constant. The classes most receptive of Christianity are those who are outside the Hindu system, or whom Hinduism regards as degraded. Conversions from Islam are relatively scarce.

Caste.—So far as Hinduism is concerned, the intermixing of the racial types described above has left one definite ethnical legacy in Caste; for it is apparently from the differences in civilization and political power resulting from the imposition of successive strata of conquerors over the conquered that the Hindu system of caste arose. The Census report of 1911 defines a caste as "an endogamous group or collection of such groups bearing a common name and having the same traditional occupation, who are so linked together by these and other ties, such as the tradition of a common origin and the possession of the same tutelary deity, and the same social status, ceremonial observances and family priests, that they regard themselves, and are regarded by others, as forming a single homogeneous community." Not only is the caste usually endogamous, but within it there are a number of smaller circles, each of which is also endogamous. Caste has come to be the chief factor in the life of the ordinary Hindu, regulating his acts from the cradle to the grave; and its influence extends to the Mohammedan masses who are descended from the more recent converts to Islam. (*See* CASTE.)

Languages.—According to the linguistic survey of India, no fewer than 220 distinct languages are recorded as vernacular in the country. These are grouped in linguistic families as follows:—

Austro-Asiatic	
Mon-Khmer (550,000)	10
Munda (3,974,000)	7
Tibeto-Chinese (12,885,000)	145
Dravidian (64,128,000)	14
Karen (1,114,000)	15
Indo-European, Aryan (232,847,000)	25
Smaller families (27,000)	6
Total Vernaculars of India	222

The Mon-Khmer sub-family, which is most numerous in Indo-China, is represented in India by the Talaings of southern Burma and the Khasis of Assam. The Munda languages, belonging to the Austric family of speech, are chiefly confined to Chota Nagpur, their best-known tribe the Santals. Of the Tibeto-Chinese family, the main groups are spoken from Tibet to Burma; while the Siamese-Chinese sub-family is represented by the Shans of Burma. The Dravidian family includes the four literary languages of the south, as well as many dialects spoken by hill tribes in Central India, and also the isolated Brahui in Baluchistan. The Indo-European family embraces the tongues of the great mass of the people of northern India. (ME.)

PEOPLES OF INDIA

The discoveries at Mohenjo-Daro include the skeletal remains of a dolichocephalic (long-headed) people, who, in Sir John Marshall's opinion, "may reasonably be assumed to have belonged to the great long-headed race of Southern Asia and Europe to which the name 'Mediterranean' is commonly applied" (*Times*, Jan. 4, 1928). One skull approximating to the brachycephalic (round-headed) type, which seems to possess the same characteristics as the pronouncedly brachycephalic statues, was found from a fractional burial. These remains are of the Chalcolithic period and subsequent to the abandonment of the latest city (*c.* 2500 B.C.). Two skulls found buried deep in alluvial deposits near Bombay are perhaps 2,000 years old and are regarded by Sir Arthur Keith as of the small size and narrow shape now prevalent in India. Two of the skulls discovered at Aditanallur in a prehistoric burial site are conspicuously prognathous (with prominent jaws), and others are markedly long-headed, this latter a feature still noticeable in southern India. In early Indian literature mention is made of people having the complexion of a charred stake, flattened features and very short stature, a type quite common in the present population of the continent.

Melanoderms.—The Andamanese (*q.v.*), are typical Negritos and these people can be considered to be a pure race. They have black skins, woolly hair, very broad noses, round heads and everted lips. It is possible that this element may at one time have existed on the continent but it has left no traces in the present population. More widely spread is a stock marked by short stature, longish heads, broad noses, very dark skins and curly, even frizzly, hair and lips inclined to be everted. This class includes in its numbers the jungle tribes of southern India and of Chota Nagpur, the lower castes in western Bengal and to a slight extent the lowest castes in upper India. This element appears to be related to the Veddas of Ceylon, the Sakai of the Malay peninsula and the Australoids. Here and there woolly-haired individuals may be found but they may be merely aberrant forms or due to recent African admixture.

Leucoderms.—An important element, conspicuous in southern, but found in western, India as well, is long headed, with medium to fine noses, shortish, with darkish skin and fine wavy hair. The lips are thin. This element resembles in many respects the Mediterranean stock. The dominant element in the northern, especially the north-western, area is tall, long headed, with fine noses, fair skins (allowing for the effects of exposure to the sun) and in many instances with light-coloured eyes. The lips are thin. It is a type represented among the higher castes of Bengal, and the Nambutiri Brahmans of Malabar, the Nayars, the Coorgs and the Todas also must be regarded as of this stock. In the mountain regions on the west and in Baluchistan is found a round-headed stock, fairly tall, with fine features, wavy hair, ranging from dark brown to fair, and occasional lightish eyes, which seems to be affine to the Alpine stock. A somewhat similar round-headed element can be traced along the west coast but is darker in skin, hair and eyes.

Xanthoderms.—Many groups in central, northern and eastern Bengal have Mongoloid features and the Savaras on the east coast in the Madras presidency have the Mongolian eyefold. While these main elements may be distinguished in the Indian population, miscegenation has taken place in varying intensity under different conditions all over the continent from prehistoric times. Varia-

tions of humidity, temperature, altitude, mode of life, have also had their effect.

The dissociation of language and race is complete in many parts of India so that terms such as Aryan or Dravidian, which have or may have some value when applied separately either to linguistic or to racial groups, have no significance when attached indiscriminately. Such terms have been avoided here.

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Social Organization.—The evidence as to the social system of the early Vedic Aryas is singularly vague. They were settled in the Punjab between the Indus and the Sarasvati, but had also occupied lands on the Jumna and even on the upper Ganges. This area was of very varying fertility. Probably the central Punjab was then, as later, a barren steppe; but the riverain tracts, the Kurukshetra and the sub-Himalayan belt were doubtless fertile, well-wooded and possibly densely forested. We may thus expect to find pastoral types in the steppes and agricultural in the cultivable areas. We have no good reason to assume that the Aryas found these lands unpeopled; on the contrary the pre-Aryans of the north were probably quite as advanced as the Dravidians who seem to have been settled in villages from an early period. Even in the *Rig-veda* we find mention of measured fields, and of ploughlands. The village (*grama*) sometimes contained a fort (*pur*), doubtless a tower, and might be of considerable size. Grain was certainly stored, so the villagers cannot always have been nomadic; but hints are given that the "village"-folk was in places a body of herdsmen, wandering in search of pasture under the guidance of the god Pushān. Of the social economy of the settled villages, we learn little. At its head was the village leader, but he seems to have been the chief of its militia, often connected with the *senāni,* or "leader of the host," which would be quite compatible with the exercise of civil or fiscal functions.



BY COURTESY OF CANADIAN PACIFIC S.S. CO.
TAMIL GIRLS OF SOUTHERN INDIA

Of village councils we hear nothing, although assemblies (*sabha samiti*) of the people met to advise the king; but in the Epics they disappear.

The village body included such artisans as the *rathakara,* "chariotmaker," carpenter, smith, and others, but they are not described as members of it. Only once do we read of a *gramyavādin,* seemingly a village judge. Indeed we find no term to define a "village-owner" in any way equivalent to the modern usage. On the other hand the king's relation to the soil is equally indefinite. That he was not formally its superior owner is clear, yet he could grant villages or assign his fiscal rights over them to favourites, though such gifts to Brahmans were reproved. And later the idea developed that he was legal owner of the soil, and that his grantees were landlords. Doubtless the feuds alluded to, between nobles and people, arose out of these nebulous relations.

Tribal Organization.—When we turn to the Vedic organization of the tribes the darkness deepens. The *vish* was the people as opposed to the *kshatra,* "nobility," but originally the word doubtless meant "settlement" or merely "dwelling," and the head of it was the *vishpati,* its "lord"; but again the king is *vishpati* as "lord of the people." The *vish* did not, however, include all the *jana,* a term which means "man" and collectively "people" or "tribe." It seems to have denoted the "host" collectively as well as units of it, but whether those units were clans or cantons is not explained, and we have no mention of either tribal chiefs or headmen of cantons. We cannot, however, be very wrong if we picture the Aryan hosts as composed of tribal rather than territorial levies under their own "kings" (*vishpatis*), obeying the *senani* or *senapati* with village-leaders under them.

Village Community.—The process whereby the Aryan village developed into the modern village community is nowhere described, but it is not difficult to form some idea of it. First of its factors must have been a change in inheritance laws which now gave each son an equal share in the paternal land. This stereotyped the sept or *gotra.* Meaning at first merely a "herd" or "cowstall," this word assumed later a new significance. A change of *gotra* once quite possible became unthinkable and marriage within it was disallowed. The older system had only prohibited it within three or four degrees on either side, and even so permitted a union with the daughter of a paternal uncle, but some instinctive dread of in-breeding seems to have extended the exogamous principle not only to the whole *gotra* necessitating its immutability, but to the descendants of three more kinships, the mother's and the grandparents'. The result was a solidifying, as it were, of the proprietary body which held a village or a number of villages, whether grouped or dispersed. This principle was applied with equal stringency to non-landholding castes of all degrees, though it was often relaxed so as to exclude only one or two kinships beside the paternal *gotra,* and in extreme cases it might be further relaxed by splitting even that *gotra* into two, after a long period of time had reduced the perils of in-breeding to zero. The original *gotra* indeed seems to have been an artificial unit, at least among the Brahmans, whose *gotras,* named after the semi-mythical sages (*rishis*) may well have included their disciples as well as their own issue. Not until the Epic period do we find one of the *Upanishads* enunciating the rule that spiritual succession must descend from father to son, thus closing the *gotra* to new blood. It is, however, important to note here that in the south of India the exogamous instinct still permits cross-cousin marriage.

The village community no doubt has been, and still is, a real commonwealth. But if we ask how it has enforced its collective will, we shall find it rarely evolving a constitution written or unwritten. Sporadically, in the south of India some interesting inscriptions of the 10th century tell us of village committees, under royal control, on which the members sat in rotation determined by lot. It is not clear that they were elected. But a low-caste man was eligible if he had undergone expiation.

But elsewhere investigation fails to trace any ordered forms of village rule. The convention of the village owners, often called its *panchāyat* or "council of five," includes in fact all its members, but it is singularly like the old Polish diet. It has no lawful means, but merely public opinion or collective force, of enforcing its decisions, its customs or its reforms. Its headmen rarely possess definite authority. The wonder is that it has achieved so much. It has enabled provinces devastated by war to reconstruct their rural economy. It has helped vaster areas, ruined by repeated famines, to recover their prosperity. It has re-peopled regions left desolate by massacres like those of Tīmūr. But it has failed to set up any working system of self-government on which could be grafted a legal structure. No doubt the Indian village varies in the types of its tenures. In the north its lands may be held on the precise shares heritable by descent, the tenure favoured by the Rājpūts. Or it may be that in the fragmentation of the holdings ancestral right is no longer the measure of actual occupation which has been allowed to individual co-parceners according to their energy and enterprise; so that the industrious having brought much of the common waste under the plough have bequeathed to their descendants, on its final partition, an indefeasible right to the lion's share of what is left of it. Recently much has been done to consolidate holdings, by enforced mutual exchange of scattered ones, but only under State action. In the south of India a more individualistic system was observed to exist by the earliest British administrators. There they found the village not strictly regarded by its former rulers as collectively responsible for the payment of its land-tax, and consisting of individual holdings. The village community therefore was held to be less often existent and the *ryot-wari,* or system whereby each holder paid his own land tax to the government was favoured.

Social Economics.—The repercussions of these economic phases in Indian society have been marked. The refusal to endure primogeniture has fragmented wealth too rapidly and above all impoverished the smaller gentry who have been compelled to adopt widow re-marriage as an economy. The denial of all testamentary power to the father has weakened social discipline. Hindu law and custom often almost entail property on all the sons alike, abolishing incentives to effort in the cadets. Indian society must not be regarded as aristocratic but as an infinite series of democratic strata lying one above another. Within the *gotra,* now the *got* or whatever its modern synonym may be, all men are equal. But the dictum at once calls for qualification. Within the *got* individuals shall not excel, but groups may, and so where a *got* holds a big cluster of villages and hamlets, one or two bigger, older or more prosperous than the rest, will set up a claim to be superior to the rest. This superiority will be manifested by a denial of brides to a hitherto equal clan, extra extravagance at births, weddings, funerals and so on. But the cost of placing daughters hypergamously or even isogamously being prohibitive, they will be made away with or so neglected that their chances of life are far below those of boys. (*See* INFANTICIDE.) Hence a loss of almost a moiety of the best-bred strata in the finest *gots,* an unparalleled sacrifice on the altar of snobbery. But the repercussions spread further. The *gotra* must always have been an unprogressive body, its pace being that of its slowest members, and the *got* has inherited its retardation, and it has rarely if ever created a council of canton or tribe. It has had a keen spirit of tribal self-esteem. It has done nothing to advance self-administration in the village or over it.

So far what has been said applies peculiarly to the Hindu castes, including the Sikhs and Mohammedanized tribes which hold the plains of northern India. In the south, caste is tenser, but there is less apparent tendency to subdivide socially. On the other hand two great factions—the right-hand, which is headed by the Brahmans, and includes curiously the Pariahs; and the left-hand, headed by the Panchālars, the "five-castes," workers in stone, metal, etc., and including the Pullars or Pullans—have been formed.

How the feud between these factions originated is unknown. The causes of collision were trivial and apparently for the most part of a purely sumptuary character. The Pullans are agricultural serfs, little, if at all, above the Pariahs. Offspring of a Brahman woman by a Shūdra, Devendra, they say created the work for the Tamil peasantry, which hints at a pre-Tamil origin. A stocky, sturdy black man eating meat (but not beef, and so superior to the Pariahs) the Pullan specializes in the cultivation of wet rice-land, but is excelled by his woman-folk. Some old sumptuary law forbade a Pullan woman to be clothed above the waist, and when Christian converts broke this rule disturbances ensued. Divided into numerous endogamous and innumerable exogamous groups, they trace descent through females and bury their dead. Yet they adopted some Hindu gods and even claim descent from Indra. In a faction fight they form the vanguard as do the Pariahs on the other side. Yet, low in the caste as they are, the Pullan evince a considerable power of self-organization. They have caste-councils which punish theft and adultery and discipline is enforced by flogging (of both sexes) or expulsion from the caste.

In northern India it may be said that caste self-government is confined to the artisan castes, with occasional guild committees among the traders. But no general assemblies ever seem to have existed. The traders settle commercial disputes in townships and their associations may also decide matrimonial conundrums, but the latter form the main if not the sole matter which interests the artisan *panchāyats* or juries. These are presided over by elders, usually hereditary, and sometimes have an appellate system. Owing to the dispersion of such castes in the village, the jurisdictional area may be large and it is often co-terminous with an old fiscal area.

A Summing Up.—To sum up, the social organization of India, a continent inhabited by one-sixth of the world's population, presents a wide range of complexity from the simple tribe, an endogamous group with its exogamous kinship clans, or from the local group, be it village or simple hunting group, with local exogamy, divided into family groups, the débris or the rudiments of a clan system, to an organized polity wherein the castes are ranged in order of purity (*see* CASTE) which is determined by factors deep in the history of the people, some economic, others racial, others purely political. The village (*see* above) is a microcosm, a replica of the greater organization above, often almost self-contained, always essential. Clearly, there was in Ancient India an advanced urban organization the influence of which upon the social history, upon the development of caste, upon the economic and industrial life of India has not as yet been explored. The family, be it joint or divided—for the practice varies and is conditioned by general social and historical facts—is ultimately in India, as elsewhere, the primal unit in the social organization within which, as the first instrument of cultural tradition, are built up the dispositions which, universalized within the society, become its institutions. Kinship—whether matrilineal, as in Malabar, or, as more generally, patrilineal—is with the *got* or clan system reckoned unilaterally, but with the system of cousin marriage, still, as in the early days, typical of southern India, from the highest to the lowest groups, the true bilaterality of the family appears. In this vast area, with its long history and numerous ethnic contacts, marriage rites have been developed to great variety. Every form of social experiment seems to have been tried. The caste system exhibits even now, with a vigorous endogamy strong with religious and social sanctions, the principle of separatism, of emphasis on the differences between groups, and it finds scope for perennial application. (*See* CASTE; also HYPERGAMY, POLYGAMY, LEVIRATE, SORORATE, COUSIN MARRIAGE, FAMILY, CLAN, TRIBE.)

RELIGION

The religion is not based on anything exclusively Indian but on old world-wide beliefs and universal thought. Its tenets are often pushed to their extreme logical consequences. It is well-nigh as fissiparous as caste, and while it has often in periods of burning zeal for reform caused the lineaments of caste to fade, it has never erased them, and as denominational enthusiasm wanes, the old caste outlines re-appear, generally with new lines enriching the old pattern.

Vedic Religion.—The principal religion of India is, indeed, not so much a religion as a social system tolerating several creeds, pantheism, polytheism, monotheism and atheism, yet intolerant of foreign monotheists and of its fellow-Indians who have rebelled against the caste system. Hinduism (*q.v.*) has absorbed much and rejected little. It has been a great proselytizing system yet it has had few missioners. It has accepted something from its opponents, but kept them at arm's length. Its strength lies in its eclecticism and in its insistence on the divinity of its own sacred caste, the Brahmans. It was preceded by primitive beliefs which have been called Animism (*q.v.*). It has developed by taking up those beliefs into its articles, speculating freely in its own way, learning much and unlearning nothing. It has undergone never-ceasing changes and is still unchanged.

Of the earliest pre-Aryan faiths of India, all that can be said is that the Vedic sacrifice was sympathetic magic that was directed to secure the benefits of sunshine and rain in due season. It is not safe to attribute all magical practice to aboriginal Dravidian or non-Aryan sources. The faith of the *Vedas* was untouched by Zoroaster's monotheism, yet in them we may discern at first a struggle towards it and then in the *Atharva-Veda* a re-action towards magic, but we have no evidence that the *Atharva-Veda* owes anything to the indigenous magicians of India. It was indeed rather a revival of Iranian practice. But the admission to canonical rank of the *Atharva-Veda* was none the less of cardinal importance in Indian religious history. It raised the good magician at least to priestly status, and if it denied that status to the evil-working sorcerer it tacitly confessed his power. The *Vedas* en bloc were thus made to appeal to the most primitive instincts and the task of the Brahman simplified. He had not to convert, but merely to assimilate.

In the beliefs of the most backward tribes of India, observers have detected Animism, definable concisely as a worship of spirits including impersonal forces. But it is doubtful if Indian Animism ever had any real conception of an impersonal force. It lacked quite completely a vivid idea of personality. The Santāl who still believes that if he takes a false oath on a piece of tiger skin he will be devoured by a tiger, does not seem to attribute any impersonal power to the relic, but to regard it as a convenient substitute for the live tiger which will eat him if he calls upon him to do so in his oath, and then commits perjury. So inchoate is the concept of personality that his primitive mind fails to draw much distinction between inanimate things and living beings. It is equally incapable of realizing death. Accustomed to obey his living village chiefs, he continues to placate them when dead, but worships neither their ashes nor their memorial stones, nor their spirits. The latter are not deified or even ranked as specially endowed *bongas,* the so-called spirits who in human shape marry Santāl men and maidens, cause disease and mischance when so bidden by witches and display gratitude in tangible form by material acts. The Santāls seem to have no words of their own for ghosts or spirits and their native god is Marang Buru, the "great mountain" whose personality can only be described by using a borrowed term, *dēo,* the Sanskrit *deva,* and whose main function appears to be the instruction of maidens in witchcraft. But the Santāls cannot be safely regarded as typical pre-Aryans. They dwell in the eastern outskirts of the Chota Nagpur plateau and are hunters in the forest, not assiduous cultivators. In more favoured localities the Dravidians may have attained a much higher civilization. Still less can we be certain that the conceptions of impersonal forces, of the soul and of a future life were unknown to them and kindred tribes before the Aryan conquests.



BY COURTESY OF CANADIAN PACIFIC S.S. CO.

CHILDREN STANDING BEFORE ONE OF THE MANY STONE IDOLS COMMON THROUGHOUT INDIA

Cosmogony.—The *Vedas* however display much loftier conceptions. The cosmogony of the *Rig-Veda* fluctuates between two theories, one regarding the universe as the work of a great architect, the other as the result of natural generation. In the first Indra measured out the six regions, made the expanse of earth and the dome of heaven. He and other gods built a cosmic house of timber, framed on posts but rafterless, and why the sky does not fall is a marvel. Savitri made fast the earth with hands, Vishnu fixed it with pegs and Brihaspati supports its ends. In a frame Indra fixed the air and the morning light enters by the portals of the East. But the generation theory is more complex. Dawn, Ushas, born of Night generates the Sun and morning sacrifice. But parentage is more easily assigned to place than it is to time, so Heaven and Earth, containing all, are universal parents. Dyaus, the sky, is father, the Dawn is his daughter. Generically again, he who is the chief, the most prominent of a group, is their parent. Vāyu, the wind, fathers the storm-gods, Rūdra the Maruts (*q.v.*) or Rudras, Soma all plants, and Sarasvati all rivers. But abstractions are already used figuratively so that the gods are "sons" of immortality and of skill: Agni is son of night, Pūsan of freedom, and Indra of truth. This concept recalls the Semitic idiom. On the other hand in the latest canto the world is primitively imaged as a giant from whose members sprang the universe, Indra and Agni from his mouth which also became the Brahmana, from his arms the Rājanya, "warrior," and from his thighs the Vaishya, "commonalty." His head became the sky, his navel the air and from his feet (which also produced the Shūdra) the earth. Moreover the gods are also moral, all are true and "not deceitful," friendly to honesty and righteousness. In this aspect Varuna (*q.v.*) is foremost. The Vedic gods however lack individuality and clearness of outline. Already in the *Rig-Veda* they are said to be 33 in number, a figure constantly increased. And these gods are graded, classed as celestial, those who dwell above the firmament, aerial and terrestrial.

Functions of Deities.—But when we enquire into each god's special functions we find a singular vagueness, a puzzling overlapping of jurisdictions. It is as if the Vedic Aryans had been formed of a confederacy of tribes, each affecting a god of its own, not differing much one from another, often bearing the same names with function adapted now to pastoral, now to cultivating clans, but generally war-like; and as if these gods had been transferable from tribe to tribe as treaties united their followers. Most of the gods have at least some solar attributes. None has a monopoly. If Varuna upholds physical and moral order, so does Mitra. If Varuna is invoked as universal king (*samrāj*) so are Mitra, Indra and even Agni, as though aspirants to the supreme monarchy over the Aryan hosts grasped and lost political power. Though the Vedic gods remain interdependent, Varuna and Surya subordinate to Indra; Indra, Mitra, Varuna and Rudra to Savitri, and Varuna with the Asvins to Vishnu, every god is praised in turn, even the exalted Varuna being mostly invoked in conjunction with at least one colleague while verses to pairs, triads and groups are frequent. The Vedic pantheon resembles the Aryan polity in that it never arrived at an uncontested monarchy. But the *Rig-Veda* closes with some notable hymns which treat the origin of the world as a philosophical problem, and the sun, as a golden embryo, is given the new name of Prajāpati (hitherto a mere epithet of Savitri) "lord of creatures." Foreshadowing or reflecting some monotheistic innovation, Prajāpati is the All, soon to become the anthropomorphic personification of the desire (*kāma*) which is the first seed. Such in outline is the story of the *Rig-Veda's* development, but it does not exhaust all its slowly achieved conceptions. We must at least add to them the toothless Pūsan, the "prosperer," an indistinct individuality, hardly yet anthropomorphic, who watches over paths and guides the dead on the last road. Naturally such a concept is capable of almost infinite expansion, and Pūsan was later to become a sun-god and Āditya "the preserver of all things," and then to fade into oblivion. The Ādityas, sons of Aditi, a group of some six or more gods whose names are variously given, included not only Mitra and Varuna (Indra was added later) but such minor deities as Aryaman, Bhaga, Daksa and Amsu; later they too will be sun-gods and include Vishnu. Aditi denoted bondlessness and may be regarded as the only abstraction personified as a goddess in the *Vedas.* Aditi is the great mistress of the devout, but motherhood is her essential trait. Her epithet is *pastyā,* "housewife." She cannot, however, be safely regarded as "Mother of the Gods" in the *Rig-Veda,* her recognition as such not appearing till the Epic period. Her lesser sons are as indistinct as herself, Bhaga besought to be Bhagavān, "bountiful," and Amsha also connoting "bounty," Aryaman, "comrade" and Daksa "dexterity," yet the first must be of great antiquity, *bogŭ* being "god" in old Sclavonic, while Aryaman is Avestan. In Vedic worship goddesses are fairly numerous but quite subordinate even when wives of the high gods like Indrānī. They bear simple names, Ushas (*q.v.*), Night, Earth, Speech, Pārendi or Puramdhi, a goddess of plenty like Dhishana, Ila or Ida "abundance" of milk, later "cow"—Brihaddiva, associated with her, Urvasi, beside Rākā (? giver), soon to personify the full moon. Sinīvalī, broad-hipped, fair, a mistress of the family, invoked for offspring, later to be called Vishnu's spouse, and, like Kuhū, the new moon; Prishni, "speckled" and Saranyu "swift," indicating recent origins. Not until we come to the *Brahmanas* (*q.v.*) do the wives of the gods have a place in the cult assigned to them apart from their husbands. Lower deities like the *Apsarasas* and Gandharvas (*q.v.*), deified priests and heroes like Manu (*q.v.*) animals especially horses, kine (the cow is not to be slain) birds such as Garuda, inanimate objects from rivers and hills down to weapons and tools, but not the phallus, abound. Opposed to the benevolent deities is a host of demons, *asuras* ("gods" in the *Rig-Veda* like the Avestan *ahura*), and *dasus,* possessed of occult power, the term *dasu* being at first applied to the dark aborigines, then to demons of the air, and

finally to slaves; on the other hand *vritras* were at first demons and later human foes; *rakshasas* and others.

In the *Rig-Veda* we find belief in a future life, delectable for those who have done penance, for heroes and generous donors of sacrificial gifts. In the earliest hymns burial of the dead is alluded to but cremation was more in favour, doubtless because the soul ascended to Heaven with the smoke. The *Vedas* contain no hint of a belief in metempsychosis but it appears in a *Brahmana*. Yama (*q.v.*) is essentially the king of the dead, but he is hardly their judge, as they pass between two fires, which burn the wicked and let the good go by. Nor does Yama reign alone.

Modern Religion.—We come now to the doctrines which have led to modern Hinduism. One of the principal of these is that of the transmigration of souls, but we cannot fix the date of its appearance in India even approximately. The *Vedas* contain no trace of it, and the *Brahmanas* only indicate the lines of thought whence it arose. Yet in the *Upanishads* and all later Hindu sacred writings it is accepted, and has influenced nearly all Hindu thought. Through the spread of Buddhism it has become widely promulgated amongst the whole of central, eastern and southern Asia, and Jainism assisted this process, though *karma*, "actions," meant something quite different from its meaning in Hinduism wherein a man's actions in one life determine his position in the next. The doctrines were in their inception atheistical and fixed a man's fate for him by his *karmas* in his lives which were never ending; hence arose a passionate desire to find release from the bonds of sense.

Yet, stranger still, the old Vedic ritual was not abandoned and the *Sutras* which were now written were intended to aid the student, being classified indices of its increasing perplexities, more or less unintelligible by themselves and requiring a commentary to explain them. They reflect ritualism and polytheism which are retained without misgivings as to their contradictions by the *karma* theory.

The Epic Poems.—The *Epics* were composed as popular poems in the 6th–4th centuries B.C., changed into sectarian poems by Vaishnava priests in the 2nd century, and in the 1st and 2nd centuries A.D. enlarged, especially the *Mahabharata*, by Vaishnava theism, into an encyclopaedia. The *Mahabharata* was increased from 2,800 to 100,000 verses, but no one has yet undertaken to sift the original from the added matter and there is considerable disagreement amongst scholars as to the dates above given.

The *Ramayana*, whose author was a man of low caste, is easier to dissect. It contains innumerable superstitions and the doctrines of transmigration and *karma* are not yet full-grown. But the *Mahabharata* is even more primitive. In it everyone eats beef. Brahmans often become warriors. The heroine, Draupadi, is polyandrous. On such documents we can as yet found no final theory as to the origin of the cult of Krishna, who may be identical with Vasudeva, while others hold that he was distinct. Rama was almost certainly a man.

The Upanishads.—In the next great batch of religious writing, the *Upanishads*, we have a less corrupted source. The term means secret doctrine and though the root of every idea in them may be found in the *Brahmanas* it is most probable that they were put together by Kshatriyas. Yet they are assigned to Brahmanical schools and some like the *Chhandogya Upanishad* bear the very names of their *Brahmanas*. The essential teaching of the *Upanishads* is that knowledge gives release. Dating from about 500 B.C. they took form in the lands of the Ganges and the Jumna, and they are followed by versified condensations of little later date. But these introduce Vishnu and Shiva as symbols of Brahma. Isha or Ishvara appears as the Supreme in the *Isha Upanishad*, while in the *Svetashvatara* Shiva is introduced under his older title of Rudra and, for the first time in Hindu literature, *bhakti* or devotional feeling, is spoken of as due to him. In these treatises also first occurs the term Vedanta as a name of the Upanishad philosophy.

Hence by the middle of the 6th century, we find a network of Hindu schools, already in full working order, and represented by the prose *Upanishads* the *Karma Mimamsa*, etc.

Probably in the 4th or 3rd century B.C. appear the Samkhya and Yoga (*q.v.*) systems. The former admitted Sudras, the latter outcasts as well. The one derived from the *Upanishads* in the main, the latter ultimately from popular magic and hypnotism. The Lokayata or materialistic school was probably also in existence.

Buddhism and Jainism.—But to these must be added Jainism and Buddhism (*qq.v.*) both founded by Kshatriyas, rival faiths of Hinduism. Of Jainism, the older, we have less information. As to Buddhism we have much more, but the one great fact to be stressed here is its pessimism. To the Buddhist, Nirvana meant release by extinction. But this doctrine is not consistently taught and under Asoka's influence we find each great *stupa* or tope erected over relics of the Buddha or of a noted preacher a splendid work of art while there is no mention of transmigration, karma or nirvana, in all his edicts. They preach ethics such as respect for animal life, proper treatment of slaves and generosity to religious teachers, ignoring all metaphysical teaching—as if it were something too deep or too unimportant for the laity. On such a basis no enduring Buddhist church could be founded and with Asoka's death the great hope for Buddhism dies though it survived for centuries as one of many sects.

Theistic Movements.—The great movement towards theism may be said to have begun about 200 B.C. In the conditions which then prevailed it could hardly have had a more unpromising outlook, and to add to its misfortunes its earliest writings have perished. *Upanishads* continued to be written but its principal manual has disappeared, only the sectarian writings such as the *Sannyasa, Yoga*, and *Shiva Upanishads* surviving. It seems indeed to have been an epoch when works which struck at particularism were deliberately destroyed. The original version of the laws of *Manu*, the *Dharmasutra*, was replaced by the *Dharmashastra* in verse. Probably some early versions of the Sankya and Yoga systems also existed, but both have disappeared as have the fundamental texts of the *Vaishesika, Nyaya* and *Charvaka*. The Vaishnavas took over the great epics, and changed their character.

The Bhagavadgita.—Among the twice-born we must recognize two great divisions, the orthodox faithful to the Vedic pantheon and ritual, and the sectarians exalting one god to the neglect of the rest, and in his cult using a ritual and liturgy of non-Vedic origin chiefly by temple and image. The sectarian position was greatly strengthened by the *Bhagavadgita*, the earliest and greatest of the didactic Epics. Its date is disputed. In its present form it cannot be earlier than the 1st or 2nd century A.D., but its original may go back to the 4th century B.C. Suddenly in the added matter of the great epics we find the doctrine of divine incarnation. It is useless to ask whence it came or to point to gods in the *Brahmanas* taking temporarily the forms of animals, fish or dwarf. The Vaishnavas go much further. They identify Vishnu with the Brahman-Atman of the *Upanishads*, and with Krishna to whom is given the title of Bhagavān whence the name of the poem, "The Lord's Song." Vishnu's selection is inexplicable. He was one of the great trio but Brahma was the more likely to be chosen as chief of the gods, as the Supreme. Krishna, man, a partial incarnation of Vishnu in the second stage of the Epic, is promoted as a full incarnation of Vishnu-Brahman. The change is not merely revolutionary but unexplained. The explanation must have been set forth in one of the lost works. The theology of the poem is thus a theism, but still imperfect. The Song is coloured, as it were, with some pantheistic passages.

The *Samkhya, Yoga* and *Upanishads* are all dragged in without any attempt to reconcile their differences. It recognizes no animal sacrifice but it tightens up the bonds of caste and establishes the regular worship of ancestors. If the Dharmashastras as we have them are those to which it refers the ideal is laid down that every man ought to pass through the four *asramas*, and that not even a virgin widow may re-marry. Scholars who hold that the Song was contaminated by the pantheism of the *Upanishads* in the 2nd century A.D. have much on their side. But how did it in the 2nd century B.C. appear as a purely theistic tract glorifying Krishna? It began as a sectarian thesis, it has become the very cream of orthodoxy.

This by no means exhausts the Vaishnava material in the didac-

tic Epic. It was followed by a flood of writings, notably by the Narayaniya section of the *Mokshadharma* which seems to present a later period in the history of Vaishnavism. In it to the Bhagavata are added the Sattvata and the Pancharatra, the latter a term whose name is not yet explicable and the doctrine of Vyuha or expansion according to which Vishnu exists in four forms, denoting the steps of his ascent to Brahma. It is very difficult to see what the idea behind this scheme is. The second is Samkarshana, "withdrawn," because Vishnu, identified with primaeval matter, was drawn from his mother's womb and placed in Rohini. But Vasudeva is Krishna, Balarama or Samkarshana, Krishna's brother, Pradyumna his son, and Aniruddha one of his grandsons. The *Narayaniya* has 10 incarnations of Vishnu, whereas the *Anugita* only mentions six, adding four to the original two but otherwise making no advance whatsoever. The *Narayaniya* also has a tale of Narada the saint taking a long journey to the north where he came to the White Island in the Sea of Milk wherein white men worshipped Narayana, *i.e.*, Vishnu. Here we have seemingly allusions to Christianity. But as yet there is nothing to suggest any worship of the child Krishna or any association of Krishna with the Gopis, "cowherdesses." The story of his rescue from the wrath of Kamsa is still untold and Radha is not mentioned.



FROM THURSTON, "CASTES AND TRIBES OF SOUTHERN INDIA"

A DEVIL DANCER OF SOUTHERN INDIA IN FULL CEREMONIAL COSTUME

In the didactic Epic, Shiva follows Vishnu, but at a long interval. His new theology is clearly in its inception an imitation. Pasupata, as it is called, is scarcely to be distinguished from Pancharatra. The term is formed from Pasu pati, "lord of flocks," once an epithet of Rudra. Shiv-worshippers to-day revere the phallus (*e.g.*, the Lingayats, *q.v.*), but though it appears on pre-Christian monuments no mention of it occurs in literature before this period.

Buddhism.—Buddhism was developing similar traits. This can be stated with confidence if we regard the literature which has been preserved. The Mahāyāna is the acute Hinduizing of Buddhism, and in it Buddha is conceived of as the Supreme, boundless in power and wisdom and surrounded by Bodhisattvas just attaining Buddha-hood. The text book of this school was the *Lalita Vistara,* originally the Buddha-biography of the Sarvastivadins but taken over and re-written. In it the old Hindu self-torture all re-appears. In his efforts to save men Analokitesvara, "looking down from above," can save from danger.

Jainism.—With Jainism there was a good deal of literary activity between 200 and 500 A.D., but much of it has been lost. The main writers were connected with Pataliputra and the works of one were used by both the Jain sects. They also adapted the Ramayana. All this shows how the sects were inclined to mingle with the Hindus. But what with lost, re-written, etc., books we know too little to be able to say anything with certainty.

Shakta Worship.—About 550 A.D. we see the dawn of the Shaktas though they may have been known earlier. In this system the god is neutral or inactive—apparently because he must be so if he is to remain beyond the sway of the law of *Karma*—and his spouse the goddess embodies his energy (*shaktia*). The oldest goddess of this type is Durga, the virgin goddess of the Vindhyas. Her alliance as Uma with Shiva is later and she is no longer regarded as a virgin. Here we have palpably a fruitful field for new philosophers, sects and almost religions, and we begin to get on to historical ground. Shankara in the first half of the 9th century takes up the teaching in a series of works attributed to him, but probably not all from his pen. He certainly, however, wrote commentaries or *Vhashyas* on the *Vedanta-Sutras,* the Song and many of the chief *Upanishads.* Shankara distinguishes between the supreme truth and that of experience. Besides the supreme or *para*-Brahman is a lower (*apara*) one, the world-soul and personal god. All our lower knowledge, our personal experience and conception of ourselves as distinct personalities is ignorance rather than knowledge. Liberation comes when a man rises to true knowledge which is finally granted by the grace of God and for which a man may prepare himself by the study of the Veda and the discipline of the Vedanta. Hence when a man became a Sunnyasi of the Advaita Vedanta he gave up all the duties of the ordinary Hindu, laying aside even the sacred thread. Naturally its illusion and doctrine of double truth led its opponents to term it covert Buddhism. By Shankara's day the *Upanishads,* the Song and the *Vedanta-Sutras* were recognized as fundamental for the Vedanta. Later they were called the Triple Canon. Shankara re-regulated its orders, dividing them into 10, whence their name of Dasnamis. He founded Sringeri in Mysore as his chief monastery where he himself was the head, Govardhan in Puri, Sarada (Saraswati as patroness of sciences) in Dwarka, and Joshi at Badrinath. And he was able to do what is rare in Hinduism, viz., reform the Bhagavatas, a Ramaite sect in the south, and the Shaivas of Kashmir. Many other writers followed. The Puranas, whose history is as old as it is obscure, had virtually all come into existence by the end of this period and two of them betray Shakta influence.

The Vaishnavas of the Bhagavata school also accepted the Advaita Vedanta and the five gods, but still more serious was their identification of Shiva with Vishnu in the Skanda *Upanishad.* To-day in the Tamil country the ritual is that of the Pancharatra Samhitas said to be unorthodox as inconsistent with Vedic usage, but we cannot be certain when they were written.

The Samhitas.—The Samhitas mark first the appearance of Shaktic principles among the Vaishnavas, indeed the theology of the chief one is a development of the Naraniya episode with the considerable addition of Shaktaism. The basis of their philosophy is the theistic Yoga, but it is manipulated so that it is hardly recognizable. Vishnu and his Shakti are one in the primary creation which is followed by 36,000 secondary ones in which a Samkhyan evolution appears. Their description is that of an attempt to combine most of what has gone before into a single but disconnected system. Even magic is commended. The Sri-Vaishnavas have a sect-mark, two white curving lines with a vertical red one between them, the red representing Vishnu's Shakti. The Samhitas ordain that this symbol shall also be branded on the body. The cult is open to all four castes but not to outcasts. But besides the Sri-Vaishnava several other sects arose, notably the Narsimha (Narsingh) sect which worships the man-lion incarnation of Vishnu, especially in the south and had two *Upanishads* of its own, and these were so popular that they were imitated in other sects. The Shaivas had a bewildering number of sects and schools such as the Kapalikas or skull-men, perpetrating human sacrifice and full of Shakta ideas.

Durga Worship.—The sect of Durga now reorganized with a new theology, a more varied cult, and a fresh literature, appears as the Shakta sect. Its writings still await scholarly investigation but many of them were in existence by 600 A.D. Its system is fundamentally an unlimited array of magic rites drawn from the practices of the most ignorant classes; and it has been credited with ritual usually ascribed to secret sects. It was divided into the left-handed or those who pushed such usages to an extreme, and the right-handed as reformed possibly by Shankara.

Bhakti.—Between 900 and 1350 A.D. we have a new movement in Hindu literature—that of Bhakti. The earlier singers of the Tamil country, the Alwars, in their lyrics introduced great changes in the Sri-Vaishnava temples and paved the way for Ramanuja whose influence re-acted on all the sects.

So, too, the chauntries of the Shaiva gave their cults a great uplift and made possible the creation of the Tamil Shaiva Siddhanta. The two great books are the *Sri-Bhashya* of Ramanuja and the *Bhagavata Paurana,* whence sprang two streams of Bhakti, the one meditative, the other explosively emotional. While the

Shankhya and Yoga schools stood still all the others continued their literary activity in which Bhaskaracharya, author of the *Bhaskara-Chashya*, attacks Shankara and in turn is assailed by Udayana in the Kusummanjali, between 850 and 980 A.D., while Mādhva, founder of the Mādhva sect, left Dvaita commentaries on ten principal *Upanishads*. The Bhagavata Purana seems to have sprung from the Bhagavata community and from its influences were born a number of new sects. It has several distinctive features. It devotes itself to Krishna's boyhood and youth and to the gopis or cow-maidens; but even yet Radha does not appear, her place being foreshadowed by a favourite gopi. Further, *Bhakti* now attains its highest point of mystical expression and it must have arisen among Vaishnava ascetics. It is a surging emotion which leads to tears and laughter, to sudden fainting fits and long trances of unconsciousness. But it has one fatal feature in its sensuous description of Krishna's dalliance with the gopis. Hindus are by no means in accord as to its age or authorship, but, as Alberuni mentions it, it can hardly have been written after 900 A.D. and must be due to a community of singers in the Tamil country. The sects due to the Bhagavata Purana's influence are numerous. They included the now possibly extinct Raseshvaras or Mercurials, who acquired a divine body by the use of mercury and then by Yoga an intuition of the Supreme; the aspirant is then liberated in this life. Another inchoate sect is that of the Gorakhnathis—closely related to the Kapalikas—with an unorganized laity. They have temples all over India from the Gorkatri in Peshawar, in Nepal, right down to the south. Its adherents mainly called Kanphatas, Yogis or split-eared, are its strongest part. Both Tantrik Hinduism and Tantrik Buddhism glorify Goraksha Nath and his companion saints, yet Goraksha himself probably flourished about 1200 A.D. and with his name is associated a new type of Yoga, the Hatha-yoga, destined to attain the *samadhi*, "supreme concentration of mind," by strange bodily postures, breathing exercises and attention. In the later books on this cult is added Raja-yoga, a more intellectual discipline. The book by Goraksha on the Hatha-yoga seems to be lost.

On the other hand, some of the older sects have disappeared, *e.g.*, the Rama sect which re-wrote the *Ramayana*, adding Shakta elements to it so that Sita's illusory self is carried off by Ravana and when Rama speaks as a man he is explained to be under the influence of *maya*, "illusion." This elevates the pair to the position of the Supreme.

Mohammedan Influences.—The earliest influences of the Muslim invasions were naturally confined to Sind, the Punjab and Hindustan. They were often unorthodox, the purer forms of the faith being too intent on the establishment of their own sternly monotheistic creed to win acceptance from Hindus. Not much before 1400 did Sufiism begin to make headway in India and most of the institutions which have survived from that period are due to it. The Mohammedans certainly destroyed Hindu temples which they called Jain but more for the sake of their materials than for any other purpose. With the reign of Akbar began a new movement, namely the attempt to create a new world-religion which should unite the warring elements. This religion borrowed from all. It was never strictly defined, as Akbar was suspect to his Muslim subjects, but he was at least tolerant, which the later Aurangzeb was not. It would be as difficult to deny that his austere faith was one of the principal causes of the fall of the Moghul empire as it would be to dispute its influence on Hindu monotheism. Weak as we have seen the movement towards theism to have been, it found support from Islamic example. It was the same with idolatry. To this movement we must ascribe the teachings of Namdeva and Trilochan in the Mahratha land, of Sadana and Beni in the north, and of Ramananda who lived from about 1400 to 1470. He was followed by his disciple Pipa and by Kabir. Ramananda seems to have been under Ramanuja's influence, yet he worshipped Rama and Sita and their attendants alone. He probably derived his doctrine from the Ramaites of the south, but he came to the north and among his personal followers were an outcast, a Mohammedan and a woman; yet he attempted no reform of caste restraints, though he mitigated some in the matter of food. The most numerous of the ascetics founded by him are the Baīragis "passionless," or Avadhuta, "liberated," only equalled to-day in numbers by Shankara's Dasnamis. But he founded no regular sect. Indeed sectarianism was in process of decay. Ramananda still affected images, but Kabir denounced them and worshipped God (Ram) alone. Many of his sayings were included in the Sikh Granth (*q.v.*).

Of the ten sects founded by his followers during the next three centuries, the Sikhs (*q.v.*) are incomparably the most important. All are to be found in the country about Delhi, in Rajputana and its states and the Punjab, only one, the Shiva Narayanas, having originated in Ghazipur in the United Provinces. (H. A. R.)

GOVERNMENT AND ADMINISTRATION

Political Divisions.—India (including Burma) has a total area of 1,805,332 sq.m., with a population of 318,942,480 by the 1921 census. These figures comprise:—

British India.—British India; area 1,094,300; pop. 247,003,293; and Indian States; area 711,032; pop. 71,939,187. British India proper is divided into 15 provinces. Nine of them would, in point of size and population, rank with important countries in Europe. They are Assam, Bengal, Bihar and Orissa, Bombay, Burma, Central Provinces and Berar, Madras, Punjab, and the United Provinces of Agra and Oudh; each with its own local government under a governor. Then come two smaller provinces, of special strategical and military importance, which are more directly under the control of the central government, to wit, the North-West Frontier and British Baluchistan. The remaining four are lesser areas which, for administrative convenience, are technically classed as provinces, viz.: Ajmer-Merwara, the Andaman and Nicobar islands, Coorg, and the Delhi enclave.

The Indian States.—The Indian states are governed by Indian princes or chiefs, the more important of whom are helped by political officers appointed by the British government, and resident at their courts. The degree of sovereignty exercised by the different rulers varies greatly, as do the areas under their dominion. The greater princes administer the internal affairs of their states with almost complete independence, having revenues and armies of their own, and the power of life and death over their subjects. At the other end of the scale are petty chiefs with a jurisdiction hardly higher than that of an ordinary magistrate; and between these extremes lies much gradation. The authority of each ruler is determined by treaties or engagements with the British government; or by practice that has grown up in the course of their relations with British India. The paramount power requires the states not to enter into alliances or armed disputes with each other, or with foreign states; and it asserts the right to interfere in cases of gross misgovernment.

The most important states are Hyderabad, Mysore, Kashmir, Gwalior and Baroda. After them come a number of great princes, for whom the official criterion of importance is the number of guns to which they are entitled by way of salute. Some of them are in direct relation with the central government; others belong to the large territorial circles known as the Rajputana and the Central India Agencies; others again, including all the more petty chiefs, deal with the local governments whose boundaries their states adjoin. Burma contains a number of Shan states, which technically form part of British India, but are administered through their hereditary chiefs.

Frontier States.—In addition to the internal states, there are several frontier tracts of India, whose status is fluctuating or not strictly defined. In Baluchistan there are the native states of Kalat and Las Bela, and also tribal areas belonging to the Marri and Bugti tribes. On the north-west frontier, in addition to the chiefships of Chitral and Dir, there are a number of independent tribes which reside within the political frontier of British India, but over which effective control has never been exercised. The territory belonging to these tribes, of whom the chief are the Waziris, Afridis, Orakzais, Mohmands, Swatis and Bajouris, is attached to, but is not strictly within, the North-West Frontier Province. Kashmir possesses as feudatories Gilgit and a number of petty states, of which the most important are Hunza-Nagar and Chilas. Nepal and Bhutan, though independent, are under

various commercial and other agreements with the government of India. On the north-east frontier, as on the north-west, semi-independent tribes extend across the frontier into independent country. Similarly Karenni, on the Burmese border, is not included in British territory, but the superintendent of the Shan states exercises some judicial and other powers over it.

ADMINISTRATION

Government of India.—The government of India vests in the Crown, and is exercised in England by a secretary of state who, as a member of the cabinet, is responsible to parliament. His salary is now on the British estimates, which gives parliament a clearer invitation than it formerly enjoyed to discuss Indian affairs. In administrative details the secretary of state has the machinery of the India Office, and particularly the assistance of the Council of India, an advisory body with special control over finance. The members of the Council must not be fewer than eight, nor more than 12; at least one-half of them must have recently served or resided in India for ten years; and they are appointed for five years. A Hindu and a Mohammedan were put on the Council for the first time in 1907; and there are now three Indian members. Since 1920 a High Commissioner for India has been in existence. Acting as agent for the central and provincial governments in India, and also as official trade representative of the country, he occupies a position not unlike that of the accredited representatives of the Dominion governments.

In India the head of the government is the governor-general or viceroy, who is appointed by the Crown for a period of usually five years. He functions, for practically all administrative business, in his executive council; and it is in the "governor-general-in-council" that the supreme authority, civil and military, as well as the control over the local governments, vests. The "Government of India," to use its best known name, works at Delhi in the cooler months, November to April, and migrates to Simla in the Punjab hills for the rest of the year. The members of the executive council are appointed by the Crown for a period of five years; and two of them must have had ten years' service in India. There are at present seven members, including the commander-in-chief, three of them being Indians. The departments of administration are divided among them as in a European cabinet; but by use and wont the viceroy retains the portfolio of foreign affairs. All orders, however, must issue in the name of the governor-general-in-council.

In the nine major provinces the governor is appointed by the Crown; in the case of Madras, Bombay and Bengal he is usually a nominee of the political party in power in England at the time of his selection, and in the other provinces he has generally been promoted from the ranks of the civil service. Since 1921 his administration has been carried on through two agencies, the system being explained in more detail below: in certain "reserved" departments he acts with his executive council, and in the remaining ("transferred") departments with ministers. The two intermediate and the four minor provinces are each under a chief commissioner, who is directly responsible to the Government of India, and has no council.

Within the separate provinces the administrative unit is the district, of which there are 273 in India. In every province except Madras there are divisions, consisting of three or more districts under a commissioner. The title of the district officer varies according to whether the province is "regulation" or "non-regulation"—an old distinction, which now tends to become obsolete; in a regulation province the district officer is styled a collector, while in a non-regulation province he is called a deputy-commissioner. The chief non-regulation provinces are the Punjab, Central Provinces and Burma. The districts are partitioned out into lesser tracts, which are strictly units of administration, though subordinate ones. The system of partitioning, and also the nomenclature, vary in the different provinces; but generally it may be said that the subdivision or *tahsil* is the ultimate unit of administration. Broadly speaking, the subdivision is characteristic of Bengal, where revenue duties are in the background, and the *tahsil* of Madras, where the land settlement requires attention year by year. There is no administrative unit below the subdivision or *tahsil*. The *thana*, or police division, only exists for police purposes. The old *pargana*, or fiscal division, has now but an historical interest. The village still remains as the agricultural unit, and preserves its independence for revenue purposes in most parts of the country. The township is peculiar to Burma.

The Judicial Service.—Bengal, Madras, Bombay, the old North-Western Provinces (now the Agra portion of the United Provinces), the Punjab, Burma and Bihar and Orissa, each has a high court, established by charter under an act of parliament, with judges appointed by the Crown. Of the other provinces Oudh has a chief court, and the Central Provinces, Sind and the North-West Frontier Province have judicial commissioners, all established by local legislation. From the high courts, chief courts and judicial commissioners an appeal lies to the judicial committee of the privy council in England. Below these courts come district and sessions judges, who perform the ordinary judicial work of the country, civil and criminal. Their jurisdictions coincide for the most part with the magisterial and fiscal boundaries. But, except in Madras, where the districts are large, a single civil and sessions judge sometimes exercises jurisdiction over more than one district. In the non-regulation territory judicial and executive functions are still to some extent combined in the same hands.

The chief of the Indian services is technically known as the Indian civil service. It is limited to about a thousand members, who used to be chosen exclusively by open competition in England between the ages of 21 and 24. Nearly all the higher appointments, administrative and judicial, are appropriated by statutes to this service. Other services which used to be mainly or wholly recruited in England were the education, police, engineering, public works, telegraph, forest and superior railway services. A quarter of a century ago it was estimated that, out of 1,370 appointments drawing a salary of £800 a year and upwards, 1,263 were held by Europeans; while the vast majority of the lower posts were occupied by Indians. All this is now changing fast. The pronouncement of Aug. 1917 adumbrated "the increasing association of Indians in every branch of the administration," and standard ratios for the recruitment of Indians for the different services were laid down as the result of a Royal Commission appointed in 1923. For the Indian Civil Service and the superior engineering service it will be 60 per cent; for the Police 50 and for the Forests 75 per cent; while the recruitment for the "transferred" departments will be left to the provincial governments and by them will no doubt be largely Indianized. Besides the great mass of subordinate and clerical posts, the magisterial work and the administration of the land and the revenue is very largely in the hands of Indians; the subordinate courts of justice are almost entirely manned by Indians, who also sit on the benches of all the high courts.

The Police.—The present police system, which is modelled somewhat on that of the Irish constabulary, was established by an act of 1861. It provides a regular force in each district, under a superintendent who is almost always a European, subordinate for general purposes to the district magistrate. The unit of work is the *thana* or police station; some of these have jurisdictions as big as some English counties, and staffs of not more than a dozen men. The regular force depends necessarily on the village watchmen, overworked and underpaid Dogberries, for information and help in their investigations; and they suffer from the steady failure of the general public to give them adequate support in the discharge of their duties. Though the old canker of corruption and abuse of power has not been by any means eradicated, the morale of the force has been vastly improved in recent years; and a commission appointed in 1902 led to a much needed amelioration of their pay and general conditions. The strength of the force for the whole of India is about 200,000, and its cost just under £8,000,000. A small force (about 27,000) of military police, under officers seconded from the army, is maintained along the frontiers, especially in Burma.

Jails in India are relatively cheerful abodes, and are being constantly improved. Their average population in 1924 was just over

127,000, a figure which, in its relation to the total population, is striking testimony to the general law-abiding disposition of the Indian people. Discipline is well maintained, though separate confinement has been abolished; and various industries, especially carpet-weaving, are profitably pursued wherever practicable. Diet and sanitation account for the remarkably low death rate (1924) of 14 per 1,000 inmates. A recent committee of enquiry laid stress on the reformative side of the system; and considerable progress has been made in Borstal and similar treatment. It used to be the rule to transport to the Andamans convicts with more than six years to serve; but the islands are now being abandoned as a penal settlement, and in 1925 the number of their convict inhabitants had been reduced to close on 8,000.

Local self-government, municipal and rural, in the form in which it now prevails in India, is essentially a product of British rule. Village communities and trade gilds existed previously, but only in a rudimentary form. The present system is based upon legislation by Lord Ripon in 1882, providing for the establishment of municipal committees and local boards, whose members should be chosen by election with a preponderance of non-official members. These powers lay far too long in abeyance, but their application has been greatly stimulated as part of the recent political advance. The municipalities and district boards have largely been freed from official control; but its place has too often been taken by political faction, and it seems necessary to suspend judgment on the work of the new bodies. The chief difficulty has been to induce them to raise the taxation needed for the efficient maintenance of their services. Great and small, there are 763 municipal bodies in India, with nearly 19 millions of people under their care, and their average rate of taxation is under 9 shillings per head of inhabitant. The great cities of Calcutta, Bombay and Rangoon have energetic improvement trusts, which have worked wonders in development, removal of slums and housing projects for relieving congestion; and their example is being followed in other industrial centres. In another field of work, the Port Trusts of Calcutta, Bombay, Madras, Karachi and Rangoon have proved enlightened custodians of their harbours and the commercial interests for which they cater.

India's Constitution of 1919.—Transcending in general interest the annals of administrative routine, however progressive and benevolent, is the narrative of the development of the political machinery of a country where autocratic monarchy and internecine war had for many centuries prevailed. The restoration of peace and order under the East India Company was a task which left little leisure or inclination for theories of political emancipation; and the only duty immediately in sight was to rule the land, first, for the promotion of peaceful commerce, and then, by slow degrees, in the interest also of the people, who neither sought nor were considered fit for any share in the management of public affairs. The Mutiny set back for quarter of a century any movement that might otherwise have come from England for some measure of self-government; and it was not till Lord Ripon's viceroyalty that conceptions of political rights began to stir. Broadly speaking, they were pushed aside as being, in the eyes of the responsible officials, premature; but two consequences ensued. On the one hand, an organized school of political reformers came out into the open; the National Congress was founded in 1885. On the other hand, representatives of the people were called in to the councils of the government. The former movement progressed with vastly greater rapidity than the latter. Each succeeding year brought louder insistence on India's right to share in her own administration; while the appointment of an extra Indian here and there to the small legislative bodies was but a halting response, especially as the elective principle was steadily refused. It is sometimes said that the first big forward move towards political responsibility was forced by the outbreak of revolutionary crime in Lord Minto's regime; but it is well known that he and some of his advisers had been convinced of the need for an advance before the outrages began, and as a consequence of the remarkable outburst of political claims that followed Lord Curzon's departure.

The Morley-Minto reforms, as they are commonly called, of 1909 seemed at the time a liberal and striking advance, and were received with a chorus of approval and gratitude by Indian publicists. But they entrusted the legislatures, and through them the people with no control over the executive governments; Lord Morley himself, good radical though he was, had definitely rejected the idea that they gave parliamentary institutions in embryo. What they did do was to introduce the electoral principle into the Indian legislatures, and give them a wider sphere of influence over the executive government. But in effect the legislatures remained advisory bodies, and the absence of any administrative responsibility whetted their critical faculty without giving them any corresponding practice in the actual work of government. The executive authorities, imperial and provincial, remained governments of officials, responsible to the Secretary of State, and through him to the British Parliament, and not amenable in any direct sense to popular control in India.

From this arrangement to the announcement of 1917 was a wide step, involving organic change and not taken before time. The enthusiasm which had welcomed the Morley-Minto reform had long evaporated, and the demand by the Indian leaders for administrative power was clamorous. The Montagu-Chelmsford report conceded the justice of the demand, and proposed that responsible government, in the sense of government by ministers primarily responsible to an elected assembly, should be conferred on India by progressive stages. It recognized that India was not yet ready for full responsible government, that an electorate had to be created and that its representatives must at first be inexperienced. Its authors proposed therefore to confine the first stage of advance to the major provinces, and in these provinces to set up a dual form of government, generally known as "dyarchy." This device, accepted only after all possible alternatives had been found impracticable, was a division of the provincial field of government into two sections, one of which would be transferred to the control of ministers chosen by the Governor from the elected members of his legislative council.

In July 1919 a bill embodying this scheme, with certain modifications, was introduced into the House of Commons, read a second time and referred to a joint select committee of both Houses presided over by Lord Selborne. The committee, after an elaborate investigation, accepted the main principles of the scheme, and dealt at length with the political and administrative problems involved in the bill. The bill passed both Houses substantially as amended by the committee, and left a great deal of the new constitution to be worked out by rules drafted and applied by the government to meet the needs of each particular case. The general purport of the constitution will now be described.

At the outset it demarcates the duties of the "central" or Imperial government from those of the provincial governments. The former retains certain powers of supervision and control over the provincial administrations; but its direct functions are specifically listed, and the departments which are under the provincial governments are similarly enumerated. These governments derive their revenue from the departments under their own control, *i.e.*, land revenue, stamps, excise, forest, etc. The Imperial government takes the yield of its own central departments—railways, post and telegraphs, customs, income tax, salt, opium, etc. At first, however, these did not balance its budget, which carries the whole cost of the defence of India; and consequently it had to levy subsidies from the provinces, though it is pledged to forgo them when the development of its own resources shall permit. As with the administrative and financial powers, so also are the law-making powers of the central and the provincial authorities carefully delimited.

Each of the major provinces is placed under a Governor. The whole of the provincial departments are divided in each province into two groups, the "reserved" and the "transferred." The former (at present law and order, justice, police, the land, etc.) are administered by the Governor and his Executive Council, the latter (education, public health, excise, etc.) are administered by the Governor and two or more Ministers, who are chosen by him from the leaders of the provincial legislature. These two

bodies work independently, each in its own field; and their responsibilities are clearly distinguished. The Governor is the link of union, and has full discretion to bring them together for joint consultation on matters of common interest. The Executive Council in its control of reserved subjects is responsible through the Government of India and the Secretary of State to the British Parliament; the Ministers in their control of transferred subjects are responsible to the legislative council on the spot. This, in the briefest terms, is the system which has been named or nicknamed "dyarchy." Its purpose is to provide a field of actual duty in which Indian leaders can be trained by actual practice in the art of Government.

The legislative council in each province has a large elected majority, with an element (under 30%) of officials and nominated members. The elections are direct and the constituencies mainly territorial. A property qualification, differing in different provinces, determines the franchise. The vote was originally given to about 5,000,000 of the adult male population in the whole of India, and has subsequently been extended by the grant of a restricted female suffrage in certain provinces. For whatever legislation and supply they require, both halves of the Government are dependent on the legislature thus constituted. In the "transferred" sphere, Ministers must secure the support of the legislature. If they fail, their policy fails; and the ordinary course is for them to resign or be dismissed by the Governor, so that they may be replaced by Ministers who can carry the legislative council with them.

In the "reserved" sphere, it is the task of the Governor and his official colleagues to reconcile the legislature to their policy. But if they fail, their responsibility for right policy to the British Parliament is in no wise diminished; certain safeguards are accordingly provided against the event of the council refusing a law or supply for which it has been asked by them. The Governor has an exceptional power to pass such a law by his own decree, if he certifies that it is essential for the discharge of his responsibility; but a measure enacted in this way has to be reserved for His Majesty's pleasure. Similarly the Government may restore a grant for expenditure which has been refused or reduced by the Council if the Governor certifies in the same sense; and in case of emergency he may authorise any expenditure which "may be in his opinion necessary for the safety or tranquillity of the province or for the carrying on of any department." Finally, should the legislature take action in any department which the Governor regards as dangerous, he has wide powers to stop a bill, or to refuse assent to it, or to return it for reconsideration, or to reserve it for the consideration of the Governor-General. Extensive safeguards thus exist against the possible misuse of its power by the provincial legislature.

The Imperial Sphere.—In the central Government there is no dyarchy. The Governor-General and his Executive Council still remain in sole and undivided responsibility to Parliament for the supreme Government of India. The central legislature, however, has been radically altered by the 1919 Act. The Lower House, or Legislative Assembly, has 144 members, 103 of whom are elected direct by constituencies similar to those which elect to the provincial legislatures but larger in area and with a higher property qualification. In the Upper House or Council of State are 60 members, of whom 33 are elected on a still more restricted franchise. In neither Chamber therefore is there an assured majority for the Government, to secure the laws, the taxation measures or the expenditure grants which it requires for the administration of the country.

It was foreseen that the Central Government may not always be able to carry the legislature with it, and machinery was provided for avoiding a deadlock in such an event.

In legislative business a difference between the two Chambers may be referred to a joint sitting. If in either Chamber a bill is proposed or amended so as to affect "the safety or tranquillity of British India or any part thereof," the Governor-General may stop it. He may also, as under the previous constitution, veto a bill, or refer it for His Majesty's pleasure. Should he recommend a bill which either Chamber accepts and the other rejects, he may treat it as enacted; or if both Chambers reject it, he may make it into an Act on his own responsibility. In both cases, however, the Governor-General must first have certified that the "passage of the bill is essential for the safety, tranquillity or interests of British India or any part thereof," and the measure must subsequently be laid before both Houses of Parliament; effect may not be given to it, unless in a state of emergency, until His Majesty's assent has been received. In financial business the supply grants have to be voted by the Legislative Assembly; but if a grant which the Governor-General declares to be essential to the discharge of his responsibilites is refused or reduced, he may restore it.

Expenditure on defence and in the political and ecclesiastical departments, charges prescribed by law, loan charges and certain salaries and pensions need not be voted; and the Governor-General has power to sanction vital expenditure in cases of emergency.

Further Development.—The above is an outline of the complex scheme that comprises the first stage in what the preamble of the 1919 Act describes as "the gradual development of self-governing institutions." As "the time," to quote the Act again, "and the manner of advance can be determined only by Parliament," it was provided that, 10 years after the passing of the Act, a Parliamentary Commission will go to India, to inquire into the working of the reforms, and to report on the desirability of establishing the principle of responsible government or of extending, modifying or restricting the degree of responsible government already existing. Apart from the constant war, described elsewhere, that has been waged by the extreme nationalists on the constitution and all its works, there has been ceaseless agitation by the same section of politicians to have this commission appointed before 1929, in order to expedite the issue of granting their demands for provincial autonomy and Dominion status. The working of the constitution had in fact been seriously hampered by the non-co-operation movement in its earlier years, and later by the destructive tactics of the extremists in the councils; so that the material for measuring its effects could not be accumulated as the 1919 act had contemplated. Moreover the nationalists gave no response to the repeated invitations (in particular from Lord Birkenhead) to draft a constitution which they would be prepared to work. It was thus decided at the end of 1927 to appoint the statutory commission at once; and it started for India in Jan. 1928, under the presidency of Sir John Simon (*q.v.*).

EDUCATION

At no period of its history has India been an altogether unenlightened country. Inscriptions on stone and copper, the palmleaf records of the temples, and in later days the widespread manufacture of paper, all alike indicate, not only the general knowledge, but also the common use, of the art of writing. From the earliest times the caste of Brahmans has preserved, by oral tradition as well as in mss., a literature unrivalled alike in its antiquity and in the intellectual subtlety of its contents.

The Mohammedan invaders introduced the profession of the historian which reached a high degree of excellence, even as compared with contemporary Europe. Through all changes of government vernacular instruction in its simplest form has always been given, at least to the children of respectable classes, in every large village. Even at the present day knowledge of reading and writing is, owing to the teaching of Buddhist monks, as widely diffused throughout Burma as it is in some countries of Europe.

During the early days of the East India Company's rule the promotion of education was not recognized as a duty of government.

The enlightened mind of Warren Hastings did indeed anticipate his age by founding the Calcutta *madrasa* for Mohammedan teaching, and the establishment of the Sanskrit College at Benares in 1791 was associated with the name of another servant of the Company, Jonathan Duncan. But Wellesley's schemes of imperial dominion did not extend beyond the establishment of a college for English officials.

On the 100,000 rupee grant which was prescribed, the first of

its kind, for the encouragement of education by the Charter Act of 1913, no general scheme of public instruction could be built. But the Sanskrit College in Calcutta was founded in 1824, the medical college by Lord William Bentinck in 1835, the Hooghly *madrasa* by a wealthy Indian gentleman in 1835, and the Agra college had been established in 1823. Meanwhile the missionaries made the field of vernacular education their own. Discouraged by the Official authorities, and ever liable to banishment or deportation, they not only devoted themselves with courage to their special work of evangelization, but were also the first to study the vernacular dialects spoken by the common people. Just as two centuries earlier the Jesuits at Madura, in the extreme south, composed works in Tamil, which are still acknowledged as classical, so did the Baptist mission at Serampur, near Calcutta, first raise Bengali to the rank of a literary language. The interest of the missionaries in education, which has never ceased to the present day, though now comparatively overshadowed by government activity, had two distinct aspects. They studied the vernacular, in order to reach the people by their preaching and to translate the Bible; and they taught English, as the channel of non-sectarian learning.

A fresh wind began to blow from England, with the Charter Act of 1833. The work of the missionaries received official licence; and in 1835 Lord William Bentinck decided that "the great object of the British government ought to be the promotion of European literature and science among the natives of India." This was the last word on a long-drawn controversy between a school which arrived at the extension of oriental learning in India in its own languages, and the school which urged the teaching of elementary knowledge in the vernacular tongues and of the higher branches in English. The scale had been turned by Macaulay's famous minute in support of the latter view; and the low state into which Hindu morality and culture had sunk at the time was felt to be adequate justification for the decision. It settled the aim of the British governmental system of education in India, and Sir Charles Wood's famous despatch of 1854 determined the methods and machinery. From that date onwards education has meant a network of schools, colleges and examinations ultimately controlled by the government. Many of the institutions are maintained directly from public funds, and staffed by teachers who are public officials. Another class is maintained by local authorities, subject to close control by the government. A third class under private (*e.g.*, missionary) management depends on the government for grants-in-aid or for "recognition"; and both grants and recognition imply strict compliance with governmental regulation. At the same time the government in its anxiety to hold an even balance between the different sects and creeds in India has kept carefully aloof from the teaching of religion on morality.

The British government thus, while honestly giving its best in teachers and what it believed to be its best in curricula, exposed itself to the odium of what were for long three grave defects in the system. First, by making its own type of education the qualification for government service, it tended to concentrate the energies of the youth of India on the search for public offices, rather than of learning for its own sake or of that general development of the intelligence which would serve the industrial growth of the country. Second, the mass of students who clamoured for a purely literary education as the doorway to official employment was so great that the vast majority of them absorbed only a shallow and mechanical smattering of knowledge. To those who failed in securing government service their education proved of no commercial value: and in this way a class of unemployable and half-educated lads grew up, who became ready vehicles for political unrest and in some cases for revolutionary crime.

Third, purely secular instruction which virtually ignored the vernacular languages involved neglect of the indigenous ethos and culture of India, and became in time largely responsible for the reaction against Western civilization which characterizes recent political movements in the country.

To these defects the government was far from blind, and the history of the educational policy of the last twenty years is a constant endeavour to mitigate them. Lord Curzon had the whole system overhauled and improved. The universities were liberalized, the colleges set on the way to becoming residential institutions, and the assistance to elementary schools largely extended; while technical and agricultural schools were reformed and vitalized. Lord Minto got a special ministry of education established; and the financial prosperity of Lord Hardinge's viceroyalty enabled him to make generous grants to the provinces for education, and to wage a definite war on illiteracy. But the root of the matter was attacked when a special commission was appointed, under the chairmanship of Sir Michael Sadler to inquire into the weaknesses of the Calcutta university, and incidentally of university education generally. It reported in 1919, and condemned in emphatic and impressive language the whole conduct of secondary and university education.

The commission advised radical reforms. The universities should be centralised, unitary, residential, teaching bodies with a government of their own. Tuition of a preparatory and not a university type should be removed to a new grade of intermediate colleges, where the curriculum would be a varied kind and would lead up to appropriate examinations not under university control though qualifying for entrance to a university, and having an independent value as a certificate of general education. Students would thus enter the universities at a later age and at a stage represented by the old "intermediate" examination, thus relieving the universities of a part of their unwieldy host of undergraduates. These recommendations were generally welcomed, and most of the former universities (including the Hindu University at Benares, which owed much to the energy of Mrs. Besant) have been reconstituting themselves accordingly, while new universities of the teaching and residential type are being built up at Dacca, Aligarh (Muslim), Lucknow, Rangoon, Patna, Nagpur and Delhi. In 1926 legislative provision was made for incorporating a university at Agra to relieve the external work at Allahabad, and in the same year a new Andhra university was inaugurated in Madras. The multiplying of universities, however, may go too far; there is already some danger of the lowering of standards, in competition for undergraduates; and it is hoped that an Inter-University Board for all India will be strong enough to maintain standards and insist on modern methods of instruction. In 1926 the number of students at university and professional colleges was 87,600 of whom barely 1½ per cent were women.

Secondary Education advances apace, and in high and middle schools of a non-technical type the enrolment in 1926 was 1,716,000 pupils, including between 8 and 9 per cent of females. Shortage of funds has interfered with the establishment of "intermediate" institutions advised in the Sadler report, as well as with the improvement of the mass of high schools. Boards of secondary and intermediate education are doing useful work in certain provinces, and vocational training is being slowly pressed forward. But the quality of the teaching still leaves much to be desired; its methods are often faulty, and it tends to be regarded entirely as a necessary gangway to the college course which will qualify for government employment or the legal profession. The moral, social and physical sides of education are insufficiently developed and it is recognized that the system calls for revision in order to make it more self-contained and adapted to the requirements of national efficiency.

Primary Education.—The pace of development here has also been seriously retarded by financial difficulties; but in 1916 the number of children at primary schools had risen to 7,800,000, inclusive of over 900,000 girls. Although it is recognized that here is the only nursery for an intelligent electorate in the future, the difficulties are many: the traditions which confine education to certain castes, communal troubles, bad communications, the dearth of competent teachers, but above all the poverty of the rural parent, who cannot spare his sons from the ranks of the bread-winners and has no belief whatever in educating his daughters. To these permanent obstacles must be attributed the fact that, according to the census of 1921, only 122 in every thousand men, and 18 in every thousand women, in the country can read and write. In face of these figures it is not surprising that the legislatures have frequently turned to the remedy of compulsion.

Acts asserting the compulsion principle have been passed in several provinces, but the translation of principle into practice is still incomplete. Meanwhile the decentralisation of the control of primary education offers a prospect of greater elasticity, especially in adapting the school curriculum to rural needs.

Female Education was long the despair of reformers. Social prejudices and the subordinate and largely extended position of women were antagonistic to it, and there was the greatest difficulty in obtaining, except in the Christian Community, qualified women teachers. The Brahmo Samaj and a few enlightened groups and individuals persevered in the education of their womenfolk: but progress was deplorably limited and slow. With the awakening of national feeling, some advance is now apparent. In 1926 it was possible for the official reporter to write that "female education and co-education in the primary classes are growing in popularity; schools and colleges for women are on the increase; women are being encouraged to take up physical training, games and vocational education; and propaganda in this excellent case is widespread." When this was written, there were just over one million females receiving college and school education in the whole of British India.

The following statistics show the progress of education between 1896–97, when Lord Curzon had not begun his measures of reform; 1921–22, when education (except in universities) was being handed over to the control of ministers under the new constitution; and 1926, the latest year for which complete figures are available.

		1896–97	1921–22	1925–26
Colleges	Institutions	160	231	290
	Pupils	18,783	59,505	87,589
Secondary schools	Institutions	5,267	8,987	10,837
	Pupils	535,155	1,239,524	1,716,147
Primary schools	Institutions	103,920	160,072	183,164
	Pupils	3,209,825	6,310,451	7,799,076
Training schools	Institutions	184	1,072	696
	Pupils	5,667	26,931	25,343
Special schools	Institutions	355	2,939	8,110
	Pupils	18,952	105,775	264,548
Private institutions	Institutions	42,139	34,807	34,726
	Pupils	568,488	639,125	621,618
Total	Institutions	152,025	208,108	237,823
	Pupils	4,356,870	8,381,401	10,514,321

Despite this substantial progress, illiteracy remains in complete ascendancy. At the 1921 Census, roughly 7 per cent of the population—19·8 million males and 2·8 million females—were returned as literate, in the sense of being able to read and write a letter in their own vernacular language. Literates in English were only ·8 per cent of the population.

PUBLIC HEALTH

Like education, the sanitary welfare of the country is extremely backward, and for much the same reasons,—climate, general poverty and the pressure of the population. Over an average of five recent years, the ratio of births was 33·44 per 1,000 of population, and the ratio of deaths 26·56; fully one fifth of the mortality being among infants of under a year old.

In years of bad epidemics, the death roll runs much higher; the ratio, for example, was 62·46 in 1918, the disastrous influenza year; and plague, which started in 1896, has carried off 12 millions in the last decade. Cholera is endemic in some areas, malaria in almost all; hook-worm and *kala azar* are widespread. Medical relief hardly exists outside the towns, except at the dispensaries established by the government and now controlled by local authorities. Yet improvement is being slowly effected. In the past, every important fair or seat of pilgrimage was a focus of disease and death to many thousands. This has now been brought under control; and great strides have been made in providing the cities and larger urban areas with a supply of pure drinking water and with proper sewage or conservancy. Elementary hygiene is also being introduced into the teaching in schools; and some interest is being taken in child welfare. In British India there are about 4,000 hospitals and dispensaries of very varying quality, at which 41 millions of patients were treated in 1925; but the total number of beds available was only 45,000.

FINANCE

Sources of the Revenue.—For a country where the opposition to direct taxation is so strong as it is in India, the share which it takes in the national revenue is now highly creditable. While indirect taxation is levied through the Customs, on salt, by stamps and otherwise, the direct imposts are the taxation on incomes other than those derived from land, and the land revenue, round which an ancient controversy rages, as to whether it is a tax or a rent. As the land revenue is the oldest, and used to be by far the most important element in the State's income, some description of the machinery for assessing it seems desirable, especially as it is unique to India and as no field of government policy has been more hotly canvassed in the past.

That the state should appropriate to itself a direct share in the produce of the soil is a fundamental maxim of Indian finance that has been recognized from time immemorial. In the old Hindu village community, the land was not held by private owners but by occupiers under the petty corporation; the revenue was not due from individuals, but from the community represented by its head-man. The aggregate harvest of the village fields was thrown into a common fund, and before the general distribution the head-man was bound to set aside the share of the state. No other system of taxation could be theoretically more just, or in practice less obnoxious to the people. Under the Mogul empire, as organized by Akbar, the share of the state was fixed at one-third of the gross produce of the soil; and a regular army of tax-collectors was permitted to intervene between the cultivator and the supreme government.

Shah Jahan and Aurangzeb extracted a larger land revenue than the British do. When the government was first undertaken by the East India Company, no attempt was made to understand the social system upon which the land revenue was based. The joint responsibility of the village community for the revenue was overlooked, and the convenience of collecting it from some individual or group was magnified. The conception of private property in the soil, with which the early British authorities were familiar at home, was grafted from a rural policy to which it was wholly alien. As a result, the office of *zamindar*—originally a mere farmer or lessee of the revenue under the Mohammedan régime—was transmuted into that of landowner and zamindars were created, where they did not exist, from men or families who, for almost any reason, were prominent in the areas of their residence.

The annual government demand was made the first liability on the land; subject thereto, the registered land-holder was given powers of sale or mortgage scarcely more restricted than those of a tenant in fee-simple. At the same time the possible hardships, as regards the cultivator, of this absolute right of property vested in the owner were anticipated by the recognition of occupancy rights of fixity of tenure, under certain conditions. Legal rights were substituted for unwritten customs; and the new class of landowner was endowed with a credit which he never before possessed, by allowing him a certain share of the unearned increment. Against the misuse of this credit the British government has had consistently to struggle.

The means by which the land revenue is assessed is known as settlement, and the assessor is styled a settlement officer. In Bengal the assessment has been accomplished once and for all, but throughout the greater part of the rest of India the process is continually going on. The details vary in the different provinces; but, broadly speaking, a settlement may be described as the ascertainment of the agricultural capacity of the land. The settlement officer estimates the character of the soil, the kind of crop, the opportunities for irrigation, the means of communication and their probable development in the future, and all other circumstances which tend to affect the value of the produce. With these facts before him, he proceeds to assess the government demand upon the land according to certain general principles, which vary in the several provinces. The result is the settlement report, which records, as in a Domesday Book, the entire mass of

agricultural statistics concerning the district.

Lower Bengal and a few adjoining districts of the United Provinces and of Madras have a permanent settlement, the land revenue having been fixed in perpetuity by Lord Cornwallis in 1793.

The Zamindari System.—But no detailed record of tenant-right was inserted in the settlement papers, and the cultivators lost rather than gained in security of tenure.

The rack-rented peasantry found no protection in the law courts until 1859, when an act was passed which restricted the landlord's powers of enhancement in certain specified cases. Later the Bengal Tenancy Act of 1885, since amended by an act of 1898, created various classes of privileged tenants, including one class known as "settled ryots" in which the qualifying condition is holding land, not necessarily the same land, for twelve years continuously in one village. Outside the privileged classes of tenants the act gives valuable protection to tenants-at-will; and the original vices of the Bengal system are being partly overcome, though the growing division of rights in the land is an abiding economic calamity.

The Ryotwari System.—The prevailing system throughout the Madras presidency is the ryotwari, which takes the cultivator or peasant proprietor as its rent-paying unit.

The representatives of several ancient lines of powerful chiefs exist in the extreme south and in the north of the presidency. Their estates have been guaranteed to them on payment of a peshkash or permanent tribute, and are saved by the custom of primogeniture from the usual fate of subdivision. Throughout the rest of Madras there are no zamindars either in name or fact. The influence of Sir Thomas Munro led to the adoption of the ryotwari system, which will always be associated with his name. According to his system, assessment is made with the cultivating proprietor upon the land taken up for cultivation year by year. Neither zamindar nor village officer intervenes between the cultivator and the state, which takes directly upon its shoulders all the landlord's responsibility.

Nothing can be more complete in theory and more difficult of exposition than a Madras ryotwari settlement. First, the entire area of the district, whether cultivated or uncultivated, and of each field within the district is accurately measured. The next step is to calculate the estimated produce of each field, having regard to every kind of both natural and artificial advantage. Lastly, a rate is fixed upon every field, which may be regarded as roughly equal to one-third of the gross and one-half of the net produce. The rates thus ascertained are fixed for a term of thirty years; but during that period the aggregate rent-roll of a district is liable to be affected by several considerations, which are discussed and decided by the collector at the *jamabandi* or court held every year for definitely ascertaining the amount of revenue to be paid by each ryot for the current season.

In the early days of British rule no system whatever prevailed throughout the Bombay presidency; and even at the present time there are tracts where something of the old confusion survives. The modern "survey tenure" as it is called, dates from 1838. Each field is measured, and assessment placed upon it according to the quality of the soil without any attempt to fix the actual average produce. This assessment holds good for a term of thirty years.

In Other Provinces.—In the other provinces variations of the zamindari and ryotwari systems are found. In the United Provinces and the Punjab the ascertainment of the actual rents paid is the necessary preliminary to the land revenue demand. In the Central Provinces, where the landlords (*malguzras*) derive their title from the revenue settlements made under British rule, the rents are actually fixed by the settlement officer for varying periods. In addition nearly every province has its own laws regulating the subject of tenancy.

The principles of the land revenue settlement and administration were reviewed by the government of India in a famous resolution prepared under Lord Curzon's direction and presented to parliament in 1902. It gives a full description and justification of the system and its consequences. In the previous year, the Famine Commission had come to the general conclusion that "except in Bombay, where it is full, the incidence of land revenue is low to moderate in ordinary years, and it should in no way *per se* be the cause of indebtedness." There is now an active movement to have the principles of valuation and assessment fixed by law instead of being left to usage. In areas where enhancements in the land revenue are decided to be, in whole or part, attributable to the benefits of State irrigation, an appropriate part of the field is transferred to the irrigation department. Otherwise that department charges by a rate on the land for the water it supplies, attempts to meter the flow and charge accordingly having so far met with imperfect success.

Income Tax.—Income derived from land has always been immune from the income-tax, which was first imposed in 1886, as well as from the more recent super-tax. Intensely unpopular and difficult to assess, this source of revenue has steadily been developed in recent years, and whereas the gross receipts from it twenty years ago did not exceed £1,500,000 they are now in the vicinity of £14,000,000. The present rate of income tax ranges, on incomes of Rs. 2,000 and upwards, from 2½% to 9%, the latter being the rate on companies. The super-tax falls on everything over Rs. 50,000 of the total income; it is 6⅔% for companies and is graded upwards in the case of individuals.

Salt.—Prior to the successive reductions of the salt duty in 1903, 1905 and 1907, next to land, salt contributed the largest share to the Indian revenue. Broadly speaking the salt consumed in India is derived from four sources: (1) importation by sea, chiefly from England and the Red Sea and Aden; (2) solar evaporation in shallow tanks along the seaboard; (3) the salt lakes in Rajputana; (4) quarrying in the salt hills of the northern Punjab. The salt lakes in Rajputana have been leased by the government of India from the rulers of the states in which they lie, and the huge salt deposits of the Salt Range mines are worked under government control, as also are the brine works on the Runn of Cutch. The duty on salt, which was once regarded as financial reserve for war, has often been altered and now stands at Rs. 1¼ per *maund*, or just over one farthing per lb.

Opium.—The importance of opium as a source of revenue is steadily diminishing, the area under poppy cultivation having shrunk from 207,000 acres in 1918 to 71,000 acres in 1926, and being still further reduced. The drug is manufactured from (1) poppy grown under government supervision in certain districts of the United Provinces, and (2) poppy grown in certain Indian states and yielding what is known as Malwa opium. It used to be largely auctioned for private export to China and elsewhere. But the attempts at social reform in China and the intervention of the League of Nations have led to a profound modification of the system; and cultivation is being regulated with a view to the extinction of the export trade by the end of 1935. A certain amount of opium is also sold to provincial governments for local consumption in India; and attempts are being made to develop the market for the medicinal products of the drug.

Customs has already been discussed. Excise duties vary greatly in different provinces, and flow from a special form of government monopoly. The articles taxed are intoxicants and drugs; and the avowed object of government is to check consumption as well as to raise revenue. The right to manufacture, and the right to retail, spirits and beer are monopolies of government permitted to individuals only upon terms and under strict supervision. Of excisable drugs the most important are opium, bhang, ganja and charas. Opium is sold through private retailers at a monopoly price. Bhang, ganja and charas are three different narcotic drugs prepared from the hemp plant (*Cannabis sativa*, var. *indica*).

The plant grows wild in many parts of India; but the cultivation of it for ganja is practically confined to a limited area in the Rajshahi district of Bengal, and charas is mainly imported from Central Asia.

In regard to ganja and charas, cultivation of the plants is severely restricted and a direct quantitative duty is levied on the drugs on issue from the warehouse in the province of consumption; while as regards bhang, cultivation of the hemp for its production is prohibited or taxed, and collection of the drug from

wild plants permitted only under licence, a moderate quantitative duty being levied in addition to vend fees. No duty whatever is now levied upon tobacco in any part of India. The plant is universally grown by the cultivators for their own smoking, and the impossibility of accurate excise supervision has caused the government to abandon the impost. Other sources of revenue are stamps, levied on judicial proceedings and commercial documents; registration of mortgages and other instruments; and provincial rates, chiefly in Bengal and the United Provinces for public works or rural police.

Provincial Share in the Revenues.—Prior to the 1919 constitution, the resources of the State used to be divided, by a sort of variable contract, between the central government and the provincial governments. Part of the 1919 reform was the complete severance of the central from the provincial finances: from 1833 up to 1921 they had been amalgamated; from the budget for 1921–22 onwards they were separated. Under this arrangement the nine major provinces now receive and dispose of over £50,000,000 of receipts, representing their collections of land and irrigation revenue, excise, stamps and forest income. It is spent by them on their administrative business, justice, education, public works, police and gaols, public health, etc. In other words, the local governments receive the yield of the sources which they administer, and are responsible for the expenditure of the provincial departments, both reserved and transferred. In order to enable local governments to discharge their new functions, they have been given powers of taxation, scheduled so as not to invade the sphere earmarked for the requirements of the central government. They have been authorised to raise loans, either through the central government or independently, and some of the provinces have already borrowed for works of improvement such as irrigation and city development schemes. At the outset, the central government found itself no longer in control of funds sufficient for its own business. The customs, salt, opium and net railway receipts, income tax, etc., when they ceased to be supplemented as before by a share of the provincial land revenue, stamps and excise receipts, etc., proved inadequate to meet the demands of defence, the public debt and the other central liabilities. It was thus necessary to impose a levy on the provinces, admittedly as a temporary measure pending the inevitable expansion of the central revenues. The provincial legislatures fastened on the arrangement as the main cause of their own financial stringency, and magnified a not unreasonable expedient into an intolerable grievance, under cover of which there has been a tendency to evade the imposition of taxation that might have balanced their own budgets. From 1928 however the levy ceased, and on the horizon will soon appear a new controversy as to how the central government should share its own surplus with the provinces. Meanwhile local governments claim, in addition to their own separate revenues, a share of the taxation upon income collected within their boundaries; and some concession on this point has been yielded as an exception to the general rule of separate resources, by giving each province three pies for every rupee by which the income assessed within the province exceeds the income that was similarly assessed in 1920–1.

Local Finance.—The 767 municipalities of British India have the disposal of an annual revenue of £12,000,000 excluding abnormal items and borrowings; and the district and local boards have a normal revenue of about £10,500,000. Both classes of bodies have been endowed by the 1919 constitution with a financial independence commensurate in its degree with that of the provinces. The six port trusts have statutory powers for their own business, and control an income of approximately £6 millions: Bombay and Calcutta in particular having raised considerable loans, which rank in the Indian market only second to government securities.

Recent Financial History.—Before the war India was making rapid economic progress. After the famine year of 1908 the monsoons were satisfactory and the harvests good; trade went well, and there were large windfalls in the opium revenue. During the five years immediately preceding the outbreak of war the country absorbed gold and silver to the amount of £127 millions. Large grants became possible to the provinces for education and public health; some notable new undertakings were launched, and a spirit of enterprise was displayed in commerce and in industry. When the world went to war in 1914, Indian finance enlarged its experiences. Direct expenditure on the war was at first small, but the country's external trade was dislocated, and her railway and customs receipts suffered accordingly; so that the first two years were marked by deficits. In 1916–7 additional taxation was imposed, while the export of war material had now begun to assume large proportions, and agriculture was also flourishing. In 1917 the financial position was sufficiently strong to justify the Indian government, with approval of the Legislative Council, in making a contribution of £100 to the home government towards the cost of the war; and in 1918 a further contribution was volunteered, which had, however, to be subsequently revised after the Afghan War, and was adjusted finally at about £14,000,000. In 1917–8 taxation was again increased, but such was the activity of trade and the general prosperity of the country that a surplus of £8,000,000 was realised.

Then the tide turned, and for a series of years the national accounts failed to balance. The old standard of military expenditure was doubled; the Afghan War of 1919 and the succeeding troubles in Waziristan threw a heavy burden on the revenues; the trade boom which had been stimulated by the heavy manufacture of war material slowly exhausted itself, and exchange was crumbling; while a rapid rise in the cost of living left the government with no option but to make some corresponding increase in the wages of its army of employees. The deficits were met by temporary expedients which had recently been strangers to the Indian financial system—dipping into balances, accommodation from the banks and borrowing for revenue purposes. There followed two weak monsoons, and the year 1921–22 closed with over £22,000,000 to the bad; and, what was even worse, the government had to budget for a further deficit in 1922–23, the legislature having rejected several of its proposals, among which a rise in the salt duty was prominent for improving the revenue.

Sharp retrenchment had now become imperative, and in the winter of 1922 a special committee under Lord Inchcape attacked the whole problem of expenditure. Their recommendations, drastic and comprehensive, extending to military as well as to civil charges, were put into effect, as far as time admitted, in the estimates for 1923–24, and the salt tax was doubled in the face of fierce opposition. The result, combined with a marked revival in trade, was a small surplus at the end of the year. The budget for the succeeding year was wrecked by an extremist demonstration in the Assembly; and the Viceroy had to exercise his emergency powers of restoring it, though he was careful to revert the salt tax to its old rate of Rs. 1¼ per maund. Despite this untoward start, 1924–25 went well; trade steadily improved, and with it exchange revived, the year ending with a substantial surplus. The same was true of 1925–26, a year of good harvests, though external trade was hampered by the low level of agricultural values as compared with the high prices of imports. In the two following years, the world's exchanges became more stable, the country's external trade markedly advanced, and good harvests continued. Thus it was impossible, for the fifth year in succession, to frame a prosperity budget in the spring of 1928 for the financial year 1928–29. Instead of aiming at a surplus, it used its estimated excess of revenue in cancelling, for good and all, the former levies from the provinces. Its main features are:—

Source	Revenue	Object	Expenditure
	£ Millions		£ Millions
Customs	37·5	Defence	43·5
Taxes on income	12·8	Debt services	11·1
Salt	5·2	Civil administration	8·8
Opium	2·6	Other heads	9·0
Contribution by railway	4·1		
Other heads	10·2		
	72·4		72·4

It will of course be understood that none of the "nation building" services are provided for here, as they are all charged on provincial revenues. It will also be noted that effect has been given to an arrangement arrived at in 1924–25, by which the railway finances are separated from the general account. The railways are now a self-regulating entity, instead of a handmaid to the general revenues, and the sport of their vicissitudes. In exchange for this liberty, they contribute to the exchequer 1% on the outstanding capital of the commercial lines, *plus* one-fifth of whatever surplus remains after this payment, *minus* the loss incurred on the working of the strategic lines.

Indebtedness of India.—The Government of India borrows both locally in rupees and in England in sterling—the former now to a very much larger extent than before the war. The position at the beginning of the war was thus described officially:—

"Out of a total debt equivalent to £274,000,000 outstanding at the end of March 1914, only about £13,000,000 represented ordinary or unproductive debt. The annual interest on the latter was £750,000 only, and on the productive debt about £8,500,000, so that our total interest charges amounted to some £9,250,000. Railways and irrigation works in the same year yielded us a return of £15,250,000. Thus we had left some £6,000,000 of clear revenue from our great capital undertakings, after meeting interest charges on our entire public debt."

This was the result of a long, careful policy of converting unproductive debt, *i.e.*, money raised for military purposes and the like, into productive debt, by the device of short borrowing for the capital required on railways and irrigation. It had put India into a very strong position to face the changes brought about by the war. The war debt, as well as the borrowing necessitated by the series of budget deficits, all went to swell the volume of the unproductive debt; and on March 31, 1926, the total indebtedness of India was:—

In India	Crores of rupees
Loans	372.30
Borrowed from the paper currency reserve	31.94
Other obligations	127.94
	532.18

To England	£ millions
Loans	272.32
Other obligations	72.25
	344.57

Of the total it was considered that only 18% was unproductive. The productive loans included the capital liabilities for irrigation, which were taken over by the provinces when that subject became wholly provincial. The "other obligations" are mostly unfunded debt, such as post-office cash certificates and savings bank accumulations, provident funds, etc.; while in England £54,790,000 are accounted for by capitalising liabilities which are being liquidated by certain terminable railway annuities. In lieu of a general sinking fund an annual sum is appropriated from revenue for the reduction or avoidance of debt; it is now calculated at four crores plus one-eightieth of the amount by which the outstanding debt of the year exceeds the debt outstanding on March 31, 1923.

CURRENCY AND EXCHANGE

The foundation of the currency system is the rupee (16 annas or 192 pies), a coin weighing 180 gr. and containing 165 gr. of pure silver. The subsidiary coinage comprises pieces of silver, nickel and bronze; all being legal tender up to one rupee only, except the 8-anna piece, which, like the rupee itself, is legal tender without limit. Alongside of these is a paper currency, at first of slow and lingering growth, in the form of Government currency notes; the favourite notes are for 1, 5, 10 and 100 rupees, but there are also others for 2½, 20, 50, 500, 1,000 and 10,000 rupees. The note circulation as a whole is backed, as to more than one-half, by a reserve of gold and silver, and as to the balance by Government securities held partly in England and partly in India, with a margin for seasonal expansion based on trade bills up to a strictly defined amount.

The exchange value of the rupee follows the ordinary economic law and depends on India's trade balance with the outer world. When there is a surplus of exports, import bills are at a premium and the rupee rises in terms of sterling; when in bad years exports decline and there is a relative glut of import bills, the rupee falls in terms of sterling. The operation of this law, however, assumes a fairly constant adjustment of the volumes of currency to the requirement of trade. If there were no restriction on the output of rupees, the gold value of the coin would tend to fluctuate with the gold value of silver. Up to 1873, although the Indian mints were open, the rupee continued steady at an exchange value of 2s.; then the price of silver began to tumble until the rupee dropped almost to 1s., and so disastrous were the consequences to the finances of the country that in 1893 it was decided to close the mint to free coinage and establish a "managed" currency, with the rupee as a token coin. By this policy an equilibrium was sought.

The Rupee During the War.—By the beginning of the war this system had reached considerable strength. The rupee had been given by law a parity of 16d., and trade conditions had never put it beyond the power of the Government to maintain the exchange at approximately that figure. The machinery for managing the currency was simple. The Indian Government bought silver and coined rupees to meet the requirements of the country. So long as silver was under 43 d. an oz. there was a profit on the operation, which was placed to the gold Standard Reserve. Against this reserve the Government of India could sell sterling drafts (technically known as "reserve Councils"), if the exchange value of the rupee threatened to fall. On the other hand, if it were rising, the Secretary of State could increase his normal sales of rupee drafts on India (technically known as "Councils"). Should this fail to check the rising exchange, it was generally possible to count on a free importation of private gold which would either pass into circulation or be presented to the Government for the purchase of rupees. All these arrangements were working smoothly in 1914. The Gold Standard Reserve stood at £26,000,000. The paper Currency Reserve had £24,000,000 in gold or gold securities, and the note circulation had risen to 66 crores (£44,000,000). With the War came new and disturbing demands. India was called upon to supply the British Government and the Allies with immense quantities of raw materials, manufactured goods and foodstuffs for War purposes, and also to provide funds in India and in countries where Indian troops were fighting. The Indian Government had therefore to disburse a rupee currency in very large amounts, and was compelled to increase the note issue without a corresponding increase of rupees held against the notes. The notes were convertible and their encashment drained away the reserve stock of rupees. The time drew near when either inconvertibility must be declared or silver obtained in large quantities for coinage.

The political effects of inconvertibility were regarded with grave anxiety; but in 1918 the U.S.A. came to India's aid, by passing the Pittman Act and selling 200 million ounces of its silver dollar reserve to the government of India. From July 1918 onwards American silver began to arrive in large quantities and was coined into rupees. For some months the new money went out of the reserves as fast as it was coined, but by Dec. 1918 the convertibility of the note issue was secured. Within a few months the output of the mints was represented by the enormous quantity of 1,390 million new rupees (£93,000,000) as currency.

Throughout this struggle another anxiety grew apace, in the risk of being unable to maintain the rupee as a token coin at its statutory parity with sterling. Sterling was depreciating and silver was rapidly appreciating. As the conversion of the rupee into bullion became profitable when silver touched 43d., the rapid rise beyond that figure led to a wholesale melting down of rupees for clandestine export; and the Government was forced to protect itself by hurriedly pushing up the parity of the rupee until it stood at 2s.4d. in Dec. 1919, while for a short time private remittances fetched over 2s.10d.

The whole problem was then referred to a committee of cur-

rency and banking experts sitting in London. Reporting early in 1920, this body (with one notable dissentient) recommended that the rupee should be correlated to gold, and not to sterling, and that it should be given a new statutory ratio equivalent to one-tenth of the gold contained in a sovereign. Accordingly, in Sept. 1920 the Indian Coinage Act established the new ratio of the rupee as one-tenth of a gold pound. But currency was already laughing at the law. There was a rush of remittances to England, and at the same time the export trade of India fell off. The former surplus of exports gave place during the second half of 1920 to a large adverse trade balance which had to be liquidated by bills on London. Exchange persistently dropped from 2s.6d. the rupee, which in the first months of 1920 roughly represented the parity of one-tenth of a gold sovereign, to below 1s.4d. in the early part of 1921, and the price of silver receded to 32d. the ounce. All attempts by the government to maintain the rupee at its statutory parity were defeated, and exchange had to be left to find its own level. At last, another enquiry—on this occasion by a Royal Commission—was instituted towards the end of 1925. On its report, published in 1926, is based the present currency and exchange policy of the country. What was established was a gold bullion standard, under which the rupee is fixed by law at the equivalent of 1s.6d. gold, its fluctuations being confined between the upper and lower gold points corresponding to that ratio. The maintenance of the ratio was, the Commission advised, to be the duty of a Reserve Bank, and was to be secured by laying on the Bank the obligation to buy and sell gold without limit at rates fixed to accord with the gold parity of the rupee. The Bank was to be the government banker, and to undertake the Government's remittances. It was also to be entrusted with the issue of notes, to replace the present currency notes, the notes ceasing to be convertible by law. The sovereign and half-sovereign were to be no longer legal tender; and thus the old attempts to introduce a gold circulation were finally condemned. Action on those recommendations was taken by the government of India as far as lay in its power, but on the creation of a new Reserve Bank the legislature raised questions of mechanism and control which, after prolonged discussion, forced the government to abandon that part of the scheme for the present. Meanwhile, the improvement in general economic conditions has strengthened the hands of the government in securing the new legal value of the rupee. In 1925–26 the daily telegraphic transfer rates between Calcutta and London averaged 1s.6·08d.; and in 1926–7 the average was 1s.5·902d. In this article accordingly the new ratio has usually been adopted for the conversion of rupee figures into sterling; a lakh (Rs. 100,000) being treated as equal to £7,500, and a crore (100 lakhs) to £750,000.

The strenuous efforts made during the War to preserve the convertibility of the currency notes were rewarded by a rapid expansion of their popularity. The circulation (66 crores) of March 1914 has trebled, for it touched 200 crores in Aug. 1926, notwithstanding the practical disappearance of the 2½-rupee and the 20-rupee notes. In 1920 the whole system was improved by the Paper Currency Amendment Act of that year, which allowed an unlimited note issue provided a metallic basis of 50% was observed, required the gold backing to be held in India and introduced the principle of a certain definite expansion of the note issue during the busy season against trade bills of a durance not exceeding 90 days. Before the note circulation became so firmly established as it now is, several attempts were made to lighten the task of supplying India with silver currency by the employment of gold. Among them was the opening of a branch of the British Mint at Bombay, intended to coin sovereigns and 15-rupee gold pieces. Like all other similar experiments, it was defeated by the immediate disappearance of gold into the hoards of the people. Nearly 3,500,000 gold coins were minted at Bombay in 1918–19, and work was then abandoned.

The close of the World War was marked by a great outburst of speculation. The aggregate authorised capital of new joint stock companies floated in the year 1919–20 alone was Rs. 281 crores, whereas the paid-up capital of all registered companies in existence in 1914 was only 75 crores. Subsequent liquidations were heavy. The most important of the new projects which failed to realise expectations was the Tata Industrial Bank, founded to finance new industries on much the same lines as those followed by the "D Banks."

Tariffs and Protection.—From 1894 there was a general standard customs duty of 5% *ad valorem*, with certain exemptions and certain exceptions; it was levied entirely for revenue purposes. Cotton goods were taxed at 3½%, whether imported or woven in Indian mills. During the war financial exigencies drove up the standard rate to 7½%; and in the post-war slump it rose further to 11%, with 20% on certain luxury articles. Then came the new political constitution, with its pronouncement in favour of allowing India to choose its own fiscal policy. It was speedily followed by the appointment in 1921 of the Indian Fiscal Commission, which reported for "rapid industrialization by means of discriminating protection." Coinciding as this did with a prominent tenet in the nationalist creed, the recommendation was quickly put into practice, and an Indian Tariff Board was appointed in 1923 to deal with applications for protection. The first and most important of these was from the steel industry; and in the event the Tata enterprise was protected by a heavy tariff supplemented for some years by subsidies. The tariff schedule is now a complicated document, divided into non-protective duties and other duties ranging from 2½% to 30% *ad valorem*. The distinction is subtle, seeing that some of the "non-protective" duties are as high as 25% (rough sugar) and 75% (cigars). The Board have recently decided against a general protective duty on coal. Besides the import duties, there are some low export dues on jute, hides and rice. The objectionable excise formerly levied on cotton goods manufactured in the country was removed in 1925, and the 11% duty on imported cloth became undisguisedly protective.

Labour Organisations and Legislation.—There has recently been a remarkable increase of class consciousness among Indian urban workers. Trade unionism on British lines made its first appearance in Madras during the war, the pioneer society, the Madras Labour Union, being a fairly solid organisation of the cotton-mill operatives, which quickly found imitators. The great rise of prices and the industrial boom of 1919 furnished the most favourable possible conditions for a rapid advance of trade unionism. Bombay was the chief storm centre. The cotton operatives in particular showed unsuspected staying power, and not only secured advances during the boom which meant an increase in real as well as nominal wages, but also, in 1925, won a more remarkable victory in resisting successfully a reduction of wages during the slump. Indian trade unions are still largely dependent on the help of outsiders as organisers, and the success of particular unions mainly depends on the single-mindedness with which these voluntary associates work for the material benefit of the members. An Act intended to recognize trade unionism, and to encourage it on sound lines, came into force on June 1, 1927, and the movement is going to be a permanent and growing element in Indian industrial life.

India was represented at the International Labour Conference at Washington, which was followed by an "All India Industrial Welfare Congress" held in Bombay in April 1922. Important labour legislation was enacted in the same year. The Factories Act of 1922 raised the age of admission for children from 9 to 12, for full time work from 14 to 15, prohibited night work for women, and enacted for all workers a maximum day's work of 11 hours and a maximum week of 60 hours. The Mines Act of 1923 forbade the employment of children and young persons below ground, while still permitting that of women, and limited the week's work to 60 hours above ground and 54 hours below. The Workmen's Compensation Act of the same year allowed compensation for death or accident for 3,000,000 industrial workers. The contention that long hours of labour are more tolerable and justifiable under Indian than under European conditions springs from interested motives, and is not based upon actual fact.

Foreign Trade.—The trade of India with foreign countries is conducted partly by sea and partly across the land frontiers; but the frontier trade, though capable of much extension, is only

a small fraction of the whole. The sea-borne trade is carried on chiefly through the four great ports of Calcutta, Bombay, Karachi, and Rangoon, of which Calcutta serves the fertile valley of the Ganges and Brahmaputra, Bombay serves the cotton-trade of western India, Karachi exports the wheat crop of the Punjab, and Rangoon the rice crop of Burma. Madras with its artificial harbour serves southern India, and Chittagong is rising into prominence as the point of departure for the tea and jute of eastern Bengal and Assam. The land trade is carried on with Persia, Afghanistan, Nepal, Tibet and western China.

A review of Indian trade is annually presented to parliament, and therefore it is only necessary here to mention the main channels that it has taken of recent years. The chief exports, in order of their importance today, are raw cotton, cotton goods and yarn, raw jute and jute-manufacture, food grains including rice, oilseeds, tea, hides and skins, lac, wool and rubber. Japan and China are India's best customers for raw cotton, Great Britain for raw jute, Ceylon and Germany for rice. The total value of Indian produce and manufactures exported by sea in the year 1925–6 was Rs.375 crores, of which the United Kingdom took roughly 78 crores, Japan 57 crores, the U.S.A. 40 crores and Germany 27 crores. The chief articles of import, again in order of their importance today, are cotton manufactures, which lead by a long way, metals and manufactured metal, machinery and mill work, sugar, mineral oils, railway plant and rolling stock, hardware and motor vehicles. In 1925–26 the sea-borne imports of private merchandise were valued at 226 crores, of which the United Kingdom provided 115 crores, and no other single country more than 18 crores, which was Japan's share.

Besides ordinary merchandise, there is a rarely interrupted influx of gold and silver into India. Their net import in 1925–26 was in the neighbourhood of 52 crores: but the figure varies enormously from year to year, being in effect the balancing factor in India's foreign trade, after provision has been made for what are loosely called her "home charges," *i.e.*, the interest on capital borrowed abroad, the payments abroad for her civil and military services and pensions, and the upkeep of the India Office.

Of recent years there have been significant changes in the trend of the overseas trade. There has been a marked reduction in the volume of imports, most marked in cotton goods and other textiles; but from this decline, in spite of protective duties, iron and steel have been exempt, the increase in Indian production being no greater than the increase in Indian demand; and there has been a very great increase in the imports of machinery and mill work. Other imports which have greatly increased are mineral oil and motor-cars. The volume of exports is now at least at as high a level as before the War; but the character has considerably altered. Less grain is being exported and more tea; much less raw jute and a great deal more manufactured; the export of raw cotton has increased, and so has that of cloth, particularly coloured piece-goods, but the export of yarn has greatly declined. India has in fact become much more self-sufficing with regard to manufactures, and less disposed to export food and raw materials except where, as in the case of cotton, high prices and increased production make export specially profitable. The causes of this change are partly to be found in higher freights and higher import duties; partly also in the changed condition of world trade as a whole, regarded as an interchange of manufactures for foodstuffs and raw materials, in consequence of which the Indian peasantry get only a small increase of price for most of the things they sell, but have to pay a great deal more for what they buy. But it is also partly due to Indian progress in manufacturing equipment and industrial organisation.

Local trade is conducted either at the permanent bazaars of great towns, at weekly markets held in certain villages, at annual gatherings primarily held for religious purposes, or by means of travelling brokers and agents. The cultivator himself, who is the chief producer and also the chief customer, knows little of the great towns, and expects the dealer to come to his own door. Each village has at least one resident trader, who usually combines in his own person the functions of money-lender, grain dealer and cloth seller. The money-lender deals chiefly in grain and in specie. In those districts where the staples of export are largely grown, the cultivators commonly sell their crops to travelling brokers, who re-sell to larger dealers, and so on until the commodities reach the hands of the agents of the great shipping houses. The wholesale trade thus rests ultimately with a comparatively small number of persons, who have agencies, or rather corresponding firms, at the great central marts. Buying and selling in their aspects most characteristic of India are to be seen, not at these great towns, nor even at the weekly markets, but at the fairs which are held periodically at certain spots in most districts. Crowds of petty traders attend, bringing all those miscellaneous articles that can be packed into a pedlar's wallet; and the neighbouring villagers look forward to the occasion to satisfy alike their curiosity and their household wants.

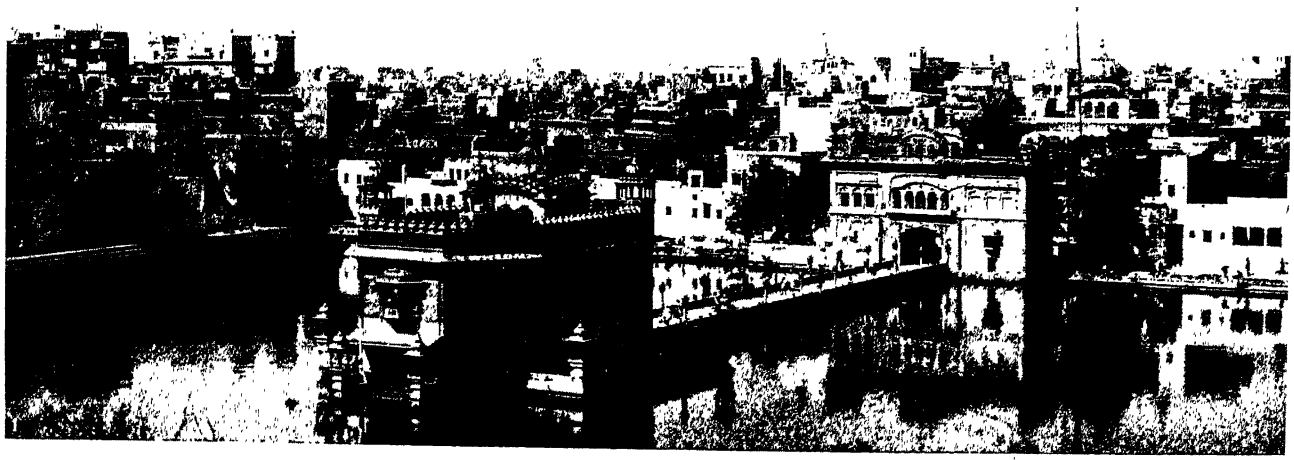
THE INDIAN STATES

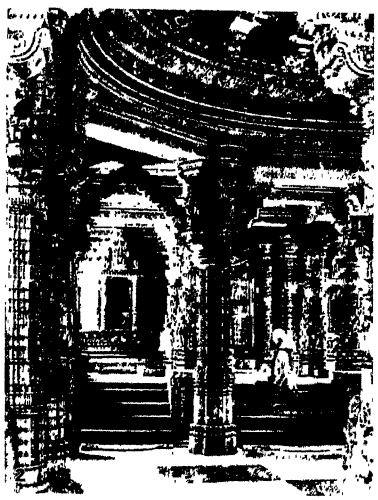
The relations now subsisting between the Indian states and the British Government are the outcome of an evolutionary process which still continues. The Mutiny, the passing of the East India Co. and the grant of *sanads* of adoption to the rulers in 1862 obliterated the peril of annexation, breached the barriers of isolation and inaugurated for the states a new era of union under the Crown. Queen Victoria's proclamation of 1858 announced to the "Native Princes of India" that all treaties and engagements made with them would be scrupulously observed and that their rights, dignity and honour would be respected. What degree of sovereignty was thus guaranteed to the different princes and chiefs, it would not be easy to describe. As Sir Henry Maine said: "There may be found in India every shade and variety of sovereignty, but there is only one independent sovereign, the British Government. . . . The mode or degree in which sovereignty is distributed between the British Government and any Native State is always a question of fact which has to be separately decided in each case, and to which no general rules apply." Two important principles have, however, been laid down by statute, namely, first, that the Indian states "have no connections, engagements or communications with foreign powers," and second, that the British Government has the right to protect and govern subjects of the states when resident or found abroad. For international purposes, therefore, state territory is in the same position as British territory, and state subjects as British subjects.

Status of the Princes.—The assumption of the Government by the Crown in 1858 called the princes to greater responsibilities as well as to higher honours. Lord Curzon speaking at Gwalior in 1899 claimed the rulers of the states as his colleagues and partners in the administration of the country. Lord Minto, perceiving an atmosphere of discontent, took the occasion to make a declaration of policy, during a visit to the Maharaja of Udaipur in Nov. 1909. He interpreted the proclamations of Queen Victoria and King Edward as inculcating a sympathetic, and therefore an elastic policy, and he laid stress on the fact that the foundation stone of the whole system must be the recognition of identity of interests between the Imperial Government and Durbars and the minimum of interference with the latter in their own affairs.

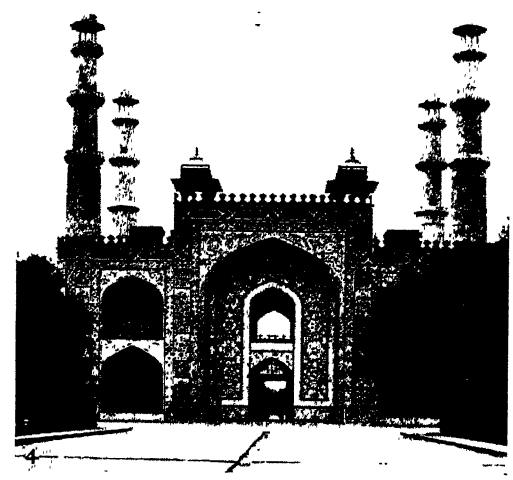
Lord Hardinge, pursuing the same policy, in 1913 and 1914 invited some of the princes to meet him in conference at Delhi to discuss a scheme for founding a central college at Delhi, and in 1914 he created a new post of political secretary to the Government of India, in order that closer attention might be devoted to relations with the states. The past fifteen years had proved an era of striking progress and development, and the rulers themselves, encouraged to play more important parts in the drama of Indian affairs, were becoming daily more advanced in their own administration, so that new methods of political treatment were required.

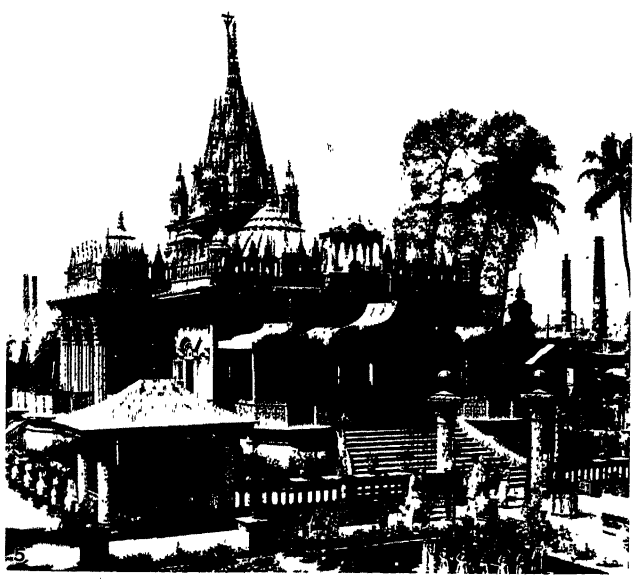
In Aug. 1914, on the outbreak of the War, the princes vied with each other in the offer of loyal service. In a telegram which stirred England the Viceroy reported that the rulers of the states in India, numbering nearly 700, had with one accord rallied to the defence of the Empire and offered their personal services and the resources of their states. Contingents of all arms were accepted from 12 states, besides a camel corps from Bikaner. A











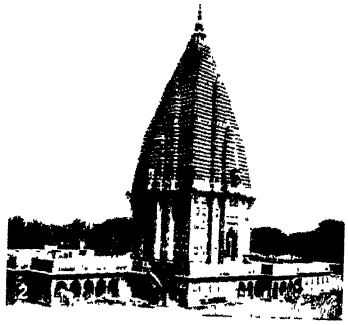


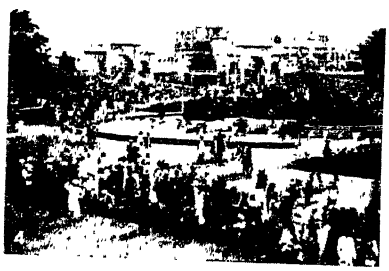
BY COURTESY OF (1—4) HERBERT G. PONTING, F.R.P.S., (5, 6) THE CANADIAN PACIFIC STEAMSHIPS

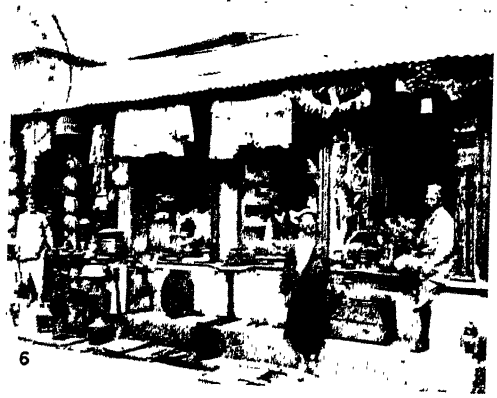
TEMPLES AND GATEWAYS OF INDIA

1. Golden Temple at Amritsar, chief worshipping place of the Sikhs. The temple is situated on an island in the middle of a lake surrounded by marble terraces, and has a copper dome covered with gold foil
2. Shrine of the god Parswanath in Vimala's temple on Mount Abu, an elaborately carved building of white marble erected about 1032 A.D.
3. A gateway in Jaipur. Pink stucco has been used throughout the city
4. Red sandstone gateway of the tomb of Akbar at Sikandra, near Agra, completed about 1613. It is seventy feet high
5. One of a group of three Jain temples, Calcutta. They are built of white marble, and stand in a beautifully laid out garden
6. A small stone shrine of Buddha overgrown by a banyan tree at the Shwe Dagon Pagoda, Rangoon, the centre of Burmese religious life

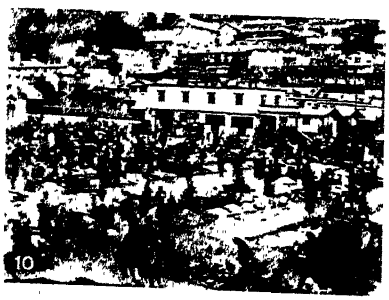
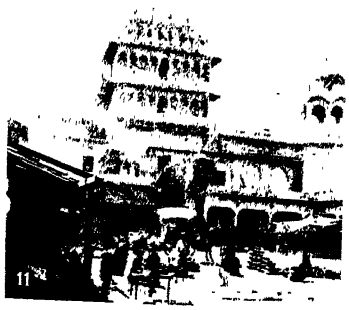
INDIA







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INDIAN TEMPLES, TOWNS AND SOCIAL LIFE

1. Ruins of an ancient brick stupa near Benares. The upper part, in which a tree has grown, is covered with grass
2. The temple of Raja Chait Singh at Ramnagar near Benares, built about 1800 A.D. It includes stables for elephants and sacred cows
3. Group of temples on the river side at Ujjain, an ancient city of Central India situated on the Sipra
4. The grounds of the palace at Mysore during a ceremonial occasion
5. A Mohammedan girl wearing the usual head covering considered essential to modesty
6. Native shops in Darjeeling, a hill station of Bengal, British India
7. Caucasian types in India
8. A snake charmer in the city of Benares
9. A peasant girl wearing nose and ear rings
10. A market square in Darjeeling near the boundary between northern India and Tibet, where the hill people come on Sundays to buy and sell. Among the articles on display are tiger skins, rugs, jewelry, curkha knives, prayer-wheels, grains and tobacco
11. Bazaar in the market place before a temple at Jodhpur, Rajputana

hospital ship was given by various states at the instance of the Maharaja of Gwalior, and as the War progressed there were many fresh evidences of the spirit of loyalty animating the princes and their peoples. The support afforded by the Durbars in the matter of raising recruits was of particular value.

Minorities and Successions.—In 1916 Lord Chelmsford, in spite of war preoccupations, decided to invite the princes to another conference. In his opening speech he laid stress on the magnificent assistance rendered by the states. The most important of the subjects discussed at the conference related to the form of administration to be adopted in a state during a minority. This thorny subject, after full discussion at the conference, was made the text of a declaration in Aug. 1917 laying down the principles for the conduct of minority administrations. In it the Government of India asserted their rôle as trustees and custodians of the rights, interests and traditions of a state during a minority, but admitted that the special conditions of each state required special treatment, and promised to attach due weight to requests by individual ruling princes or chiefs regarding any principles which they might wish to be adopted in the case of their own states or families, while reserving to themselves freedom of action in dealing with such requests. Seventeen general principles were laid down for observance during minority administrations. The pronouncement was welcomed as an event hardly second in constitutional importance to the *sanads* of adoption granted by Lord Canning. The next conference, held in 1917, saw the decision of another very important question, viz.: the form of recognition by Government of successions in the states. Lord Chelmsford announced that in the case of the succession of a direct natural heir recognition on the part of a paramount power was purely formal, and that the obligation on the part of the new ruler to obtain it in no way impaired his inherent right to succeed.

The Chamber of Princes.—His Highness the Maharaja of Bīkaner, who took the lead in this conference, expressed the hope of the princes that before the British Government made a decision on the subject of political reforms to be introduced in British India the ruling princes would also be consulted, and a constitutional chamber established to safeguard their interests. In Dec. 1919 the King issued a royal proclamation signifying his assent to the establishment of a chamber of princes, which was eventually inaugurated by the Duke of Connaught in Feb. 1921. In the proclamation then read, the following occurs:—

"In my former proclamation I repeated the assurance, given on many occasions by my Royal predecessors and myself, of my determination ever to maintain unimpaired the privileges, rights and dignities of the princes of India. The princes may rest assured that this pledge remains inviolate and inviolable. I now authorise my Viceroy to publish the terms of the constitution of the new chamber. My Viceroy will take its counsel freely in matters relating to the territories of the Indian States generally, and in matters that affect those territories jointly with British India, or with the rest of my Empire. It will have no concern with the internal affairs of individual states or their rulers or with the relations of individual states to my Government, while the existing rights of the states and their freedom of action will be in no way prejudiced or impaired."

His Royal Highness also conveyed to the princes a special message of thanks from His Majesty in public acknowledgment of their splendid record of achievement during the War. He alluded to the fact that H.H. of Bīkaner had taken part in the Peace Conference and had signed the Treaty of Versailles, while H.H. the Maharaja of Nawanagar had attended the League of Nations Assembly at Geneva. H.H. the Maharaja of Bīkaner was appointed to be the first chancellor of the chamber (Narendra Mandal), and was re-elected to the office each year until 1926 when he was succeeded by H.H. the Maharaja of Patiala.

The Salute states in the Punjab Province were taken into direct relation with the Government of India in Nov. 1921, through the appointment of an agent to the Governor-General. A similar arrangement was made in 1923 for the five states in the Madras Presidency, and in 1924 for the Bombay states of Kāthiāwār, together with Cutch and Palanpur, while the Bombay Political Department was combined with that of the Government of India. In 1921 the Gwalior state was separated from the Central India Agency and brought into contact with the central Government through a single intermediary officer, while in Rājputāna the states of Bīkaner, Sirohi and Jhālawār were at different times placed in direct relations with the agent to the Governor-General instead of through a subordinate political agent. At the meeting of the chamber in the autumn of 1921, Lord Reading announced that for the future, except at installations and investitures, where local custom would continue to be followed, the King had been pleased to dispense with the presentation of nazars at ceremonial visits or receptions, either to himself or to the members of his family or to any of his officers to whom it had hitherto been customary to present them.

Constitutional Development.—While the paramount power has parted with none of its prerogatives, the evolutionary process has gradually led to a certain breaking down of the isolation of the states among themselves, the strengthening of their position and the advancement of the dignity of the princes. They not only gained, in the chamber, means for expression of their collective needs and opportunity for influencing the development of political doctrine, but they were admitted, as joint representatives of India, to the innermost councils of the Empire. In a few advanced states, legislative bodies have been constituted bearing some analogy to those in British India, Mysore being a prominent example, while in others the rulers have devised means for the people to voice their grievances and aspirations more easily through consultative councils. Thus the processes at work in British India are insensibly influencing the States and tending to break down their conservative traditions. At the same time the princes cannot but regard with interest the constitutional changes beyond their borders, and the possibility that they may ultimately be brought into relations with a democratic Indian Government in place of their present personal association with the Viceroy and his officers. This prospect has not been wholly absent from their motives in pressing for an enquiry into a number of questions of "political practice," which they claim to be derogations from their status as treaty powers. A committee appointed by the Government of India to make such an enquiry has been at work in 1928, and the princes sent a strong delegation to England, for the purpose of presenting their claims, as well as of interesting and instructing public opinion on a technical and little understood aspect of India's constitutional problems.

BIBLIOGRAPHY.—In contrast with the former scarcity of good books on India, they now abound; and the following is necessarily an arbitrary selection from the newer works. The standard all-round text-book is *The Imperial Gazetteer of India*, vol. 1 to 4. Add to this the Statistical Abstract of British India from 1914–15 to 1925–26 (Cmd. 3046 of 1928); and the reports to Parliament on the Moral and Material Progress of India, now published as India in 1918, etc., up to *1926–27* written by Prof. Rushbrook Williams, and later by Mr. J. Coatman, and bringing a full narrative of current events up to date.

Historical: Sir Verney Lovett's *India* in the "Nations of To-day" series (1923) is the latest authoritative work. Sir V. Chirol's trilogy should be studied: *Indian Unrest* (1910); *India Old and New* (1921); and "India" in The Modern World series (1926).

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(MR.)

DEFENCE

The defence of India, involving as it does the services of the British and Indian Armies and Navies, and the Royal Air Force, naturally falls into three sections, dealing respectively with mili-

tary, naval and air operations, and will be dealt with accordingly.

ARMY

Historically, the Indian army grew up in three distinct divisions, the Bengal, Madras and Bombay armies. This separation was the natural result of the original foundation of separate settlements and factories in India.

Bengal.—The English traders in Bengal were long restricted by the native princes to a military establishment of an ensign and 30 men; and this force may be taken as the germ of the Indian army. In 1695 native soldiers were first enlisted. In 1756 occurred the defence of Calcutta against Suraj-ud-Dowlah, and the terrible tragedy of the Black Hole. The work of reconquest and punishment was carried out by an expedition from Madras, and in the little force with which Clive gained the great victory of Plassey (*q.v.*) the Bengal army was represented by a few hundred men only (the British 39th, now the Dorsetshire regiment, which was also present, was the first King's regiment sent to India, and bears the motto *Primus in Indis*); but from this date the military power of the Company rapidly increased and in 1763 the total forces amounted to 1,500 Europeans and 12 battalions of native infantry (11,500 men). In 1765 the whole force was organized in three brigades, each consisting of one company of artillery, one regiment of European infantry, one troop of native cavalry and seven battalions of sepoys. In 1766, on the reduction of some money allowances, a number of officers of the Bengal army agreed to resign their commissions simultaneously. This dangerous combination was promptly put down by Clive (*q.v.*), to whom the Bengal army may be said to owe its existence. The constant wars and extensions of dominion of the next 30 years led to further augmentations; the number of brigades and of European regiments was increased to six; and in 1794 the Bengal army numbered about 13,500 Europeans and 24,000 natives.

Madras.—The first armed force in the Madras presidency was the little garrison of Armegon on the Coromandel coast, consisting of 28 soldiers. In 1644 Fort St. George was built and garrisoned, and in 1653 Madras became a presidency. In 1745 the garrison of Fort St. George consisted of 200 Europeans, while a similar number, with the addition of 200 "Topasses" (descendants of the Portuguese), garrisoned Fort St. David. In 1748 the various independent companies on the Coromandel coast and other places were consolidated into the Madras European regiment. From this time the military history of the Madras army was full of incident, and it bore the principal part in Clive's victories of Arcot, Kavaripak and Plassey. In 1754 the 39th regiment of the Royal army was sent to Madras. In 1758 three others followed. In 1772 the Madras army numbered 3,000 European infantry and 16,000 natives, and in 1784 the number of native troops had risen to 34,000.

Bombay.—The island of Bombay formed part of the marriage portion received by Charles II. with the infanta of Portugal, and in 1662 the Bombay regiment of Europeans was raised to defend it. In 1668 the island was granted to the Company, and the regiment at the same time transferred to them. In 1708 Bombay became a presidency, but it did not play so important a part as the others in the early extension of British power, and its forces were not so rapidly developed. It is said, however, to have been the first to discipline native troops, and Bombay sepoys were sent to Madras in 1747, and took part in the battle of Plassey in 1757. In 1772 the Bombay army consisted of 2,500 Europeans and 3,500 sepoys, but in 1794, in consequence of the struggles with the Mahratta power, the native troops had been increased to 24,000.

Consolidation of the Army.—In 1796 a general reorganization took place. Hitherto the officers in each presidency had been borne on general "lists," according to branches of the service. These lists were now broken up and cadres of regiments formed. The colonels and lieutenant-colonels remained on separate lists, while the divisional commands were distributed between the royal and Company's officers. Further augmentations took place, consequent on the great extension of British supremacy, and in 1808 the total force in India amounted to 24,500 Europeans and 154,500 natives. The first half of the 19th century was filled with wars and annexations and the army was steadily increased. Horse artillery was formed, and the artillery in general greatly augmented. "Irregular cavalry" was raised in Bengal and Bombay, and recruited from a better class of troopers, who received high pay and found their own horses and equipment. "Local forces" were raised in various parts from time to time, the most important being the Punjab irregular force (raised after the annexation of the Punjab in 1849). Another kind of force, gradually formed, was that called "contingents"—troops raised by the protected native states. The strongest of these was that of Hyderabad, originally known as the Nizam's army.

The Army Before the Mutiny.—The officering and recruiting of the three armies were in all essentials similar. The officers were mainly supplied by the Company's military college at Addiscombe in Surrey (established in 1809), and by direct appointments. The Bengal infantry was mostly drawn from Oudh and the great Gangetic plains and composed chiefly of high-caste Hindus, a sixth being Mohammedans, while the cavalry were mainly Mohammedans, recruited from Rohilkhand and the Gangetic Doab. The only other elements in the army were four Gurkha regiments, enlisted from Nepal, and the local Punjab irregular force. The Madras army was chiefly recruited from that presidency, or the native states connected with it, and consisted of Mohammedans, Brahmans, and of the Mahratta, Tamil and Telugu peoples. The Bombay army was recruited from its own presidency, with some Hindustanis, but chiefly formed of Mahrattas and Mohammedans; the Bombay light cavalry mainly from Hindustan proper. Including the local and irregular troops (about 100,000 strong), the total strength amounted to 38,000 Europeans of all arms, with 276 field guns, and 348,000 native troops, with 248 field guns—truly a magnificent establishment, and, outwardly, worthy of the great empire which England had created for herself in the East, but inwardly unsound, and on the very verge of the great mutiny of 1857. An account of the events of 1857–58 will be found under INDIAN MUTINY.

The Reorganization.—After the catastrophe the reorganization of the military forces on different lines was of course unavoidable. Fortunately, the armies of Madras and Bombay had been almost wholly untouched by the spirit of disaffection, and in the darkest days the Sikhs, though formerly enemies of the British, had not only remained faithful to them, but had rendered them powerful assistance.

On Sept. 1, 1858, the East India Company ceased to rule, and Her Majesty's government took up the reins of power. The local European army was abolished, and its *personnel* amalgamated with the royal army. The artillery became wholly British, with the exception of a few native mountain batteries. The total strength of the British troops, all of the royal army, was largely increased, while that of the native troops was largely diminished. Three distinct native armies—those of Bengal, Madras and Bombay—were still maintained. The reduced Indian armies consisted of cavalry and infantry only, with a very few artillery, distributed as follows:—

	Battalions Infantry	*Regiments Cavalry*
Bengal	49	19
Madras	40	4
Bombay	30	7
Punjab Force	12	6
Total	131	36

The Punjab force continued under the Punjab government. In addition, the Hyderabad contingent and local forces in Central India were retained under the government of India. After all the arrangements had been completed the army of India consisted of 62,000 British and 125,000 native troops.

The college at Addiscombe was closed in 1860, and the direct appointment of British officers to the Indian local forces ceased in 1861. In that year a staff corps was formed in each presidency "to supply a body of officers for service in India." The corps was at first recruited partly from officers of the Company's service and partly from the royal army, holding staff appoint-

ments (the new regimental employment being considered as staff duty) and all kinds of political and civil posts. The only English warrant and non-commissioned officers now to be employed in the native army were to be those of the Royal Engineers with the sappers and miners. In 1863 the system prevailing in the Punjab Frontier Force was applied to the whole army, each regiment and battalion having seven British officers attached to it for command and administrative duties, the immediate command of troops and companies being left to the native officers. Thus was the system reverted to, which was initiated by Clive, of a few British officers only being attached to each corps for the higher regimental duties of command and control.

A new spirit was breathed into the army. The supremacy of the commandant was the main principle. He was less hampered by the unbending regulations enjoined upon the old regular regiments, had greater powers, greater freedom of action, and was supported in the full exercise of his authority. The system made the officers. Many important changes took place between 1885 and 1904. Seven Madras infantry regiments were converted into regiments for service in Burma, composed of Gurkhas and hardy races from northern India; six Bengal and Bombay regiments were similarly converted into regiments of Punjabis, Pathans and Gurkhas; a system of linked battalions was introduced with the formation of regimental centres for mobilization; and reserves for infantry and mountain artillery were formed. The number of British officers with each regiment was increased to nine, and the battalions converted into four double-company commands of 250 men each, under a British commander, who should be responsible to the commandant for their training and efficiency, the command of the companies being left to the native officers. This system admitted of closer individual attention to training, and distributed among the senior British regimental officers effective responsibility of a personal kind.

An addition (at the imperial expense) of five battalions of Sikhs, Punjabi Mohammedans, Jats and hillmen in northern India was made in 1900, as the result of India being called upon to furnish garrisons for Mauritius and other stations overseas. The unification of the triplicate army departments in the different presidential armies was completed in 1891, all being brought directly under the supreme government; and the three separate staff corps of Bengal, Madras and Bombay were fused into one in 1891 as the Indian Staff Corps. The term "Indian Staff Corps" was in turn replaced by that of "Indian Army" in 1903. These measures prepared the way for the new system of army organization which placed the whole army of India under the governor-general and the commander-in-chief in India.

The Indian Defence Problem.—Before following the further development of the army in India, it is desirable to review the military problem as it appeared after the Boer War, when the Empire was taking stock of its military systems in the light of the experience there gained, and by the lessons of the Russo-Japanese War. Up till the days of the Mutiny in 1857 the armies of India were largely organized and located to dominate the powerful forces of the native states within India or on her borders. The fierce conflicts with the Sikhs and the annexation of the Punjab brought this period in some sort to a close, though in 1857 the troops of several of the states also mutinied against their own rulers and joined in that struggle. Between that period and the Boer War Britain had been at war with Burma and Afghanistan. The policy with regard to the latter country has always aimed at a strong, friendly, independent state, and for close on a hundred years the gradual absorption of the Central Asian Khanates by Russia and avowed threats toward India had made Britain very sensitive as regards the integrity of Afghanistan. Since 1881 the protection of Afghanistan against Russian aggression had been the keynote of the military policy as the major operation to be faced. At the same time there were and are other responsibilities. In the Far East, China, especially in time of disturbance, might be a very genuine and a very serious problem on the trade routes that run between China and Burma. On the Northern frontier, Nepal, which had overrun the submontane tract of India, the Himalaya, early in the nineteenth century, and might want to do so again, could not be neglected. On the north-west frontier, the thousand miles of independent hill tribes between the administered British province and the Afghan boundary had presented a military problem ever since 1849, a problem, however, less costly than an annexation and pacification of the hills in which they lived. Since the World War, when modern rifles and ammunition were scattered over the battlefields of the East, the tribes have obtained possession of large quantities of modern arms and can easily number over 100,000 combatants. Added to these possible dangers, there has always been present the fear of internal disturbance, in a country of over 300,000,000 people of antagonistic races and religions, while the possibility of a repetition of 1857 could not be entirely disregarded.

Lord Kitchener's Reorganization.—Until the days of the Boer War, there had been no attempt to frame a principle of organization of the forces throughout the empire, or to evolve a scheme whereby all these forces should pass from a peace to a war footing. The lessons of that war produced a more definite train of thought. The decision was arrived at that the division should be the British war unit, and that it was desirable that each division and brigade should be trained together in peace by the men who would lead them in war. While the army in the United Kingdom was in process of reorganization, Lord Kitchener was sent to India to bring the army there on to modern lines, and more especially to prepare it for its major rôle, the defence of Afghanistan against Russian aggression. Lord Kitchener found that while there were four commands, the line was still numbered as three distinct presidential armies, and that there were numerous smaller forces which also had separate numerals. For instance, at least eight infantry battalions were numbered "1." Further there were many units formed of material which, from years of peaceful living, had lost their martial characteristics. The divisional organization in peace time did not exist and there was no definite allotment of troops to field army and garrison units, while it was impossible to collect units under the brigadiers who would train them, in view of the way in which the cantonments had grown up in pursuance of requirements which no longer existed.

Eventually, after much consideration, the following main reforms were inaugurated. The whole army was renumbered in one series; the Punjab Frontier Force, the Hyderabad contingent, the local regiments in Baluchistan and other corps hitherto deemed local were brought into one roster and made available for general service. The four commands were abolished and ten divisional areas were introduced (including Burma). Of these, at least seven were to contain a field army division of which the first five were to be complete in all essentials and the remainder maintained in a lesser state of preparation. The divisional area was to be the administrative unit, and, in addition to the field army division, might contain one or more cavalry brigades and a number of units, including the Volunteers, allotted to the maintenance of internal order, and the defence of arsenals and stores. Two commands, Northern and Southern, were formed, as inspectory rather than administrative organizations. In addition, certain independent brigades were created directly under Command Headquarters, chiefly the three areas on the frontier between the Khyber and the Gomal passes. The class composition of the battalions and cavalry regiments was exhaustively studied, companies and squadrons and, in certain cases, whole corps, being filled more definitely than heretofore by the martial classes and races so as to produce a healthy rivalry, and to supplement each other's qualities, while the less warlike races were largely eliminated, and new classes of fighting value that had hitherto been neglected were sought for. In this connection it cannot be too widely understood that in the immense population of India the number of men of martial proclivities and even personal courage is a very small proportion of the whole (for instance the entire Sikh community, men, women and children, barely number three million), and the great mass of the people, educated and otherwise, are quite devoid of any martial potentiality. The scientific grouping by race and creed which now ensued produced an army far superior in fighting value to anything that had existed before, and enabled the Indian Army to take so notable a part in the World War.

The great factor, however, which militated against the military efficiency of the Indian Army was the administrative system, inherited from the Moguls, suited to their period and to the warfare of the earlier days of the Company, which had broken down absolutely in the First and Second Afghan Wars, but which even in Kitchener's time was too economical in peace to be abolished. Under this system the native army provided its own food, horses, clothing and much of its equipment regimentally on a contract basis, and this meant that the administrative services to supply food, transport, remount, clothing, and equipment other than fighting equipment did not exist in peace in India save for the European troops, and could not be efficiently found in war. Kitchener, while doing what he could to improve matters, found that the cost was too prohibitive, and it was not till the breakdown of the Indian administrative services in the field during the World War that it was possible to put the supply, remount and ordnance services on the same footing as all other armies, and for the army to draw all its supplies through departmental army sources. Until this was done India had neither reserves of equipment nor personnel to deal with the war requirements. This essential measure of efficiency has, however, greatly increased the cost of the army.

The War Ministry.—Kitchener's administration will be most remembered by the controversy as regards the war minister, or, in Indian terms, the military member of the Governor-General's council. Hitherto, the military member, though a distinguished soldier, was in the position towards the commander-in-chief of secretary of State for war. Kitchener urged that, in a country like India where war problems were always immediate, a civilian minister was not a suitable one, while a military member must always tend to clash with the commander-in-chief, who should be the sole military adviser of Government. In spite of strong opposition from Lord Curzon, the Viceroy, Kitchener's view prevailed, and the commander-in-chief with a small secretariat on the civil side, was to be also secretary of State for war or, as it was now to be termed, "army member" of the Governor-General's council. A further measure of efficiency, which was of immense value in the World War, was the starting in India of gun, rifle and cordite factories on a large scale, so that India should be more independent of Europe for munitions than she had been since the introduction of rifled and breechloading weapons. The organization and training of the staff on a more thorough system was also undertaken in Kitchener's time, by the establishment of a staff college in India, the institution in England not being large enough for both armies. A few years before the World War, India followed the example of Great Britain in establishing a general staff on modern lines.

The World War.—When the World War broke out, India was able to despatch forces to Mesopotamia, primarily to protect the oil fields, to East Africa, and to Egypt to hold the Canal. The best force, however, was almost immediately sent on to France and more troops sent to Egypt in their stead, while India denuded herself to the point of danger of her war reserves, a course Britain's alliance with Russia alone made possible. The system of administrative services referred to above, militated for some time against the full efficiency of her forces, but these matters were put on a modern basis as time went on. The military contribution by India to the World War, of troops who in their real aspect were mercenary is a remarkable tribute to the general loyalty and affection of the martial classes of India inspired by the Crown. Eventually the Indian forces were concentrated in the Mesopotamia and Palestine theatres in terrain more suited to them than that of France.

Hardly was the war over when, in 1919, immediately after the rebellion in the Punjab, the Amir of Afghanistan invaded India, when the force was in the midst of demobilizing, and the best part of the Indian army still overseas. Driving back the Afghans after some hard fighting, the army then found itself involved in some three years' frontier operations, the direct result of the upset of the tribes on the frontier by the Afghan invasion. *Pari passu* with these prolonged operations, the Indian army needed remodelling in the light of the experience of the World War and the post-war conditions. The principal changes introduced were the abolition of practically half the Indian cavalry by combining regiments, the disbanding of all the Carnatic battalions and the reduction by several thousand men of the British army to be maintained in the country. In actual organization, the army was divided into four commands, in lieu of the two inspectory commands of the Kitchener organization, with divisional areas somewhat readjusted. The troops holding the frontier were to be called the covering force, and were to be fully mobilized and strong enough to allow of the army behind mobilizing at leisure. In addition, five divisions, those of Peshawur, Rawal Pindi, Quetta, Mhow and Meerut, were to be considered field army formations. Motor transport companies were introduced and a large repair works opened at Rawal Pindi. The administrative services were to remain as constituted during the war, on the same lines as the British army, and the old, cheap but ineffective Mogul system was not returned to. A radical change in the grouping of the infantry was introduced as the result of the experience of the war.

All battalions were grouped into regiments of several service battalions and one depot or "training" battalion, and the new regiments numbered entirely fresh with due regard to the dates of the original raisings of the various corps. The class composition of many corps was also rearranged to allow for simpler reinforcement in war time. In the new organization it was necessary to absorb the famous corps of Guides into the line of the cavalry and infantry. The Gurkha two-battalion regiments, ten in number, alone retained their pre-war organization. The volunteer force of pre-war days, which during the War had been called the defence force, was now reorganized and termed the auxiliary force, and deemed to be a second line to the British troops in India, while a new Indian territorial force was inaugurated, on much the same lines as the territorial army in Great Britain.

A considered policy was also adopted in the last years of the War and continued after, of admitting Indian gentlemen to commissions with the same status as British officers, a number of young men being put through Sandhurst each year, and schools being started in India to train them in their younger days. It was also decided to select certain corps in which the officer cadre should, as an experiment, be in due course completely Indianized. The reductions and regrouping brought the number of European units in India from 9 to 6 cavalry regiments and from 51 to 45 battalions and the Indian units from 39 to 21 cavalry regiments, and from 129 to 140 battalions, which include 21 training battalions for each of the regiments. This number varies slightly according with the overseas obligations which the Government of India may have undertaken. The strength of the artillery consists of 9 horse artillery batteries of which four are brigaded, 11 brigades of field artillery totalling 44 batteries, 3 heavy brigades of 11 batteries and 6 mountain artillery brigades of 24 batteries of which 12 are Indian. The total strength of the reorganized army in India which varies slightly from year to year is some 204,000 men of whom two-thirds are Indian and one-third British.[1]

The Armies of the Native States.—A description of the Indian army would not be complete without a reference to the armies of the Native States of India. In 1885 these forces were numerous, badly disciplined, ill-armed and yet costly. The Penjdeh incident on the Afghan-Russo frontier in 1885, and the subsequent imminence of war with Russia, produced loyal offers by the rulers of many states to contribute in men or money to the defence of India. Eventually was evolved a policy of each state preparing a certain portion of its troops for the service of the Indian Empire in war. They were termed "Imperial Service Troops," and were armed by the British Government while British officers superintended their training. In their place a considerable portion of the older and badly organized state troops were disbanded. From 1890 to 1914 these troops took part, by the offer of the rulers, in many of the campaigns on the frontier, China, etc., in which the Indian army took part, and during the World War served far afield in many theatres of war. After the war, the rulers undertook to place all their troops, if need be, at the service of the empire, and the term "Imperial Service" was

[1] *The Army in India and its Evolution,* Government Press, Calcutta.

abandoned for the better trained portion, and the term "State Troops" applied to the whole. Several of the Princes themselves accompanied their troops into the field. The State Troops comprised infantry, cavalry, engineers and transport, and in Kashmir, which alone of the States of India was on the outer border and marched with Russia, two mountain batteries existed. Under the post-war organization some artillery is being added to the State forces in the interior.

Mechanization.—Mention is necessary of the mechanization desirable and possible in India. At present, apart from other factors, it is hampered by the low state of mechanization in civil life, and the absence of manufacturing or repairing firms of any size. For the repair of its own vehicles the Government of India have had to build large works, and are not able to rely on aid from civil firms. So far as the tactical requirements go, the heavy artillery and a proportion of the field artillery can undoubtedly be mechanized and some progress has been made. Where carts were expected to take supplies in the past, there lorries can go with advantage, while the coming of the lorry has immensely simplified transport problems so far as the main lines of movement towards Central Asia are concerned. The mechanizing of the mounted troops is a more complex problem. In India much of the cavalry exists for the *prevention* rather than the *suppression* of disturbance. The sight of lancers streaming across country must always be far more impressive than the presence of a few tanks and armoured cars, however much more destructive these may be when actual rebellion has broken out. (G. MA.)

Navy.—For three centuries a naval service, under various designations has been maintained in Indian waters. The East India Company, under their charter, maintained an armed naval force and in 1829 the Company founded an Indian Navy. After the Mutiny this service was abolished for reasons of economy and an Indian Marine Service was formed which developed, in 1892, into the Royal Indian Marine. In 1914 this force consisted of six armed transports manned by British officers and native crews. During the war the ships were employed in patrolling the Red Sea and the Persian Gulf, and the Royal Indian Marine took charge of the inland water transport in Mesopotamia until the end of 1916. The Indian Government besides maintaining the Royal Indian Marine, pays annually a sum of £100,000 towards the upkeep of the British East Indies Squadron, which has its base at Trincomalee.

Reforms in the internal government of India have engendered a desire that the Indian Empire should have a Navy of her own: "such force, raised by the Governor in Council to be used for the purpose of the Indian Empire alone, except if a state of emergency be declared, when the Governor may place all or any of the ships at the disposal of the British Admiralty." The force is to be commanded by a British Flag Officer and one third of the vacancies for officers are to be held open to Indians. The formation of the new navy was delayed, early in 1927, by the rejection (by one vote) by the Indian Parliament of necessary legislation dealing with naval discipline. In this situation the Indian Government proceeded with the reorganization of the Royal Indian Marine, with a view to its conversion, in due course into the Royal Indian Navy. At the end of 1928 a British Rear-Admiral was appointed to command the new force and the training of a few Indian officers was commenced in England. (S. T. H. W.)

The Air Force.—The Royal Air Force in India is under the control of the Air Vice-Marshal, who is under the supreme control of the Commander-in-Chief. Originally it comprised six squadrons organized in three wings of two squadrons each and its establishment was 218 officers and 1,757 British and 138 Indian other ranks. The Aircraft Depot and the various Aircraft Parks are directly under R.A.F. Headquarters in India.

The growing need for aerial defence in various parts of India resulted in claims being made by the Government of India for an extension of the existing equipment of the air stations. The use of the machines in reconnaissance, and the possibilities of their use in actual warfare or frontier risings, was freely discussed and the advantages of this arm in a country of long distances were clearly recognized. Those squadrons already in use were a charge on the Indian Government, and, after lengthy discussion, it was decided in May 1928 to make application for two other squadrons, and two new units, taken from the Wessex or Bombing Area of the Home Defence Force, were sent to India at the end of December, 1928. These were No. 11 Squadron, formerly stationed at Netheravon, and No. 39 Squadron, which was stationed at Bircham Newton, and they were equipped in England before departure with Hawker Horsley and D.H. 9a aircraft engines. In India, however, they were to be re-equipped with Westland Wapite general purpose aircraft engines. No. 11 Squadron has 11 officer and six airman pilots and No. 39 has 13 officer and seven airman pilots. This squadron was for some years associated with the massed bombing formations at the annual R.A.F. display at Hendon. The destination of the units was Risalpur on the North-West Frontier.

The splendid work done during the Afghan troubles of 1928–29 by the R.A.F., in rescuing British subjects and foreigners of every nationality from Kabul and transporting them to Peshawar was the subject of favourable comment throughout all Europe. King Amanullah himself was thus transported after his formal abdication. (X.)

ECONOMICS

Resources.—Agriculture is, as it has always been, the dominant feature in the economics of India. According to the 1921 census, close to three-fourths of the total population derive their being from occupations connected with the land, while no other single industry supports as many as 3 per cent of the inhabitants. And the fertility of the land, except where it is protected by irrigation, largely depends on the adequacy and timeliness of the monsoon rains. Should they fail, vast areas remain unsown or yield no harvest: masses of people, chiefly agricultural labourers and petty cultivators, are thrown out of employment; and their inability to get food, or to buy it when as now it is brought to their doors, constitutes that heart-rending calamity, an Indian famine.

The second powerful force which affects the economic situation in India is the constant demand of the outer world for her raw produce, coupled with her own industrial weakness in converting that produce into manufactured articles. From earliest times India was noted for her spices, her precious stones and her delicate textiles: in return she imported gold and silver in untold quantities and absorbed them. Spices are no longer a necessity in western diet; the diamond-mines of Golconda have been worked out; and the famous Cashmeres and muslins have been ousted, like cottage industries everywhere, by loom-made substitutes. To-day what the outer world clamours for is the surplus wheat, rice, cotton, jute, oilseeds and hides: and what it gives India in exchange is manufactured cotton (piece-goods) and yarn, metals and machinery, sugar and oil.

Agriculture.—The cultivation of the soil occupies the Indian people in a sense which it is difficult for the foreigner to realize, and which cannot be adequately expressed in figures. The village community contains many other members besides the cultivator: but they all exist for his benefit, and all alike are directly maintained from the produce of the village fields. The operations of rural life are familiar to every class. Everywhere, the same untiring labour is found, but inherited experience had taught the cultivators to adapt their simple methods to different conditions. Irrigation, apart from the great network of government canals, is practised wherever possible from wells of all types and depths, from tanks and evanescent streamlets. Manure is applied to the more valuable crops wherever it is available, although the land as a rule is starved by the much more insistent demand for manure as fuel. The rotation of crops is an ideal that is widely recognized, but poverty, as at every other turn, makes the use of periodic fallows unattainable. On the other hand, the regularity of the seasons allows two, and on highly manured soils even three, harvests in the year, though comparatively rarely on the same fields; and there is much natural fertility. For inexhaustible productiveness, and for retentiveness of moisture in a dry year, no soil could surpass the "black cotton soil"; but at the other end

of the scale vast areas of the driest sandy land are coaxed to yield a scrannel harvest of poor millets and thin pulses. An elaborate report on the whole subject of Indian agriculture was issued in the autumn of 1928 by the Linlithgow Commission.

Departments of Agriculture.—Despite the innate conservatism of the peasantry, and in the face of a very inadequate provision of staff and funds, the departments of Agriculture, which were organized early in the century, have achieved a variety of important results. In the fore-front of their work has been the introduction of improved varieties of plants. This involves, firstly, research in order to obtain from abroad, or evolve locally, the variety which will prove its superiority under Indian conditions; secondly, growing the improved variety in sufficient quantities to furnish the ryots with seed; thirdly, convincing ryots by means of demonstration farms, and otherwise, of the advantage offered; and, fourthly, in many cases, watching over the subsequent fate of the new variety to prevent it from being swamped by inter-mixture with others. The area sown in 1923–4 with improved varieties popularised in this way exceeded 5,000,000 ac., including over 2,000,000 ac. under wheat and rice, and even more under cotton. The Imperial Research Institute at Pusa has had remarkable success in its work with wheat, particularly in the introduction of types which are immune from rust; very valuable work has also been done on sugar at Coimbatore.

Irrigation.—In the age-long contest against the tyranny of a semi-tropical climate, irrigation has played the dominant part, not only as a preventive of scarcity due to drought, but as an everyday adjunct to the productivity of the soil. In 1925–26 the area actually sown (some of it more than once) in British India was 257 million acres, of which close on 48 millions were irrigated. About half the irrigated area is supplied from canals; the rest largely from wells and tanks. The canal system is one of the greatest achievements of the British government, and it is steadily extending. It embraces the great Ganges canals in northern India, with over 1,200 miles of main channels and 6,500 miles of distributaries: the vast network of the Punjab canals, and the elaborate Delta systems of Madras, besides extensive works in Sindh and Deccan. Some of these draw on rivers fed by the Himalayan snows: others are channels for inundation and thus of less assured permanency: others again, chiefly in Madras, are supplied by storage works. The substitution of a permanent supply for the uncertainties of an inundation supply is in the fore-front of the modern projects. Among these the greatest, and indeed one of the largest in the world, is the Sukkur barrage in Sindh. At the point where the combined five rivers of the Punjab enter Sindh through a narrow gorge, the flow will be stemmed by a barrage 4,725 ft. long between abutments. The inundation system of Sindh will be served, and a vast new area brought under irrigation, by seven canals which will take off from the barrage, and which will ultimately water close on 6 million acres, or considerably more than the whole cultivated area of Egypt.

Second only to the Sukkur scheme in magnitude is the Sutlej Valley project. It consists of four weirs, with ten main canals taking off from above them, and irrigating over 5 million acres in British and State territory which are now partly waste and partly served inadequately by inundation channels. Outside the Indus basin there is no scope for works of equal magnitude, but a great scheme has just been completed for the irrigation of Oudh, by canal fed from the Sarda river. This project had been under contemplation for 50 years, but was in abeyance because of the opposition of the Oudh landowners (taluqdars). The area to be irrigated is estimated at 1,700,000 acres. In Madras even older schemes first planned by Sir A. T. Cotton, the great pioneer of scientific canal irrigation in India, have been revived, for great storage reservoirs in the Cauvery, Bhavani, Tangabhadra and Kistna rivers, and the Cauvery scheme is well advanced. Two great dams are being erected in the Deccan, one of which is said to be the largest mass of masonry in the world: and all over India smaller works are being planned. An irrigable area of 50 million acres is aimed at.

Crops.—Of the total cropped area in British India, fully one-third is occupied by rice, which is the dominant crop of the staple food in Bengal, Bihar and Orissa, and in Burma, as well as parts of Madras and the United Provinces, the so-called Patna rice coming mainly from the latter. Burma however is the great exporter and Germany its chief customer. The total value of the rice export in 1925–26 was £30,000,000 sterling.

In area the next most important crops are the great variety of millets and pulses. The millets are probably the most prolific grain in the world, and the best adapted to the vicissitudes of a tropical climate, requiring practically no irrigation.

Grain is the predominant variety, and occupied over 10 million acres in the U.P. and Punjab alone: but lentils and the smaller pulses are more universal. They are not an export commodity.

Wheat was grown on 24 million acres, of which more than two-thirds was in the U.P. and Punjab. The canal colonies of the Punjab have turned northern India into one of the chief granaries of the British Empire: and the total export of wheat in a bumper year (1924–25) rose to 1,112,000 tons (value £14 millions), of which 68 per cent was taken by the United Kingdom.

Cotton.—The great cotton areas are Bombay and the Central Provinces: the total acreage being now over 18 millions.

The export of raw cotton in 1925–26 was close on 750,000 tons: but the figure for cotton twist and yarn has fallen grievously in recent years, mainly owing to the activity of Japan. Much is being done to improve the staple: and an Indian Cotton Committee has been established, which is financed by a small cess on the output. It has taken measures for the control of cotton gins and the transport of cotton, in order to prevent adulteration and the intermixture of inferior varieties. There is now more Indian cotton on the Liverpool market than before the war, and the difference in the price it realizes as compared with American has almost disappeared. The total crop of Indian (including the States) cotton has reached 6 million bales of 400 lbs., as compared with a pre-war quinquennial average of 4 million bales: Japan and China readily swallowing the excess.

Oilseeds, Sugar and Jute.—A crop of great importance and universally grown is the mixed group which yields oilseeds: for oil is an essential to the Indian toilet, to Indian cookery and as an illuminant. The chief varieties are ground-nuts, sesamum, rape or mustard, and linseed, which between them occupy nearly 13 million acres. The export has attained a value of £25,000,000, France being now the chief customer and Great Britain the second.

Barley, maize and fodder crops each cover more than 5 million acres: and the sugar cane accounts for roughly 3 million acres, nearly one half of which is in the United Provinces. It is an expensive crop, occupying the land for more than a year and exhausting it: but the yield is poor compared with that of other countries, and it has to be supplemented by heavy imports.

The world's supply of jute is derived almost wholly from Bengal.

Indigo.—Owing to the manufacture of synthetic indigo by German chemists the export trade in indigo, which was formerly the most important business carried on by European capital in India, has been almost entirely ruined. In the early years of the 19th century there were colonies of English planters in many districts of Bengal, and it was calculated that the planters of North Behar alone had a turnover of a million sterling. In 1895–1896 the area under indigo was 1,570,000 acres, and the value of the exports £3,569,700, while in 1925–26 the area had sunk to 133,000 acres, and the value of the exports to £42,000.

Tea.—The cultivation of tea in India has replaced indigo as the chief article for European capital, more particularly in Assam. The real tea (*Thea viridis*), a plant akin to the camellia, grows wild in Assam, being commonly found throughout the hilly tract between the valleys of the Brahmaputra and the Barak. There it sometimes attains the dimensions of a large tree; and from that, as well as from other indications, it has been plausibly inferred that Assam is the original home of the plant, which was thence introduced at a prehistoric date into China. The area under tea in 1885 was 283,925 acres and the yield 71,525,977 lb., while in 1925 the area had increased to 728,860 acres and the

yield to 363 million lbs., the export alone being worth over £20,000,000 sterling. The United Kingdom takes 88 per cent of the export and the home consumption is rapidly rising.

Coffee.—The cultivation of coffee is confined to southern India, though attempts have been made to introduce the plant both into Lower Burma and into the Eastern Bengal district of Chittagong. The coffee tract includes almost the whole of Coorg, the districts of Kadur and Hassan in Mysore, the Nilgiri hills, and the Wynaad. The cultivation has also extended to the Shevaroy hills in Salem district and to the Palni hills in Madura. Although local tradition dates its introduction two centuries back, coffee was not grown systematically until 1840. Since 1860 it has spread with great rapidity along the whole line of the Western Ghats, clearing away the primeval forest, and opening a new era of prosperity to the labouring classes. The export of coffee in 1905 was 360,000 cwt.; but mainly owing to the competition of Brazil, it has fallen considerably. The United Kingdom and France are the chief consumers. There is practically no local market for coffee in India.

Cinchona.—The cultivation of cinchona was introduced into India in the year 1860 under the auspices of government, owing to the efforts of Sir Clements Markham, and a stock of plants was prepared and distributed to planters in the Nilgiris and in Coorg. At the same time governmental plantations were established in the Nilgiri hills and at Darjeeling, and these have been continued up to the present time. A considerable amount of the bark from private plantations is bought by the government and treated at the government factories.

Garden Crops.—Vegetables occupy an important place in the Indian dietary and are grown everywhere. Besides the ordinary European species, which can mostly be grown in the cold season, the favourites are the egg-plant (brinjal), garlic, yams and a great variety of cucurbitaceous plants. Among cultivated fruits the commonest are the mango, plantain, guava, tamarind, jack, pomegranate, pineapple, papaw, custard-apple and several varieties of fig, melon, orange, lime and citron. The mangoes of Bombay, of Multan and of Malda in Bengal, and the oranges of Nagpur and the Kasi hills, enjoy a high reputation; while the guavas of Madras make an excellent preserve. Spices form another essential element in the Indian diet: turmeric and chillies are in universal use and are cultivated everywhere. Ginger, coriander, aniseed, black cummin and fenugreek come next in importance. Pepper is confined mostly to the Malaba Coast, and cardamons are hardly less localized. *Pan*, however, or betel-leaf, is grown pretty generally: it is a difficult crop, tended by a special caste. The betel-nut or areca palm is found in the deltaic districts of Bengal and the highlands of northern India. Other palms include the coco-nut, which flourishes on the western coast of south India; the bastard date, which supplies the jaggery sugar of commerce and the intoxicating liquor known as tari or toddy; the palmyra, and the true date which grows only in Sind.

Co-operation.—To the improvement of Indian agriculture few obstacles are so grave as the chronic indebtedness of the peasantry. Legislation to combat this by restricting the alienation of rights in land has long been active: but the most effective remedy yet devised is undoubtedly the establishment of rural credit banks on the Raiffeisen plan. It was initiated by an Act of 1904, when registrars of co-operative societies were appointed for the different provinces, to draft model rules, register, inspect and audit the accounts of co-operative banks, and also to carry on propaganda and education in co-operative principles. In 1912 an amending Act was passed, as the result of eight years' experience; and also to extend the official encouragement to co-operation in other fields. The number of registered societies increased from 5,432 in 1911 to 80,182 in 1926; the membership from 308,000 to 3,287,000; the capital employed from Rs.227 lakhs to Rs.57 crores (about £43,000,000). The great majority of the societies are village banks; but there are a large number of "Central Banks" situated in towns, which gather in deposits, supply funds to the rural banks in their neighbourhood, and act as links between them. There are also "Apex" banks, for most of the provinces, Assam and Mysore.

Cattle.—Throughout the whole of India, except in Sind and the western districts of the Punjab, horned cattle are the only beasts used for ploughing. The well-known humped species of cattle predominates everywhere, being divided into many varieties. The last livestock census in 1924–25 returned 150 million cattle in British India: but, owing partly to unfavourable conditions of climate and soil, partly to the insufficiency of grazing ground, and partly to the want of selection in breeding, the general condition of the cattle is miserably poor. There are, however, some fine breeds in existence. In Mysore the *amrit mahal*, a breed said to have been introduced by Hyder Ali for military purposes, is still kept up by the state. In the Madras districts of Nellore and Kurnool the indigenous breed has been greatly improved, and in the Central Provinces there is a peculiar breed of trotting bullocks which is in great demand for wheeled carriages. The large and handsome oxen of Gujarat in Bombay and of Hariana in the Punjab are excellently adapted for drawing heavy loads in a sandy soil. Cattle-breeding farms have been set up by the government in different parts of the country; and invaluable work is being done by the Veterinary Service in the discovery and use of a serum prophylactic against the devastations of rinderpest. The worst cattle are to be found always in the deltaic tracts, but there their place is to a large extent taken by buffaloes. These last are more hardy than ordinary cattle: their character is maintained by crossing the cows with wild bulls, and their milk yields the best *ghi* or clarified butter. Along the valley of the Indus, and in the sandy desert which stretches into Rajputana, camels supersede cattle for agricultural operations. The breed of horses is little better than that of milch-kine. In Bengal and in Madras, it may be broadly said that horses are not bred. But horses are still required for the Indian cavalry and the police; and in order to maintain the supply of remounts a civil veterinary department was founded in 1892. Horse-breeding is carried on chiefly in the Punjab, the United Provinces, and Baluchistan, and government keep a number of stallions in the various provinces. Formerly Norfolk trotters held the first place in point of number, but their place has been taken in recent years by English thoroughbreds, Arabs, and especially Australians. For the supply of ordnance, baggage, and transport mules a large number of donkey stallions have been imported by the government.

Forests.—Up to 1850 the destruction of forests by timber-cutters, by charcoal-burners, and above all by shifting cultivation, was allowed to go on everywhere unchecked. But as the pressure of population on the soil became more dense and the construction of railways increased the demand for fuel, the question of forest conservation forced itself into notice, while its importance also as affecting the general meteorology of a country was being learned from bitter experience in Europe. In 1864 Dr. Brandis was appointed inspector-general of forests to the government of India, and in the following year an act of the legislature was passed (No. VII. of 1865). In the interval that has since elapsed, sound principles of forest administration have been gradually extended. Indiscriminate timber cutting has been prohibited, the burning of the jungle by the hill tribes has been confined within bounds, large areas have been surveyed and demarcated, plantations have been laid out, and, generally, forest conservation has become a reality. In 1894 the government divided forests into four classes: forests the preservation of which is essential on climatic or physical grounds, forests which supply valuable timber for commercial purposes, minor forests, and pasture lands. In the first class the special purpose of the forests, such as the protection of the plains from devastation by torrents and the conservation of the rainfall for the service of the great canals, must come before any smaller interests. The second class includes tracts of teak, *sal* or *deodar* timber, and the like, where private or village rights of user are few. In these forests, while every reasonable facility is afforded to the people concerned for the satisfaction of their needs, restrictions are imposed, and the system of shifting cultivation is only permitted, under due regulation, where forest tribes depend on it for their sustenance. In the third place, there are minor forests, which produce inferior

or smaller timber. These are managed mainly in the interests of the surrounding population, and supply grazing or fuel to them at moderate rates. The fourth class includes pastures and grazing grounds. In these even more than in the third class the interests of the local community stand first. The state forests, which are under the control of the forest department, amount to about 227,500 sq.m., or more than one-fifth of the total area of British India, varying from 68% in Burma to 5% in the United Provinces.

Timbers.—A large part of the reserved forests, where the control of the forest department is most complete, consists of valuable timber, in which the first place is held by teak, found at its best in Burma, on the south-west coast of India, and inland from the Ghats as far as the middle of the Central Provinces. Here it meets the *sal*, which, however, is more especially found in the sub-Himalayan tracts of the United Provinces and Eastern Bengal and Assam. In the Himalayas themselves the *deodar* and other conifers form the bulk of the timber while in the lower ranges, such as the Khasi hills in Assam, and those of Burma, various pines are prominent. In the north-east of Assam and in the north of Upper Burma the *Ficus elastica*, a species of India-rubber tree, is found. The sandal-wood flourishes all along the southern portion of the Ghats, especially about Mysore and Coorg; and in the same regions, as well as in Upper India, the blackwood occurs. A valuable tree, known as the padouk, is at present restricted almost entirely to the Andaman Islands, with a scattering in Lower Burma. There are many other timber trees that are in general demand in different parts of India. The annual yield of timber and fuel from the Indian forests is over 300 millions of cubic feet. About half of this quantity comes from the forests of Burma, where large amounts of teak and other woods are annually extracted, chiefly through the agency of private firms. Many by-products of the forests are now being exploited on commercial lines; and the great Forest Research Institute at Dehra Dun is busy on silvicultural work and wood technology.

Mineral Resources.—The chief underground wealth of India, apart from salt which will be discussed separately, is derived (in order of its present value) from coal, petroleum, manganese, gold, lead, silver, iron and copper; the first two being by far the most important.

Coal was first mined at Raniganj in 1820. It exists in varying quantity under a very extensive area, being found almost everywhere except in Bombay and Mysore. The finest coal, however, and the largest output by far come from the seams in Chota Nagpur and the adjoining districts of Bengal. There are also considerable mines in the Central Provinces and the contiguous State of Rewah and an important field in Hyderabad. The value of the total output is now in the neighbourhood of £10 million sterling, and there are 242 companies working in the industry.

The great oilfields of India are in Burma, which supplies 90% of the total output. The remainder comes from Assam and from new wells in the Punjab; and the total output is valued at something like £8 million.

A comparatively new industry is the extraction of manganese ore, which is found in large quantities in the Central Provinces, as well as in scattered parts of Madras, Bombay and elsewhere. The production in 1925–26 was 839,000 tons.

The mining of gold is practically confined to the Kolar gold fields in Mysore, the amounts obtained by sand-washing in scattered areas elsewhere being negligible. The mines are worked under leases from the Mysore government, which secure to the State a royalty of 5 per cent of the production.

Silver and lead have an output which has risen to 5 million ounces and 50,000 tons respectively. They come from mines in the Northern Shan States of Burma. There is also an inconsiderable vein of silver in Mysore.

The centre of the iron deposits is in the State of Mayurbhanj and the adjacent tracts in Oriasa. It is the contiguity of iron ore and coal that determined the site of the great Tata works at Jamshedpur in the midst of what was formerly a primitive jungle. Mica has long been obtained in Bihar, chiefly in the Hazaribagh district, and there is a ruby-coloured variety which is held in great estimation. In Madras also a mica industry has grown up. Tin is found in the Tavoy and Mergui districts of Lower Burma, and was for many years worked in an unprogressive manner chiefly by Chinese labour, until the recent increase of the world demand led to improved methods. Copper ore is found in many tracts throughout India, plumbago in Madras, corundum in southern India, wolfram in Burma and chromite in Baluchistan.

Precious Stones.—Despite its legendary wealth, which is really due to the accumulations of ages, India cannot be said to be naturally rich in precious stones. Under the Mohammedan rule diamonds were a distinct source of state revenue; and the name of Golconda has passed into literature, but that city, once the Mussulman capital of the Deccan, was rather the home of diamond-cutters than the source of supply. At the present day the only place where the search for diamonds is pursued as a regular industry is the state of Panna in Bundelkhand. The stones are found by digging down through several strata of gravelly soil and washing the earth. Even there, however, the pursuit is unremunerative, and has failed to attract European capital. At the present day the only important industries are the rubies and jade of Burma. The former are worked by the Ruby Mines Company or by licensed miners under the company. Pearls are found off the southern coast of Madras, on the shores of Gujarat and in the Mergui archipelago.

MANUFACTURING INDUSTRIES

Cotton and Jute.—On the basis of the number of people who are employed hand-loom weaving is still by far the greatest of Indian non-agricultural industries. The census of 1921 found very nearly 2,000,000 hand-looms at work, and the actual number was probably considerably greater. The Indian Industrial Commission (1916–18) discovered that the consumption of mill-spun yarn by hand-loom weavers increased by about 30% in the two decades before the war, which would more than compensate for the diminution in the output of hand-spun yarn. But from 1922 onwards, in the fierce and very equal competition which so ensues between Indian and Japanese mills, it is the hand-loom weavers who have suffered most. In some districts after a struggle to live on less than subsistence earnings, they have been compelled to abandon their hereditary calling; in others, where the level of skill and enterprise is higher, they have given up cotton weaving for silk, or textures with gold or silver thread interwoven. The industry as a whole shows a surprising degree of vitality, fly-shuttles, which increase a weaver's output from 20 to 100%, have been adopted widely, and so also have simple machines for winding and warping, owned and used co-operatively.

Out of some 1,500,000 workers in factories of all sorts, about 330,000 are employed in cotton-mills, and some 140,000 in cotton gins and presses. This industry has had very considerable vicissitudes, but taking bad years with good, it has been prosperous and progressive. Before the War Indian mills supplied just under 30% of the total Indian consumption of mill-woven cloth: their share has now risen to 52%; while the share of the United Kingdom has fallen from 68·5% to 42·5. On the other hand, Indian mills have lost in China their chief foreign market. The first cotton mill in India was opened in 1851, and the industry received a powerful stimulus during the Americal Civil War. The staple, however, is short; and until the cultivation of better varieties is more general, no competition will be possible with cottons of the American type, and trade must be confined to the home and far eastern markets.

The manufacture of jute employs about 350,000 hands, and in this field the supremacy of Bengal is more firmly established than ever. Nearly two-thirds of the jute crop is worked up in the Bengal mills; so that Bengal now produces about twice as great a bulk of jute manufactured goods (gunny bays, hessian cloth, cordings, etc.) as all the rest of the world.

Silk.—The silk industry in India has experienced many vicissitudes. Under the East India Company large quantities of mulberry silk were produced chiefly in Bengal, and exported

to Europe; and Malda, Murshidabad, and other places in that province have long been famous for their silk manufactures. Other kinds of silk are native to certain parts of India, but the chief of the wild silks is the tussore silk, which is found in the jungles nearly throughout India. Large quantities of comparatively coarse silk are made from silk so produced. The most hopeful ground, however, for the industry is Kashmir, where Sir Thomas Wardle reported that the silk was of as high a quality as from any part of the world. The most important seat of the silk-weaving industry is Bengal, but there are few parts of India where some silk fabrics are not woven.

Other Manufactures.—The demand of the Indian population for woollen fabrics is very small in comparison with that for cotton, and although the manufacture of blankets is carried on in many parts of India, the chief part of the indigenous woollen industry was originally concerned with shawls. Kashmir shawls were at one time famous, but the industry is practically extinct. The chief seat of the woollen industry now is the Punjab, where a considerable number of weavers, thrown out of work by the decline of the shawl industry, have taken to carpet-making. The chief centre of this industry is Amritsar. The output of the woollen mills at Cawnpur and elsewhere is chiefly used for the army and the police. In addition to these and the cotton and jute mills there are rice mills, timber mills, leather works, oil mills, iron and brass foundries, tile factories, printing presses, lac factories, silk mills, and paper mills. There is a large trade in wood-carving, the material being generally Indian ebony in northern India, sandal-wood in southern India, and teak in Burma and elsewhere.

The village brazier, like the village smith, manufactures the necessary vessels for domestic use. Chief among these vessels is the *lota*, or globular bowl, universally used in ceremonial ablutions. Benares enjoys the first reputation for work in brass and copper. In the south, Madura and Tanjore have a similar fame, and in the west, Ahmedabad, Poona and Nasik. Silver is sometimes mixed with the brass, and in rarer cases gold. The brass or rather bell-metal ware of Murshibad, known as *khagrai*, has more than a local reputation, owing to the large admixture of silver in it.

Pottery.—Pottery is made in almost every village, from the small vessels required in cooking to the large jars used for storing grain and occasionally as floats to ferry persons across a swollen stream. Sind is the only province of India where the potter's craft is pursued with any regard to artistic considerations; its pottery is of two kinds, encaustic tiles and vessels for domestic use. In both cases, the colours are the same,—turquoise blue, copper green, dark purple or golden brown, under an exquisitely transparent glaze. The tiles, which are evidently of the same origin as those of Persia and Turkey, are chiefly to be found in the ruined mosques and tombs of the old Mussulman dynasties. Artistic pottery is made at Hyderabad, Karachi, Tatta and Hala, and also at Multan and Lahore in the Punjab. The Madura pottery deserves mention from the elegance of its form and the richness of its colour. The United Provinces have, among other specialties, an elegant black ware with designs in white metal worked into its surface.

Banking.—In another field an important step forward was taken in the amalgamation of the Presidency Banks of Bengal, Bombay and Madras into the Imperial Bank of India. This institution has taken over, at its London branch, the work which the Bank of England used to do for the government of India; it has also opened 100 new branches up-country to supplement the comparatively few branches of its constituents. Thus is established the coping-stone of the gravely inadequate banking system of the country. Next to the Imperial Bank come the exchange banks, whose main interests are in Europe or the Far East and who finance the Indian export trade as a supplement to their main operations. After them rank the Indian joint-stock banks, and lastly the scattered Indian bankers, brokers, marwaris, etc., whose operations are confined almost entirely to the interior of India. It is they who finance the movement of the crops to the ports, where the exchange banks take over the business. Despite these ramifications, it is estimated that there are 500 towns in India with populations of 10,000 and upwards which have no modern banking facilities at all.

COMMUNICATIONS

Railways.—Indian railways serve at least three different purposes,—the ordinary business of carrying passengers and commerce; safeguarding the internal and external peace of the country; and protection against famine by facilitating the movement of grain. For this reason the interest on capital cannot, in the case of all the lines, be judged by a purely commercial standard: but for India as a whole the return on the capital expended is normally between 5½ and 6 per cent. In the early days of railway enterprise the agency of private companies guaranteed by the state was exclusively employed, and nearly all the great trunk lines were built under this system. In 1870 a new policy of railway development by the direct agency of the state was inaugurated; and the government of India has often been criticized for lack of enterprise, undue complexity, and vacillation in its railway policy. But the tide is now running strongly in the direction of taking over under state control the main lines as the leases of their working companies fall in, or as the purchase powers under their original concessions mature. And, despite changes in policy, the broad fact remains that 39,000 m. of railroad have been constructed, for a capital outlay of £565 million, which convey passengers (nearly 600 millions in a year) at under one-third of a penny (3·47 pies) per mile as the average third-class fare, and goods at a little over a halfpenny (6·21 pies) per ton per mile.

There are roughly 19,000 m. of broad gauge (5½ feet) lines, 16,000 m. of metre-gauge, and 4,000 m. of narrow gauge. Of the total mileage 72 per cent are owned by the State and 40 per cent directly managed by it. The more extensive employment of Indians in the superior grades of the railway service is being rapidly pushed on, and a Railway Staff College is being established at Dehra Dun. The railway administration is under a Railway Board, with wide discretionary powers, and the finance of railways has now, to the marked advantage of the department, been separated from the general budget of the country.

Posts and Telegraphs.—In addition to its primary duties, this department has served miscellaneous functions. It acts as the people's savings-bank: and it allows the people to do their shopping at all distances through the system known as the V(alue) P(ayable) P(ost). It collects customs charges on dutiable articles coming to India by post. It has a life insurance department; it pays the pensions of retired officials of the Indian Army; and it sells quinine. In 1926 there were 20,000 post offices, and the number of postal-articles handled was 1,273 millions. There were 90,000 m. of telegraph line, and 16,000 state telephones were at work, besides 28,000 maintained by licensed companies in the larger cities. Telegraphic communication with Europe is maintained by the cable of the Eastern Telegraph Company *via* Aden, and by the Indo-European Department, working *via* Persia to Karachi. Wireless communication is being rapidly developed, and an extension of the Cairo-Basrah Air Mail service to Karachi will materially shorten intercourse between London and all parts of India.

HISTORY

For the early history of India the material is difficult but is steadily accumulating. Once we reach the Mohammedan period, information abounds; for Muslim literature is rich in annals and memoirs. But before A.D. 1000 the art of contemporary narrative hardly existed in India. The historical sense is not a feature of Hinduism; and while the orthodox Hindu takes no account of millennia, he accepts the *Mahabharata* as authentic history.

Sources of History.—The first exact date in the story is 326 B.C., the year when Alexander the Great invaded India; but even after that, there are long periods when the written record ceases and we have to revert to much the same sources as those on which we draw for the earlier eras. Those sources are fourfold. By far the most important hitherto has been the inscriptions on stone (caves, rocks and pillars) and on metal (mostly grants of

land), of which the volume is great, chiefly in southern India, though the dates are rarely more distant than Asoka. Coins form the next prolific source of information, though it is mostly dynastic in character and never of course of remote antiquity. Rapidly growing in importance is the study of buildings and monuments, more particularly on prehistoric sites which are now being explored. The excavations at Taxila, and those now being conducted at Mohenjo-Daro and Harappa, promise a flood of new light on the earlier Indian civilizations; and all over India there is an enormous mass of material waiting for the excavator of the future. The fourth source of history is the ancient literature and traditions of the country, if treated mainly as legends and wisely interpreted in the light of the surer facts deducible from the other sources. Besides these reservoirs of historical material, we get occasional help from the narratives of foreign travellers, such as the reports of Alexander's officers; the diaries of Megasthenes, of which long fragments have been preserved, when he resided at the Maurya court; the Greek pamphlet (*c.* A.D. 80) styled "Periplus of the Erythraean Sea"; and the writings of the Buddhist pilgrims from China who visited India in the Gupta period and again in Harsha's reign. But, at the best, much of the older history is based on skilled inference, and the margin for controversy among scholars remains considerable.

Earliest Civilizations.—Particularly is this true of estimates of the various layers of civilization which underlie the life of India today. There seems good reason to assume that, in the dim past, the country was widely occupied by an ancient pre-Dravidian race, of unknown origin but with Austric affinities; and that they were driven into the scattered hilly tracts where their purest survivals are still identifiable, and south of the Nerbudda, by another ancient race of a higher type which came in from outer Asia, probably through Baluchistan. The latter, popularly called the Dravidians, would seem to have developed a civilization of their own over a lengthened period, and in varying measure to have blended with, especially in south India, and to have absorbed or been absorbed by, the older inhabitants. Discoveries in the Indus valley indicate the existence of great cities, with traces of luxury and refinement which suggest affinities with the Sumerian, or even an earlier, culture, Sir John Marshall going so far as to put their standard of life higher than anything contemporary in Mesopotamia or Egypt. Some revision therefore is needed of the old conception of the Indo-Aryans finding themselves in a land of primitive savagery when they first descended through the passes of the north-west frontier, and started those long waves of immigration that flowed between 2400 and 1500 B.C. With the arrogance of a young and virile people, they may, as passages in the Vedas suggest, have scorned the older and complex civilization of a darker race; but that they were slowly drawn into it is clear, and the Dravidian reaction on the faith and life of the Indo-Aryans still awaits adequate judgment. It was apparently only in the Middle Land that they settled in force, roughly between the Indus and the Jumna; when they ventured further east, it was mainly in colonies surrounded by the older inhabitants, where, despite the inhibitions of earlier days, the purity of their blood slowly disappeared. That there was any penetration by the Indo-Aryans as such into peninsular India seems open to doubt. What did ultimately permeate into the south was the Hindu scheme of life which emerged from the racial blends that had matured in the north.

Vedic Times.—The *Rigveda* towers up as the great literary monument of the early Aryan settlements in the Punjab. Compiled possibly about A.D. 1200 or a little later from much older material, it is a collection of hymns, divided into ten books of unequal age, and approximating in length the Iliad and Odyssey combined. The more ancient hymns depict the invaders grouping on the Indus before they began to force their way into Hindustan. They were divided into various tribes, sometimes quarrelling among themselves, sometimes uniting against the "black-skinned" indigenes. Society with them still bears the imprint of the free life of their original homes. Caste, in its later sense, is unknown. Each father of a family is the priest of his own household. The chieftain acts as father and priest to the tribe; but at the greater festivals he chooses some one specially learned in holy offerings to conduct the sacrifice in the name of the people. The chief himself seems to have been elected. Women enjoyed a high position, and some of the most beautiful hymns were composed by ladies and queens. Marriage was held sacred. Husband and wife were both "rulers of the house" (*dampati*), and drew near to the gods together in prayer. The burning of widows on their husbands' funeral-pile was unknown, and the verses in the *Veda* which the Brahmans afterwards distorted into a sanction for the practice have the very opposite meaning.

The Aryan tribes in the *Veda* are acquainted with most of the metals. They have blacksmiths, coppersmiths and goldsmiths among them, besides carpenters, barbers and other artisans. They fight from chariots, and freely use the horse, although not yet the elephant, in war. They have settled down as husbandmen, till their fields with the plough, and live in villages or towns. But others cling to their old wandering life, with their herds and "cattle-pens." Cattle, indeed, still form their chief wealth, the coin in which payments of fines are made; and one of their words for war literally means "a desire for cows." They have learned to build "ships," perhaps large river-boats, and seem to have heard something of the sea. Unlike the modern Hindus, the Aryans of the *Veda* ate beef, used a fermented liquor or beer made from the *soma* plant, and offered the same strong meat and drink to their gods. Thus the stout Aryans spread eastwards through northern India, pushed on from behind by later arrivals of their own stock, and driving before them, or reducing to bondage, or settling in amity beside, the earlier "black-skinned" races. They marched in whole communities from one river-valley to another, each house-father a warrior, husbandman and priest, with his wife and his little ones, and cattle.

Early States.—Of the political development of the country after the Indo-Aryans settled into their new homes, we know little: but before Buddhist times, the country between the Himalaya mountains and the Nerbudda river was divided into sixteen independent states, some monarchies and some tribal republics, the most important of which were the four monarchies of Kosala, Magadha, the Vamsas and Avanti. Kosala, the modern kingdom of Oudh, appears to have been the premier state of India in 600 B.C. Later the supremacy was reft from it by the kingdom of Magadha, the modern Behar (*q.v.*). South of Kosala lay the kingdom of the Vamsas, and south of that again the kingdom of Avanti. In the north-west was Gandhara, on the banks of the Indus, in the neighbourhood of Peshawar. The history of these early states is only a confused record of war and intermarriages, and is still semi-mythical. The list of the sixteen states ignores everything north of the Himalayas, south of the Vindhyas, and east of the Ganges where it turns south.

Capital Cities.—The principal cities of India at this date were Ayōdhyā, the capital of Kosala at the time of the Ramayana, though it afterwards gave place to Srāvastī, which was one of the six great cities of India in the time of Buddha. Baranasi, the modern Benares, had in the time of Megasthenes a circuit of 25 m. Kosambi, the capital of the Vamsas, lay on the Jumna, 230 m. up-stream from Benares. Rajagriha (Rajgir), the capital of Magadha, was built by Bimbisara, the contemporary of Buddha. Roruka, the capital of Sovira (? the Ophir of the Bible) was an important centre of the coasting trade. Saketa was sometime the capital of Kosala. Ujjayinī, the modern Ujjain, was the capital of Avanti.

The early Hindu writings classify mankind into four social grades on a basis of occupation: the Kshatriyas or nobles, who claimed descent from the early leaders; the Brahmans or learned and priestly order; the Vaisyas, the traders and peasantry; and last of all the Sudras, the hewers of wood and drawers of water, of non-Aryan descent. Below these there were low tribes and trades, aboriginal tribes and slaves. In later documents mention is made of eighteen gilds of work-people, whose names are nowhere given, but the complex institution of caste was of later date.

It is supposed that sea-going merchants, mostly Dravidians, and not Aryans, availing themselves of the monsoons, traded in the 7th century B.C. from the south-west ports of India to Baby-

lon, and that there they became acquainted with a Semitic alphabet, which they brought back with them, and from which all the alphabets now used in India, Burma, Siam and Ceylon have gradually evolved.

THE BUDDHIST PERIOD

The systems called Jainism and Buddhism had their roots in prehistoric philosophies, but were founded respectively by Vardhamana Mahavira and Gotama Buddha, both of whom were preaching in Magadha during the reign of Bimbisara (*c.* 520 B.C.).

The Emperor Asoka.—During the next two hundred years Buddhism spread over northern India, perhaps receiving a new impulse from the Greek kingdoms in the Punjab. About the middle of the 3rd century B.C. Asoka, the Maurya emperor who reigned from 264 B.C. to 227 B.C., became a zealous convert to Buddhism. He is said to have supported 64,000 Buddhist priests; he founded many religious houses, and his central kingdom is called the Land of the Monasteries (Vihara or Behar) to this day. He did for Buddhism what Constantine effected for Christianity; he organized it on the basis of a state religion. This he accomplished by five means—by a council to settle the faith, by edicts promulgating its principles, by a state department to watch over its purity, by missionaries to spread its doctrines, and by an authoritative collection of its sacred books. In 246 B.C. Asoka is said to have convened at Pataliputra (Patna) the third Buddhist council of one thousand elders (the tradition however rests on no actual evidence that we possess). In a number of edicts, both before and after the synod, he published throughout India the grand principles of the faith. Such edicts are still found graven deep upon pillars, in caves and on rocks, from the Yusafzai valley beyond Peshawar on the north-western frontier, through the heart of Hindustan, to Kathiawar and Mysore on the south and Orissa in the east. Tradition states that Asoka set up thousands of memorial columns; and the thirty-five inscriptions extant in our own day show how widely these royal sermons were spread over India. He created a special department to convert the aborigines, and he was equally vigilant of their material interests. Wells were to be dug and trees planted along the roads; a system of medical aid was established throughout his kingdom and the conquered provinces, as far as Ceylon, for both man and beast. Officers were appointed to watch over domestic life and public morality, and to promote instruction among the women as well as the youth.

Asoka recognized proselytism by peaceful means as a state duty. The rock inscriptions record how he sent forth missionaries "to the utmost limits of the barbarian countries," to "intermingle among all unbelievers" for the spread of religion. They shall mix equally with Brahmans and beggars, with the dreaded and the despised, both within the kingdom "and in foreign countries, teaching better things." Conversion is to be effected by persuasion, not by the sword. This character of a proselytizing faith which wins its victories by peaceful means has remained a prominent feature of Buddhism to the present day. Asoka, however, not only took measures to spread the religion; he also endeavoured to secure its orthodoxy. He collected the body of doctrine into an authoritative version, in the Magadhi language or dialect of his central kingdom in Behar—a version which for two thousand years has formed the canon (*pitakas*) of the southern Buddhists.

The fourth and last of the great councils was held in Kashmir under the Kushan king Kanishka (*see* below). This council, which consisted of five hundred members, compiled in the Sanskrit language three commentaries on the Buddhist faith. These commentaries supplied in part materials for the Tibetan or northern canon, drawn up at a subsequent period. The northern canon, or, as the Chinese proudly call it, the "greater vehicle of the law," includes many later corruptions or developments of the Indian faith as originally embodied by Asoka in the "lesser vehicle," or canon of the southern Buddhists.

Buddhism and Brahmanism.—Buddhism never ousted Brahmanism from any large part of India. The two systems co-existed as popular religions during more than a thousand years (250 B.C. to about A.D. 800). Certain kings and certain eras were intensely Buddhistic; but the continuous existence of Brahmanism is abundantly proved from the time of Alexander (327 B.C.) downwards. The historians who chronicled his march, and the Greek ambassador Megasthenes, who succeeded them (300 B.C.) in their literary labours, bear witness to the predominance of the old faith in the period immediately preceding Asoka. Inscriptions, local legends, Sanskrit literature and the drama disclose the survival of Brahman influence during the next six centuries (250 B.C.–A.D. 400). From A.D. 400 we have the evidence of the Chinese pilgrims, who toiled through Central Asia into India as the birthplace of their faith. Fa-Hien entered India from Afghanistan, and journeyed down the whole Gangetic valley to the Bay of Bengal in A.D. 399–413. He found Brahman priests equally honoured with Buddhist monks, and temples to the Indian gods side by side with the religious houses of his own faith. Hsüan Tsang also travelled to India from China by the Central Asia route. His journey extended from A.D. 629 to 645, and everywhere throughout India he found the two faiths eagerly competing for the suffrages of the people. The monuments of the great Buddhist monarchs, Asoka and Kanishka, confronted him from the time he neared the Punjab frontier; but so also did the temples of Siva and his "dread" queen Bhima. Throughout north-western India he found Buddhist convents and monks surrounded by "swarms of heretics." The political power was also divided, although Buddhist sovereigns predominated. A Buddhist monarch ruled over ten kingdoms in Afghanistan. At Peshawar the great monastery built by Kanishka was deserted, but the populace remained faithful. In Kashmir king and people were devout Buddhists; in the country identified with Jaipur, on the other hand, the inhabitants were devoted to heresy and war.

Decline of Buddhism.—During the next few centuries Brahmanism gradually became the ruling religion. There are legends of persecutions instigated by Brahman reformers, such as Kumarila Bhatta and Sankara-Acharya. But the downfall of Buddhism seems to have resulted from natural decay, and from new movements of religious thought, rather than from any general suppression by the sword. Its extinction is contemporaneous with the rise of Hinduism, and belongs to a subsequent part of this sketch. In the 11th century, only outlying states, such as Kashmir and Orissa, remained faithful; and before the Mohammedans fairly came upon the scene Buddhism as a popular faith had disappeared from India. During the last ten centuries Buddhism has been a banished religion from its native home. But it has won greater triumphs in its exile than it could ever have achieved in the land of its birth. It has created a literature and a religion for more than a third of the human race, and has profoundly affected the beliefs of the rest. In India its influence has survived its separate existence: it supplied a basis upon which Brahmanism finally developed from the creed of a caste into the religion of the people.

HINDU PERIOD

The external history of India may be considered to begin with the Greek invasion in 327 B.C. Some indirect trade between India and the Levant existed from very ancient times. Homer was acquainted with tin and other articles of Indian merchandise by their Sanskrit names; and a long list has been made of Indian products mentioned in the Bible. In the time of Darius the valley of the Indus was a Persian satrapy. But the first Greek historian who speaks clearly of India was Hecataeus of Miletus (549–486 B.C.); the knowledge of Herodotus (450 B.C.) ended at the Indus; and Ctesias, the physician (401 B.C.), brought back from his residence in Persia only a few facts about the products of India, its dyes and fabrics, its monkeys and parrots. India to the east of the Indus was first made known in Europe by the historians and men of science who accompanied Alexander the Great in 327 B.C. Their narratives, although now lost, are condensed in Strabo, Pliny and Arrian.

Alexander's March.—Alexander the Great entered India early in 327 B.C. Crossing the lofty Khawak and Kaoshan passes of the Hindu Kush, he advanced by Alexandria, a city previously founded in the Koh-i-Daman, and Nicaea, another city to the west of Jalalabad, on the road from Kabul to India. Thence he turned

eastwards through the Kunar valley and Bajour, crossed the Gouraios (Panjkora) river, laid siege to Mount Aornos, and then moved over the Indus at Ohind, 16 m. above Attock, receiving there the submission of the great city of Taxila, represented by miles of ruins, which are now being systematically excavated, near the modern Rawalpindi. Crossing the Hydaspes (Jhelum) he defeated Porus in a great battle, and crossing the Acesines (Chenab) near the foot of the hills and the Hydraotes (Ravi), reached the Hyphasis (Beas). Here he was obliged by the temper of his army to retrace his steps, and retreat to the Jhelum, whence he sailed down the river to its confluence with the Indus, and thence to Patala, probably the modern Hyderabad. From Patala the admiral Nearchos was to sail round the coast to the Euphrates, while Alexander himself marched through the wilds of Gedrosia, or modern Makran. Ultimately, after suffering agonies of thirst in the desert, the army made its way back to the coast at the modern harbour of Pasni, whence the return to Susa in Persia was easy.

During his two years' campaign in the Punjab and Sind, Alexander captured no province, but he made alliances, founded cities and planted garrisons. He had transferred much territory to chiefs and confederacies devoted to his cause, and every petty court had its Greek faction. At Taxila (Dehri-Shahan) and Nicaea (Mong) in the northern Punjab, at Alexandria (Uchch) in the southern Punjab, at Patala (Hyderabad) in Sind, and at other points along his route, he established military settlements of Greeks or allies. A large body of his troops remained in Bactria; and, in the partition of the empire which followed Alexander's death in 323 B.C., Bactria and India eventually fell to Seleucus Nicator, the founder of the Syrian monarchy.

Chandragupta Maurya.—Meanwhile a new power had arisen in India. Among the Indian adventurers who thronged Alexander's camp in the Punjab, was Chandragupta Maurya, an exile from the Gangetic valley. In the confused years which followed Alexander's departure, he managed to form a kingdom on the ruins of the Nanda dynasty in Magadha or Behar (322 B.C.). He seized the capital, Pataliputra, the modern Patna, established himself firmly in the Gangetic valley, and compelled the north-western principalities, Greeks and natives alike, to acknowledge his suzerainty. While, therefore, Seleucus was winning his way to the Syrian monarchy, Chandragupta was building up an empire in northern India. Seleucus reigned in Syria from 312 to 280 B.C., Chandragupta in the Gangetic valley from 322 to 298 B.C. In 312 B.C. the power of both had been consolidated, and the two new sovereignties were brought face to face. Seleucus, having recovered Babylon, proceeded to re-establish his authority in Bactria and then moved on to India. There he met Chandragupta, now master of all Hindustan, with an immense army; and prudence decided him to ally himself with the new power in India rather than to oppose it. In return for five hundred elephants, he ceded the Greek settlements in the Punjab and the Kabul valley, gave his daughter to Chandragupta in marriage, and stationed an ambassador, Megasthenes, at the Gangetic court (302 B.C.). Chandragupta became familiar to the Greeks as Sandrocottus, king of the Prasii; his capital, Pataliputra, was called by them Palimbothra. On the other hand, the names of Greeks and kings of Grecian dynasties appear in the rock inscriptions, under Indian forms.

Previous to the time of Megasthenes the Greek idea of India was a very vague one; and it was he who first opened up the land to the western world. He describes the classification of the people, dividing them, however, into seven castes instead of four, namely, philosophers, husbandmen, shepherds, artisans, soldiers, inspectors and the counsellors of the king. The philosophers were the Brahmans, and the prescribed stages of their life are indicated. Megasthenes observes with admiration the absence of slavery in India, the chastity of the women, and the courage of the men. In valour they excelled all other Asiatics; they required no locks to their doors; above all, no Indian was ever known to tell a lie. Sober and industrious, good farmers and skilful artisans, they scarcely ever had recourse to a lawsuit, and lived peaceably under their native chiefs. The kingly government is portrayed almost as described in Manu, with its hereditary castes of councillors and soldiers. Megasthenes mentions that India was divided into one hundred and eighteen kingdoms; some of which, such as that of the Prasii under Chandragupta, exercised suzerain powers.

The Brahmanism of northern India was destined to be profoundly influenced by the two powerful monarchies which sprung up toward the close of the fourth century B.C. On the east, in the Gangetic valley, Chandragupta firmly consolidated the dynasty which during the next century produced Asoka (264–228 or 227 B.C.), and established Buddhism throughout India. On the west, the Seleucids diffused Greek influences, and sent forth Graeco-Bactrian expeditions to the Punjab. Antiochus Theos (grandson of Seleucus Nicator) and Asoka (grandson of Chandragupta), who ruled these two monarchies in the 3rd century B.C., made a treaty with each other (256). In the next century Eucratides, king of Bactria, conquered as far as Alexander's royal city of Patala, and possibly sent expeditions into Cutch and Gujarat, 181–161 B.C. Of the Graeco-Indian monarchs, Menander advanced farthest into north-western India, and his coins are found from Kabul, near which he probably had his capital, as far as Muttra on the Jumna. The Buddhist dynasty of Chandragupta affected the religion of northern India from the east; the Seleucid empire, with its Bactrian and later offshoots, influenced the science and art of Hindustan from the west.

GREEK INFLUENCE

Astronomy and Art.—The Brahman astronomy owed much to the Greeks, and what the Buddhists were to the architecture of northern India, that the Greeks were to its sculpture. Greek faces and profiles constantly occur in ancient Buddhist statuary, and enrich almost all the larger museums in India. The purest specimens have been found in the North-West Frontier Province (the ancient Gandhara) and the Punjab, where the Greeks settled in greatest force. As we proceed eastward from the Punjab, the Greek type begins to fade. Purity of outline gives place to lusciousness of form. In the female figures, the artists trust more and more to swelling breasts and towering chignons, and load the neck with constantly accumulating jewels. Nevertheless, the Grecian type of countenance long survived in Indian art and it may even be traced in the delicate profiles on the so-called sun temple at Kanarak, built in the 12th century A.D. on the remote Orissa shore.

The Maurya Dynasty.—Chandragupta was one of the greatest of Indian kings. The dominions that he had won back from the Greeks he administered with equal power. He maintained an army of 600,000 infantry, 30,000 horsemen, 36,000 men with the elephants, and 24,000 men with the chariots; which was controlled by an elaborate war-office system. The account given of his reign by Megasthenes makes him better known to us than any other Indian monarch down to the time of Akbar. In 297 B.C. he was succeeded by his son, Bindusara, who is supposed to have extended his dominions down to Madras. In 272 B.C. he in turn was succeeded by Asoka, the Buddhist emperor, the religious side of whose reign has already been described. Asoka's empire included the greater part of Afghanistan, a large part of Baluchistan, Sind, Kashmir, Nepal, Bengal to the mouths of the Ganges, and peninsular India down to the Palar river. After Asoka the Mauryas dwindled away, and the last of them, Brihadratha, was treacherously assassinated in 184 B.C. by his commander-in-chief, Pushyamitra Sunga, who founded the Sunga dynasty.



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A DEVIL DANCER IN DARJEELING, IN THE EXTREME NORTH OF INDIA

Sunga, Kanva and Andhra Dynasties.—During the 2nd century B.C. north-western India was invaded and partially conquered by Antiochus III. the Great, Demetrius, Eucratides and Menander. With the last of these Pushyamitra Sunga waged successful war, driving him from the Gangetic valley and confining

him to his conquests in the west. Pushyamitra established his own paramountcy over northern India; but his reign is mainly memorable as marking the beginning of the Brahmanical reaction against Buddhism, and his savage persecution of the Buddhist monks. The Sunga dynasty, after lasting 112 years, was succeeded by the Kanva dynasty, which lasted 45 years, *i.e.*, until about 27 B.C., when it was overthrown by an unknown king of the Andhra dynasty of the Satavahanas, whose power, originating in the deltas of the Godavari and Kistna rivers, by A.D. 200 had spread across India to Nasik and gradually pushed its way northwards.

The Saka Satraps.—About A.D. 100 there appeared in the west three foreign tribes from the north, who established themselves in Malwa, Gujarat and Kathiawar. These tribes were the Sakas (Scythians), a horde of pastoral nomads from Central Asia, the Pahlavas, whose name is supposed to be a corruption of "Parthiva" (*i.e.*, Parthians of Persia), and the Yavanas (Ionians), *i.e.*, foreigners from the old Indo-Greek kingdoms of the north-west frontier, all of whom had been driven southwards by the advance of the Yueh-chi. Their rulers, of whom the first to be mentioned is Bhumaka, took the Persian title of satrap. They were hated by the Hindus as barbarians who disregarded the caste system and despised the holy law, and for centuries an intermittent struggle continued between the satraps and the Andhras, with varying fortune. Finally, however, about A.D. 236, the Andhra dynasty, after an existence of some 460 years, came to an end, and their place in western India was taken by the satraps, until the last of them was overthrown by Chandragupta Vikramaditya at the close of the 4th century.

The Kushan Dynasty.—Meanwhile, the Yueh-chi had themselves crossed the Hindu Kush to the invasion of north-western India. They were originally divided into five tribes, which were united under the rule of Kadphises I. (A.D. 40–78), the founder of the Kushan dynasty, who conquered the Kabul valley, annihilating what remained there of the Greek dominion, and swept away the petty Indo-Greek and Indo-Parthian principalities on the Indus. His successors completed the conquest of north-western India from the delta of the Indus eastwards probably as far as Benares. One effect of the Yueh-chi conquests was to open up a channel of commerce with the Roman empire by the northern trade routes; and the Indian embassy which, according to Dion Cassius (ix. 58), visited Trajan after his arrival at Rome in A.D. 99, was probably sent by Kadphises II. (Ooemokadphises) to announce his conquest of north-western India. The most celebrated of the Kushan kings, however, was Kanishka, whose date (?acc. A.D. 120) is still a matter of controversy. From his capital at Purushapura (Peshawar) he not only maintained his hold on north-western India, but conquered Kashmir, attacked Pataliputra, carried on a successful war with the Parthians, and led an army across the appalling passes of the Taghdumbash Pamir to the conquest of Kashgar, Yarkand and Khotan.

The dynasties of the Andhras in the centre and south and of the Kushans in the north came to an end almost at the same time (*c.* A.D. 236–225 respectively). The history of India during the remainder of the 3rd century is a confused record of meaningless names and disconnected events; and it is not until the opening of the 4th century that the veil is lifted, with the rise to supreme power in Magadha (A.D. 320) of Chandragupta I., the founder of the Gupta dynasty and empire.

The Gupta Age, 320 to 480 A.D.—Often described as the Golden Age of Hinduism, the Gupta period comprised the reigns of five great monarchs, who occupied an imperial throne, first at Pataliputra and afterwards at Ajodhya, for 160 years. The second of these, Samudragupta, a ruler of high personal accomplishments, brought under his sway the country from the Nerbudda on the south to the Himalayas on the north, from the Jumna on the west to the Brahmaputra on the east, and exercised considerable suzerainty even beyond those limits. Chandragupta II., the third of the line, was the Vikramajit of Indian legend. Under the last of the great five, Skandagupta, the pressure of the invading Huns began to break up the strongest power that gave India peace until the coming of Akbar. It was in peace and the arts of peace that the Gupta empire shone. The land was rich and prosperous; the administration enlightened and tolerant; and Hindu art reached its zenith. Science was cultivated; music, sculpture and painting attained a high level of excellence. Literature flourished; it was under the Guptas that Kalidasa wrote his great play Sakuntala; and Sanskrit, as its vehicle, developed unequalled suppleness and grace. Trade extended in all directions, and diplomatic relations followed in its course; not less than three missions to imperial Rome figuring among the long tale of embassies sent by the Guptas to foreign courts. The Buddhist rule of life prevailed. Buddhism remaining in theory the State religion; but it was during this period that reviving Hinduism absorbed the best elements in Buddhism, and at the same time undermined its tenets by new orientations of Brahmanical philosophy.

The Hun Invasions.—The barbarian invasions of the fifth and sixth centuries, dismembering the Gupta empire and converting India into a Hun province, cut clean across the history and traditions of India. They began with the White Huns or Ephthalites, who after breaking (*c.* 470) the power of Persia and Kabul, swarmed across India in irresistible numbers. Their dominion was a mere organization for brigandage on an imperial scale and it did not long survive. It was shaken (*c.* 528) by the defeat, at the hands of tributary princes goaded to desperation, of Mihiragula, the most powerful and bloodthirsty of its rulers—the "Attila of India." It collapsed with the overthrow of the central power of the White Huns on the Oxus (*c.* 565) by the Turks. Though, however, this stopped the incursions of Asiatic hordes from the north-west, and India was to remain almost exempt from foreign invasion for some 500 years, the Ephthalite conquest added new and permanent elements to the Indian population. After the fall of the central power, the scattered Hunnish settlers, like so many before them, became rapidly Hinduized, and are probably the ancestors of some of the most famous Rajput clans.

Harsha.—The last Indian monarch, prior to the Mohammedan conquest, to establish and maintain paramount power in the north was Harsha, or Harshavardhana (also known as Siladitya), for whose reign (606–648) full and trustworthy materials exist in the book of travels written by the Chinese pilgrim Hsüan Tsang and the *Harsha-charita* (Deeds of Harsha) composed by Bana, a Brahman who lived at the royal court. Harsha was the younger son of the raja of Thanesar, and gained his first experience of campaigning while still a boy in the successful wars waged by his father and brother against the Huns on the north-western frontier. After the treacherous murder of his brother by Sasanka, king of Central Bengal, he spent five and a half years in continual warfare. By A.D. 612 he had actually conquered the north-western regions and also, probably, part of Bengal. After this he reigned for 34½ years, devoting most of his energy to perfecting the administration of his vast dominions. In his campaigns he was almost uniformly successful; but in his attempt to conquer the Deccan he was repulsed (620) by the Chalukya king, Pulikesin II., who successfully prevented him from forcing the passes of the Nerbudda. Towards the end of his reign Harsha's empire embraced the whole basin of the Ganges from the Himalayas to the Nerbudda, including Nepal, besides Malwa, Gujarat and Surashtra (Kathiawar); while even Assam (Kamarupa) was tributary to him. The empire, however, died with its founder. His benevolent despotism had healed the wounds inflicted by the barbarian invaders, and given to his subjects a false feeling of security. For he left no heir to carry on his work; his death was followed by centuries of disruptive internecine war.

The Deccan.—In the Deccan the middle of the 6th century saw the rise of the Chalukya dynasty, founded by Pulikesin I. about A.D. 550. The most famous monarch of this line was Pulikesin II., who repelled the inroads of Harsha (A.D. 620); but in A.D. 642 he was defeated by the Pallavas of Conjeeveram, and though his son Vikramaditya I. restored the fallen fortunes of his family, the Chalukyas were finally superseded by the Rashtrakutas about A.D. 750. The Kailas temple at Ellora was built in the reign of Krishna I. (*c.* A.D. 760). The last of the Rashtrakutas was overthrown in A.D. 973 by Taila II., a scion of the old Chalukya stock, who founded a second dynasty known as the Chalukyas of Kalyani, which lasted like its predecessor for about two centuries

and a quarter. About A.D. 1000 the Chalukya kingdom suffered severely from the invasion of the Chola king, Rajaraja the Great. Vikramanka, the hero of Bilhana's historical poem, came to the throne in A.D. 1076 and reigned for fifty years. After his death the Chalukya power declined. During the 12th and 13th centuries a family called Hoysala attained considerable prominence in the Mysore country, but they were overthrown by Malik Kafur in A.D. 1310. The Yadava kings of Deogiri were descendants of feudatory nobles of the Chalukya kingdom, but they, like the Hoysalas, were overthrown by Malik Kafur, and Ramachandra was the last independent Hindu sovereign of the Deccan.

The Kingdoms of the South.—According to ancient tradition the kingdoms of the south were three—Pandya, Chola and Chera. Pandya occupied the extremity of the peninsula, south of Pudukottai, Chola extended northwards to Nellore, and Chera lay to the west, including Malabar, and is identified with the Kerala of Asoka. All three kingdoms were occupied by races speaking Dravidian languages. The authentic history of the south does not begin until the 9th and 10th centuries A.D., though the kingdoms are known to have existed in Asoka's time.

The most ancient mention of the name Pandya occurs in the 4th century B.C., and in Asoka's time the kingdom was independent, but no early records survive, the inscriptions of the dynasty being of late date, while the long lists of kings in Tamil literature are untrustworthy. During the early centuries of the Christian era the Pandya and Chera kingdoms traded with Rome. The most ancient Pandya king to whom a definite date can be ascribed is Rajasimha (*c.* A.D. 920). Records begin towards the end of the 12th century, and the dynasty can be traced from then till the middle of the 16th century. The most conspicuous event in its history was the invasion by the Sinhalese armies of Parakramabahu, king of Ceylon (*c.* A.D. 1175). The early records of the Chera kingdom are still more meagre; and the authentic list of the rajas of Travancore does not begin till A.D. 1335.

The Chola kingdom, like the Pandya, is mentioned by the Sanskrit grammarian Katyayana in the 4th century B.C., and was recognized by Asoka as independent. The dynastic history of the Cholas begins about A.D. 860, and is known from then until its decline in the middle of the 13th century. During those four centuries their history is intertwined with that of the Pallavas, Chalukyas, Rashtrakutas and other minor dynasties. In A.D. 640 the Chola country was visited by Hsüan Tsang, but the country at that time was desolate, and the dynasty of small importance. In A.D. 985 Rajaraja the Great came to the throne, and after a reign of twenty-seven years died the paramount ruler of southern India. He conquered and annexed the island of Ceylon, and was succeeded by four equally vigorous members of the dynasty; but after the time of Vikrama (A.D. 1120) the Chola power gradually declined, and was practically extinguished by Malik Kafur.

The Pallava Confederacy.—Of the Pallavas, and the powerful part they played in the history of the peninsula, the records are scanty. The first Pallava king about whom anything substantial is known was Sivaskanda-Varman (*c.* A.D. 150), whose capital was Kanchi (Conjeeveram), his power extending into the Telugu country as far as the Kistna river. Two centuries later Samudragupta conquered eleven kings of the south, of whom three were Pallavas. It appears that in the 4th century three Pallava chiefs were established at Kanchi, Vengi and Palakkada, the latter two being subordinate to the first, and that Pallava rule extended from the Godavari on the north to the Southern Vellaru river on the south, and stretched across Mysore from sea to sea. About A.D. 609 Pulikesin II., the Chalukya king, defeated Mahendra-Varman, a Pallava chief, and drove him to take refuge behind the walls of Kanchi. About A.D. 620 a prince named Vishnuvardhana founded the Eastern Chalukya line in the province of Vengi, which was taken from the Pallavas. Hsüan Tsang visited Kanchi, the Pallava capital, in the year A.D. 640; the country was, according to his account, 1000 m. in circumference, and the capital was a large city 5 or 6 m. in circumference. In A.D. 642 the Pallavas defeated in turn Pulikesin II. The conflict became perennial, and when the Rashtrakutas supplanted the Chalukyas in the middle of the 8th century, they took up the old quarrel with the Pallavas. Towards the end of the 10th century the Pallava power, which had lasted for ten centuries, was destroyed by the Chola monarch, Rajaraja the Great.

MOHAMMEDAN PERIOD

With northern India disrupted by the continual struggles of its warring Rajput chiefs, and southern India torn by its rival Dravidian principalities, all semblance of unity in the country had vanished before the sword of Islam was unsheathed. Warnings of the new danger came, and passed unheeded; for the Punjab was ravaged, and Sind was conquered by the Arabs, within a century of the death of the Prophet Mohammed. When at last India was seriously invaded by Subaktagin, Amir of Ghazni, a hurried effort was made to unite the Rajput powers, but it came too late, and Peshawar was thenceforth the advanced base for Muslim inroads. Subaktagin's son, Mahmud, extended the limits of his father's kingdom from Persia on the east to the Ganges on the west; and it is related that he led his armies into the plains of India no fewer than seventeen times. In 1001 he defeated Raja Jaipal a second time, and took him prisoner. But Anandpal, son of Jaipal, raised again the standard of national independence, and gathered an army of Rajput allies from the farthest corners of Hindustan. The decisive battle was fought in the valley of Peshawar. Mahmud won the day by the aid of his Turkish horsemen, and thenceforth the Punjab has been a Mohammedan province, except during the brief period of Sikh supremacy. The most famous of Mahmud's invasions of India was that undertaken in 1025–1026 against Gujarat. The goal of this expedition was the temple dedicated to Siva at Somnath. Tradition tells how Mahmud marched through Ajmere to avoid the desert of Sind; how he found the Hindus gathered on the neck of the peninsula of Somnath in defence of their holy city; how the battle lasted for two days; how in the end the Rajput warriors fled to their boats, while the Brahman priests retired into the inmost shrine; how Mahmud, introduced into this shrine, rejected all entreaties by the Brahmans to spare their idol, and all offers of ransom; how he smote the image with his club, and forthwith a fountain of precious stones gushed out. Until the British invasion of Afghanistan in 1839, the club of Mahmud and the wood gates of Somnath were preserved at the tomb of the great conqueror near Ghazni. The club has now disappeared, and the gates brought back to India by Lord Ellenborough are recognized to be a clumsy forgery. The Ghazni dynasty was a short one, and the Afghans of Ghor rose on its ruins. A cadet of this family, generally known in history as Mohammed Ghori, is the second of the great Mohammedan conquerers of India. In 1175 he took Multan and Uchch; in 1186 Lahore fell into his hands; in 1191 he was repulsed before Delhi, but soon afterwards he redeemed this disaster. By 1193 he had extended his conquests as far east as Benares, and the defeated Rajputs migrated in a body to the hills and deserts now known as Rajputana. In 1199 one of his lieutenants, named Bakhtiyar, advanced into Bengal, and expelled by an audacious stratagem the last Hindu raja of Nadia. The entire northern plain, from the Indus to the Brahmaputra, thus lay under the Mohammedan yoke. But Mohammed Ghori never settled permanently in India. His favourite residence is said to have been the old capital of Ghazni, while he governed his Indian conquests through the agency of a favourite slave, Kutb-ud-din.

The Slave Dynasty.—On the death of Mohammed Ghori (A.D. 1206), Kutb-ud-din at once laid aside the title of viceroy and proclaimed himself sultan of Delhi. He was founder of what is known as the slave dynasty, which lasted for nearly a century (1206–1288). From this period dates the *minar*, or pillar of victory, which still stands amid the ruins of ancient Delhi, towering high above all later structures. Kutb himself is said to have been successful as a general and an administrator, but none of his successors has left a mark in history.

In 1294 Ala-ud-din Khilji, the third of the great Mohammedan conquerors of India, raised himself to the throne of Delhi by the treacherous assassination of his uncle Feroz II. who had himself supplanted the last of the slave dynasty. Under the extensive schemes of conquest which he planned, one army was sent to

Gujarat, to conquer and expel the last Rajput king of Anhalwar or Patan. Another army, led by the sultan in person, marched into the heart of Rajputana, and stormed the rock-fortress of Chitor, where the Rajputs had taken refuge with their women and children. A third army, commanded by Malik Kafur, a Hindu renegade and favourite of Ala-ud-din, penetrated to the extreme south of the peninsula, scattering the unwarlike Dravidian races, and stripping every Hindu temple of its accumulations of gold and jewels.

Mohammed b. Tughlak.—Ala-ud-din died in 1316, having subjected to Islam the Deccan and Gujarat. Three successors followed him upon the throne, but their united reigns extended over only five years. In 1321 a successful revolt was headed by Ghiyas-ud-din Tughlak, governor of the Punjab, who is said to have been of Turkish origin. His son and successor, Mohammed b. Tughlak, reigned from 1325 to 1351. He conceived the project of transferring the seat of empire to the Deccan, and compelled the inhabitants of Delhi to remove a distance of 700 m. to Deogiri or Daulatabad. Mohammed was succeeded by his cousin Feroz, who likewise was not content without a new capital, which he placed a few miles north of Delhi, and called after his own name. Meanwhile the remote provinces of the empire began to throw off their allegiance to the sultans of Delhi. The independence of the Afghan kings of Bengal is generally dated from 1336, when Mohammed Tughlak was yet on the throne. The commencement of the reign of Ala-ud-din, the founder of the Bahmani dynasty in the Deccan, is assigned to 1347. Zafar Khan, the first of the Ahmedabad kings, acted as an independent ruler from his first appointment as governor of Gujarat in 1391.

Timur's Invasion.—Accordingly, when Timur (Tamerlane) invaded India in 1398, he encountered but little organized resistance. Delhi was sacked and the inhabitants massacred by the victorious Moghuls. The details of the fighting and of the atrocities may be found related in cold blood by Timur himself in the *Malfuzat-i-Timuri,* which has been translated in Elliot's *History of India as told by its own Historians,* vol. iii. Timur marched back to Samarkand as he had come, by way of Kabul, and Mahmud Tughlak ventured to return to his desolate capital. He was succeeded by what is known as the Sayyid dynasty, which held Delhi and a few miles of surrounding country for about forty years. The Sayyids were in their turn expelled by Bahlol, an Afghan of the Lodi tribe, whose successors removed the seat of government to Agra, which thus for the first time became the imperial city. In 1526 Babur, the fifth in descent from Timur, and also the fifth Mohammedan conqueror, invaded India at the instigation of the governor of the Punjab, won the victory of Panipat over Ibrahim, the last of the Lodi dynasty, and founded the Moghul empire, which lasted, at least in name, until 1857.

Vijayanagar.—In southern India at this time authentic history begins with the Hindu empire of Vijayanagar, which exercised an ill-defined sovereignty over the entire south from the 14th to the 16th century. The empire of Vijayanagar represents the last stand made by the national faith in India against conquering Islam. For at least two centuries its sway was undisputed.

The earliest of the Mohammedan dynasties in the Deccan was that founded by Ala-ud-din in 1347, which has received the name of the Bahmani dynasty. The capital was first at Gulbarga, and was afterwards removed to Bidar, both which places still possess magnificent palaces and mosques in ruins. Towards the close of the 14th century the Bahmani empire fell to pieces, and five independent kingdoms divided the Deccan among them. These were—(1) the Adil Shahi dynasty, with its capital at Bijapur, founded in 1490 by a Turk; (2) the Kutb Shahi dynasty, with its capital at Golconda, founded in 1512 by a Turkoman adventurer; (3) the Nizam Shahi dynasty, with its capital at Ahmednagar, founded in 1490 by a Brahman renegade; (4) the Imad Shahi dynasty of Berar, with its capital at Ellichpur, founded in 1484 also by a Hindu from Vijayanagar; (5) the Barid Shahi dynasty, with its capital at Bidar, founded about 1492 by one who is variously described as a Turk and a Georgian slave. In 1565 they combined against the Hindu raja of Vijayanagar, who was defeated and slain in the decisive battle of Talikota. But, though the city was sacked and the supremacy of Vijayanagar for ever destroyed, the Mohammedan victors did not themselves advance far into the south. The Naiks or feudatories of Vijayanagar everywhere asserted their independence. One of the blood-royal of Vijayanagar fled to Chandragiri, and founded a line which exercised a prerogative of its former sovereignty by granting the site of Madras to the English in 1639. Another scion claiming the same high descent lingers to the present day near the ruins of Vijayanagar, and is known as the raja of Anagundi, a feudatory of the nizam of Hyderabad. Despite frequent internal strife, the sultans of the Deccan retained their independence until conquered by the Moghul emperor Aurangzeb in the latter half of the 17th century. To complete this sketch of India at the time of Baber's invasion it remains to say that an independent Mohammedan dynasty reigned at Ahmedabad in Gujarat for nearly two centuries (from 1391 to 1573), until conquered by Akbar; and that Bengal was similarly independent, under a line of Afghan kings, with Gaur for their capital, from 1336 to 1573.

The Moghul Dynasty.—In 1525 there descended upon India the most romantic figure in all her history, Babur, the young king of Kabul, who "laid the first stone of the splendid fabric" of the Moghul empire. On the famous field of Panipat he met the immense host of the Delhi Sultan; his own army was almost insignificant, but it was supported by artillery, seen for the first time in India, and it was brilliantly led. Prompt and complete was the triumph of the invader; Delhi and Agra were occupied; and Babur set himself to the task of subduing Hindu India, with the help of his Moghul comrades. A Rajput confederacy had been established, under the gallant Rana of Udaipur; and Babur met it in battle at Sikri near Agra. Before the attack, Babur solemnly abjured wine, his besetting sin, and then led his forces to victory. Thence-forward he never turned back; and by his death in 1530 his dominions extended from the Oxus to the frontier of Bengal and from the Himalayas to Gwalior. He was succeeded by his son Humayun, who is chiefly known as being the father of Akbar. In Humayun's reign the subject Afghans rose in revolt under Sher Shah, a native of Bengal, who for a short time established his authority over all Hindustan. Humayun was driven as an exile into Persia; and, while he was flying through the desert of Sind, his son Akbar was born to him in the petty fortress of Umarkot. But Sher Shah was killed at the storming of the rock-fortress of Kalinjar, and Humayun, after many vicissitudes, succeeded in re-establishing his authority at Lahore and Delhi.

Akbar.—Humayun died by an accident in 1556, leaving but a circumscribed kingdom, surrounded on every side by active foes, to his son Akbar, then a boy of only fourteen years. Akbar the Great, the real founder of the Moghul empire as it existed for two centuries, was the contemporary of Queen Elizabeth of England. He was born in 1542, and his reign lasted from 1556 to 1605. When his father died he was absent in the Punjab, fighting the revolted Afghans, under the guardianship of Bairam Khan, a native of Badakshan, whose military skill largely contributed to recover the throne for the Moghul line. For the first seven years of his reign Akbar was perpetually engaged in warfare. His first task was to establish his authority in the Punjab, and in the country around Delhi and Agra. In 1567 he stormed the Rajput stronghold of Chitor, and conquered Ajmere. In 1570 he obtained possession of Oudh and Gwalior. In 1572 he marched in person into Gujarat, defeated the last of the independent sultans of Ahmedabad, and formed the province into a Moghul viceroyalty or subah. In the same year his generals drove out the Afghans from Bengal, and reunited the lower valley of the Ganges to Hindustan. Akbar was then the undisputed ruler of a larger portion of India than had ever before acknowledged the sway of one man. But he



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CONJURORS PLAYING FLUTES TO CHARM THE COBRAS

continued to extend his conquests throughout his lifetime. In 1578 Orissa was annexed to Bengal by his Hindu general Todar Mall, who forthwith organized a revenue survey of the whole province. Kabul submitted in 1581, Kashmir in 1587, Sind in 1592, and Kandahar in 1594. At last he turned his arms against the Mohammedan kings of the Deccan, and conquered Berar.

It is as a civil administrator that Akbar is remembered in India to the present day. With regard to the land revenue, the essence of his procedure was to fix the amount which the cultivators should pay at one-third of the gross produce, leaving it to their option to pay in money or in kind. As regards his military system, Akbar invented a sort of feudal organization, by which every tributary raja took his place by the side of his own Moghul nobles. In theory it was an aristocracy based only upon military command; but practically it accomplished the object at which it aimed by incorporating the hereditary chiefships of Rajputana among the mushroom creations of a Mohammedan despotism. The third and last of Akbar's characteristic measures were those connected with religious innovation, about which it is difficult to speak with precision. The necessity of conciliating the proud warriors of Rajputana had taught him toleration from his earliest days; and he was gradually led on by the stimulus of cosmopolitan discussion to question the truth of his inherited faith. The counsels of his friend Abul Fazl, coinciding with that sense of superhuman omnipotence which is bred of despotic power, led him at last to promulgate a new state religion, based upon natural theology, and comprising the best practices of all known creeds. In this strange faith Akbar himself was the prophet, or rather the head of the church. Every morning he worshipped the sun in public, as being the representative of the divine soul that animates the universe, while he was himself worshipped by the ignorant multitude.

Akbar died in 1605, in his sixty-third year. He was buried beneath a plain slab in the magnificent mausoleum which he had reared at Sikandra, near his capital of Agra.

Jahangir.—The reign of Jahangir, his son, extended from 1605 to 1627. It is chiefly remarkable for the influence exercised over the emperor by his favourite wife, surnamed Nur Jahan. The currency was struck in her name, and in her hands centred all the intrigues that made up the work of administration. She lies buried by the side of her husband at Lahore, whither the seat of government had been moved by Jahangir. It was in the reign of Jahangir that the English first established themselves at Surat, and also sent their first embassy to the Moghul court.

Shah Jahan.—Jahangir was succeeded by his son Shah Jahan, who had rebelled against his father, as Jahangir had rebelled against Akbar. Shah Jahan's reign is generally regarded as the period when the Moghul empire attained its greatest magnificence, though not its greatest extent of territory. He founded the existing city of Delhi, which is still known to its Mohammedan inhabitants as Shahjahanabad. At Delhi also he erected the celebrated peacock throne; but his favourite place of residence was Agra, where his name will ever be associated with the marvel of Indian architecture, the Taj Mahal. That jewel in marble was erected by Shah Jahan as the mausoleum of his favourite wife Mumtaz Mahal, and he himself lies by her side. Shah Jahan had four sons, of whom the third, Aurangzeb, by mingled treachery and violence, supplanted or overthrew his brothers and proclaimed himself emperor in 1658, while Shah Jahan was yet alive.

Aurangzeb.—Aurangzeb's long reign, from 1658 to 1707, may be regarded as representing both the culminating point of Moghul power and the beginning of its decay. Unattractive as his character was, it contained at least some elements of greatness. He was the first to conquer the independent sultans of the Deccan, and to extend his authority to the extreme south. But even during his lifetime two new Hindu nationalities were being formed in the Mahrattas and the Sikhs; while immediately after his death the nawabs of the Deccan, of Oudh and of Bengal raised themselves to practical independence. Aurangzeb had indeed enlarged the empire, but he had not strengthened its foundations. During the reign of his father Shah Jahan he had been viceroy of the Deccan or rather of the northern portion only, which had been annexed to the Moghul empire since the reign of Akbar. His early ambition was to conquer the Mohammedan kings of Bijapur and Golconda, who were practically supreme over the south.

This object was not accomplished without many hard-fought campaigns, in which Sivaji, the founder of the Mahratta confederacy, first comes upon the scene. In name Sivaji (whom Aurangzeb called the "mountain rat") was a feudatory of the house of Bijapur, on whose behalf he held the rock-forts of his native Ghats; but by sheer ability and courage he built up a great military power, based on masses of mobile horsemen, unequalled in guerilla warfare. A master of stratagem, he fought the Mohammedan generals with their own weapons, and carved out a kingdom which was to bulk largely in later history. As an enemy he was merciless and often treacherous: as ruler of his own people he was just and often generous. His memory is revered to this day as the acme of Hindu patriotism. In 1680 Sivaji died, and his son and successor, Sambhaji, was betrayed to Aurangzeb and put to death. The rising Mahratta power was thus for a time checked, and the Moghul armies were set free to operate in the eastern Deccan. In 1686 the city of Bijapur was taken by Aurangzeb in person, and in the following year Golconda also fell. No independent power then remained in the south. Early in his reign Aurangzeb had fixed his capital at Delhi, while he kept his dethroned father, Shah Jahan, in close confinement at Agra. In 1682 he set out with his army on his victorious march into the Deccan, and never again returned to Delhi. In this camp life Aurangzeb may be taken as representative of one aspect of the Moghul rule, which has been picturesquely described by European travellers of that day. They agree in depicting the emperor as a peripatetic sovereign, and the empire as held together by its military highways no less than by the strength of its armies. The Grand Trunk road running across the north of the peninsula, is generally attributed to the Afghan usurper, Sher Shah. The other roads branching out southward from Agra, to Surat and Burhanpur and Golconda, were undoubtedly the work of Moghul times. Each of these roads was laid out with avenues of trees, with wells of water, and with frequent *saráis* or rest-houses.

The Decline of the Moghul Empire.—On the death of Aurangzeb in 1707, the decline of the Moghul empire set in with extraordinary rapidity. Ten emperors after Aurangzeb are enumerated in the chronicles, but none of them has left any mark on history. In 1739 Nadir Shah of Persia, the sixth and last of the great Mohammedan conquerors of India, swept like a whirlwind over Hindustan, and sacked the imperial city of Delhi. Thenceforth the Great Moghul became a mere name, though the hereditary succession continued unbroken down to the time of the Mutiny. During the troubled period of intrigue and assassination that followed on the death of Aurangzeb, two Mohammedan foreigners rose to high position as courtiers and generals, and succeeded in transmitting their power to their sons. The one was Chin Kulich Khan, also called Asaf Jah, and still more commonly Nizam-ul-Mulk, who was of Turkoman origin, and belonged to the Sunni sect. His independence at Hyderabad in the Deccan dates from 1712. The other was Saadat Ali Khan, a Persian, and therefore a Shiah, who was appointed subahdar or nawab of Oudh about 1720. Thenceforth these two important provinces paid no more tribute to Delhi, though their hereditary rulers continued to seek formal recognition from the emperor on their succession. The Mahrattas were in possession of the entire west and great part of the centre of the peninsula; while the rich and unwarlike province of Bengal, though governed by an hereditary line of nawabs founded by Murshid Kuli Khan in 1704, still continued to pour its wealth into the imperial treasury. The central authority never recovered from the invasion of Nadir Shah in 1739, who carried off plunder variously estimated at from 8 to 30 millions sterling. The Mahrattas closed round Delhi from the south, and Ahmad Shah Durrani, a successor of Nadir Shah, came down from the west in quest of fresh plunder. After long skirmishing the two forces met at Panipat, and on January 7, 1761, they fought for the empire. The Mahrattas were disastrously routed: but the Durrani could not keep his troops from turning homewards to Kabul, and puppets continued on the Moghul throne until the last of them, Bahadur Shah, was banished to Burma in 1857.

EARLY EUROPEAN SETTLEMENTS

A Portuguese expedition under Vasco da Gama started from Lisbon in the year 1497, and, doubling the Cape of Good Hope, cast anchor off the city of Calicut on the 20th of May 1498, after a prolonged voyage of nearly eleven months.

Portuguese Expeditions.—After staying nearly six months on the Malabar coast, da Gama returned to Europe by the same route as he had come, bearing with him the following letter from the zamorin, or Hindu raja of Malabar, to the king of Portugal: "Vasco da Gama, a nobleman of your household, has visited my kingdom and has given me great pleasure. In my kingdom there is abundance of cinnamon, cloves, ginger, pepper, and precious stones. What I seek from thy country is gold, silver, coral and scarlet." The arrival of da Gama at Lisbon was celebrated with great rejoicings. A second expedition, consisting of thirteen ships and twelve hundred soldiers, under the command of Cabral, was despatched in 1500. Ultimately he reached Calicut, and established factories both there and at Cochin, in the face of active hostility from the Indians. In 1502 the king of Portugal obtained from Pope Alexander VI. a bull constituting him "lord of the navigation, conquest, and trade of Ethiopia, Arabia, Persia, and India." In that year Vasco da Gama sailed again to the East, with a fleet numbering twenty vessels. He formed an alliance with the rajas of Cochin and Cannamore against the zamorin of Calicut, and bombarded the latter in his palace. In 1503 the great Alfonso d'Albuquerque is first heard of, as in command of one of three expeditions from Portugal. In 1505 a large fleet of twenty sail and fifteen hundred men was sent under Francisco de Almeida, the first Portuguese viceroy of India. In 1509 Albuquerque succeeded as governor, and widely extended the area of Portuguese influence. Having failed in an attack upon Calicut, he seized Goa, which from 1530 became the capital of Portuguese India. Then, sailing round Ceylon, he captured Malacca, the key of the navigation of the Indian archipelago, and opened a trade with Siam and the Spice Islands (Moluccas). Lastly, he sailed back westwards, and, after penetrating into the Red Sea, and building a fortress at Ormuz in the Persian Gulf, returned to Goa only to die in 1515. In 1524 Vasco da Gama came out to the East for the third time, and he too died at Cochin.

Decline of the Portuguese.—For exactly a century, from 1500 to 1600, the Portuguese enjoyed a monopoly of Oriental trade. Their three objects were conquest, commerce and conversion, and for all three their position on the Malabar coast strip was remarkably well adapted. Their trade relations with Vijayanagar were very close, when that great empire was at the height of its power; but with its fall began the decline of Portugal. During the whole of the 16th century the Portuguese disputed with the Mohammedans the supremacy of the Indian seas. After the middle of the 17th century the Asiatic trade of Portugal practically disappeared, and now only Goa, Daman and Diu are left to her as relics of her former greatness.

Dutch Settlements.—The Dutch were the first European nation to break through the Portuguese monopoly. During the 16th century Bruges, Antwerp and Amsterdam became the great emporia whence Indian produce, imported by the Portuguese, was distributed to Germany and even to England. Private companies for trade with the East were formed in many parts of the United Provinces, but in 1602 they were all amalgamated by the states-general into "The United East India Company of the Netherlands." Within a few years the Dutch had established factories on the continent of India, in Ceylon, in Sumatra, on the Persian Gulf and on the Red Sea, besides having obtained exclusive possession of the Moluccas. In 1618 they laid the foundation of the city of Batavia in Java. In the far East the Dutch ruled without a rival, and gradually expelled the Portuguese from almost all their territorial possessions.

Decline of the Dutch.—The knell of Dutch supremacy was sounded by Clive, when in 1758 he attacked the Dutch at Chinsura by land and water, and forced them to an ignominious capitulation. In the great French war from 1781 to 1811 England wrested from Holland every one of her colonies, though Java was restored in 1816 and Sumatra in exchange for Malacca in 1824. At the present time the Dutch flag flies nowhere on the mainland of India.

British Expeditions.—The earliest English attempts to reach the East were the expeditions under John Cabot in 1497 and 1498. Their objective was not so much India as Japan (Cipangu), of which they only knew vaguely as a land of spices and silks, and which they hoped to reach by sailing westward. They failed, but discovered Newfoundland, and sailed along the coast of America from Labrador to Virginia. In 1553 the ill-fated Sir Hugh Willoughby attempted to force a passage along the north of Europe and Asia; and many subsequent attempts were made at the North-West Passage from 1576 to 1616.

East India Company.—The "Governor and Company of Merchants of London trading into the East Indies" was founded by Queen Elizabeth on the last day of 1600, and the first expedition of four ships under James Lancaster left Torbay towards the end of April 1601, and reached Achin in Sumatra on the 5th of June 1602, returning with a cargo of spices. Soon the English began to feel their way towards the mainland of India itself. In 1608 Captain Hawkins visited Jahangir at Agra, and obtained permission to build a factory at Surat. Wherever the English went they were met by the hostility of the Portuguese; and on the 29th of November 1612 the Portuguese admiral with four ships attempted to capture the English vessels under Captain Best at Swally, off the mouth of the Tapti river; but the Portuguese were severely defeated, and the action formed the beginning of British maritime supremacy in Indian seas. The first fruits of the victory were the foundation of a factory at Surat and at other places round the Gulf of Cambay and in the interior. From the imperial firman of December 1612 dates the British settlement on the mainland of India.

Rivalry with Portugal.—The ten years that elapsed between the battle of Swally and the British capture of Ormuz in 1622 sufficed to decide the issue in the struggle for supremacy between the British and the Portuguese. The latter, unwillingly linked to the dying power of Spain, were already decadent, and on the 20th of January 1615 a great Portuguese armada, consisting of six great galleons, three smaller ships, two galleys and sixty rowed barges, was defeated in another action in Swally roads by Captain Nicholas Downton, in command of four British vessels. In 1618 the English opened trade between Surat and Jask in the Persian Gulf, and in 1620 gained a victory over the Portuguese fleet there. Early in 1622 the English fleet gained a second decisive victory, and captured Ormuz, the pearl of the Portuguese possessions in Asia.

Rivalry with the Dutch.—The struggle with the young and growing power of Holland was destined to be a much more serious affair than that with the exhausted power of Portugal. They were already too strongly entrenched in the Indian archipelago for English competition to avail there, and the intense rivalry between the two nations led to the tragedy of Amboyna in 1623, when Governor Van Speult put to torture and death nine Englishmen on a charge of conspiring to take the Dutch forts. This outrage was not avenged until the time of Cromwell (1654), and in the meantime the English abandoned the struggle for the Spice Islands, and turned their attention entirely to the mainland of India. In 1616 the Dutch began to compete with the English at Surat, and their piracies against native vessels led to the Moghul governor seizing English warehouses; but soon the Indian authorities learnt to discriminate between the different European nations, and the methods of the Dutch brought them into disfavour.

Madras Settlements.—In 1611 Captain Hippon founded the first English settlement (Pettapoli) in the Bay of Bengal, which finally perished through pestilence in 1687. In 1639 Francis Day founded Madras, building Fort St. George (1640), and transferring thither the chief factory from Masulipatam. Here the English obtained their first grant of Indian soil, apart from the plots on which their factories were built. In 1653 Madras was raised to an independent presidency, and in 1658 all the settlements in Bengal and on the Coromandel coast were made subordinate to Fort St. George.

Bengal Settlements.—In 1633 eight Englishmen from Masul-

ipatam, under Ralph Cartwright, sailed northward to Harishpur near Cuttack on the mouth of the Mahanadi, and entered into negotiations to trade with the governor of Orissa; and in June 1633 Cartwright founded a factory at Balasore, which proved very unhealthy. In 1651 the English reached Hugli, which was at that time the chief port of Bengal; about that year Gabriel Boughton, a surgeon, obtained from the Moghul viceroy permission for the English to trade in Bengal. In 1657 Hugli became the head agency in Bengal, with Balasore and Cossimbazar in the Gangetic delta and Patna in Behar under its control. In that year the name of Job Charnock, the future founder of Calcutta, appeared in the lowest grade of the staff.



A SMALL GIRL OF BENGAL

Acquisition of Bombay.—The company had long fixed an eye on Bombay. Its position half way down the Indian seaboard gave it both strategic and commercial importance, while it lay beyond the authority of the Moghuls, and so could be fortified without offending them. In 1661 Charles II. received Bombay from Portugal as part of the Infanta Catherine's dowry, but effective possession was not taken until 1665, and in 1668 Charles handed the island over to the company. In the year 1670 Gerald Aungier fortified the island, and so became the true founder of its prosperity. In 1674 a treaty was entered into with Sivaji. In 1682 Sir Josiah Child at home and Sir John Child in India formed a combination, which recognized that in the struggle between the Moghul and the Mahrattas the English must meet force with force; and in 1687 Bombay supplanted Surat as the chief seat of the English in India.

The Founding of Calcutta.—In 1679 the English obtained from the Moghul emperor a firman exempting them from dues everywhere except at Surat; but Shaista Khan, the viceroy of Bengal, refused to recognize the document, and on the 14th of January 1686 the court of directors resolved to have recourse to arms to effect what they could not obtain by treaty. An expedition was despatched to India consisting of six companies of infantry and ten ships under Captain Nicholson. Two of the ships with 308 soldiers arrived at the Hugli river in the autumn of 1686. At this time Job Charnock was the chief of the Bengal council, and, owing to an affray with the Moghul troops at Hugli on the 28th of October 1686, he embarked the company's goods and servants on board light vessels and dropped down the river to Sutanati, the site of the modern Calcutta. At this place, about 70 m. from the sea and accessible at high tide to heavily armed ships, the stream had scooped for itself a long deep pool, now Calcutta harbour, while the position was well chosen to make a stand against the Bengal viceroy. On the 20th of December 1686 Charnock first settled at Calcutta, but in the following February Shaista Khan despatched an army against him, and he was forced to drop farther down the river to Hijili. In June Charnock capitulated and returned to Ulubaria, 16 m. below Calcutta, thence moving in September to Calcutta for the second time. On the 8th of November 1688 Captain Heath arrived with orders from England, and took away Charnock against his will; but after peace was restored between the Moghul emperor and the company in February 1690, Charnock returned to Calcutta for the third and last time on the 24th of August of that year. It was thus that the modern capital of India was eventually founded.

INDIA UNDER THE COMPANY

The political history of the British in India begins in the 18th century and in the struggle for dominion with the French. On the death of Aurangzeb in 1707, the whole of southern India had become practically independent of Delhi. In the Deccan proper, the Nizam-ul-Mulk founded an independent dynasty, with Hyderabad for its capital, which exercised a nominal sovereignty over the entire south. The Carnatic was ruled by a deputy of the nizam, known as the nawab of Arcot. Farther south, Trichinopoly was the capital of a Hindu raja, and Tanjore formed another Hindu kingdom under a degenerate descendant of the line of Sivaji. Inland, Mysore was gradually growing into a third Hindu state.

French and British Wars.—Such was the condition of affairs when the French carried the War of the Austrian Succession into India. Dupleix was at that time governor of Pondicherry and Clive was a young writer at Madras. In 1746 a French squadron arrived, under the command of La Bourdonnais. Madras surrendered almost without a blow, and the only settlement left to the British was Fort St. David, a few miles south of Pondicherry, where Clive and a few other fugitives sought shelter. In 1748 a British fleet arrived under Admiral Boscawen and attempted the siege of Pondicherry, while a land force co-operated under Major Stringer Lawrence. The French successfully repulsed all attacks, and at last peace was restored by the treaty of Aix-la-Chapelle, which gave back Madras to the British (1748).

Clive.—The first war with the French was merely an incident in the greater contest in Europe. The second war had its origin in Indian politics, while England and France were at peace. The easy success of the French arms had inspired Dupleix with the ambition of founding a French empire in India, under the shadow of the existing Mohammedan powers. Disputed successions at Hyderabad and at Arcot supplied his opportunity. In the latter case the French and English espoused rival candidates. In the war that ensued the one incident that stands out conspicuously is the capture and subsequent defence of Arcot by Clive in 1751. This heroic feat, even more than the battle of Plassey, established the reputation of British valour throughout India. British influence predominated in the Carnatic, but the French were no less supreme in the Deccan, whence they were able to take possession of the coast tract called "the Northern Circars." The final struggle was postponed until 1760, when Colonel (afterwards Sir Eyre) Coote won the decisive victory of Wandiwash over the French general Lally, and proceeded to invest Pondicherry, which was starved into capitulation in January 1761.

Meanwhile the interest of history shifts with Clive to Bengal, where British, French and Dutch were established, with their headquarters respectively at Calcutta, Chandernagore and Chinsura, all three towns being situated close to each other in the lower reaches of the Hugli, where the river is navigable for large ships. The last great nawab or governor of Bengal was Ali Vardi Khan, in whose days the Mahratta horsemen began to ravage the country, and the British at Calcutta obtained permission to erect an earth-work, which is known to the present day as the Mahratta ditch. Ali Vardi Khan died in 1756, and was succeeded by his grandson, Suraj-ud-Dowlah, a youth of only nineteen years, whose ungovernable temper led to a rupture with the British within two months after his accession. In pursuit of one of his own family who had escaped from his vengeance, he marched upon Calcutta with a large army. Many of the British fled down the river in their ships. The remainder surrendered after a feeble resistance, and were thrown as prisoners into the "black hole" or military jail of Fort William, a room 18 ft. by 14 ft. 10 in. in size, with only two small windows barred with iron. It was the month of June, in which the tropical heat of Calcutta is most oppressive. When the door of the prison was opened in the morning, only twenty-three persons out of one hundred and forty-six were found alive.

Battle of Plassey.—The news of this disaster fortunately found Clive returned to Madras, where also was a squadron of king's ships under Admiral Watson. Clive and Watson promptly sailed to the mouth of the Ganges with all the troops that could be got together. Calcutta was recovered with little fighting, and Clive then moved up the river and captured Chandernagore. Finally he marched out to give battle to Suraj-ud-Dowlah on the field of Plassey (Palasi), at the head of about 900 Europeans and 2,000 sepoys, with 8 pieces of artillery. The Mohammedan army is said to have consisted of 35,000 foot, 15,000 horse and 50 pieces of cannon. But there was a traitor in the Mohammedan camp in the person of Mir Jafar, who had married a sister of the late nawab, Ali Vardi Khan. The battle was short but decisive. After

brief artillery fire, Suraj-ud-Dowlah fled, and the foundations of the British Empire in India were laid (23rd June, 1757).

In place of Suraj-ud-Dowlah Clive obtained a patent of investiture from the Moghul court in favour of his nominee Mir Jafar as governor of Bengal. Enormous sums were exacted from Mir Jafar as the price of his elevation; and the nawab made a grant to the company of the *zamindari* rights over an extensive tract of country (about 882 sq.m.) round Calcutta, now known as the district of the Twenty-four Parganas. The superior lordship, or right to receive the quit rent, remained with the nawab; but in 1759 this also was parted with by the nawab in favour of Clive, who thus became the landlord of his own masters, the company. On Clive's death his land passed to the company, thus merging the *zamindari* in the proprietary rights.

Massacre of Patna.—In 1758 Clive was appointed by the court of directors to be governor of all the company's settlements in Bengal; and in 1760 he left India. For the next five years the history of the British in Bengal contains little that is creditable. In 1761 it was found expedient and profitable to dethrone Mir Jafar, the nawab of Murshidabad, and substitute his son-in-law, Mir Kasim, in his place. On that occasion, besides private donations, the British received a grant of the three districts of Burdwan, Midnapur and Chittagong, estimated to yield a net revenue of half a million sterling. But Mir Kasim proved to possess a will of his own, and to cherish dreams of independence. He retired from Murshidabad to Monghyr, a strong position on the Ganges, which commanded the only means of communication with Upper India. There he proceeded to organize an army, drilled and equipped after European models, to carry on intrigues with the nawab wazir of Oudh, and finally to attack the company's settlements. When regular warfare began Mir Kasim met with no more successes. His trained regiments were defeated in two pitched battles by Major Adams, at Gheria and at Udha-nala, and he himself took refuge with the nawab wazir of Oudh, who refused to deliver him up. This led to a prolongation of the war. Shah Alam, who had now succeeded his father as emperor, and Shuja-ud-Daula, the nawab wazir of Oudh, united their forces, and threatened Patna, which the British had recovered. In 1764 Major (afterwards Sir Hector) Munro won the decisive battle of Buxar, which laid Oudh at the feet of the conquerors, and brought the Moghul emperor as a suppliant to the British camp.

Clive's Reforms.—Meanwhile the council at Calcutta had twice found the opportunity they desired of selling the government of Bengal to a new nawab. But in 1765 Clive (now Baron Clive of Plassey, in the peerage of Ireland) arrived at Calcutta, as governor of Bengal for the second time. Two objects stand out conspicuously in his policy. First, he sought to acquire the substance, though not the name, of territorial power, by using the authority of the Moghul emperor for so much as he wished, and for no more; and, secondly, he desired to purify the company's service by prohibiting illicit gains, and at the same time guaranteeing a reasonable remuneration from honest sources. Clive's first step was to hurry up from Calcutta to Allahabad, and there settle in person the fate of half northern India. Oudh was given back to the nawab wazir, on condition of his paying half a million sterling towards the expenses of the war. The provinces of Allahabad and Kora, forming the lower part of the Doab, were handed over to Shah Alam himself, who in his turn granted to the company the *diwani* or financial administration of Bengal, Behar and Orissa, together with the Northern Circars. In attempting to reorganize and purify the company's service, Clive undertook a task yet more difficult. Despite the resistance of the civil servants, and an actual mutiny of two hundred military officers, Clive carried through his reforms. Private trade and the receipt of presents were prohibited, while a substantial increase of pay was provided out of the monopoly of salt.

Warren Hastings.—Lord Clive quitted India for the third and last time in 1767. Five years later Warren Hastings was nominated governor by the court of directors, with instructions to carry out a predetermined series of reforms. He removed the exchequer from Murshidabad to Calcutta, and for the first time appointed European officers, under the now familiar title of collectors, to superintend the revenue collections and preside in the civil courts. The reform of civil administration was finally accomplished by Lord Cornwallis.

From 1772 to 1774 Hastings was governor of Bengal; from 1774 to 1785 he was the first titular governor-general of India. In his domestic policy he was greatly hampered by the opposition of Sir Philip Francis; but, so far as regards external relations with Oudh, with the Mahrattas, and with Hyder Ali, he was generally able to compel assent to his own measures.

Rise of the Mahrattas.—Sivaji the Great, as already mentioned, died in 1680, while Aurangzeb was still on the throne. All real power passed into the hands of the peshwa, or Brahman minister, who founded in his turn an hereditary dynasty at Poona, dating from the beginning of the 18th century. Next rose several Mahratta generals, who, though recognizing the suzerainty of the peshwa, carved out for themselves independent kingdoms in different parts of India, sometimes far from the original home of the Mahratta race. Chief among these generals were the Gaikwar in Gujarat, Sindhia and Holkar in Malwa, and the Bhonsla raja of Berar and Nagpur. The Mahrattas were the most formidable military power in India.

First Mahratta War.—The Bombay government was naturally emulous to follow the example of Madras and Bengal, and to establish its influence at the court of Poona by placing its own nominee upon the throne. The attempt took form in 1775 in the treaty of Surat, by which Raghunath Rao, one of the claimants to the throne of the peshwa, agreed to cede Salsette and Bassein to the British, in consideration of being himself restored to Poona. The military operations that followed are known as the first Mahratta War. Warren Hastings threw the whole force of the Bengal army into the scale. One of his favourite officers, General Goddard, marched across the peninsula, and conquered the rich province of Gujarat almost without a blow. Another, Captain Popham, stormed the rock-fortress of Gwalior, which was regarded as the key of Hindustan. These brilliant successes atoned for the disgrace of the convention of Wargaon in 1779, when the Mahrattas dictated terms to a Bombay force, but the war was protracted until 1782. It was then closed by the treaty of Salbai. Raghunath Rao was set aside; Gujarat was restored, and only Salsette and some other small islands were retained by the English.

First Mysore War.—Meanwhile Warren Hastings had to deal with a more formidable enemy than the Mahratta confederacy. The reckless conduct of the Madras government had roused the hostility both of Hyder Ali of Mysore and of the nizam of the Deccan, the two strongest Mussulman powers in India, who attempted to draw the Mahrattas into an alliance against the British. The diplomacy of Hastings won over the nizam and the Mahratta raja of Nagpur, but the army of Hyder Ali fell like a thunderbolt upon the British possessions in the Carnatic. A strong detachment under Colonel Baillie was cut to pieces at Perambakam, and the Mysore cavalry ravaged the country unchecked up to the walls of Madras. For the second time the Bengal army, stimulated by the energy of Hastings, saved the honour of the British name. Sir Eyre Coote, the victor of Wandiwash, was sent by sea to relieve Madras. The war was hotly contested. Hyder died in 1782, and peace was concluded with Tippoo in 1784, on the basis of a mutual restitution of all conquests.

Permanent Settlement of Bengal.—Warren Hastings was governor or governor-general for thirteen years. He was succeeded by Lord Cornwallis, the first English nobleman of rank to become governor-general. His rule lasted from 1786 to 1793, and is celebrated for two events—the introduction of the permanent settlement into Bengal and the second Mysore war. It was he who first entrusted criminal jurisdiction to Europeans, and established the appellate court of criminal judicature at Calcutta. But the achievement most familiarly associated with the name of Cornwallis is the permanent settlement of the land revenue of Bengal. Up to this time the revenue had been collected pretty much according to the old Moghul system. *Zamindars*, or government tax farmers, whose office always tended to become

hereditary, were recognized as having a right of some sort to collect the revenue from the actual cultivators. But no principle of assessment existed, and the amount actually realized varied greatly from year to year. Cornwallis took out with him in 1787 instructions to introduce a permanent settlement. The assessment began in 1789 and terminated in 1791. At first the settlement was called decennial, but in 1793 it was declared permanent for ever. The total assessment amounted to about 2¾ millions sterling.

Second Mysore War.—The second Mysore War of 1790–92 is noteworthy on two accounts: Lord Cornwallis, the governor-general, led the British army. The nizam of the Deccan and the Mahratta confederacy, co-operated as allies of the British. In the result, Tippoo Sultan submitted, and agreed to yield one-half of his dominions to be divided among the allies, and to pay three millions sterling towards the cost of the war.

The period of Sir John Shore's rule as governor-general, from 1793 to 1798, was uneventful. In 1798 Lord Mornington, better known as the marquis Wellesley, arrived in India, already inspired with imperial projects that were destined to change the map of the country. From the first he laid down as his guiding principle that the British must be the one paramount power in the peninsula, and that the Indian princes could only retain the insignia of sovereignty by surrendering the substance of independence. This policy received its finishing touch when Queen Victoria was proclaimed empress of India in 1877.

The French Menace.—To frustrate the possibility of a French invasion of India, led by Napoleon in person, was the governing idea of Wellesley's foreign policy. Napoleon was in Egypt, dreaming of the conquests of Alexander; and no man knew in what direction he might turn his hitherto unconquered legions. Wellesley first addressed himself to the nizam, where his policy prevailed without serious opposition. He then turned against Tippoo, whom Cornwallis had defeated but not subdued. His intrigues with the French were laid bare, and he was given an opportunity of adhering to the new subsidiary system. On his refusal war was declared. Tippoo, after offering but a feeble resistance in the field, retired into Seringapatam, and, when his capital was stormed, died fighting bravely in the breach (1799). Since the battle of Plassey no event so greatly impressed the native imagination as the capture of Seringapatam, which won for General Harris a peerage and for Wellesley an Irish marquisate. In dealing with the territories of Tippoo, Wellesley acted with moderation. The central portion, forming the old state of Mysore, was restored to an infant representative of the Hindu rajas, whom Hyder Ali had dethroned, while the rest was partitioned between the nizam and the British. At about the same time the province of the Carnatic, or all that large portion of southern India ruled by the nawab of Arcot, and also the principality of Tanjore, were placed under direct British administration, making the Madras presidency almost what it is to-day.

Wars with Sindhia and Holkar.—The Mahrattas had now formed a confederacy of five powers. The recognized head of the confederacy was the peshwa of Poona, who ruled the hill country of the Western Ghats, the cradle of the Mahratta race. The fertile province of Gujarat was annually harried by the horsemen of the Gaekwar of Baroda. In central India two military leaders, Sindhia of Gwalior and Holkar of Indore, alternately held the pre-eminency. Towards the east the Bhonsla raja of Nagpur reigned from Berar to the coast of Orissa. Wellesley tried assiduously to bring these several Mahratta powers within the net of his subsidiary system. The plan and provision of resources were due to the marquis Wellesley. The armies were led by General Arthur Wellesley (afterwards duke of Wellington) and General (afterwards Lord) Lake. Wellesley operated in the Deccan, where, in a few short months, he won the decisive victories of Assaye and Argaum. Lake's campaign in Hindustan was as brilliant. He won pitched battles at Aligarh and Laswari, and captured the cities of Delhi and Agra. Before the year 1803 was out, both Sindhia and the Bhonsla raja were glad to sue for peace. Sindhia ceded all claims to the territory north of the Jumna, and left the blind old emperor Shah Alam once more under British protection. The Bhonsla raja forfeited Orissa to the English, and Berar to the nizam. The freebooter, Jaswant Rao Holkar, alone remained in the field. The concluding years of Wellesley's rule were occupied with a series of operations against Holkar. Lake was repulsed at the siege of Bharatpur (Bhurtpore) (1805).

In 1804 Lord Cornwallis was sent out as governor-general a second time, with instructions to bring about peace at any price, but he died at Ghazipur before he had been ten weeks in the country. His immediate successor, Sir George Barlow, had no alternative but to carry out faithfully the orders of his employers.

Minto.—Lord Minto, governor-general from 1807 to 1813, consolidated the conquests which Wellesley had acquired. The condition of central India continued to be disturbed, but Lord Minto succeeded in preventing any violent outbreaks without himself having recourse to the sword. In his time the Indian government first opened relations with a new set of foreign powers by sending embassies to the Punjab, to Afghanistan and to Persia. Sir Charles Metcalfe was the envoy to the court of Ranjit Singh at Lahore; Mountstuart Elphinstone met the shah of Afghanistan at Peshawar; and Sir John Malcolm was despatched to Persia.

Gurkha War.—The successor of Lord Minto was Lord Moira, better known as the marquis of Hastings, who governed India for the long period of nine years, from 1814 to 1823. This period was marked by two wars of the first magnitude, the campaigns against the Gurkhas of Nepal, and the third and last Mahratta War. The Gurkhas, the present ruling race in Nepal, are Hindu immigrants who claim a Rajput origin. Their sovereignty dates only from 1767. Organized upon a sort of military and feudal basis, they soon became a terror to all their neighbours, marching east into Sikkim, west into Kumaon, and south into the Gangetic plains. In the last quarter their victims were British subjects, and nothing was left to Lord Moira but to take up arms. The campaign of 1814 was little short of disastrous. But in 1815 General Ochterlony, who commanded the army operating by way of the Sutlej, stormed one by one the hill forts which still stud the Himalayan states now under the Punjab government, and compelled the Nepal *darbar* to sue for peace. In the following year the same general advanced from Patna into the valley of Katmandu, and finally dictated the terms which had before been rejected, within a few miles of the capital. By the treaty of Segauli, which defines the English relations with Nepal to the present day, the Gurkhas withdrew on the one hand from Sikkim, and on the other from those lower ranges of the western Himalayas, which have supplied the health-giving stations of Naini Tal, Mussoorie and Simla.

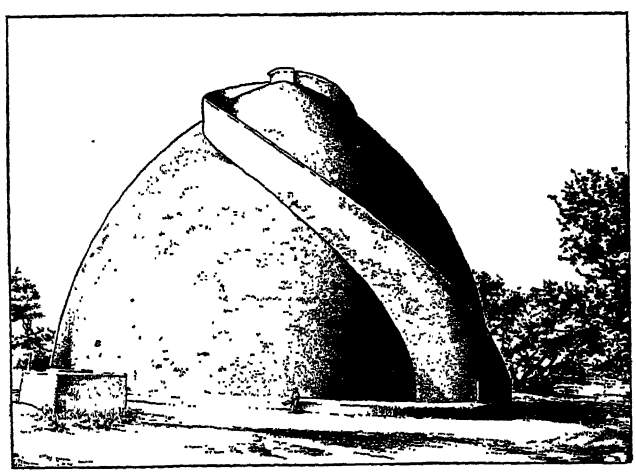
Meanwhile the condition of central India was every year becoming more unsatisfactory. There a new breed of freebooters had arisen in the Pindaris, who welcomed to their ranks the outlaws of all India—Afghans, Mahrattas or Jats. Their headquarters were in Malwa, but their depredations were not confined to central India. In bands, sometimes numbering a few hundreds, sometimes many thousands, they rode out on their forays as far as the Coromandel coast. To suppress the Pindari hordes, who were supported by the sympathy, more or less open, of all the Mahratta chiefs, Lord Hastings collected the strongest British army that had been seen in India, numbering nearly 120,000 men. The Pindaris were attacked and cut to pieces.

Third Mahratta War.—In the same year (1817) as that in which the Pindaris were crushed, and almost in the same month (November), the three great Mahratta powers at Poona, Nagpur and Indore rose against the English. The peshwa, Baji Rao, had long been chafing under the terms imposed by the treaty of Bassein (1802), and the subsequent treaty of Poona (1817), which riveted yet closer the chains of dependence upon the paramount power. Elphinstone, then resident at his court, foresaw what was coming and ordered up a European regiment from Bombay. The next day the residency was burned down, and Kirkee was attacked by the whole army of the peshwa. The attack was bravely repulsed, and the peshwa immediately fled from his capital. Almost the same plot was enacted at Nagpur,

where the honour of the British name was saved by the sepoys who defended the hill of Sitabaldi against enormous odds. The army of Holkar was defeated in the following month at the pitched battle of Mehidpur. The peshwa himself surrendered, and was permitted to reside at Bithur, near Cawnpore, on a pension of £80,000 a year. His adopted son was the infamous Nana Sahib. The greater part of his dominions was ultimately incorporated in the Bombay presidency, while the nucleus of the Central Provinces was formed out of territory taken from the peshwa and the raja of Nagpur. The map of India, as thus drawn by Lord Hastings, remained substantially unchanged until the time of Lord Dalhousie.

First Burmese War.—The marquis of Hastings was succeeded by Lord Amherst, whose administration lasted for five years, from 1823 to 1828. It is known in history by two prominent events, the first Burmese War and the capture of Bharatpur. For some years past the north-east frontier had been disturbed by the restlessness of the Burmese. The successors of Alompra, after having subjugated all Burma, and overrun Assam, which was then an independent kingdom, began a series of encroachments upon British territory in Bengal. As all peaceful proposals were scornfully rejected, Lord Amherst was compelled to declare war in 1824. One expedition with gunboats proceeded up the Brahmaputra into Assam; another marched by land through Chittagong into Arakan, for the Bengal sepoys refused to go by sea; a third, and the strongest, sailed from Madras direct to the mouth of the Irrawaddy. The war was protracted over two years. At last, after the loss of about 20,000 lives and an expenditure of £14,000,000, the king of Ava consented to sign the treaty of Yandabu, by which he abandoned all claim to Assam, and ceded the provinces of Arakan and Tenasserim. He retained all the valley of the Irrawaddy, down to the sea at Rangoon. The capture of Bharatpur in central India by Lord Combermere in 1826 wiped out the repulse which Lord Lake had received before that city in January 1805. A disputed succession had necessitated British intervention. The city was taken by storm.

Bentinck.—The next governor-general was Lord William Bentinck, who had been governor of Madras twenty years earlier at the time of the mutiny of Vellore. His seven years' rule (from 1828 to 1835) forms an epoch in administrative reform. He re-



BANKIPORE, INDIA. A GREAT GRANARY BUILT IN 1780 TO BE FILLED WITH GRAIN TO GUARD AGAINST FAMINE. STAIRWAY LEADS TO TOP: GRAIN TAKEN OUT AT BOTTOM

stored equilibrium to the finances and widened the gates by which educated Indians could enter the service of the company.

His two most memorable acts are the abolition of suttee and the suppression of the Thugs. Lord William carried the regulation in council on the 4th of December 1829, by which all who abetted suttee were declared guilty of "culpable homicide." The honour of suppressing Thuggism must be shared between Lord William and Captain Sleeman. Between 1826 and 1835, 1,562 Thugs were apprehended in different parts of British India.

Two other historical events are connected with the administration of Lord William Bentinck. In 1833 the charter of the East India Company was renewed for twenty years, but only upon the terms that it should abandon its trade and permit Europeans to settle freely in the country. At the same time a legal or fourth member was added to the governor-general's council, who might not be a servant of the company, and a commission was appointed to revise and codify the law. Macaulay was the first legal member of council, and the first president of the law commission. In 1830 it was found necessary to take the state of Mysore under British administration, where it continued until 1881, when it was restored; and in 1834 the frantic misrule of the raja of Coorg brought on a short and sharp war. The raja was permitted to retire to Benares, and the brave and proud inhabitants of that mountainous little territory decided to place themselves under the rule of the company.

After a brief and provisional tenure by Sir Charles Metcalfe of the office of governor-general, Lord Auckland was sent out, and with him commenced a new era of war and conquest, which may be said to have lasted for twenty years.

First Afghan War.—In 1837, when the curtain rises upon the drama of British interference in Afghanistan, a usurper, Dost Mohammed Barakzai, was firmly established at Kabul. His great ambition was to recover Peshawar from the Sikhs; and when Captain Alexander Burnes arrived on a mission from Lord Auckland, with the ostensible object of opening trade, the Dost was willing to promise everything, if only he could get Peshawar. But Lord Auckland had another and more important object in view. At this time the Russians were advancing rapidly in Central Asia, and a Russian envoy was at Kabul at the same time as Burnes. The latter was unable to satisfy the demands of Dost Mohammed in the matter of Peshawar, and returned to India unsuccessful. Lord Auckland forthwith resolved upon the hazardous plan of placing a more subservient ruler upon the throne of Kabul. Shah Shuja, an exiled predecessor of Dost Mohammed, was selected for the purpose, and a British army escorted him to Afghanistan through the Bolan Pass. Kandahar surrendered, Ghazni was taken by storm, Dost Mohammed fled across the Hindu Kush, and Shah Shuja was triumphantly led into the Bala Hissar at Kabul in August 1839. During the two years that followed Afghanistan remained in the military occupation of the British. The catastrophe occurred in November 1841, when Sir Alexander Burnes was assassinated in the city of Kabul. The troops in the cantonments were then under the command of General Elphinstone (not to be confounded with the civilian Mountstuart Elphinstone), with Sir William Macnaghten as chief political adviser. Elphinstone was an old man, unequal to the responsibilities of the position. Macnaghten was treacherously murdered at an interview with the Afghan chief, Akbar Khan, eldest son of Dost Mohammed. After lingering in their cantonments for two months, the British army set off in the depth of winter to find its way back to India through the passes. When they started they numbered 4,000 fighting men, with 12,000 camp followers. A single survivor, Dr. Brydon, reached the friendly walls of Jalalabad, where General Sale was gallantly holding out. The rest perished in the defiles of Khurd Kabul and Jagdalak, either from the knives and matchlocks of the Afghans or from the effects of cold. A few prisoners, mostly women, children and officers, were considerately treated by the orders of Akbar Khan.

The punitive forces under generals Pollock and Nott converged on Kabul in September 1842. The great *bazar* was blown up with gunpowder to fix a stigma upon the city; the prisoners were recovered; and all marched back to India, leaving Dost Mohammed to take undisputed possession of his throne.

Annexation of Sind.—Lord Ellenborough, who had now superseded Lord Auckland, soon plunged into two more wars. In 1843 the Mohammedan rulers of Sind, known as the "meers" or amirs, whose only fault was that they would not surrender their independence, were crushed by Sir Charles Napier. The victory of Meeanee, in which 3,000 British troops defeated 20,000 Baluchis, is perhaps the most brilliant feat of arms in Indian history; but an honest excuse can scarcely be found for the annexa-

tion of the country. In the same year a disputed succession at Gwalior, fomented by feminine intrigue, resulted in an outbreak of the overgrown army which the Sindhia family had been allowed to maintain. Peace was restored by the battles of Maharajpur and Punniar, at the former of which Lord Ellenborough was present in person.

First Sikh War.—In 1844 Lord Ellenborough was recalled by the court of directors, and succeeded by Sir Henry (afterwards Lord) Hardinge, who had served through the Peninsular War and had lost a hand at Ligny. In 1845 the *khalsa,* or Sikh army, numbering 60,000 men with 150 guns, crossed the Sutlej and invaded British territory. Sir Hugh Gough, the commander-in-chief, together with the governor-general, hurried up to the frontier. Within three weeks four pitched battles were fought, at Mudki, Ferozeshah, Aliwal and Sobraon. The British loss on each occasion was heavy; but by the last victory the Sikhs were driven across the Sutlej, and Lahore surrendered to the British. By the terms of peace then dictated the infant son of Ranjit, Dhuleep Singh, was recognized as raja; the Jullundur Doab, or tract between the Sutlej and the Ravi, was annexed; the Sikh army was limited to a specified number; Major Henry Lawrence was appointed to be resident at Lahore; and a British force was detailed to garrison the Punjab for a period of eight years.

Dalhousie.—Lord Dalhousie succeeded Lord Hardinge, and his eight years' administration (from 1848 to 1856) was more pregnant of results than that of any governor-general since Wellesley. Though professedly a man of peace, he was compelled to fight two wars, in the Punjab and in Burma. These both ended in large acquisitions of territory, while Nagpur, Oudh and several minor states also came under British rule. But Dalhousie's own special interest lay in the advancement of the moral and material condition of the country. No branch of the administration escaped his reforming hand. He founded the public works department, to pay special attention to roads and canals. He opened the Ganges canal, still the largest work of the kind in the country, and he turned the sod of the first Indian railway. He promoted steam communication with England via the Red Sea, and introduced cheap postage and the electric telegraph.

Second Sikh War.—Lord Dalhousie had not been six months in India before the second Sikh war broke out. Two British officers were treacherously assassinated at Multan, and this outbreak of fanaticism led to a general rising. The *khalsa* army again came together, and more than once fought on even terms with the British. On the fatal field of Chillianwalla, the British lost 2,400 officers and men, besides four guns and the colours of three regiments. Before reinforcements could come out from England, with Sir Charles Napier as commander-in-chief, Lord Gough had restored his own reputation by the crowning victory of Gujrat, which absolutely destroyed the Sikh army. The Punjab henceforth became a British province, supplying a virgin field for the administrative talents of Dalhousie and the two Lawrences. Raja Dhuleep Singh received an allowance of £50,000 a year, on which he retired to Norfolk in England.

Second Burmese War.—The second Burmese war of 1852 was caused by the ill-treatment of European merchants at Rangoon, and the insolence offered to the captain of a frigate who had been sent to remonstrate. The whole valley of the Irrawaddy, from Rangoon to Prome, was occupied in a few months, and, as the king of Ava refused to treat, it was annexed, under the name of Pegu, to the provinces of Arakan and Tenasserim, which had been acquired in 1826.

Lord Dalhousie's dealings with the Indian states, though actuated by the highest motives, seem now to have proceeded upon mistaken lines. His policy of annexing each Indian state on the death of its ruler without natural heirs produced a general feeling of insecurity of tenure among the princes, and gave offence to the people of India. The first state to escheat to the British government was Satara, which had been reconstituted by Lord Hastings on the downfall of the peshwa Baji Rao in 1818. In 1853 Jhansi suffered the same fate as Satara. But the most conspicuous application of the doctrine of lapse was the case of Nagpur. The last of the Bhonslas, a dynasty older than the British government itself, died without a son, natural or adopted, in 1853. That year also saw British administration extended to the Berars, or the assigned districts which the nizam of Hyderabad was induced to cede as a territorial guarantee for the subsidies which he perpetually kept in arrear.

Annexation of Oudh.—The annexation of Oudh was justifiable on the ground of morals, though not on that of policy. Ever since the nawab wazir, Shuja-ud-Dowlah, received back his forfeited territories from the hands of Lord Clive in 1765, the very existence of Oudh as an independent state had depended only upon the protection of British bayonets. Thus, preserved alike from foreign invasion and from domestic rebellion, the long line of subsequent nawabs had given way to neglect of public affairs and private vices. Repeated warnings were neglected, and Lord Dalhousie at last (1856) issued orders to General (afterwards Sir James) Outram, then resident at the court of Lucknow, to assume the direct administration of Oudh. The king, Wajid Ali, bowed to irresistible force, and settled down in the pleasant suburb of Garden Reach near Calcutta, where he lived in the enjoyment of a pension of £120,000 a year. Oudh was thus annexed without a blow.

The Mutiny.—Lord Dalhousie was succeeded by his friend, Lord Canning, who, at the farewell banquet in England given to him by the court of directors, uttered these prophetic words: "I wish for a peaceful term of office. But I cannot forget that in the sky of India, serene as it is, a small cloud may arise, no larger than a man's hand, but which, growing larger and larger, may at last threaten to burst and overwhelm us with ruin." In the following year the sepoys of the Bengal army mutinied, and anarchy filled the valley of the Ganges from Patna to Delhi.

The various motives assigned for the Mutiny appear inadequate. In the first place, the policy of Dalhousie was utterly distasteful to the Indian mind. Repeated annexations, the spread of education, the appearance of the steam engine and the telegraph wire, all alike revealed a consistent determination to substitute an English for an Indian civilization. The Bengal sepoys were unbalanced by a sense of their own importance; they believed it was by their prowess that the Punjab had been conquered, and all India was held quiet. The numerous dethroned princes, their heirs and their widows, were the first to take advantage of the spirit of disaffection that was abroad.

But in addition to these general causes of unrest the condition of the Indian army had long given anxiety to acute observers. During the course of its history it had broken out into mutiny at recurrent intervals, the latest occasion being the winter of 1843–1844, when there were two separate mutinies in Sind and at Ferozepur. Sir Hugh Gough and other commanders-in-chief had petitioned for the removal of India's chief arsenal from Delhi to Umballa; and Lord Dalhousie himself had protested against the reduction of the British element in the army. But all these warnings were disregarded. Moreover the outbreak was immediately provoked by an unparalleled instance of carelessness; for it is now clear that the sepoys' belief that their cartridges were greased with the fat of cows and pigs had some foundation in fact. (For the military incidents of the Mutiny *see* INDIAN MUTINY.)

Transfer to the Crown.—The Mutiny sealed the fate of the East India company, after a life of more than two and a half centuries. The Act for the Better Government of India (1858) finally transferred the entire administration from the company to the crown. The governor-general received the new title of viceroy. The European troops of the company, numbering about 24,000 officers and men, were amalgamated with the royal service, and the Indian navy was abolished. By the Indian Councils Act (1861) the governor-general's council and also the councils at Madras and Bombay were augmented by the addition of non-official members for legislative purposes only; and by another act passed in the same year high courts of judicature were constituted.

(ME.)

INDIA IN THE BRITISH EMPIRE

It fell to the lot of Lord Canning both to suppress the Mutiny

and to introduce the peaceful revolution that followed. He preserved his equanimity undisturbed in the darkest hours of peril, and the strict impartiality of his conduct incurred alternate praise and blame from the extremists on either side. The epithet then scornfully applied to him of "Clemency" Canning is now remembered only to his honour. On November 1, 1858, at a grand durbar held at Allahabad the royal proclamation was published which announced that the queen had assumed the government of India. This document, which has been called the Magna Charta of the Indian people, went on to explain the policy of political justice and religious toleration which it was her royal pleasure to pursue, and granted an amnesty to all except those who had directly taken part in the murder of British subjects. Peace was proclaimed throughout India on the 8th of July 1859. The suppression of the Mutiny increased the debt of India by about 40 millions sterling, and the military changes that ensued augmented the annual expenditure by about 10 millions. To grapple with this deficit, the Government reorganized the customs system, imposed an income tax and licence duty and created a state paper currency. The penal code, originally drawn up by Macaulay in 1837, passed into law in 1860, with codes of civil and criminal procedure.

Lord Canning left India in March 1862, and died before he had been a month in England. His successor, Lord Elgin, only lived till November 1863, when he too fell a victim to the excessive work of the governor-generalship, dying at the Himalayan station of Dharmsala, where he lies buried. He was succeeded by Sir John Lawrence, the saviour of the Punjab. The chief incidents of his administration were the Bhutan war and the terrible Orissa famine of 1866. Lord Mayo, who succeeded him in 1869, carried on the permanent British policy of moral and material progress with a special degree of personal energy. While engaged in exploring with his own eyes the furthest corners of the empire, he fell by the hand of an assassin in the convict settlement of the Andaman islands in 1872. His successor was Lord Northbrook, whose ability showed itself chiefly in the department of finance. During his administration a famine in Lower Bengal in 1874 was successfully obviated by government relief and public works, though at an enormous cost; the Gaekwar of Baroda was dethroned in 1875 for misgovernment and disloyalty, while his dominions were continued to a nominated child of the family; and the prince of Wales (Edward VII.) visited the country in the cold season of 1875–1876. Lord Lytton followed Lord Northbrook in 1876. On the 1st of January 1877 Queen Victoria was proclaimed empress of India at a durbar of great magnificence, held on the historic "Ridge" overlooking the Moghul capital Delhi.

Second Afghan War.—In the autumn of 1878 the affairs of Afghanistan again forced themselves into notice. Shere Ali, the amir, who had been hospitably entertained by Lord Mayo, was found to be favouring Russian intrigues. A British envoy was refused admittance to the country, while a Russian mission was received with honour. This led to a declaration of war. British armies advanced by three routes—the Khyber, the Kurram and the Bolan—and without much opposition occupied the inner entrances of the passes. Shere Ali fled to Afghan Turkistan, and there died. A treaty was entered into with his son, Yakub Khan, at Gandamak, by which the British frontier was advanced to the crests or farther sides of the passes and a British officer was admitted to reside at Kabul. Within a few months the British resident, Sir Louis Cavagnari, was treacherously attacked and massacred, together with his escort, and an advance became necessary. Yakub Khan abdicated, and was deported to India, while Kabul was occupied in force. Shortly afterwards a British brigade was defeated at Maiwand by the Herati army of Ayub Khan, a defeat promptly and completely retrieved by the brilliant march of General Sir Frederick Roberts from Kabul to Kandahar, and by the total rout of Ayub Khan's army on the 1st of September 1880. Abdur Rahman Khan, the eldest male representative of the stock of Dost Mohammed, was then recognized as amir of Kabul.

Lord Ripon.—While these operations were in progress, Lord Ripon was sent out to India by the Liberal ministry of 1880 for the purpose of reversing Lord Lytton's policy in Afghanistan, and of introducing a more sympathetic system into the administration of India. The disaster at Maiwand, and the Russian advance east of the Caspian, prevented the proposed withdrawal from Quetta; but Kandahar was evacuated, Abdur Rahman was left in complete control of his country and was given an annual subsidy of twelve lakhs of rupees in 1883. In the second purpose of his administration Lord Ripon laid the foundation of a system of local self-government, on which the superstructure was long delayed. A relatively minor measure known as the Ilbert Bill, which proposed to subject European offenders to trial for certain offences by native magistrates, aroused a storm of indignation amongst the European community which finally resulted in the bill being modified; but it also set a fashion in political agitation, which was to bear bitter fruit. Lord Ripon's good intentions and personal sympathy were recognized by the Indians, and on leaving Bombay he received a great ovation.

After the arrival of Lord Dufferin as governor-general the incident known as the Panjdeh scare brought Britain to the verge of war with Russia. During the preceding decades Russia had gradually advanced her power from the Caspian across the Turkoman steppes to the border of Afghanistan, and it was found necessary to appoint a joint Anglo-Russian commission to delimit the Afghan frontier. In March 1885, while the commission was at work, a Russian general attacked and routed the Afghan force holding the bridge across the river Kushk, and the incident might possibly have resulted in war between Britain and Russia but for the slight importance that Abdur Rahman attributed to what he termed a border scuffle.

The incident, however, led to military measures being taken by the government of Lord Dufferin, which had far-reaching effects on Indian finance. The total strength of the army was raised by 10,000 British and 20,000 Indian troops, at an annual cost of about two millions sterling; and the frontier post of Quetta, in the neighbourhood of Kandahar, was connected with the Indian railway system by a line that involved very expensive tunnelling.

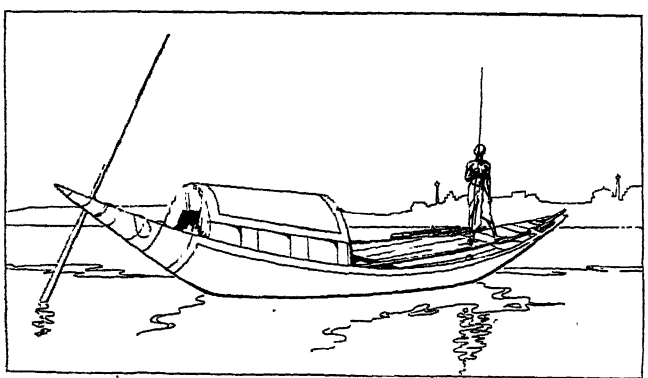
Imperial Service Troops.—The Panjdeh incident was likewise the cause of the establishment of Imperial Service troops in India. Many of the leading Indian princes agreed to set up a small military force in their States, to be at the disposal of the British government, to be commanded by state officers, but drilled, disciplined and armed under the supervision of British officers and on British lines, the government finding the necessary supervising officer, arms and organization. The Imperial Service troops, as they are called, amounted in 1928 to some 20,000 cavalry, infantry and transport, whose efficiency was put to the highest test during the Great War. Later in the same year (1885) occurred the third Burmese war, which ended in the annexation of Upper Burma. For the causes of the dispute with King Thebaw, and a description of the military operations which ensued before the country was finally pacified, *see* BURMA. Between the years 1885 and 1895 there were delimited at various times by joint commissions the Russo-Afghan frontier between the Oxus and Sarakhs on the Persian frontier, the Russo-Afghan frontier from Lake Victoria to the frontier of China and the Afghan-Indian frontier from the Kunar river to a point in the neighbourhood of the Nawa Kotal.

About the same time in the extreme north the post of British resident in Gilgit was re-established, and the supremacy of Kashmir over the adjoining petty chiefships of Hunza-Nagar was enforced (1891–1892). In 1893 the frontiers of Afghanistan and British India were defined by a joint agreement between the two governments, known as the Durand agreement. There followed an extension of British defensive posts into tribal territory, which aroused the alarm of the local clans. The Waziris and Swatis successively rose in arms, in June and July 1897, and their example was followed by the Mohmands. Finally, in August the powerful Afridi tribe joined the combination and closed the Khyber Pass, which runs through their territory, and which was held by them, on conditions, in trust for the government of India. This led to the Tirah campaign, which proved very costly both in men and money.

Lord Curzon's Reforms.—When Lord Curzon became viceroy in 1898, he reversed the frontier policy, which had given rise to the Tirah campaign, withdrew outlying garrisons in tribal

country, substituted for them tribal militia, and created the new North-West Frontier province, for the purpose of introducing consistency of policy and firmness of control upon that disturbed border. This was only one phase of his boundless activity. In almost every branch of the administration he introduced far-reaching reform. He reorganized the systems of education and police, laid down a comprehensive scheme of irrigation, improved the leave rules and the excessive report-writing of the civil service, encouraged the princes by the formation of the Imperial Cadet Corps and exhibited a practical zeal for justice between Indian and Englishman, which at times imperilled his personal popularity. His term of office was also notable for the coronation durbar at Delhi in January 1903, the expedition to Lhasa in 1904, which first unveiled that forbidden city to European gaze, and the partition of the overgrown province of Bengal in 1905. In December 1904 Lord Curzon entered upon a second term of office, which was unfortunately marred by a controversy with Lord Kitchener, the commander-in-chief, as to the position of the military member of council. Lord Curzon, finding himself at variance with the secretary of state, resigned before the end of the first year, and was succeeded by Lord Minto.

Lord Minto.—The new viceroy, who might have expected a tranquil time after the energetic reforms of his predecessor, soon found himself face to face with grave unrest, the outcome of the growing nationalist movement, and of the pressure of a western civilization upon a people with an increasing pride in their own ancient culture. Ever since 1885 the small class of Indians with an English education had been claiming for themselves a larger share in the administration, and had organized a political party under the name of the National Congress, which held annual meetings at Christmas in one or other of the large cities of the peninsula. This class also exercised a wide influence through the press, printed both in the vernacular languages and in English, especially among young students. There is no doubt too that the adoption of Western civilization by the Japanese and their victorious war with Russia set in motion a current through all the peoples of the East. The occasion though not the cause of trouble arose from the partition of Bengal, which was represented by Bengali agitators as an insult to their mother country. Beneath the constitutional agitation lay a stratum of bitter economic discontent. The schools and colleges had been pouring out masses of young men, imperfectly educated, underfed, for whom no place existed in the public services or the industrial system of the country, and whose misery generated a fierce hostility to existing order. From this soil sprang the *swadeshi* movement for the boycott of English goods, the most seditious speeches and writings and conspiracies for the assassination of officials.



A DINGHY, THE NATIVE PASSENGER AND LIVING BOAT OF INDIA

At first the government attempted to quell the disaffection by means of the ordinary law, with fair success outside Bengal; but there, owing to the secret ramifications of revolutionary activity, it was found necessary to adopt special measures. Recourse was had to a regulation of the year 1818, by which persons may be imprisoned or "deported" without reason assigned; and three acts of the legislature were passed for dealing more directly with the prevalent classes of crime: (1) an Explosives Act, containing provisions similar to those in force in England; (2) a Prevention of Seditious Meetings Act, which could only be applied specially by proclamation; and (3) a Criminal Law Amendment Act, of which the two chief provisions were a magisterial inquiry in private (similar to the Scotch procedure) and a trial before three judges of the High Court without a jury.

While the law was thus strictly enforced, important acts of conciliation and measures of reform were carried out simultaneously, in concert between Lord Minto and Lord Morley, then secretary of state for India. In 1907 two Indians, a Hindu and a Mohammedan, were appointed to the secretary of state's council. Occasion was taken of the fiftieth anniversary of the assumption by the crown of the government of India to address a message (on November 2, 1908) by the king-emperor to the princes and peoples, reviewing in stately language the later development, and containing these memorable words:—

From the first, the principle of representative institutions began to be gradually introduced, and the time has come when, in the judgment of my viceroy and governor-general and others of my counsellors, that principle may be prudently extended. Important classes among you, representing ideas that have been fostered and encouraged by British rule claim equality of citizenship, and a greater share in legislation and government. The politic satisfaction of such a claim will strengthen, not impair, existing authority and power. Administration will be all the more efficient if the officers who conduct it have greater opportunities of regular contact with those whom it affects and with those who influence and reflect common opinion about it.

The Morley-Minto Reforms.—The policy here adumbrated was translated by parliament into the India Councils Act, 1909, of which the main object was to enlarge the Legislative Councils and make them more fully representative, introduce the elective principle, give greater powers of discussion and of obtaining information from the executive. In each Council the nominated members comprised: (1) a substantial *bloc* of officials, the *bloc* in the Imperial Legislative Council being large enough to secure, together with the members of the Executive Council, an absolute majority; (2) non-officials nominated to represent classes or interests which would otherwise be unrepresented or inadequately represented. The number of elected members was too few to admit of any system of territorial constituencies and direct voting. Special constituencies therefore were formed, such as universities, chambers of commerce, groups of municipalities and district boards, and also for Mohammedans as a separate class or community. The councils were empowered to discuss and move resolutions on the annual budget and in like manner to raise discussions by resolution on matters of general public interest. But they did not vote the budget, and resolutions operated only as recommendations which were not binding on the Government.

The Act increased the number of members of the executive councils of Madras and Bombay from two to a maximum of four, thereby providing a seat for an Indian or two Indian members; it also authorized the creation of an executive council in any province having a lieutenant-governor. The policy of associating Indians with the executive government thus affirmed as regards to provinces, was given effect to in the Government of India by the appointment first of Mr. S. P. (afterwards Lord) Sinha, and then of Sir Ali Imam as Law Member of the Governor-General's executive council. The first elections under the new scheme took place in December 1909, and aroused widespread interest. The new council of the Governor-General met in January 1910.

Lord Hardinge.—In the spring of 1910 the appointment of Lord Kitchener to succeed Lord Minto as Viceroy seemed probable. Fate reserved Lord Kitchener for other tasks, and the choice fell on Sir Charles Hardinge, permanent Under-Secretary for Foreign Affairs and formerly ambassador to St. Petersburg, who was raised to the peerage as Lord Hardinge of Penshurst. His viceroyalty (Nov. 1910–March 1916) was strenuous and eventful. The earlier years were marked by the visit of King George V. and Queen Mary to India, the selection of Delhi as the site of the future capital of the Indian Empire, the revision of the "partition" of Bengal and the nefarious attempts of anarchists to compass the deaths of the Viceroy and his wife on the occasion of their state entry into Delhi. The closing years saw India in the throes of the World War, when the popularity of the Viceroy

and his personal influence and friendship with the ruling Princes had much to do with the magnificent response of India to the call of the Empire.

Lord Minto had predicted that the conciliatory measures embodied in and associated with these changes would clear the political atmosphere. He prophesied rightly. On Jan. 5, 1911, a deputation from the Indian National Congress presented an address to the new Viceroy expressing deep and heartfelt loyalty to the Crown and appreciation of the reforms which "had done much to bring about a better understanding between the Government and the people." As the enlarged councils settled down to their work, even the advanced party found, for a time at least, a healthy outlet for their energies. As consultative and critical bodies the reformed councils exercised a real and growing influence and were an educative force. They formed, directed, and developed public opinion in political matters. They acted as a restraint upon the autocratic tendencies of the Executive and made it more responsive to popular demands, and they strengthened its hands when it had to sustain Indian interests against the interests of Great Britain or of the self-governing Dominions.

The Royal Visit.—The royal visit in the winter of 1911 was a remarkable triumph. The presence of the King-Emperor and his Consort in India touched the imagination and fired the innate loyalty of the people. The Delhi ceremonies drew vast crowds eager to see and salute the sovereign. When a visit to Calcutta followed, the welcome given by the populace of that city was even more enthusiastic and unrestrained. On Dec. 12, 1911, in a great arena outside Delhi specially prepared for the occasion, the King held a coronation durbar at which he received in person the homage of the great officers of state and the ruling princes and chiefs of the Indian Empire. Largesse and "boons" of various kinds were granted, and an announcement made of great political moment. The seat of the Government of India was to be transferred from Calcutta to Delhi; Eastern Bengal was reunited to Bengal and the enlarged province given a Governor in Council; Behar, Orissa and Chota Nagpur, tracts which are loosely connected with Bengal proper, were made a Lieutenant-Governorship in Council; and Assam was re-formed into a chief commissionership. The secret had been well kept, and the surprise was complete. The scheme, though open to obvious objections, was ingenious and cleverly balanced. A reasoned exposition of its object is contained in a despatch, dated Aug. 25, 1911, from the Government of India to the Secretary of State, submitting the proposed changes for the home Government's approval in advance of the King's visit.

Prosperity and Progress.—The period was one of much material prosperity, and it was possible to make large grants for the advance of popular education and for sanitary reforms that had long seemed unattainable. The funds were in considerable measure found from the fanciful prices paid for opium by the China market in view of the steps that were being taken to reduce and ultimately extinguish the trade in the drug from India. A royal commission enquired into the public services and recommended a larger proportion of Indians in the higher ranks. A Legislative Council was established in the Central Provinces. The position of Indians in the Dominions and Colonies began to attract criticism; serious dissatisfaction being in particular aroused by the treatment of indentured labour in Fiji and elsewhere, and by the disabilities imposed on Indian residents in South Africa and Canada. In 1911 the Indian Government prohibited the future emigration of indentured labourers to Natal; and in the following year there was widespread unrest among the Indians domiciled in the Union. Speaking at Madras in Nov. 1913, Lord Hardinge attacked the "invidious and unjust laws" against which the Indians were protesting, and pressed for an independent inquiry into the whole matter. This was subsequently conceded, and peace was reached for a time by the Union Government passing its Indian Relief Act, 1914. With regard to Canada the Indian grievances were less easy of settlement, and Lord Hardinge could only advise a policy of reciprocity, which could be made effective without direct retaliation.

Revolutionary Crime.—Under the surface of all this peaceful progress the new and sinister feature in Indian life which had emerged in Lord Minto's time was gaining in intensity. Secret societies, composed chiefly of young men belonging to respectable families, sprang up in many districts of Bengal, having for their object the deliverance of India from the foreign yoke. This they sought to compass by assassination and terrorism. The art of bomb-making was imported from Europe. Revolutionary literature and the use of pistols and explosives were sedulously studied, and a series of anarchical crimes occurred from 1907–9. On Dec. 23, 1912, as the Viceroy was making his first state entry into Delhi, a bomb was thrown and exploded in the *howdah* of the elephant on which he and Lady Hardinge were riding, severely wounding him and killing an attendant. In 1914 and 1915 revolutionary activities became more daring, with the assistance of German agents in America and the Dutch East Indies; but the vigorous use of the special powers provided by the Defence of India Act broke up the movement for the time being and restored order. The organisation of the revolutionary societies, their inter-connection and propaganda methods, their success in corrupting the educated youth of the country, are minutely described in the report of the Sedition Committee (1918) over which Mr. Justice Rowlatt presided.

THE WORLD WAR

On the outbreak of the World War in Aug. 1914, the response made by India to the needs of the Empire was signal testimony of her pride in the British connection. The political leaders suspended their controversies with the Government. The martial classes eagerly responded to the call to arms. From the rulers of the Indian states lavish offers of help poured in. They were recounted in the Viceroy's telegram to the Secretary of State, dated Sept. 7, 1914, which was read in both Houses of Parliament and circulated throughout the Empire. Its effect on popular feeling was immense.

With this confidence and enthusiasm were mingled some alarm and bewilderment; and the Punjab in particular was disturbed for some months by murders, dacoities and robberies, and the reckless use of arms and explosives.

But India as a whole was calm, and the Government was able to denude itself freely of its military resources to meet the demands of the home Government for troops and supplies. Most of the British troops, the flower of the Indian army, the best of the artillery, and large quantities of ammunition were despatched to France and other theatres of war. In Sept. 1914 a force of 70,000 men was sent to France. By the end of 1915 India's contribution amounted to nearly 80,000 British and 210,000 Indian officers and men. At one time the original British garrison was reduced to only 15,000 men.

The entrance of Turkey into the War placed Indian Mohammedans in a difficult position; but they loyally rallied to the side of the Crown. Against a few prominent agitators only was it necessary to take action. The premier Mohammedan prince, the Nizam of Hyderabad, and the Begum of Bhopal, in addresses to their co-religionists, effectively stated the British case. These addresses and a declaration by the Government of India as to its attitude towards Islam in general and the Holy Places in particular served greatly to maintain tranquillity.

Lord Chelmsford.—Lord Chelmsford, the new Viceroy, assumed office on April 4, 1916. Previously Governor of Queensland and of New South Wales, at the time of his appointment he had been serving as an officer with a territorial battalion in India; and he was cast at once into one of the most difficult periods of British-Indian history. In the very first year of his administration the political peace enjoyed by his predecessor came to an end. Mrs. Annie Besant and Mr. B. G. Tilak raised the home-rule flag in Madras and Bombay respectively. In Oct. 1916, a group of elected Indian members of the Imperial Legislative Council submitted a memorandum on proposed reforms to the Government of India. It propounded a scheme which, while retaining irremovable executives responsible to Parliament and the Secretary of State, would have subjected them in legislation, finance and administration, to the orders of a legislative body in which elected

members would be predominant.

At meetings held in Lucknow in Dec. 1916 the National Congress and the Muslim League agreed upon a scheme of reforms as the irreducible minimum with which the National party would be content; and made a compact guaranteeing to Mohammedans a proportion of seats in the future Legislative Councils in excess of the number they could hope otherwise to win. Following the Lucknow conferences an energetic Home Rule campaign was opened in all provinces. The whole problem, however, had already been referred to the British Cabinet; for before the close of 1916 Lord Chelmsford's government had submitted to the Secretary of State a considered scheme of reforms, and asked for an authoritative declaration of policy. Was the goal for the Indian peoples to be responsible government? If so, by what stages and steps should it be reached? The questions raised were large and delicate. The Cabinet was preoccupied by the War. In July 1917 the Secretary of State Mr. (Sir) Austen Chamberlain, resigned on the report of the Mesopotamian Commission.

Declaration of Aug. 20, 1917.—It fell to his successor, Mr. E. S. Montagu, to announce on Aug. 20, 1917, in the House of Commons, the Indian policy of the government:

> The policy of H.M. Government is that of increasing the association of Indians in every branch of the administration and the gradual development of self-governing institutions with a view to the progressive realisation of responsible government in India as an integral part of the British Empire. . . . Progress in this policy can only be achieved by successive stages. The British Government and the Government of India, on whom the responsibility lies for the welfare and advancement of the Indian peoples, must be the judges of the time and measure of each advance, and they must be guided by the co-operation received from those upon whom new opportunities of service will thus be conferred and by the extent to which it is found that confidence can be reposed on their sense of responsibility.

In the course of the winter Mr. Montagu visited India, and a joint report, dated April 22, 1918, by himself and the Viceroy was drawn up before he left.

War Conference of 1918.—The Montagu-Chelmsford report was nearing completion when attention was recalled to the pressing realities of the War. In the Near East, German troops had penetrated the Caucasus and Turks were invading Persia. With the collapse of Russia, the opening up of a road to Afghanistan and thence to India seemed possible. In a telegram (April 2, 1918), the Prime Minister made an appeal to the Government and people of India to redouble their efforts and prevent German tyranny from "spreading to the East and engulfing the world."

Lord Chelmsford's response was to convene a War conference at Delhi, to which many ruling princes and representatives of all provinces of every shade of opinion were invited. The conference heartily and loyally responded to the appeal, and agreed upon a programme of measures of no small value. In the five months preceding the Armistice 200,000 men were recruited, and had the War gone on this number would have been greatly increased. In the spring of 1917 the Legislative Council had accepted the Government's proposal to make a free gift of £100,000,000 to the home Government towards the expenses of the War. This was in addition to the obligation the Indian Government had undertaken of bearing the normal charges of all troops on the Indian establishment sent overseas. The part borne by India in the War and the sacrifices made by her people for the common cause are represented by an addition of over 230 crores of rupees (£153,000,000) to her debt, the sending overseas of 800,000 combatants and 400,000 non-combatants, and the furnishing of foodstuffs and other supplies at the cost of much privation among the poorer classes.

Renewal of Unrest.—The Armistice in Nov. 1918 was the signal for general rejoicings but ushered in a season of political strife and agitation unfavourable for the peaceful introduction of the new constitution. Over what is generally known as the Rowlatt bills, a controversy arose, which was fated to overshadow and prejudice the constitutional question by the passions which it kindled and the bitterness which it imported into the relations of the people and the Government. The report of the Sedition Committee, over which Mr. Justice Rowlatt presided, had provided impressive evidence of the existence of a revolutionary and anarchical conspiracy in Bengal and elsewhere and the ineffectiveness of the ordinary criminal law to deal with it. The Committee proposed to endow the Governor-General in Council with emergency powers, to be used only in specified areas, and only after a notification declaring the existence of a state of affairs in those areas which demanded emergency measures. Those measures included: (*a*) the trial of seditious crime by three judges of the highest status, without juries or assessors who were liable to be affected by public discussion or deliberate terrorism; and (*b*) the investing of a provincial Government with certain limited powers of internment. In Jan. 1919 the publication of the draft bills embodying the Committee's proposals was followed by a violent campaign by the Nationalist press and Nationalist politicians. They were represented as an attack upon the popular liberties, a monstrous engine of tyranny and oppression, the forerunner of a policy of reaction and an unmerited slur upon the loyalty and law-abidingness of the Indian people.

Gandhi.—While the bills were before the Legislative Assembly, M. K. Gandhi, a well-known social and religious reformer, revered in the Bombay Presidency as an ascetic and holy man, initiated a passive resistance movement. *Satyagraha*, as he termed it, means insistence on truth and a reliance on soul force. On the Rowlatt bills receiving the Viceroy's assent, Gandhi announced a day of general mourning and cessation of business. A wave of excitement passed over the Punjab. Violent disturbances broke out in Lahore, Amritsar and other centres. Disorder assumed the character of open rebellion, definitely anti-government and anti-British, communications were cut, and the civil authority was only maintained by military force. Martial law was proclaimed in Amritsar on April 14, was extended subsequently to other districts and was not finally withdrawn from every part of the Province until June. In Bombay the news of Gandhi's arrest at Delhi was the occasion of an immediate outbreak of disorder in Ahmadabad, the capital of Guzerat, and in neighbouring towns. The military had to be called in, but not before numerous acts of incendiarism and violence and some loss of life had occurred.

Amritsar.—On April 13 "the tragedy of Amritsar" occurred. In that city banks and other buildings had been pillaged and burnt and Europeans murdered. The civil officers, finding themselves powerless to cope with the mobs in possession of the city, called upon the military to restore order. Brigadier-General Dyer, the officer commanding, deemed it necessary in the course of his operations to disperse forcibly an unlawful assembly held in the Jalianwala Bagh. Nearly 400 persons were killed by the fire of his troops, and probably thrice that number wounded. His action aroused intense indignation among Indians of all shades of political opinion, and led to the appointment towards the end of the year of the Hunter Committee to inquire into the disturbances which had arisen in consequence of the Rowlatt legislation. General Dyer's action was condemned by this committee, and it was decided by the authorities that he should receive no further employment in India. After a warm debate in the House of Commons (July 8, 1920), this action was approved by 230 votes to 129, but the House of Lords, on July 20, by 129 votes to 86, passed a motion "deploring" the treatment of General Dyer as "unjust" and as "establishing a precedent dangerous to the preservation of order in the face of rebellion."

The Third Afghan War.—Relations with Afghanistan had been uniformly good ever since the Amir Habibullah's visit to Lord Minto in 1908. The Amir was delighted with his reception, and let it be known that his friendship with the British Government had been immensely strengthened. During the World War he was staunch; but on Feb. 20, 1919, he was murdered, and his son Amanullah ascended the throne. The succession was disliked by powerful factions in the state; and in his difficulties the new Amir lent an eager ear to the distorted reports of the disturbed state of the Punjab, which found their way to Afghanistan. He concluded that an invasion of India might prove a solution of his domestic differences, appealing as it would to the religious fanaticism of his Mohammedan subjects, deeply stirred by the humiliation and defeat of Turkey and by the British conquest of Mesopotamia. Aggressive movements of his troops in

the Khyber were countered by the rapid mobilisation of the army in India early in May, the occupation of the Afghan advanced base at Dacca and the bombing by aeroplanes of Kabul and Jalālābād. By the middle of May the Afghans asked for a cessation of hostilities, and in June the Amir accepted an armistice. On Aug. 8 a treaty of peace was signed at Rawalpindi, under which the Amir lost his subsidy and the privilege of importing arms through India. A separate letter officially recognised the freedom of Afghanistan from foreign control.

Waziristan.—The Rawalpindi Treaty did not end the troubles on the frontier. The independent tribes of Wazirs and Mahsuds, who occupy a large block of country south of the Khyber line between Afghanistan and the British districts to the east, had risen in May at the instigation of the Afghans and raided the adjoining British districts. The Indian Government determined to undertake the permanent pacification of the country, a serious undertaking, as the tribes could place some 30,000 well-armed men in the field. The Wazirs in the Tochi Valley were soon subdued, but the Mahsuds fought with dogged obstinacy and great skill. There were two considerable encounters (on Dec. 21, 1919, and Jan. 14, 1920) with heavy British casualties. In the end the Mahsuds accepted the terms imposed upon them, and the military operations closed on May 7, 1920.

In Dec. 1919 the Montagu-Chelmsford scheme of constitutional reform became law by the passing of the Government of India (Amendment) Act. The King's proclamation of Dec. 23 dwelt in eloquent and arresting language on the political advancement conferred upon the Indian peoples, and the Duke of Connaught, in opening the new legislatures a year later, made an earnest appeal for a fresh start and a new spirit. Unfortunately by this time Gandhi and his followers had burned their boats.

Non-co-operation.—The publication in 1920 of the report of the committee of enquiry into the Punjab disturbances, and of the correspondence between the Government of India and the Secretary of State regarding its findings, and the subsequent debates in Parliament renewed the bitterness and indignation which the Amritsar proceedings had aroused in India. About the same time the terms of the Sèvres Treaty became known to Indian Mohammedans and added flame to the "Khilāfat" agitation, which the pro-Turk section of that community had been vigorously fomenting. In August Gandhi proclaimed in a letter to the Viceroy his adoption of non-co-operation as a remedy against a Government for which he retained "neither respect nor affection" on account of its "unscrupulous, immoral and unjust" action in the matter of the Caliphate and its failure to punish adequately the officials responsible for "the wanton cruelty and inhumanity" with which the disorders in the Punjab were suppressed.

On April 2, 1921, Lord Chelmsford laid down the office of viceroy and was promoted viscount. No viceroy had been more tried by circumstances beyond his control, and no viceroy had shown more steadfast courage or devotion to the ideals of his great office. The era will be a landmark in the history of modern India. It saw India started on the road to self-government and admitted on equal terms to a partnership in the British Empire.

MODERN TIMES

Lord Reading.—Arriving in April 1921, the Earl of Reading brought to the office of Governor-General a prestige, as a former Lord Chief Justice of England, not exceeded by that of any of his forerunners. The task which confronted him required all his courage and experience. Though the actual machinery of the new constitution had begun its work with relative smoothness, the country was seething with an excitement for which the political changes were merely a pretext. A moderate section of Indian leaders commanded the Councils and furnished ministers to the provincial Governments. But they owed their position to the boycott of the whole scheme by the extremist politicians, whether Hindus or Muslims, who had taken no part in the elections of the previous winter, and now held no place in the Councils or the Ministries. The real battle of India's future was being fought outside the domain of constitutional Government.

Gandhi, who had been appointed virtual dictator of the nationalist forces at the National Congress of Christmas 1920, was sweeping the country with his cry of non-violent non-co-operation. India would then be worthy of complete Home Rule, and a date (at first Sept. 30, 1921, but subsequently extended on several occasions) was actually prophesied for the disappearance of the British Government. The Treaty of Sevres was attacked as a device of England to humiliate her former friend and ally; and a movement of protest was engineered by the Khilāfat party, so called from their claim that the temporalities of the Sultan, as Khalifa of Islam, should be restored. It was in a struggle against this combination of forces that the first three years of Lord Reading's government were mainly spent.

The Moplah Rising.—In Aug. 1921 the most serious of many unpardonable deeds of violence broke out. The Malabar country in Madras is occupied by 2,000,000 Hindus and about 1,000,000 Moplahs, an ignorant Mohammedan peasantry of mixed Arab and Indian descent with an evil reputation for outbreaks of fanaticism. Among the latter the Khilāfat excitement flared into open rebellion. Railway and telegraph lines were cut, roads blocked, Government offices burned and a Moplah king proclaimed. The few Europeans who failed to escape from the district were brutally murdered, and then the Moplahs turned upon their inoffensive Hindu neighbours. They burned villages, sacked temples, outraged women, massacred and attempted wholesale the forcible conversion of the Hindus to Islam. Working through very difficult country, a strong military force ultimately crushed the rising in October. Gandhi and his lieutenants professed to belittle the outbreak, but it soon became apparent how gravely the Moplah atrocities rankled in the minds of the ordinary Hindus.

Visit of the Prince of Wales.—On Nov. 17, 1921 H.R.H. the Prince of Wales landed at Bombay for a visit to India which had been postponed in the preceding year. Efforts, partly successful, but frequently defeated by the Prince's arresting popularity, were made to boycott the public ceremonials arranged in his honour; yet the tour was courageously carried through. He rapidly traversed British India, carried through a heavy tale of ceremonies and interviews, visited several of the leading Indian States, as well as Nepal, inspected the northwest frontier, attended the Kadir Cup (pig-sticking meet) near Meerut, and finally left for England from Karachi in March.

During 1921 Gandhi had prepared a scheme of mass civil disobedience, both aggressive and defensive, and was on the eve of launching it, when on Feb. 4, 1922, another hideous outrage occurred. At the Chauri Chaura village, in the east of the United Provinces, 21 policemen and village watchmen were set upon by a mob of "volunteers" and excited peasants and battered to death or burned alive. Gandhi at once suspended his orders for civil disobedience, issued a new "constructive programme" which threw his followers into confusion, but he was at last arrested on March 10, 1922. Put on trial at Ahmadabad on three charges of spreading disaffection and instigating the overthrow of the Government, he pleaded guilty and was sentenced to six years' simple imprisonment. His trial produced no popular excitement. It was overshadowed by the resignation by E. S. Montagu of his office as Secretary of State, as a sequel to his having published, without Cabinet approval, a despatch from Lord Reading's Government, in which His Majesty's Government was urged, in deference to Mohammedan sentiment in India, to revise the Treaty of Sevres.

Unrest in the Punjab.—The spirit of non-co-operation, definitely on the wane elsewhere, was now penetrating the slow-moving Punjab, and the doctrine of non-violent obstruction to authority was bearing strange fruit on unlikely soil. For some years there had been a reforming movement among the Sikhs, directed at recovering a number of scattered temples of their religion from hereditary incumbents (Mahants) and employing their revenues for the spiritual service of the people generally. The puritan reforming section (Akalis) had got into the habit of taking the law into their own hands, and ejecting by violence the Mahants of whom they disapproved. The latter appealed to the courts, or engaged armed retainers to defend their property. In either case it was necessary for the Government to intervene; and it suited the employers of the Akali bands, adherents of the non-co-opera-

tion movement, to distort this intervention into hostility against the Sikh religion. All attempts by the Government to bring the Akali fervour into orderly channels were frustrated, and in 1922 the Akalis established such a reign of terror that military assistance had to be supplied to the police.

Extremists in the Councils.—At the end of 1923 came the second general election. A strong section of the Congress Party, adopting the label of Swaraj (Home Rule), broke away from Gandhi's programme of boycott and put up a mass of candidates for the councils. They secured nearly half the elected seats in the Central Assembly; and in at least two of the provinces they commanded the provincial councils. Their discipline was good, and they had entered the legislatures with the avowed object of "uniform, continuous and consistent obstruction with a view to make Government through the Assembly and the Councils impossible." In the central legislature, they concentrated on demanding that the grant of full responsible government should be expedited. When this was not endorsed by the Government, they retaliated, in coalition with a sufficient number of members of the other parties, by rejecting the Finance bill for the year, with the result that the Viceroy had to use his emergency powers and certify the necessary expenditure of the administration. The episode, however, and the subsequent conduct of the Nationalist Coalition during the remainder of the session, established them in the role of a constitutional opposition.

Lord Birkenhead on the Constitution.—In the summer of 1925, Lord Reading accepted an invitation from the Secretary of State for India (now the Earl of Birkenhead) to visit England for the purpose of personal discussion; the Governor of Bengal, Lord Lytton, officiating as Viceroy in his absence. This was the first exercise of a new Act enabling viceroys and provincial governors to obtain leave during their term of office. It was obviously desirable to announce a line of policy in answer to the protestations of the Nationalists that the 10-year period of experiment should be curtailed, and that the British Parliament ought not to impose its judgment as to the fitness of India for self-government. On July 10 accordingly Lord Birkenhead made a careful statement in the House of Lords, reviewed the working of the Reform Act of 1919, and emphasised the lack of co-operation and the actual hostility displayed by a section of the Indian leaders. He expressed his willingness to consider any practical scheme of advance on which Indians could agree, and he did not close the door to an antedating of the statutory inquiry due in 1929, if Indian leaders gave evidence of a sincere and genuine desire to work the present machinery. Fortunately there had been steady advance in agricultural prosperity. A short monsoon in 1920 necessitated considerable famine-relief operations in the succeeding year; but thenceforward a series of remarkably good harvests lowered prices and restored the contentment of the masses. The epoch of economic distress in 1920–21 had affected the manufacturing classes even more than the patient agriculturists. Labour trouble came to the front as never before, 1921 witnessing no fewer than 400 strikes of varying magnitude, and legislative measures of a new type began to appear on the statute book.

An amended Factory Act in 1922 prescribed a 60-hour week and raised the minimum age of child workers from nine to 12. A Mines Act in 1923 dealt with the employment of women and children below ground, restricted the hours of adult labour to 60 above ground and 54 below, and enacted a weekly day of rest. The first Workmen's Compensation Act came into force in 1924, and measures were undertaken for the regulation of trade unions and the settlement of industrial disputes. Besides these legislative measures, a quieter process was at work in the steady improvement of the depressing housing conditions in the large labour centres, such as Calcutta, Bombay and Cawnpore.

In the social organization of India change was slowly moving. The non-Brahmans of Madras struck against Brahman domination, and seized power in the new provincial legislature. The lowest strata of outcasts or "untouchables" showed signs of organizing for their protection and betterment, and Gandhi led a vigorous, if not a wholly popular, mission for their uplift. Some flutterings of a feminist movement were perceptible. An accomplished Indian lady, the poetess, Mrs. Sarojini Naidu, occupied the chair of the National Congress of 1925. Numerous ladies of the classes which formerly prided themselves on their seclusion are now to be met on political and other platforms, and some little progress is being made towards the recognition of the re-marriage of Hindu widows. Social progress, however, lags far behind political aspirations.

Anarchical Crime.—The inroads on the tranquillity of the country which ensued on extremist agitation unfortunately provided cover for a revival in Bengal of revolutionary crime on the familiar lines:—dacoities, looting, assassination and the intimidation of witnesses. Conspiracies multiplied in 1923; and early in 1924 an inoffensive Englishman was shot in the streets of Calcutta in mistake for a police official; the Bengal Provincial Conference in the following July passing a resolution laudatory of the "noble self-sacrifice" of the murderer. In Oct. 1924 came a special ordinance for dealing, by exceptional procedure of arrest and trial, with anarchical offences in the province; and among the earliest suspects against whom it was enforced were two members of the Bengal Legislative Council, and the chief executive officer of the Calcutta Municipal Corporation.

Not least among the anxieties of the time was the effect of political change on the public services which constitute the main structure of Indian administration. It was not only that members of the Indian Civil and other services found their position substantially altering, as they became transformed from the originators of policy into the subordinate executants of a quasi-parliamentary system. This was inevitable, but it was accompanied by virulent attacks from Indian politicians, who impugned the good faith of the services and made no secret of their desire to replace Englishmen by their own countrymen; and it was accentuated by the domestic anxiety which resulted from the growing cost of living, of passages to England and the like. Many valuable public servants retired prematurely, and the English universities soon stopped the supply of recruits of the type that had previously been available. In 1923 a royal commission was appointed to inquire into the whole problem. It recommended a large increase in the recruitment of Indians for the services, and the entrusting entirely to local Governments of recruitment for the "transferred" services. On the other hand, it advised several alleviations of the financial position of Europeans in the services, the adequate protection of the services in the execution of their duties, and the establishment of a Public Service Commission on the lines familiar in several of the Dominions.

Indians Abroad.—The Indian Relief Act of 1914 in the Union of South Africa and the outbreak of the war in the same year pushed into the background for a time the indignation felt in India about the treatment of its nationals in certain of the Dominions and Crown Colonies. But the grievance soon acquired increased impetus with the argument that Indian troops were considered good enough to fight by the side of forces from parts of the Empire which refused civic rights to Indians in peace time. Raised in a definite form at the Imperial Conferences of 1917 and 1918, the issue led to a "reciprocity agreement." Trouble revived, however, in various forms in Natal and the Transvaal, in East Africa and in Fiji; and the Imperial Conference of 1921 was again called into consultation. It passed a resolution to the effect that British Indians domiciled in another part of the Empire should be given recognition of their right to citizenship. South Africa, however, where it is estimated that 160,000 Indians are settled, declined to be a party to this declaration, and has uniformly urged its own responsibility for regulating the status of its inhabitants in its own interests. Trouble subsequently reached a dangerously acute point in Kenya, where at one time there seemed an imminent prospect of open hostilities between the British and the Indian settlers, and the whole question was again brought before the Imperial Conference in the same year. Four of the Dominions and the Colonial Office itself accepted the principle of consultation with the government of India on the status of Indians in the Dominions and Colonies; South Africa stood alone in refusing to hold out any hopes of the extension of the political rights of the Indian residents.

The North-West Frontier.—On the conclusion of the war which the new amir forced on India in 1919, there came clear evidence of a revival of Russia's old thrust towards India. It was with a view to fomenting revolutionary trouble in India that Bolshevik tentacles were pushed into Persia and Afghanistan; and when in 1921 a Russo-Afghan treaty was concluded, one of its chief features was the establishment of Russian consulates so near the Indian border as Kandahar and Jalalabad. The amir was not averse from playing off one of his neighbours against the other; and after inviting a mission from India to come to Kabul and negotiate an Anglo-Afghan treaty, he kept it dangling throughout 1921 before coming to final terms in November of that year. The conditions included the full independence of Afghanistan, and the opening of legations at London and Kabul.

Relations with the frontier tribes improved after the campaigns of 1919 and 1920; but in 1923 a gang of outlaws in Afghan territory was guilty of slaying two British officers near Landi Kotal, of shooting the wife and abducting the daughter (afterwards gallantly rescued) of an officer in Kohat cantonment, and of murdering another officer and his wife at Parachinar. Apart from the necessary punitive measures, the government of India initiated a permanent policy of controlling the Mahsud country, one of the chief storm-centres on the border. Dropping the plan of military occupation, they adopted a scheme of penetration of roads suitable for motor transport, guarded by local irregulars, and commanded by two strong posts at Raxmak and Manzai. Of even higher importance was the extension by five years of labour in the most forbidding country of the Khyber railway from Jamrud to Landi Khana; the first train through the Khyber Pass being run on Nov. 2, 1925.

Lord Irwin, Viceroy.—At the end of March 1926 Lord Reading laid down the office which he had filled with courage and distinction during a period of special difficulty. On retirement he received the high honour of promotion to Marquess: and he was succeeded by Lord Irwin of Kirby Moordale, a grandson of the Sir Charles Wood who had in 1854 sent out from the Board of Control an educational programme for India on which the existing system has largely been based. In spite of an earnest appeal for national unity with which the new Viceroy began his work, the year 1926 was marked by a greatly embittered continuance of the clash between Hindus and Mohammedans. The culminating point was the assassination by a Muslim fanatic of Swami Shradhananda, a much respected leader of Hindu orthodoxy who had headed a movement for the re-conversion of low-caste Hindus who had been absorbed by Islam. Apart from grave communal disturbances, 1926 was in politics the quietest year since the war. A Royal Commission on Indian Agriculture began its labours, and an important enquiry into the currency question was completed. As the result of long negotiations, visits and return visits by delegations from both sides, a settlement was reached on the grievances of Indians domiciled in South Africa: on its announcement in Feb. 1928 it was hailed by Gandhi, no mean authority on the subject, as an honourable compromise.

Events of 1927.—In January 1927 the new legislative palace at Delhi was formally opened and at once occupied. The third general election which was held in the preceding November had resulted in the grouping of the non-official members into three sections, the *Swaraj* or home-rule party, the nationalist party, and the Mohammedan *bloc*. The two former worked together in practice and in steady undiscriminating opposition to the government: the Mohammedans tended more and more to side with the government out of hostility to the Hindu combination: and the fortunes of government measures have been at the mercy of this fortuitous balance. The moderate or liberal element of earlier years has virtually disappeared: there is only a communal, and no real party, cleavage: and personal ambitions have played the chief part in dictating programmes. In the provinces the home-rule party did not secure its former ascendancy except in Madras: and the dyarchic system was re-established where it had been temporarily in abeyance. A noteworthy event was the election of a Madrasi lady by the legislative council of Madras as their vice-president; her membership of the council, however, was due, not to popular suffrage, but to nomination by the provincial government. In general administration 1927 had a comparatively uneventful record of slow progress battling against *swaraj* obstruction. The rupee, in accordance with the advice of Sir E. Hilton Young's commission, was fixed at an exchange value of approximately 18 pence: a number of minor fiscal reforms were effected as incidents in a prosperity budget: and substantial measures were taken to relieve the provinces of a cherished grievance in the form of their contributions to the central exchequer.

All other topics of interest were overwhelmed by the announcement in Nov. 1927 of the commission to enquire into the working of the constitution of 1919.

Revision of the Constitution.—It is a statutory body whose duty is to advise on what further progress, if any, towards self-government should be arranged on the results of the first ten years' working of the 1919 experiment. It was appointed by the British parliament, and consisted exclusively of members of parliament, under the chairmanship of Sir John Simon. Its eight members included no Indian, and no person with experience of Indian administration; the open mind being thus ensured. Wide and loud was the outcry with which the announcement was received. The exclusion of Indians from the commission was denounced as an insult to India: the whole claim of Great Britain to adjudicate on India's fitness for independence was sheer racial arrogance: and the commission was to be boycotted and rendered impotent. Since then all other public business has been caught up in the ebb and flow of the boycott movement. It secured the defeat, with other important government measures, of a bill for the creation of a Reserve Bank, which was to be the coping-stone of the new currency edifice.

The Simon Commission.—On Feb. 3, 1928, the Simon Commission landed at Bombay. Strenuous efforts were made to meet them with a display of national resentment, a *hartal* or closing down of business, and so forth: but the response of the people at large was inadequate. The Commission did not risk an organized boycott by holding a public enquiry at this stage, and contented themselves by touring India and collecting opinions privately. At the same time Sir John Simon made generous proposals for the regular association of Indian leaders with his work; and when the Commission returned to England in spring, the expediency of a boycott was arousing serious doubts in the nationalist camp. Further endeavours were also made to remove the causes of difference between Hindu and Muslim: and an "All Parties" conference was held at Delhi in February and March. As a result, the nationalists took up the challenge that they had never made any constructive contribution to the settlement of India's political future. A constitution and a declaration of rights were drafted: the constitution moved on the familiar lines of dominion status, provincial autonomy, and a federal system for the States; there was to be manhood and womanhood suffrage; and all elections were to be by joint mixed electoral rolls, with no reservation of seats for minorities. On this last point the scheme ship-wrecked. Its publication in August was followed by an immediate repudiation on the part of Mohammedans of practically every shade of political opinion. They declared communal electorates and the reservation of seats to be indispensable conditions of their joining in any demand for political advance. Excitement grew and was reflected, as usual, in a revival of sectarian riots and affrays. Meanwhile, the boycott crumbled, and all the provincial legislatures, with one exception, decided to co-operate with the Commission. While the Central Assembly hesitated on the same point, the Viceroy nominated a committee of its members to be associated in the enquiry. Accordingly, when Sir John Simon and his colleagues returned to India in the autumn to begin their public sittings, they found committees of both the central and the provincial legislatures ready to sit with them, for the examination of witnesses and consultation on their conclusions. (ME.)

INDIA, FRENCH, a general name for the French possessions in India—on the Coromandel coast, Pondicherry, Karikal and Yanaon; on the Malabar coast, Mahé and Calicut; and in Bengal, Chandernagore. There are a few "lodges" elsewhere, but they are merely nominal remnants of French factories. The total

area amounts to 203 sq.m., of which 113 sq.m. belong to the territory of Pondicherry. Pop. 42,725 (1926). The total population of the French possessions in India amounted in 1926 to 273,081 (estimate). Of these 92% were Hindus. These territories are found on the alluvial plains or in the neighbourhood of more or less important estuaries. The tropical vegetation is rich in valuable woods. Rice, cotton and earthnuts are cultivated and a few industries (oil works and weaving) arise out of the agricultural resources. The governor resides at Pondicherry, and is assisted by a private council. There are two tribunals of first instance (at Pondicherry and Karikal), one court of appeal (at Pondicherry) and five justices of the peace.

The first French expedition which was made to India is believed to have taken place in the time of Francis I. In his reign two ships were fitted out by some merchants of Rouen for trading in eastern seas, but they were never afterwards heard of. *La Compagnie des Indes* was formed under the auspices of Richelieu (1642) and reconstructed under Colbert (1664), sending an expedition to Madagascar. In 1667 the French India Company sent out another expedition, which reached Surat in 1668, where the first French factory in India was established. In 1741 Dupleix became governor of Pondicherry, and in 1744 war broke out between France and England. For the remaining history of the French in India *see* INDIA.

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INDIAMAN, a name applied early in the eighteenth century to the large sailing ships belonging to the East India Company (*q.v.*) which was chartered by Queen Elizabeth on Dec. 31, 1600, the last day of the sixteenth century. This charter conferred the sole right of trading with the East Indies, that is, with all countries lying beyond the Cape of Good Hope or the Straits of Magellan. The length of the voyages involved and the bulk and value of the cargoes called for excellent ships. To meet this need the East India Company in 1609 constructed a dockyard at Deptford on the Thames, thus bringing about, as Monson writes, "the increase of great ships in England." By Earl Grey's act of 1833, the activities of the East India Company were greatly curtailed; in 1858 the Company ceased to exist, and the history of the "Indiamen" came to a natural end.

See *Anson's Voyages*, III., vii., 365.

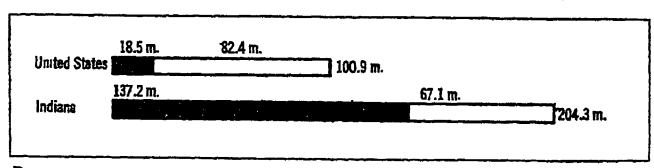
INDIAN, an adjective originally derived from India, and properly applied to the peoples and products of that country, but later, through a geographical and historical blunder, transferred to the peoples of the New World, especially of North America and the West Indian Islands but also in a lesser degree to the inhabitants of Central and South America. The beginning of this confusion between widely different races, separated by half the world, marks a turning point in history. The Turkish conquests of the middle of the fifteenth century had blocked the earlier route to India across the Isthmus of Suez, depriving Europe of the rich and lucrative Eastern trade. Christopher Columbus, among others, came to the conclusion that India might be reached by another route, by sailing westward instead of eastward. He knew that the world was round, but he underestimated its size, and at the same time overestimated the eastward extension of Asia. Therefore, when he began his memorable voyage on August 3, 1492, his purpose was to sail to India; and when, two months and nine days later, he sighted land, he was convinced that he had reached India, or an island off the coast of India. As a natural consequence, he thought and spoke of the natives as Indians, and the misnomer has ever since attached itself to the races of the New World, excepting the Eskimo. Many attempts to repair the original error have been made, as in the term, American Indian, with its abbreviation, Amerindian, but the confusion of names still persists. Thus Shakespeare's "Indian beauty" belonged to Asia, his "dead Indian" to America; Indian corn is a product of the New World, while Indian ink is a product of the Old.

The word Indian, meaning an attribute of India, is derived from the Sanskrit, *sindhu*, a river, and, in particular, the great river Indus. The European forms of the word are derived from the Persian *Hendu* and *Hind*.

INDIANA, popularly known as the "Hoosier State," is one of the north-central group of the United States of America, and the second State to be erected out of the old North-west Territory. It is located between lat. 37° 47′ and 41° 50′ N. and long. 84° 49′ and 88° 2′ W. Indiana is bounded on the north by Michigan and Lake Michigan, on the east by Ohio, on the south by Kentucky, from which it is separated by the Ohio river, and on the west by Illinois. In size Indiana ranks 37th among the States of the Union, its total area being 36,354 sq.m., of which 309 sq.m. exclusive of its Lake Michigan jurisdiction are water surface.

Physical Features.—Topographically, Indiana is similar to Ohio and Illinois, the greater part of its surface being undulating prairie land, with a range of sand-hills in the north and a chain of picturesque and rocky hills, known as "knobs," some of which rise to a height of 500 ft. above the surrounding country, in the southern counties along the Ohio river. This southern border of hills is the edge of the "Cumberland plateau" physiographic province. In the northern portion of the State there are a number of lakes of glacial origin of which the largest are English lake in Stark county, James lake and Crooked lake in Steuben county, Turkey lake and Tippecanoe lake in Kosciusko county and Lake Maxinkuckee in Marshall county. In the limestone region of the south there are numerous caves, the most notable being Wyandotte cave in Crawford county, next to Mammoth cave the largest in the United States. In the southern and south-central part of the State, particularly in Orange county, there are many mineral springs; the best known are French Lick and West Baden.

The larger streams flow in a general south-westerly direction, and the greater part of the State is drained into the Ohio through the Wabash river and its tributaries. The Wabash, which has a total length of more than 500 m., has its source in the western part of Ohio, and flows in north-west, south-west and south across the State, emptying into the Ohio river and forming for a considerable distance the boundary between Indiana and Illinois. Its principal tributaries are the Salamanie, Mississinewa, Wild Cat, Tippecanoe and White rivers. Of these the White river is by far the most important, being second only to the Wabash itself in extent of territory drained. It is formed by the confluence of its East and West Forks, almost 50 m. above its entrance into the Wabash, which it joins about 100 m. above the Ohio. Other portions of the State are drained by the Kankakee, a tributary of the Illinois; the St. Joseph and its principal branch, the Elkhart, which flow north through the south-west corner of Michigan and empty into Lake Michigan; the St. Mary's and another St. Joseph, whose



ROAD MILEAGE (OUTSIDE CITIES) ON DEC. 31, 1926, PER 100 SQ.M. OF LAND AREA, IN INDIANA, AS COMPARED WITH THE AVERAGE FOR CONTINENTAL U.S. THE BLACK SECTION REPRESENTS MILES OF SURFACE ROADS; WHITE SECTION, MILES OF EARTH ROADS

confluence forms the Maumee, which empties into Lake Erie; and the White Water, which drains a considerable portion of the south-west part of the State into the Ohio.

The soil of the greater part of the State consists of a drift deposit of loose calcareous loam, which extends to a considerable depth, and which is exceedingly fertile. In the Ohio and White Water river valleys a sandstone and limestone formation predominates. The north and north-central portions of the State, formerly rather swampy, have become since the clearing of the forest and drainage as productive as the south-central. The most fertile part of the State is the Wabash valley; the least fertile, the sandy region of small extent immediately south of Lake Michigan.

A large portion of the central and northern part and a considerable area in the south-west corner of Indiana have been included in drainage enterprises. About three-fourths of these enterprises were reported as having been organized for the purpose of draining land

that was swampy or so generally wet as to interfere with profitable cultivation. In 1920 54·3% of the total number of farms reported land having drainage. In the same year 8,308,844 ac. or 39·4% of the total farm-land was reported as provided with drainage and 1,717,068 ac. or 8·2% as needing drainage. The operating drainage enterprises in 1920 consisted of 17,470·7 m. of open ditch and 8,227·6 m. of tile drains, and represented a capital investment of $31,047,682.

Climate.—The climate of Indiana is unusually equable. The mean annual temperature is about 52° F, ranging from 49° in the north to 54° in the south. The mean monthly temperature varies from 25° in the months of December and January to 79° in July and August. Cold winds from the Great Lakes region frequently cause a fall in temperature to an extreme of −25° in the north and north-central parts of the State. The mean annual rainfall for the entire State is about 43 in., varying from 35 in. in the north to 46 in. in the Ohio valley.

Government.—Indiana is governed under a Constitution adopted in 1851, which superseded the original State Constitution of 1816. An amendment to the Constitution may be proposed by either branch of the general assembly; if a majority of both houses vote in favour of an amendment and it is favourably voted upon by the general assembly chosen by the next general election, the amendment is submitted to popular vote and a majority vote is necessary for its ratification. The Constitution of 1816 had conferred the suffrage upon all "white male citizens of the United States of the age of 21 and upward," had prohibited slavery and had provided that no alteration of the Constitution should ever introduce it. The new Constitution contained similar suffrage restrictions, and further by Article xiii., which was voted upon separately, prohibited the entrance of negroes or mulattoes into the State and made the encouragement of their immigration or employment an indictable offence. This prohibition was held by the United States Supreme Court in 1866 to be in conflict with the Federal Constitution and therefore null and void. It was not until 1881 that the restriction of the suffrage to "white" males, which was in conflict with the 15th amendment (1870) to the Federal Constitution, was removed by constitutional amendment. Suffrage is now granted to all citizens 21 years old and upward who have lived in Indiana six months immediately preceding the election, and in the township for at least 60 days.

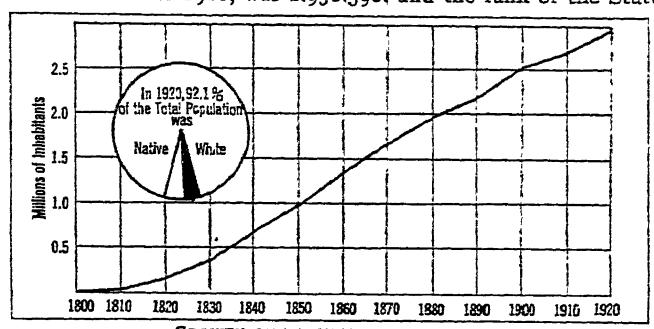
The Australian ballot was adopted in 1889. The general State election (up to 1881 held in October) takes place on the first Tuesday after the first Monday in November of even-numbered years. The governor and lieutenant governor (minimum age, 30 years) and the clerk of the supreme court are chosen in presidential years for a term of four years, the other State officers—secretary of State, attorney general, auditor, treasurer and superintendent of public instruction—every two years. The State legislature, known as the general assembly, which meets biennially in odd-numbered years and in special session summoned by the governor, consists of a senate of 50 members (minimum age, 25 years) elected for four years, and a house of representatives of 100 members (minimum age, 21 years) elected for two years. Two-thirds of each house constitute a quorum to do business. The governor has the veto power, but a bill may be passed over his veto by a majority of all elected members.

The judiciary consists of a supreme court of five members elected for districts by the State at large for a term of six years, an appellate court (first constituted in 1891) of six members elected for a term of four years and a system of circuit courts (75 in 1927) with judges elected for six years.

The system of local government has undergone radical changes in recent years. A law of 1899, aimed to separate the legislative and executive functions, provided for the election of legislative bodies in every township and county. These bodies have control of the local expenditures and tax levies, and without their consent the local administrative officers cannot contract debts. In 1905 a new municipal code, probably the most elaborate and complete local government act in the United States, providing for a uniform system of government in all cities and towns, went into effect. Its controlling principle was the more complete separation of the executive, legislative and judicial powers. For this purpose all cities are divided into five classes according to population, the power being concentrated and simplified by degrees in the case of smaller cities, and reaching a maximum of separation and completeness in class I.; *i.e.*, cities of 100,000 and over, which included only Indianapolis. In 1921 the system was amended so as to allow cities, at their option, to provide for city planning and to adopt the city manager or commission form of city government. Communities under 2,500 in population are regarded as towns, and have a separate form of government by a board of trustees.

SOCIO-ECONOMIC LIFE

Population.—The population of Indiana, according to the Federal census of 1920, was 2,930,390, and the rank of the State



GROWTH OF POPULATION 1800–1920

in the Union as regards population was 11th. The population as of July 1, 1928, was 3,176,000, as estimated by the U.S. census bureau. In 1810, the year following the erection of the western part of Indiana into Illinois Territory, the population was 24,520; in 1820 it had increased to 147,178; in 1850 to 988,416; in 1870 to 1,680,637; in 1890 to 2,192,404; in 1900 to 2,516,462; and in 1910 to 2,700,876. The density of population in 1920 was 81·3 to the sq.m.; in 1910, 74·9. The foreign-born white population in 1920 amounted to 150,868, or 5·3% of the whole, and the negro population to 80,810 or 2·8%. Of the foreign-born population Germans (37,377), Poles (17,791), Hungarians (9,351), Austrians (9,100) and English (8,522) were the most numerous. The urban population (in places over 2,500) was 50·6% of the whole in 1920, as against 42·4% in 1910. The six cities of Indiana with a population of 50,000 or more in 1920 were:

	1920	1910	Increase	Estimated 1928
			%	
Indianapolis . .	314,194	233,650	34·5	382,100
Fort Wayne . .	86,549	63,933	35·4	105,300
Evansville . .	85,264	69,647	22·4	98,100
South Bend . .	70,983	53,684	32·2	86,100
Terre Haute . .	66,083	58,157	13·6	73,500
Gary	55,378	16,802	229·6	89,100

Finances.—The total true receipts for the year ending Sept. 30, 1926, were $44,886,461. Of this amount the tax on property furnished $14,793,997, or 33% of the total; poll taxes, $540,198, or 1·2%; insurance taxes, $1,578,867, or 3·5%; inheritance taxes, $1,047,238, or 2·3%; gasolene taxes, $8,641,337, or 19·3%; Federal aid, $3,013,926, or 6·7%; fees, $8,070,624, or 18%; the remainder came from miscellaneous sources. The total true disbursements for the above period were $42,125,456. Of this amount, the chief disbursements were as follows: State department-schools, $6,597,304, or 15·7%; State highways, $12,375,512, or 5·4%; schools, $5,536,764, or 13·1%; universities and normal schools, $6,597,304, or 15·7%; State highways, $12,375,512, or 29·4%; gasolene fund, $2,462,694, or 5·9%; and benevolent institutions, $6,016,001, or 14·3%. The balance in the treasury on Sept. 30, 1926, was $12,218,960. The total State debt on the above date was $1,689,000, held as State bonds.

Education.—Indiana has a well-organized free public school system. Provision was made for such a system in the first State Constitution, by utilizing school lands set aside in all the Northwest Territory by the Ordinance of 1787, but the existing system is

of later growth. The first step toward such a system was a law of 1824 which provided for the election of school trustees in every township and for the erection of school buildings, but made no provision for support. Therefore, before 1850 what schools there were were not free. The Constitution of 1851 made further and more complete provisions for a uniform system, and on that basis the general school law of 1852 erected the framework of the existing system. It provided for the organization of free schools, supported by a property tax, and for county and township control. The movement, however, was retarded in 1858 by a decision of the supreme court holding that under the law of 1852 the system was not "uniform" as provided for by the Constitution. In 1865 a new and more satisfactory law was passed, which, with supplemental legislation, is still in force. Under the existing system administrative control is vested in a State superintendent elected biennially. County superintendents, county boards, city boards and township trustees are also chosen, the last possessing the important power of issuing school bonds.

In 1921 the State increased the tax for common school support as well as for the support of the higher educational institutions, and provision for teachers' pensions was enacted. There was a tax levy of five cents on each $100 of taxable property for the support of the higher educational institutions of the State, producing about $2,750,000, and a levy of a fraction of a cent for vocational education, which had been introduced by a law of 1913, producing yearly about $115,000. In 1925 the tax levy for higher education was repealed and the State schools received special appropriations. The expenditures for public elementary and secondary schools in 1925 were $60,288,000 as compared with $35,764,000 in 1920; the *per capita* expenditure based on population 5–17, inclusive, was $82.14 and $50.18, respectively. The proportion of illiterates is very small; in 1920 only 2·2% of the population (of 10 years old or over) were unable to read and write. Of the total public school enrolment (642,496) in 1925, 518,637 were in the kindergarten and elementary grades and 123,859 in secondary schools.

The average number of days attended per year per pupil enrolled increased from 125·8 in 1920 to 164·5 in 1925. School attendance has been compulsory since 1897.

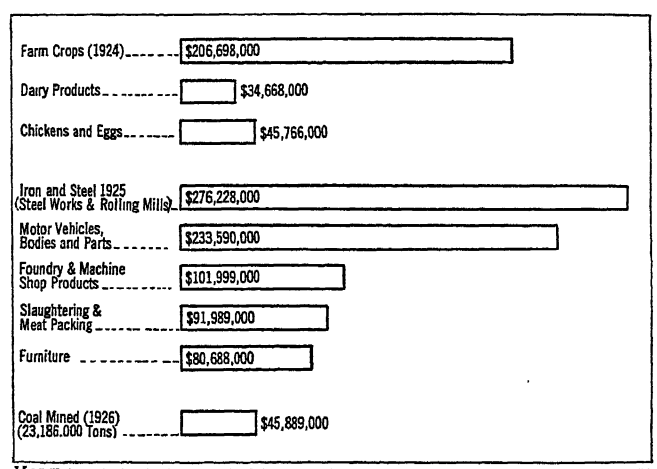
The State-supported institutions for the training of teachers are the State normal school (organized 1870) at Terre Haute and the Ball Teachers' college (organized 1918) at Muncie. Other normal schools, which are on the State's "accredited" list but not supported by it, are the Central normal college at Danville and the Teachers' College of Indianapolis at Indianapolis. A State college was opened in 1824 at Bloomington; it was rechartered in 1838 as Indiana university. Purdue university (organized 1869) at Lafayette is the State's school of agriculture and mechanical arts. It received the benefit of the Federal land grants under the Morrill and subsequent acts. In 1927 there were 19 non-State supported educational institutions of college rank within the State. The better known of these included the University of Notre Dame (1842, Roman Catholic) at Notre Dame; DePauw university (1837, Methodist Episcopal) at Greencastle; Butler college (1855, Christian) at Indianapolis; Wabash college (1832, non-sectarian) at Crawfordsville; and Valparaiso university.

Charities and Correction.—The charitable and correctional institutions of Indiana are well administered and form one of the most complete and adequate systems possessed by any State in the Union. The State was one of the first to establish schools for the deaf and the blind. The State School for the Deaf was established in 1844, and the School for the Blind in 1847, both being in Indianapolis. The first State hospital for the insane was opened in Indianapolis in 1848 and became the Central State hospital in 1883; other similar institutions are the Logansport State hospital at Logansport, the Richmond State hospital at Richmond, the Evansville State hospital at Evansville, and the Madison State hospital at North Madison. Institutions for the feeble-minded include the School for Feeble-minded Youths at Ft. Wayne, the Farm Colony for Feeble-minded at Butlerville, and the Village for Epileptics at Newcastle. There is a State Soldiers home at LaFayette, a Soldiers and Sailors Orphans' home at Knightstown, a State sanatorium at Rockville and the Indiana University hospitals at Indianapolis. There are six correctional and penal institutions: the Boys' school at Plainfield, the Girls' school at Indianapolis, the prison for women at Indianapolis, the State reformatory at Pendleton, the State prison at Michigan City and the State farm at Putnamville. Indiana has a habitual-criminal law, and a law providing for the sterilization of mental degenerates, confirmed criminals and rapists. There are also an adult probation law and a juvenile court law, the latter applying to every county in the State. Each of the State institutions mentioned above is under the control of a separate bipartisan board. The whole system of public charities is under the supervision of a bipartisan board of State charities (1889), which is appointed by the governor.

INDUSTRIAL ACTIVITY

Industry, Trade and Transportation.—Agriculture has always been an important industry of the State of Indiana: According to the 1925 census of agriculture, the farm population was 798,157, or 25·8% of the total population. In 1920 the farm acreage was 21,063,000, or 91·3% of the total land area; by 1925 the acreage had decreased to 19,915,000, or 86·3% of the total area. The actual acreage of crop land in 1925 was 11,981,000, and 10,616,000 ac. produced crops for harvest. The number of farms has also shown a steady decrease since 1900. In 1925 the total number of farms was 195,789 as compared with 205,126 in 1920 and 221,897 in 1900. The value of all farm property increased rapidly during the World War period, reaching a value of $3,042,311,000 in 1920; by 1925 the total value of all farm property had decreased to $1,931,742,000. The proportion of farms rented comprised 29·2% of the whole number. The average size of farms, which in 1850 was 136·2 ac., was 101·7 ac. in 1925.

Indiana was 16th in the value of its farm crops in 1926, the total product being valued at $225,000,000. The principal crops in which the State has maintained a high relative rank are Indian corn, oats, rye and hay; the acreage devoted to oats and rye has increased considerably since 1910. In 1926, according to the Department of Agriculture, the acreage of Indiana corn was 4,672,000 (6th of the States), and the yield was 170,085,000 bu. (4th of the States); of wheat, 1,703,000 ac. (12th of the States)



VALUE OF ANNUAL OUTPUT OF CERTAIN IMPORTANT PRODUCTS. THE AGRICULTURAL ITEMS ARE FOR 1924, THE MANUFACTURES FOR 1925 AND COAL FOR 1926

were planted, and the crop was 34,048,000 bu. (9th of the States); from the 2,234,000 ac. (6th of the States) devoted to oats the yield was 67,020,000 bu. (7th of the States); the 2,015,000 ac. of hay produced 2,536,000 tons.

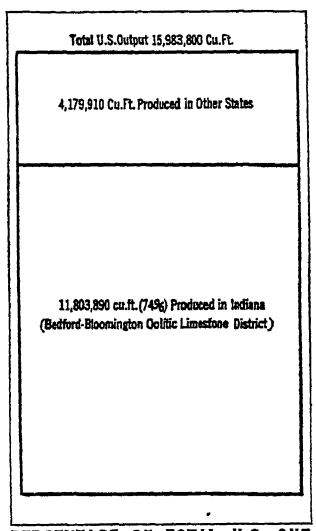
Other important staple crops were potatoes, rye and barley, of which the crops in 1926 were respectively 3,840,000 bu., 2,102,000 bu. and 925,000 bu. The tobacco crop in 1926 was 14,913,000 lb. valued at $1,491,000. In the production of onions (2,539,000 bu.) the State ranked second only to New York; in the acreage devoted to the commercial tomato crop, Indiana ranked first. Orchards in 1926 produced 4,100,000 bu. of apples, 900,000 bu. of peaches and 328,000 bu. of pears. The canning industry both

for fruits and vegetables is valuable ($31,674,387 in 1925).

The number of live-stock reported on Jan. 1, 1927, was 533,000 horses, valued at $42,816,000; 98,000 mules, valued at $8,381,000; 699,000 sheep, valued at $7,138,000; 2,764,000 swine (6th in rank among the States), valued at $46,988,000; and 1,308,000 cattle, valued at $66,456,000.

Indiana ranked 12th in value of mineral products for 1925. The production in the above year showed an increase of 111.8% over the corresponding figures for 1919. The chief products, in order of value in 1925, were: coal, cement, stone and clay. The 22,839,000 tons of coal produced in 1926 represented, in value, about 50% of the total mineral products of the State. Indiana continued to rank 6th among the States of the Union as a producer of coal. The coal-producing area of the State is part of the eastern-interior coal-field which extends into Illinois and Kentucky and covers approximately 7,500 sq.m. in 22 counties in the south-western part of Indiana. The deposit consists of workable veins, 50 to 220 ft. in depth, and averaging 80 ft. below the surface. It is a high-grade block, or "splint" coal, remarkably free from sulphur and rich in carbon, peculiarly adapted to blast-furnace use. The limestone industry was second in importance. The chief enterprises were in the Bedford-Bloomington district in Lawrence and Monroe counties. This district produced about 70% of the limestone used in the United States for building, the 1924 output being 3,824,440 tons, valued at $17,269,407. Indiana oolitic limestone is used in nearly every State and also abroad. Beds of brick-clays and potters' clay are widely distributed throughout the State, the total value of clay products in the year 1925 being $18,037,932. Marls adapted to the manufacture of Portland cement are found along the Ohio river, and in the lake region of the north. Sand and gravel in 1925 had a value of $5,275,743.

The petroleum and natural gas industries were once of great importance in Indiana. In 1906 the State ranked 5th in the Union in the value of natural gas produced and 6th in petroleum; in 1926 the State's rank was 14th and 17th respectively. The natural gas production in 1925 (1,168,000,000 cu.ft.) showed a slight increase over that of preceding years, while the petroleum production for the foregoing year (829,000 bbl.) showed a decrease. The industry is located in two fields, the Lima-Indiana field in east-central Indiana, which extends into Ohio, and the south-western Indiana field, which is continuous with the Illinois field. There are many mineral springs in the State, and there are famous resorts at French Lick and West Baden in Orange county. A large part of the water bottled is medicinal. In 1923 500,064 gal. of mineral water, valued at $152,082, were sold. The total mineral production of the State in 1925 had a value of $111,833,732.



PERCENTAGE OF TOTAL U.S. OUTPUT OF BUILDING LIMESTONE (1925) QUARRIED IN INDIANA

In the value, extent and producing power of her manufacturing industries Indiana has advanced rapidly. This was largely due to excellent transport facilities, to the discovery and development of natural gas and an abundant coal supply. The number of manufacturing establishments in the State was 8,022 in 1914, 4,772 in 1925; the number of wage-earners was 197,503 in 1914 and 280,854 in 1925, an increase of 42.2%; and the value of their total product was $730,795,000 in 1914 and $2,125,023,000 in 1925, an increase of 190.8%. As compared with other States of the Union in value of manufactured products, Indiana ranked 9th in 1925. The most important manufactured products in 1925 were iron and steel, valued at $334,236,625 ($67,008,451 for blast-furnace products and $267,228,174 for steel and roller-mill products). Next in importance was the manufacture of motor vehicles ($179,510,952) and motor vehicle parts ($54,078,861). Other manufactured products exceeding $30,000,000 in value in 1925 were: those of machine shops and foundries, $101,999,155; slaughtering and meat-packing, $91,988,643; furniture, $80,687,630; electrical machinery and apparatus, $77,555,648; electric and steam railway cars, $59,024,272; construction in steam railway repair shops, $57,073,134; coke, not including gas-house production, $44,721,218; flour and grain mill products, $41,484,262; glass, $36,199,554; canned fruits and vegetables, $31,674,387; butter, cheese and condensed milk, $30,231,115; and bread and bakery products, $30,223,581. The most important manufacturing centres were Indianapolis, South Bend, East Chicago, Gary, Ft. Wayne, Evansville, Hammond, Anderson, Muncie, Michigan City, Mishawaka, Elkhart, Kokomo, Marion, La Porte and Terre Haute, each having a gross annual product of more than $20,000,000. Indianapolis, with a product valued at $344,924,907, was by far the chief industrial centre. It was the centre of the slaughtering and meat-packing industry and the printing and publishing of newspapers and periodicals; it was also an important centre for the motor vehicle, furniture and foundry industries. The cities of East Chicago, Gary and Hammond were the centre of the State's iron and steel industry. South Bend was the principal manufacturing centre of Indiana's motor vehicle and clock and watch industries.

During the early period, the settlement of the northern and central portions of the State was greatly retarded by the lack of highways or navigable waterways. The Wabash and Erie canal (1843), which connected Lake Erie with the Ohio river, entering the State in Allen county, east of Ft. Wayne, and following the Wabash river to Terre Haute and the western fork of the White river from Worthington, Greene county, to Petersburg, Pike county, whence it ran south-south-west to Evansville; and the White Water canal from Hagerstown, Wayne county, mostly along the course of the White Water river, to Lawrenceburg, on the Ohio river, in the south-eastern corner of the State, although now abandoned, served an important purpose in their day. The completion (about 1850) of the national road, which traversed the State, still further aided the internal development. With the beginning of railway construction (about 1847), however, a new era was opened. Indiana is unusually well served with railways, which form a veritable network of track in every part of the State. It is traversed by nearly all the great transcontinental trunk-line systems, and also by important north and south lines. The total railway mileage in Jan., 1925, was 7,187 miles. This figure represents a slight decrease from the 7,479 m. in operation in 1915. There was great development also in interurban electric lines, which have been adapted both to passenger and to light freight and express traffic; in 1925 there were 28 street and interurban electric lines within the State with a mileage of 2,485. The State highway system under the control of the highway commission was, on Jan. 1, 1927, 4,263 m., of which 4,155 m. were surfaced. During 1926 376.7 m. of new surfacing were laid. The annual expenditures for rural highways under the supervision of the State highway department increased rapidly from the $401,000 spent in 1919 to $14,920,000 in 1924 and $14,518,000 in 1925.

History.—Of the prehistoric inhabitants of Indiana little is known, but extensive remains in the form of mounds and fortifications abound in every part of the State. Upon the earliest arrival of Europeans the State was inhabited chiefly by the various tribes of the Miami confederacy, a league of Algonquin Indians formed to oppose the advance of the Iroquois. The first Europeans to visit the State were probably French *coureurs de bois* or Jesuit missionaries. Apparently a French trading-post was in existence on the St. Joseph river of Michigan about 1672, but it was in no sense a permanent settlement. It also seems probable that the Wabash-Maumee portage was known to Father Claude Jean Allouez as early as 1680. A few years later this portage came to be generally used by traders, and the necessity of establishing a base on the upper Wabash as a defence against the Carolina and Pennsylvania traders became evident; however, the first perma-

nent settlement was not made until well into the 18th century. The military post at Vincennes was founded about 1731 by François Margane, Sieur de Vincennes (or Vincent), but it was not until about 1735 that eight French families were settled there. Vincennes, which thus became the first actual white settlement in Indiana, remained the only one until after the Revolutionary War, although military posts were maintained at Ouiatenon and at the head of the Maumee, the site of the present Ft. Wayne, where there was a French trading-post (1680) and later Ft. Miami. After the fall of Quebec the British took possession of the other forts, but not at once of Vincennes, which remained for several years under the jurisdiction of New Orleans, both under French and Spanish rule. The British garrisons at Ouiatenon and Ft. Miami (near the site of the later Ft. Wayne) on the Maumee were captured by the Indians as a result of the Pontiac conspiracy. All Indiana was united with Canada by the Quebec act (1774), but it was not until three years later that the forts and Vincennes were occupied by the British, who then realized the necessity of ensuring possession of the Mississippi valley to prevent its falling into the hands of the rebellious Colonies. Nevertheless, in 1778 Vincennes fell an easy prey to agents sent to occupy it by George Rogers Clark (*q.v.*), and although again occupied a few months later by the British under Gen. Henry Hamilton, the lieutenant governor at Detroit, it passed finally into American control in Feb., 1779, as a result of Clark's remarkable march from Kaskaskia. Ft. Miami remained in British hands until the close of the war.

The first American settlement was made at Clarksville, between the present cities of Jeffersonville and New Albany, at the Falls of the Ohio (opposite Louisville), in 1784. The decade following the close of the Revolutionary War was one of ceaseless Indian warfare. The disastrous defeats of Gen. Josiah Harmar (1753–1813) in Oct., 1790, on the Miami river in Ohio, and of Gov. Arthur St. Clair on Nov. 4, 1791, near Ft. Recovery, O., were followed in 1792 by the appointment of Gen. Anthony Wayne to the command of the frontier. By him the Indians were signally defeated in the battle of Fallen Timbers (or Maumee Rapids) on Aug. 20, 1794, and Ft. Wayne, Ind., was erected on the Maumee river. On Aug. 3, 1795, at Greenville, O., a treaty was concluded between Wayne and 12 Indian tribes, and a narrow slice of the east-south-eastern part of the present State (the disputed lands in the valley of the Maumee) and various other small but not unimportant tracts were ceded to the United States. Then came several years' respite from Indian war, and settlers began at once to pour into the region. The claims of Virginia (1784) and the other eastern States having been extinguished, a clear field existed for the establishment of Federal jurisdiction in the "Territory North-west of the Ohio," but it was not until 1787 that by the celebrated ordinance of that year such jurisdiction became an actuality. In 1800 the North-west Territory was divided, and from its western part (including the present States of Indiana, Illinois and Wisconsin, the north-east part of Minnesota, and a large part—from 1803 to 1805 all—of the present State of Michigan) Indiana Territory was erected, with Gen. William Henry Harrison as first governor, and Vincennes as the seat of government. Harrison made many treaties with the Indians, the most important being that signed at Ft. Wayne on June 7, 1803, defining the Vincennes tract transferred to the United States by the Treaty of Greenville; those signed at Vincennes on Aug. 18 and 27, 1804, transferring to the United States a strip north of the Ohio river and south of the Vincennes tract; that concluded at Grouseland on Aug. 21, 1805, procuring from the Delawares and others a tract along the Ohio river between the parcels of 1795 and 1804; and the treaties of Ft. Wayne, signed on Sept. 30, 1809, and securing one tract immediately west of that of 1795 and another north of the Vincennes tract defined in 1803. In Jan., 1805, Michigan Territory was erected from the northern part of Indiana Territory, and in the following July the first general assembly of Indiana Territory met at Vincennes. In March, 1809, the territory was again divided, Illinois Territory being established from its western portion; Indiana was then reduced to its present limits. In 1810 began the last great Indian war in Indiana, in which the confederated Indians were led by Tecumseh, the celebrated Shawnee chief; it terminated with their defeat at Tippecanoe (the present battle ground) by Gov. Harrison on Nov. 7, 1811. After the close of the second war with Great Britain, immigration began again to flow rapidly into the territory, and, having attained a sufficient population, Indiana was admitted to the Union as a State by joint resolution of Congress Dec. 11, 1816. The seat of government was established at Corydon, whither it had been removed from Vincennes in 1813. In 1820 the site of the present Indianapolis was selected for a new capital, but the seat of government was not removed thither until 1825.

The first great political problem presenting itself was that of slavery, and for a decade or more the only party divisions were on pro-slavery and anti-slavery lines. Although the Ordinance of 1787 actually prohibited slavery, it did not abolish that already in existence. Slavery had been introduced by the French, and was readily accepted and perpetuated by the early American settlers, almost all of whom were natives of Virginia, Kentucky, Georgia or the Carolinas. According to the census of 1800 there were 175 slaves in the Territory. It was but natural, therefore, that efforts should at once have been made to establish the institution of slavery on Indiana soil, and as early as 1802 a convention, called to consider the expediency of slavery, asked Congress to suspend the prohibitory clause of the ordinance for ten years, but a committee of which John Randolph of Virginia was chairman reported against such action. Within the Territory attempts to escape the effects of the ordinance led to the enactment of a law regulating the status of "servants" and another which established a system of indenture. By 1808 the opponents of slavery, found chiefly among the Quaker settlers in the south-eastern counties, began to awake to the danger that confronted them, and in 1809 elected their candidate, Jonathan Jennings (1776–1834), to Congress on an anti-slavery platform. In 1810, by which year the number of slaves had increased to 237, the anti-slavery party was strong enough to secure the repeal of the indenture law, and the State Constitution of 1816 pronounced strongly against slavery. The liberation of most of the slaves in the eastern counties followed; and some slave-holders removed to Kentucky. In 1830 there were only three slaves in the State, and the danger of the establishment of slavery as an institution on a large scale was long past.

The problem of "internal improvements" came to be of paramount importance in the decade 1820–30. In 1827 Congress granted land to aid in the construction of a canal to connect Lake Erie and the Ohio river. This canal was completed from the St. Joseph river to the Wabash in 1835, opened in 1843 and later abandoned. In 1836 the State legislature passed a law providing for an elaborate system of public improvements, consisting largely of canals and railways. The State issued bonds to the value of $10,000,000, a period of wild speculation followed, and the financial panic of 1837 forced the abandonment of the proposed plan and the sale to private persons of that part already completed. The legislature authorized the issue of $1,500,000 in Treasury bonds, which by 1842 had fallen in value to 40 or 50% of their face value. A new Constitution was adopted in Feb., 1851, by a vote of 109,319 against 26,755.

Despite its large Southern population, Indiana's answer to President Lincoln's first call for volunteers at the outbreak of the Civil War was prompt and spirited. In all the State furnished 208,000 officers and men for the Union armies, besides a home legion of some 50,000, organized to protect the State against possible invasion. The efficiency of the State military organization as well as that of the civil administration during the trying years of the war was largely due to the extraordinary ability and energy of Gov. Oliver P. Morton, one of the greatest of the "war governors" of the North. The problems met and solved by Gov. Morton, however, were not only ones of furnishing troops as required. The legislature of 1863 and the State officers were opposed to him politically, and did everything in their power to thwart him and deprive him of his control of the militia. The Republican members seceded, legislative appropriations were blocked, and Gov. Morton was compelled to take the extra-constitutional step of arranging with a New York banking-house for the payment of

the interest on the State debt, of borrowing money for State expenditure on his own responsibility, and of disbursing money in disregard of the State officers.

Furthermore Indiana was the principal centre of activity of the disloyal association known as the Knights of the Golden Circle or Sons of Liberty, which found a ready growth among the large Southern population. The Knights of the Golden Circle at first confined their activities to the encouragement of desertion and resistance to the draft, but in 1864 a plot to overthrow the State Government was discovered, and Gov. Morton's prompt action resulted in the seizure of a large quantity of arms and ammunition, and the arrest, trial and conviction of several of the leaders. In June, 1863, the State was invaded by Confederate cavalry under Gen. John H. Morgan, but most of his men were captured in Indiana and he was taken in Ohio.

Politically Indiana has been rather evenly divided between the parties. Before the Civil War, except when William Henry Harrison was a candidate for the presidency, its electoral vote was generally given to the Democratic Party, to which also most of its governors belonged. After the war the control of the State alternated between the Republican and Democratic Parties. In legislation the State has been more progressive. Laws were passed establishing the direct primary for State nominations (1915), labour protection (1915), a State prohibition act (1917), a highway commission (1917), a system of State parks (1919) and a State budget system (1921).

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INDIANA, a borough in the west central part of Pennsylvania, U.S.A., 46m. N.E. of Pittsburgh; the county seat of Indiana county. It is on Federal highways 119 and 422, and is served by the Buffalo, Rochester and Pittsburgh and the Pennsylvania railways. The population in 1920 was 7,043 (95% native white) and was estimated locally at 10,000 in 1928. Indiana is beautifully situated in the foot-hills of the Alleghenies, and is in the midst of an important coal-field. It has an extensive trade, is the chief shipping point and shopping centre for the county, and there are glass works and other manufacturing industries. The Indiana State Teachers' college (opened 1875) has an enrolment of over 1,300.

INDIAN AND SINHALESE ART AND ARCHAEOLOGY. Indian religion and ritual exist in two forms, known to Indians as the Vedic and the Āgamic traditions, but more often designated by western scholars as respectively Āryan and Brahmanical, and Dravidian (Southern) and popular. Vedic (Āryan) religion consisted in a worship of the great powers of nature by means of hymns and sacrifices (*yajña*), without any use of temples or images, or any devotional cult properly so to be described. On the other hand, the much older and quantitatively predominant element of the population worshipped local and tutelary deities, powers of nature conceived as personal beings; these deities included the Yakṣas (genii, tree-spirits, sources of life and abundance), Nāgas (dragons, spirits of springs and lakes), and innumerable goddesses of fecundity or disease, the Śaktis of later Hinduism. To this Āgamic tradition belonged an elaborate cosmology, many myths, the doctrines of reincarnation and acts (*saṁsāra* and *karma*), the practice of asceticism (*sannyāsa*) and ecstatic meditation (*yoga*), which appear only late in Vedic literature.

Significance and Character.—The indigenous divinities were worshipped with devotion (*bhakti*) as personal beings, with a ritual (*pūjā*, a non-Āryan word referring to the anointment of sacred objects) which included offerings of flowers, food, lights and incense; and for this ritual images and temples, though of impermanent materials, wood and clay, must have been in use from a very early period.

The Vedic culture is gradually penetrated by indigenous belief and closes with the reactionary teachings of the Upaniṣads and Buddhism, where *yajña* is discounted, *pūjā* not considered, the goal is Release, the means is Knowledge. Meanwhile there was developing a higher and inclusive devotional theism, in which the indigenous deities are fused with those of the Vedas, and interpreted in the light of philosophic and psychological speculation. The great system (*see* HINDUISM) thus built up, sanctioned on the one hand by scripture and on the other by popular belief, became a truly national vehicle of thought; Hindu theology and myth, in verbal and visual expression, provided means of statement for all that was felt and thought about the soul of man and the nature of the universe. At the same time, new divinities came into being, amongst others the Buddha himself; for the prevailing tendency involved in iconolatry, cult and ritual even such systems as those of Buddhism and Jainism which had originated as purely psychological and ascetic disciplines.

For some centuries before and after the beginning of the Christian era the dominant mode of creative thought was theological; and we must realize that all the arts were governed by a great enthusiasm like that of the cathedral builders of mediaeval Europe, and in all enduring aspects and in their greatest splendour, in the service of the churches, upon whose endowment and adornment was lavished enormous wealth.

Long after the first creative impulses had been crystallised in the mediaeval period, there can still be traced successive developments of thought and feeling, modifications and elaborations of the older iconography, with the result that India, despite the destruction wrought by Mohammedan invaders, is even to-day covered with magnificent temples and a wealth of sculpture in which the spiritual and material history of two millenniums are visibly recorded. Further, the same initial impulses, translated to other lands and moulded by the imagination of other races, Pyu, Thai, Khmer, Malay and Polynesian, created other and scarcely less significant and varied cycles of art in Further India and Indonesia, and influenced profoundly the spiritual and artistic development of Central Asia, China, Korea and Japan.

Thus Indian art is essentially a hieratic art devoted to the exposition of the personality and acts of deities, and providing for their service. Authoritative texts declare that the making of images of deities leads to heaven, not the making of likenesses of men; that only that which accords with the canons is beautiful in the eyes of the discerning, not that which pleases individual fancy.

Hieratic Art.—But while Indian works evoke aesthetic experiences when beheld by alien eyes, Indian and European art are not identical in kind; the intention is different. Nor is there identity of method. In its main development, sculpture and architecture, Indian art was not produced with a view to aesthetic experience, nor even regarded as "art." Images, in particular, were not regarded as works of art but as means (*sādhanā*) of edification.

An image is a piece of apparatus (*yantra*) employed in personal devotions, the object of which is an identification in consciousness of worshipper and deity. In the words of a well-known text, the deity can only be worshipped (in spirit and in truth) in so far as the worshipper becomes the deity. For this spiritual exercise *yantras* of two kinds are employed, one purely geometrical and linear, the other three-dimensional and more or less anthropomorphic or theriomorphic. Both types are alike in kind; both are equally externalisations of mental visions evoked in *dhyāna* with a view to *samādhi*.

The obtaining of this mental visualisation (which is more essential than its material realisation) is a process of *yoga*.

Such a visualisation differs from those present in normal vision: it is more vivid; it fills the whole field of view; all parts are equally and simultaneously present; the relation of these parts is not organic, nor on the other hand accidental, but ideally determined; such an image can only represent a condition of being, or to use a more strictly Indian term, a type of activity.

Such an image is not a memory image, which is the foundation

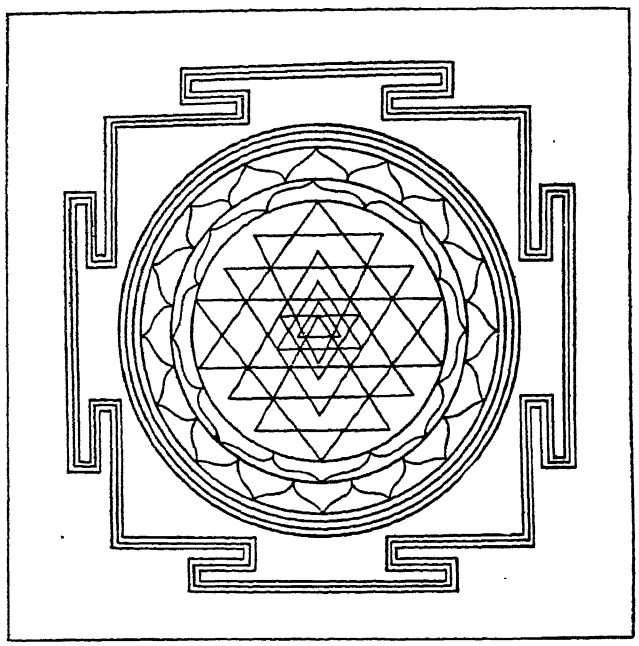


FIG. 1.—YANTRA, A DIAGRAM FOR WORSHIP

of all realistic art, inasmuch as time passes between the moment of vision and that of execution.

What may at first sight look like the observation of nature at Amarāvatī or Ajaṇṭā, is simply the most vital and the most felt part of Indian art, where the worshipper attains the most complete *samādhi*, the artist is most completely and literally identified with his subject. Critically examined, this art reveals no knowledge of anatomy, but rather a deep understanding of life, of emotion, and of the language of gesture, long codified in the *Nāṭya Śāstra*. (*See* DANCE IN INDIA.) Nor are its themes confined to those set forth in terms of human life; side by side with these are dogmatic and mythological forms unparalleled in nature.

Narrative and Decorative Art.—A part of Indian art is secular. There exist, beside the cult image, both narrative arts, and an Industrial Art, or Arts and Crafts. The narrative art such as is used to illustrate *Jatākas* or the Epics or the Kṛṣṇa legend is not hieratic to the same degree as the cult image, but a dramatic presentation comparable to the stage. It is nevertheless governed by principles similar to those which determine the nature of the cult image: the use of formulae is general, and the part of the spectator quite distinct from that of mere perception. A typical peculiarity of Indian (and in general Oriental) art is the kind of perspective known as vertical projection, whereby the landscape is presented as seen from a height, so that the horizon almost reaches the upper edge of the frame; the planes are differentiated in the sense that an object or figure behind another is represented as above it, while the atmosphere, apparently reduced to the narrow space remaining above the horizon, is really brought forward to embrace the whole representation together with the spectator.

Although in Sanskrit literature we hear much of portraits of individuals recognized as likenesses, these are invariably drawn from memory, in the absence of the model, so far at least as the actual references inform us.

Further, Indian art reveals nothing like *genre*. The nude, for example, while sometimes represented with a frankness disconcerting to European eyes, is never studied or treated for its own sake, as in European art, and only appears as symbolism or narrative may require. In the same way landscape is never represented for its own sake.

Thus the narrative art of India is of the same kind as the purely hieratic art. All true pattern is of this kind; this is especially evident in its repetitive character and in a mathematical rather than organic relation of the parts. Accordingly, the industrial and "decorative" arts in India cannot be sharply divided from the "higher" arts. In both, design and formula, rather than imitative shapes, are found; definite meanings are present in both, for Oriental ornament is never originally without, and very rarely loses, a precise significance, and is never "merely" decorative.

A Theory of Beauty.—India developed as a means of literary criticism a theory of aesthetic experience of considerable importance in the history of aesthetic theory.

A work of art is a statement informed by flavour (*rasa*); there are nine such flavours, the Erotic, Heroic, Odious, Furious, Terrible, Humorous, Wondrous, Pathetic and Peaceful. The component elements of a work of art (physical stimulants of aesthetic experience) are Determinants (*vibhāva*, theme, etc.), Consequents (*anubhāva*, deliberate actions), Moods (*bhāva*, thirty-three transient, *e.g.*, joy, impatience, and nine permanent, viz., the nine *rasas* listed above), and Involuntary Emotional Conditions (*sattvabhāva*).

Aesthetic experience (*rasāsvādana*) is the tasting of *rasa*, and depends mainly on the innate and acquired sensibility of the spectator (*rasika*). To appreciate the art of India from the standpoint of life it must be studied not only from this point of view as form, but also as meaning and with reference to use.

The Artist.—A general term covering both sculpture, reliefs and painting is *citra;* this word can also be used in a more restricted sense with reference to painting only. *Śilpa* is the practical activity of the craftsman, rather than "art" in a modern sense. The artist or craftsman is designated as *śilpin, sthapati, karmāra, rūpa-kāra, citra-kāra*, etc. The higher craftsmen practise many arts; an architect, for example, will also be a sculptor, bronze founder and goldsmith. On the other hand workers in iron, weavers, potters and the like are restricted to a single craft. No artist is solely a designer, like a modern architect; the Indian architect is, during the greater part of his life, a manual worker.

In the Indian idea, the "artist," the *śilpin*, is not a peculiar individual with a special gift for experience, but simply a trained man meeting a general demand. His vocation is hereditary, and he receives his education in the workshop. Genius is not an individual achievement, but the quality of the society at any given period; in the works of a single school, therefore, practically the same degree of vitality appears everywhere, and the workmanship of individuals is only to be distinguished by varying degrees of skill. In these circumstances it is only natural that the names of craftsmen are not in fact recorded even on the most magnificent works, with a few accidental exceptions; the sequence of styles and of increased or decreased vitality reveals the political and spiritual history not of individuals but of societies.

PREHISTORIC

Palaeolithic and Neolithic.—Rough chipped stone implements have been found abundantly in Southern India. But a great gap, ethnic and cultural, seems to separate them from those of the Neolithic period. Neolithic implements, both chipped and polished, some antedating and some coeval with the knowledge of copper, have been found all over India. They exhibit a great variety of forms, including pygmy types. Most of the forms are identical with those of Western Asia and Europe; but a peculiar chisel-shaped, high-shouldered celt is found in Chota Nāgpur, Assam, and more abundantly in Burma, Indo-China and the Malay Peninsula (*see* FURTHER INDIA). Indian culture must have had a continuous history from prehistoric times; this must be borne in mind in a discussion of the earlier history of Indian religion and art, especially in connection with the beginnings of sculpture and design.

Prehistoric Painting.—Primitive ruddle paintings have been found in natural caves in various parts of north central India, and have been regarded by some authors as of Neolithic or even



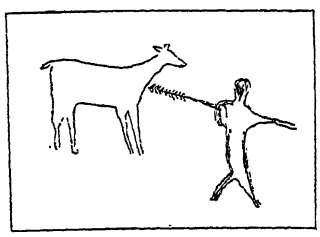
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INDIAN PAINTINGS OF THE RAJPUT SCHOOL

These paintings, executed in the late 16th and early 17th centuries, are done in brilliant tempera colours on a paper surface and show no trace of Persian or Mughal influence. The one on the upper left illustrates an episode of the Krishna cycles showing Radha, supported by two companions, keeping an appointment with Krishna, who is seated at the trysting place in a walled orchard. The three other paintings illustrate Ragas and Raginis, or musical modes, depicting emotional situations corresponding to the content of the music in accordance with established conventions

Palaeolithic date. Those from the Mirzapur District in the Vindhya hills, include a representation of a rhinoceros hunt. This animal is now extinct, but may have survived as late as the sixteenth century. The hunters are shown with barbed spears, suggesting certain of the ancient Indian copper weapons.

Cave paintings from the Hoshangābād District are said to include representations of a giraffe. Those from the Kaimūr range (fig. 2) show stag hunts. Those from Singanpur include an animal rather like a kangaroo; and also some representations of a horse and of deer which present an extraordinary resemblance even in details to the Palaeolithic paintings of Cogul in Spain.



FROM "JOURNAL OF THE ROYAL ASIATIC SOCIETY"

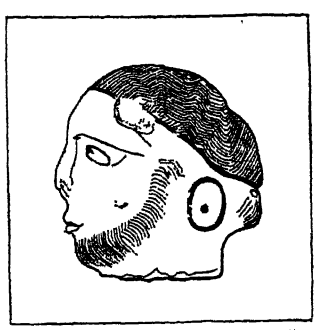
FIG. 2.—CAVE DRAWING, KAIMŪR RANGE

The literature of the subject is cited by Herbert Kühn (*see* Bibliography), who discusses the Singanpur examples and their resemblance to Spanish drawings. Those from Hoshangābād are referred to in the Annual Report of the Archaeological Survey of India, 1917–18, Pt. 1, p. 25.

Southern India.—In Southern India the Neolithic culture may have lasted until the middle of the first millennium B.C. The south until then had been fairly effectively isolated from the north by the natural barrier of the Vindhyas and the jungles of central India. We find no copper age, but iron directly replaces stone—presumably as the result of intercourse with the then mixed culture of the north, perhaps about 500 B.C. The southern prehistoric antiquities include very numerous slab-built dolmens, and abundant pottery; amongst the last are oblong, short-legged sarcophagi very similar to those found near Baghdad. The use of coracles is another feature characteristic equally of Southern India and the Euphrates valley. No remains of such a highly developed culture as that of the Indus valley have been found; but it is beyond doubt that the South was already highly civilised centuries before the beginning of the Christian era.

Chalcolithic: Indus Valley Culture.—Excavations at Harappa in the Pañjāb and Mohenjo-Daro in Sind have revealed the existence of ancient city sites belonging to a chalcolithic culture, *i.e.*, one in which both stone and copper implements were in use. Of three superimposed cities at Mohenjo-Daro the youngest may be dated about 2700 B.C., the earliest about 3300 B.C. The Harappa site has remains of the same period, and below these are still older strata.

The buildings are of well-burnt brick. Sculptures in alabaster and marble include a painted figure of a man, and a much finer bearded head wearing what looks like a wrought metal skull cap decorated in imitation of hair (fig. 3); in terracotta, figurines of a nude goddess with an elaborate headdress, girdle, and the body ornament (*channavīra*) characteristic of later Indian art; in terracotta and in faience, admirable figures of animals, including the bull, rhinoceros, dog and cock. All these are sculptures in the round. But the most abundant and not the least remarkable works of art are the square seals of faience or ivory, which bear in relief figures of animals, usually a bull, elephant or rhinoceros, with a cult object, apparently a wicker crib or manger, and pictographic signs, partly related to early Sumerian forms and even more similar to pre-Sumerian forms found at Kish, but so far undecipherable. Some scholars believe that the later Indian Brāhmī (Sanskrit) script has been developed from this early pictographic type. One seal bears a seated cross-legged figure attended by snake-hooded Nāgas, as in much later, Buddhist, art; another a sacred tree (the *pippala, Ficus religiosa*, later known as a symbol of various deities, particularly the Buddha) with a horned dragon projecting from the trunk (*cf.* Ward, *Seal Cylinders of Western Asia*, fig. 710); another a row of men bearing totem standards like those of predynastic Egypt. One earlier seal from Harappa represents a tiger hunt.



AFTER "ARCHAEOLOGICAL SURVEY OF INDIA"

FIG. 3.—PREHISTORIC SCULPTURE, INDUS VALLEY CULTURE

Amongst personal ornaments are finely wrought gold, silver, and copper gilt jewellery, chank and carnelian beads, faience bangles. Other metals known included tin and lead, but not iron; some utensils and ornaments are made of bronze. India has no bronze age properly so-called but the alloy is found already at this early date and has remained in use to a limited extent ever since, though most of the so-called Indian bronzes are really of cast copper. A copper model of a hooded two-wheeled cart obtained from the lower strata at Harappa is evidence of the very early use of wheeled vehicles. Few weapons have been found.

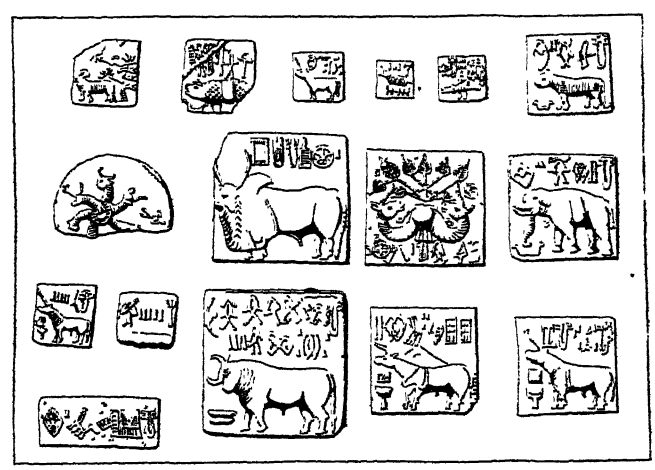


AFTER "ARCHAEOLOGICAL SURVEY OF INDIA"

FIG. 4.—PREHISTORIC PAINTED POTTERY, TERRACOTTAS AND SCRIPT OF THE INDUS VALLEY CULTURE

The pottery is wheel-made, and includes painted types; the shapes are varied, but types with handles are rare. The painted designs are usually in black on a dark red slip and consist of advanced geometrical patterns, foliar motifs, and occasional figures of animals. The dark red and black ware has been found abundantly at Nal in Baluchistan, associated with copper implements, also on the Waziristan frontier and in Sistan. The style bears some relation to that of Anau and of Susa II.

When the Indus culture was flourishing the valley was better watered and more wooded than now. The same culture, perhaps in more provincial forms, may have extended to other parts of northern India, over an area reaching from Baluchistan to Kāṭhiāwār and through Rājputana to the Ganges valley, as indicated by the Gungeria hoard and other finds of copper and neolithic implements.



AFTER "ARCHAEOLOGICAL SURVEY OF INDIA"

FIG. 5.—SIXTEEN PREHISTORIC SEALS OF THE INDUS VALLEY CULTURE

The Indus valley civilisation and culture show close resemblances on the one hand with those of early Sumer and Babylonia (especially with the proto- or pre-Sumerian of Kish), and on the other with that of historic India. Apart from these archaeological evidences, there has gradually accumulated a mass of evidence tending to show that the early Indian and Mesopotamian cultures represent cognate developments. This applies especially to considerations derived from a study of the history of design (particularly in connection with the animal style and architecture), and to the analogies between Babylonian mythology and cult and

those of the Dravidian (Āgamic) tradition in India, such as the use of the same formulae in representing mountains, clouds and water; the motif of animals with long necks interlaced, and of heraldic and fabulous animals generally; the representation on Babylonian seals of dragons with serpentine bodies and human busts, like Indian Nāgas; the cult of the waters connected with the symbol of the flowing vase in Babylonia and the brimming



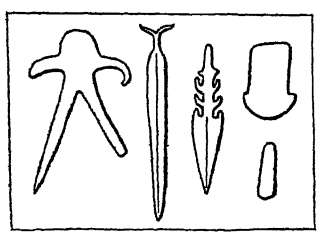
AFTER "ARCHAEOLOGICAL SURVEY OF INDIA"

FIG. 6.—TYPES OF PREHISTORIC PAINTED POTTERY FROM NAL, BALUCHISTAN

vessel or vase of plenty (*pūrṇa kalaśa*) of India, the former significantly spoken of by Heuzy as the "merveilleux symbole qui était comme le Sainte-Graal de l'épopée chaldéenne," and both of importance in connection with the origins of the Grail cult. To these may be added similarities of technical procedure, as in the process of decorating carnelian by calcining and in the similar composition of Indian and Assyrian glass.

Neither the archaeological nor the mythological evidence suggests that either the Mesopotamian or early Indian cultures have been derived from the other, or has borrowed extensively from the other at any one period, but rather that both have developed *in situ*, though not without intercourse and contact, on the common basis of the early chalcolithic culture which in the fifth and fourth millennia B.C. extended over an area extending from the Adriatic to Japan, and can be associated with the dolichocephalic "Mediterranean" races of southern Asia and Europe and attained its fullest development in the great river valleys of the Nile, Euphrates and Tigris, Karun, Helmund, Indus and perhaps the Ganges. According to one not unreasonable conjecture, the original focus of this culture may have been in Armenia, a country rich in metals and possibly the starting point of early race movements across the highlands of Persia in one direction towards Elam and southern Mesopotamia, in the other towards central Asia and India. Many years of work in this comparatively novel field of research will be required before more definite conclusions can be advanced.

Vedic and Pre-Maurya.—It will be assumed that the Āryans entered India from the North-West, about 1500 B.C., and occupying the Pañjāb, had gradually passed on to the Ganges valley. They probably brought with them a knowledge of iron, and a superior breed of horse, and it may have been these advantages that enabled them to subjugate the existing peoples who already possessed cities and forts, and a more developed material civilisation. After the first period of conflict, the Āryans (as with the later invaders, Scythians, Huns and Mughals) ceased to be foreigners, and became Indians: long before 500 B.C., northern India had become the seat of a mixed culture in which, and especially in the art, both as regards its motifs, and its technical achievement, the non-Āryan element predominated. The conquerors had been conquered by the conquered.



AFTER "ARCHAEOLOGICAL SURVEY OF INDIA"

FIG. 7.—PREHISTORIC COPPER IMAGE (?) AND WEAPONS FROM GUNGERIA

Vedic literature, mainly in the relatively later texts, reveals a knowledge of tin, lead, silver, gold and iron, of cotton, silk, linen, and woollen garments, sometimes embroidered, vessels of gold and silver, iron needles, bedsteads, thrones, turbans, jewellery, earthenware, round and square huts, and storied buildings, and wheeled vehicles. Some or all of these arts may have been known to them before they entered India; but probably the use of bricks, and certainly everything connected with maritime or purely Indian products (chank, ivory, cotton, pearls, indigenous dye-stuffs, etc.) they must have found in India for the first time. The *Śulva Sūtras* show a knowledge of principles now known as those of dynamic symmetry. Vedic culture shows little or no evidence of Babylonian or Semitic connections.

LATER PRE-MAURYA

Few sites likely to yield remains of this period have been adequately excavated. The later strata of Mohenjo-Daro probably come down to 400 B.C. The greatest number of pre-Mauryan antiquities has been obtained at the Bhir mound, Taxila; most notable are the finely wrought polished sandstone discs, with bands of concentric ornament, in which are found cable, cross and bead, and palmette motifs, the taurine symbol, elephants, fan palms, and the nude goddess. It is also certain that the cutting and polishing of hard stones, and the technique of glassmaking had attained already in the fourth and fifth centuries B.C. a perfection never afterwards surpassed; and when in the Maurya period we first meet with stone sculptures, we find the surface of the hard stone highly polished. One other important type of early art is represented by the punch-marked coin symbols; these coins were in use from about 600 B.C. to A.D. 100. The marks include some hundreds of types; amongst the commonest are the mountain (usually with three or more peaks—the so-called *caitya* of older numismatists), river or tank with fish, sacred tree, elephant, horse, bull, sun, moon, "caduceus," "taurine"; the lion, rhinoceros, *makara*, and human figure are rarer. No lingam, thunderbolt, foot-marks or stūpa is represented. These signs (*rūpa*), forming an extensive symbolic repertory, appear to have been those of issuing and ratifying authorities. Many of the symbols are those of particular deities; for example, the three-peaked mountain with moon crescent is otherwise known to have been a symbol of Śiva, and so also the bull. Few or none of the marks are exclusively Buddhist. Some are connected with particular cities, and in their day identified the issuing mints.

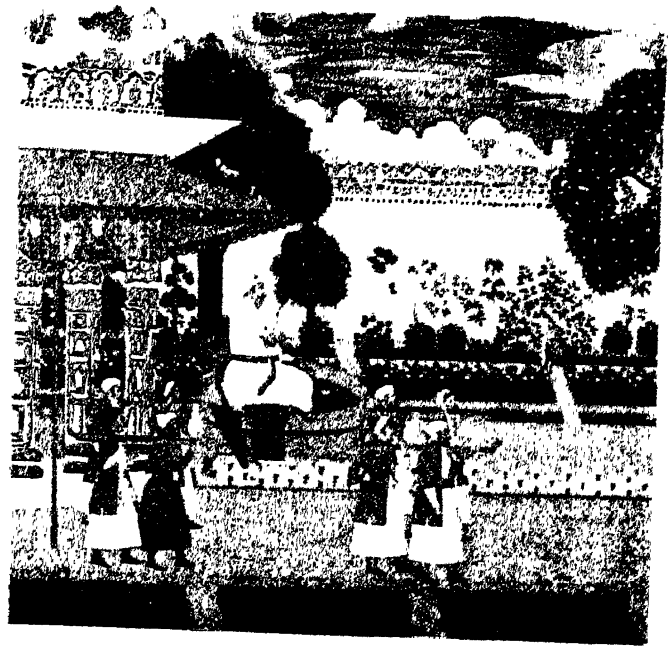


AFTER "ARCHAEOLOGICAL SURVEY OF INDIA," BY PERMISSION OF THE HIGH COMMISSIONER OF INDIA

FIG. 8.—PRE-MAURYA STONE DISC FROM BHIR MOUND, TAXILA

As regards design the same forms which are found in the reliefs of the Maurya, Śuṅga, and Āndhra periods were already current during many centuries before the fourth B.C. These forms include meanders, palmettes, vases with flowers, sacred trees, diapers, spirals, frets, twists and the like, animals addorsed or affronted, and fantastic animals of all kinds. Many or all of these characteristic forms are clearly related to, but not identical with, Mesopotamian types, Assyrian or older. They constitute a common ground of early Asiatic, and in India are cognates of the Mesopotamian forms, not late borrowings. The fact that we find them extant only in the stone sculpture when it first appears in the Maurya period is of course no proof of their late origin; some of the most ancient survive most characteristically in quite modern folk-art, and may well have been current during three or four millennia. Thus, the motif of animals with interlacing necks, known in Ceylon as *pūṭṭuva*, where it is one of the commonest motifs of the folk art, was already current in Sumerian art of the fourth millennium B.C., and very many other instances of the same kind could be cited.

As regards sculpture, late Vedic literature, in which a large non-Āryan element has been absorbed, affords evidence for the making of images of popular deities in impermanent materials; and it is certain that the earliest known stone figures (after the Indus valley types), viz., the Yakṣas of the Maurya and Śuṅga periods,





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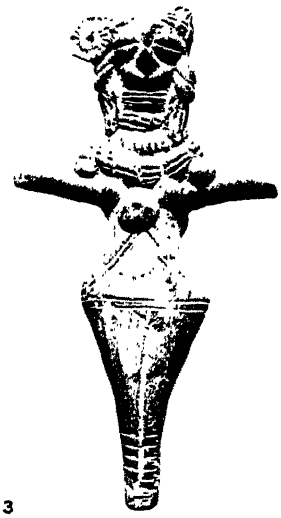
RAJPUT PAINTINGS, 17TH AND 18TH CENTURIES

Above: Muhammad Shah in a garden, Rajasthani, early 18th century Below: Ramayana, the siege of Lanka, Pahari, Jamu, 17th century





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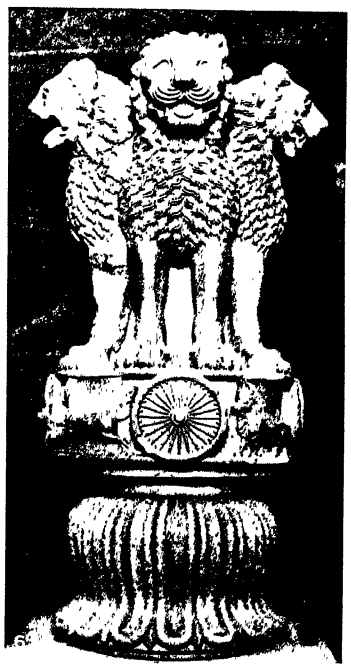
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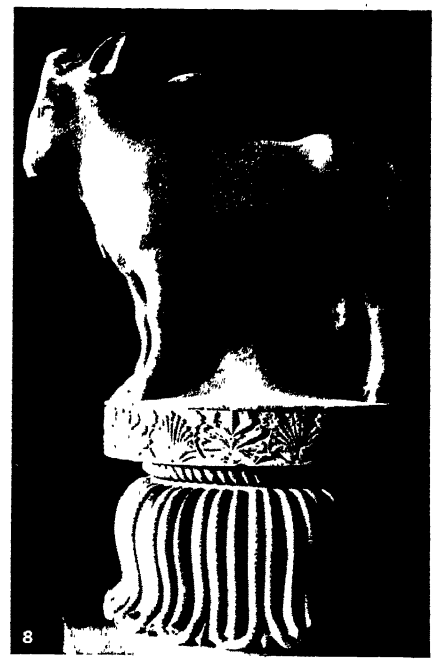
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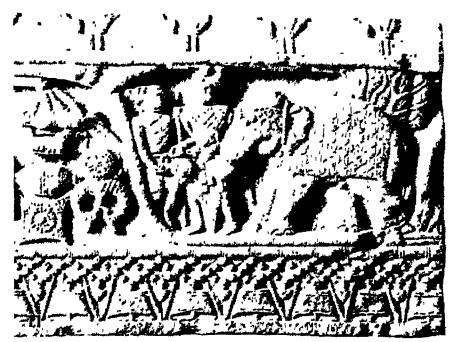
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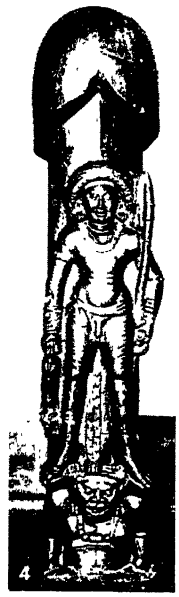


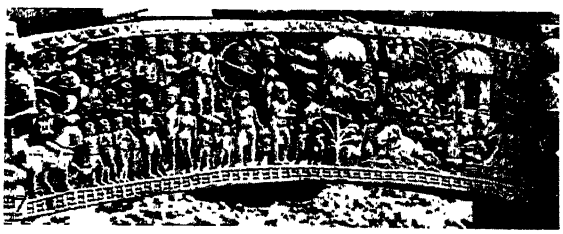
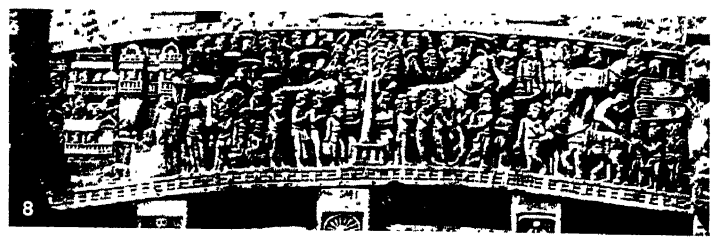
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EARLY ART OF INDIA

1. Indus Valley seal. Steatite. 3000–2000 B.C. 2. Nude goddess; gold, Lauriyā-Nandangaṛh. Pre-Maurya, (?) *c.* 800 B.C. 3. Nude goddess; Indus valley. Terracotta. 3000–2000 B.C. Height 4″. 4. Goddess; terracotta Pre-Maurya, Height 7¾″. 5. Goddess, terracotta Suṅga. *c.* 200–100 B.C. 6. and 8. Lion and bull capitals of Asoka edict columns, polished sandstone. Maurya. 3rd century B.C. 7. Indra; verandah relief, *Vihāra* at Bhājā, *c.* 200 B.C. 9. Jātaka of the jackal hanged by an ox; railing medallion at the Bharhut stupa. *c.* 175 B.C. 10. Terracotta sealing from Bhīṭā, Suṅga, 2nd century B.C. 11. *Vessantara Jātaka;* railing of Bharhut stupa, *c.* 175 B.C.






PHOTOGRAPHS, (1, 10, 11) JOHNSTON AND HOFFMANN, (2, 4, 6) THE ARCHAEOLOGICAL SURVEY OF INDIA, (9) A. K. COOMARASWAMY

CARVINGS AND ARCHITECTURAL DETAIL

1. Yakṣa; sandstone. Maurya-Suṅga, 3rd–2nd century B.C., from Parkham, Besnager. Height 8′ 8″. In the Mathurā Museum
2. Yakṣa; sandstone, Suṅga, 2nd century B.C. from Patna. Height c. 5′. Patna Museum
3. Kubera Yakṣa; railing pillar, Suṅga, Bharhut, *c.* 175 B.C. Calcutta Museum
4. Siva liṅgam, Gudimallam, polished sandstone, 1st century B. C. Height 5″
5. Yakṣa; from base of a *toraṇa* pillar Sāñcī, Suṅga, *c.* 100 B.C.
6. Indra as the Brahman Sānti; and above, the *abhiseka* of Srī (Laksmī), railing pillar, Bodhgayā, *c.* 100 B.C.
7. Part of the *Vessantara Jātaka;* architrave detail north *toraṇa,* Sāñcī, *c.* 50 B.C.
8. The Great Renunciation; architrave detail, east *toraṇa,* Sāñcī, *c.* 100 B.C.
9. Yakṣī bracket (Sālabhañjikā) east *toraṇa,* Sāñcī, *c.* 100 B.C.
10. Frieze (subject unknown) in the upper gallery of Rānī Gumphā Khaṇḍagiri, Orissā *c.* 100 B.C. (*see* Indian Architecture, Pl. II., fig. 4)
11. Effigies of donors (Āndhra king and queen) verandah of caitya hall at Kārlī, late 1st century B.C.

despite their retention of primitive qualities (frontality, etc.), are not first efforts in any sense; they represent an already advanced stage in stylistic and technical development. We have also the evidence of pre-Maurya terracottas representing the nude goddess and some other types. The latter are of very great importance for the history of art, for though they belong to a stylistic cycle older than that of the stone sculpture, and are still too little known, they provide connecting links between the oldest Indo-Sumerian art and that of the historical period, in style, technique, and costume. In their sense of the inseparable connection of beauty and fruitfulness, and in details of ornament (the body ornament later known as the *channavīra*, and the broad auspicious girdle, *mekhala*) as well as in some facial types, they connect with the earliest sculptures in stone.

MAURYA, ŚUṄGA AND EARLY ĀNDHRA PERIODS

Maurya: Aśoka.—With the Maurya period, and especially the reign of Aśoka, we meet for the first time with sculptural and architectural monuments in stone. These fall more or less definitely into two groups, (1) the court art of Aśoka, and (2) the popular and perhaps more purely native art. The chief monuments of the court art are the remains of the great palace at Pāṭaliputra (Patna), and the monolithic pillars on which Aśoka's well-known edicts are inscribed. The edict pillars, six in number, distributed over an area including Meerut, Allahābād, Benares, and the Nepal terai, have round polished monolithic shafts and are provided with elaborate capitals consisting of a lotus "bell," an abacus decorated with geese, palmettos or Buddhist symbols, and a crowning sculpture in the round consisting of one or more animals; they average from forty to fifty feet in height. The finest has been excavated at Sārnāth, the old "Deer park" at Benares, where first "Turning of the Wheel of the Law" (the Buddha's first sermon) took place. Here there are four addorsed lions supporting a Wheel (the *Dharmacakra*, Wheel of the Law and of Dominion); the abacus is decorated with four smaller wheels, and a bull, lion, elephant and horse. Other pillars bear a single lion, a bull or an elephant. The naturalistic treatment of these animals, the technical accomplishment of the work and the fact that this is evidently a stylistically late art all distinguish these sculptures from the contemporary religious sculptures to be referred to below, and it has been argued that the court art of Aśoka owes much to western sources, and even that it was produced by imported craftsmen: it is certain that close and friendly relations were maintained between the Maurya and Seleucid houses. The problem, however, is far from simple. All that is beyond doubt novel at this period is the use of stone to a limited extent for architectural purposes, and probably the use of stone for large sculpture. Nor can the Maurya period, with its invaluable but very imperfect record be considered alone; early Indian art as a whole and the folk art up to the present day bear an intimate relation to Western Asiatic art. This relation is more obviously Babylonian-Assyrian than Persepolitan. Indian bell capitals, for example, are very different from those of Persia. Indian shafts are smooth or octagonal, and monolithic: Persian fluted and segmented. The use of animal standards as symbols of deities is at once Indian. Chaldaean and Assyrian, but not Achaemenid or Seleucid. The so-called Persepolitan capital with addorsed bulls (often horses, elephants or lions) again is so widely distributed and so much an integral part of the whole architectural style in the 2nd century, that it could hardly have been introduced only a century earlier. So too with the civil architecture represented on the reliefs, showing walled cities with towers, and battlements like those of Assyria, with the mythical monsters, and with the elements of the decoration; in all the relationship to Western Asia is conspicuous, but the individual character is equally unmistakable. Nor is it possible to suppose that no art of any kind existed in India before Aśoka; or that there existed some different sort of art just before Aśoka, of which no trace can be found in the abundant reliefs just after him. Thus Maurya and Śuṅga art directly continue the traditions of pre-Maurya art; Indian and early Persian art are both late phases of a tradition common to all Western Asia.

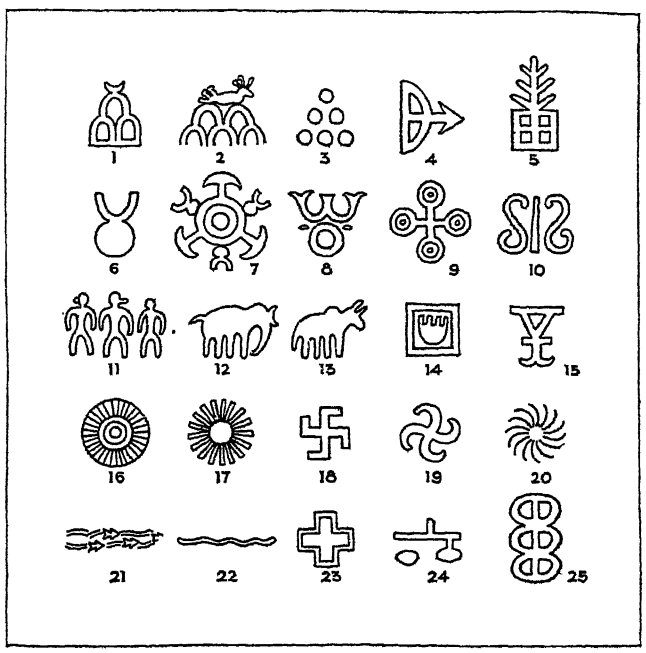


FIG. 9.—SYMBOLS FROM PUNCH-MARKED COINS 500 B.C. TO A.D. 100
1, 2. Mountain; 5. Railed tree; 6. "Taurine"; 8. Combined *chakra* and *triśūla*; 9. Ujjain symbol; 10. Śrīvatsa; 16, 17, 20. Solar; 21, 22. Rivers; 24. Steelyard; 25. Tank

The early Indian stone sculpture in the round of Maurya and Śuṅga date is represented by a number of colossal figures in royal costume, apparently statues of independent or attendant Yakṣas and Yakṣīs, two of these being found at Pārkham, near Barodā (Plate X., fig. 20) and at Besnagar, one at Deoriyā near Allahābād, one in Mathurā, and three at Patna; all are in sandstone, and some are polished. The figures are distinguished by great mass and volume. There is no conscious effort for grace, but a statement of an ideal concept in a technique that is still primitive; for the form is frontally conceived, and the transitions from one plane to another are somewhat abrupt. The style achieves its perfection some centuries later in a Buddha figure set up at Sārnāth.

To the same school of art belong the reliefs of the early vihāra (monastery) at Bhājā,—this is apparent in their volume, and in details of the costume, particularly the enormous turbans, and the pearl-fringed bracelets, which last are found also on some early Śuṅga terracottas. One of the most remarkable of these reliefs seems to represent Indra, seated on his cloud-elephant Airāvata. Sacred trees (*caitya-vṛkṣas*) guarded by railings and adorned with garlands and umbrellas, are to be seen, and on one side a horse-headed Yakṣī and a man, perhaps with reference to the *Padakusalamānava Jātaka*. On the opposite side of the doorway, which divides what are evidently two parts of a single grandiose conception of earth and sky, is represented the Sun in a four-horsed chariot.

From this time onwards the history of Indian sculpture is richly documented. The great stūpa of Bharhut (175–150 B.C.), of which the extant remains are now all in Calcutta, had an elaborately decorated railing (*vedikā*) and gateways (*toraṇa*). The rail coping bears a continuous floral meander, the flowers and leaves being partly vegetative, partly consisting of jewellery; in the interspaces of the meander are represented many of the Buddhist Jātakas, and other edifying legends. The railing medallions are developed as expanded lotus flowers, or occupied by Jātaka subjects or scenes from the life of Buddha. On the upright pillars of the gateways and some of the railing pillars are found representations of various devatās, Yakṣas and Yakṣīs, many of which are provided with inscriptions recording their names, as for example, Kubera; thus Buddhism made use of the popular divinities, as guardians and worshippers. The reliefs are all more or less compressed between the surface plane and that of the background, lacking equally the plastic volume of the Bhājā types and the

technically more advanced relief of Sāñcī; but the costumes, though modified, are closely related to those of Bhājā. The various decorative motifs, floral and geometrical, are indicative of a highly evolved art. Of the same date are some of the railing pillars of Stupa II. at Sāñcī, and the remains of early sculptured walls (*pākāra*) at Jagayyapeṭa and Amarāvatī.

Nearly contemporary with the Bharhut stupa, are the excavated monasteries of Udayagiri and Khandagiri in Orissā. The best sculptures are reliefs forming a frieze in the upper storey of the Rānī Gumphā; the subject, which includes the hunting of a winged deer as a part, has not been identified. The monasteries here are, so far as can be determined, all Jaina; but many of the motifs familiar to Buddhist art, *e.g.*, the Lustration of Śrī-hakṣmī, and the Sun drawn in a four-horsed chariot, are found. Above the arches of the cell doors are found three-headed serpents (Nāgas), and below the frieze a series of small Garuḍa brackets, both features that are later on extensively developed in Khmer art.

Prior to the Śuṅga period the major Indian deities seem to have been represented mainly or exclusively by symbols. As Aśoka speaks of engraving edicts on already existing columns it is possible that the Mauryan bull and elephant capitals were originally erected in honour of Śiva and Indra. Garuda and *makara* standards of Śuṅga date at Besnagar refer to Viṣnu and Kāmadeva, the fan palm capitals perhaps to Baladeva. Śiva is represented on early coins by a bull, or a mountain of three peaks surmounted by a crescent; later, in the Kuṣāna period he appears in person together with the bull and other symbols; Indra and Agni appear on the coins of the Pañcālas in the 2nd century B.C.; the *abhiṣekha* of Śrī on those of Azilises in the first (as well as on the earlier Bharhut reliefs and on terracottas), other forms of Śrī on coins of Amoghabhūti. Indra and Brahmā are freely represented in Buddhist art at Bharhut and Sāñcī wherever the narrative requires; the former with his *vajra* (thunderbolt), and a vessel containing the "Water of Life," usually, too, with a cylindrical metal headdress (*q.v.*), the first appearance of any kind of crown in Indian art (the original royal headdress is a turban).

Patañjali, commenting on Pāṇini, *c.* 200 B.C., refers to the public exhibition of images or Śiva, Skanda and Viśākha; and there is evidence enough in the later Brāhmaṇas, Law Books, Epics, and Buddhist and Jaina literature to show that the use of images and temples (*qq.v.*) had come into general prominence from about 400 B.C. onwards. Probably the oldest surviving anthropomorphic representation of a deity, forming a cult image, is that of Śiva on the Paraśurāmeśvara liṅgam, from Guḍimallam in Eastern India a little above Madras; here the deity stands on a dwarf Yakṣa vehicle, and in this respect and stylistically, though more developed, recalls the Kubera of Bharhut. This early figure of Śiva is a great and powerful work, fortunately preserved from a period when a majority of Hindu images were still made of wood or clay. There is an interesting, though later, reference to such images in the *Divyāvadāna*, where Upagupta, worshipping an appearance of the Buddha created by Māra explains that he is bowing, not to the object before him, but to the Master himself, "just as people venerating images of Gods do not revere the clay, but the immortal ones represented by them."

The most perfectly preserved Buddhist monument in India is the great stūpa at Sāñcī in Bhopal State. Enclosed and hidden within it is an earlier brick stūpa dating from the time of Aśoka, but the stūpa itself as enlarged and cased with masonry dates from the second century B.C., the plain railing from the same time, and the gateways from the first half of the first century B.C. Two other stūpas with their railings in whole or part are to be dated in the second century B.C.

The reliefs of the great gateways (*toraṇas*) of the main stūpa, occurring on the upright pillars and on the horizontal architraves illustrate Buddhist legends, including Jātakas and scenes from the Buddha's ultimate incarnation. They are executed with a delicacy and wealth of detail suggestive of ivory carvings, and indeed a votive inscription records that some were carried out "by the ivory workers of Bhilsā." Apart from their original intention they afford a veritable encyclopedia of manners, weapons, decoration and symbolism. At the base of the upright pillars are very beautiful figures of guardian Yakṣas; and the architrave brackets are Yakṣīs represented as dryads clinging to their trees and leaning outwards. Several of the smaller panels illustrate the Lustration of Śrī, an old and popular goddess of fortune, standing or seated on a lotus, which rises from a jar of plenty (*puṇṇa-ghaṭa*), and laved by two cloud-elephants holding in their trunks inverted jars from which proceed streams of water; other panels in corresponding positions represent the jar of plenty with its lotuses, but without a figure, are probably symbols of the same divinity. On the tops of the uppermost architraves are Buddhist symbols guarded by *caurī*-bearing Yakṣas.

Just as at Bharhut, and in early Indian art generally, in the scenes from the Buddha's life, though they tell their story with perfect clarity, the Buddha himself is never represented in human form, but only by symbols, footprints (*pāduka*), and umbrella (*chatra*), or wheel (*cakra*), or tree. These symbols indicate the presence of the Buddha wherever required in the representation, and some refer to specific episodes in the life, including most of those which are afterwards grouped together in panels illustrating the Four (or Eight) Great Events. Thus, the Wheel designates the First Preaching of the Law; the sacred tree (*Bodhi-druma*) with its altar or railing, the Great Enlightenment. Where the tree is represented with guardian Yakṣas on either hand, we recognize the prototype of the later Buddha triads, where the Buddha is seated between a pair of attendant Bodhisattvas; for there is no doubt that the principal Bodhisattvas, especially Padmapāṇi (Avalokiteśvara) and Vajrapāṇi were originally guardian Yakṣas.

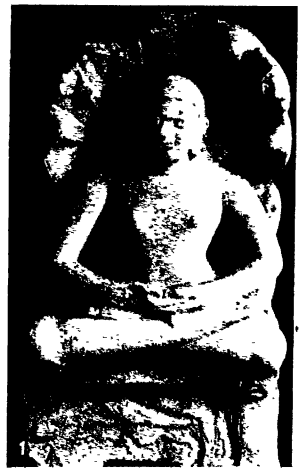
Further, the art of Sāñcī, though Buddhist in theme, is scarcely Buddhistic in content; the legends illustrated are always edifying, but the manner of treating them and the feeling for the human form are far from ascetic or introspective. And this becomes especially evident in connection with the accessory figures, such as the dryads, filled as they are with the abundance and joy of life.

A very important school flourished at Mathura from the second century B.C. to the sixth A.D. The early fragments are in a manner closely related to that of Bharhut. More important are those which cover the period of transition from the old aniconic to the later anthropomorphic representation of the Buddha figure: these are of Kuṣāna, and perhaps somewhat earlier (Indo-Parthian or Kṣatrāpa) date and will be discussed below.

KUṢĀNA

Assuming the date of A.D. 120 for the accession of Kaniṣka, we can safely say that the first century and a half of the Christian era represents the most critical period in the history of art in India, the second to the fourth century that of highest achievement. For the earlier period, and only to a somewhat lesser extent the later, the prolific school of Mathurā is of primary importance, for here were evolved types that can be traced in all the later development. While confining ourselves in the main to a study of the Buddhist art at this time, we must recollect that at all times "Buddhist India" was equally and at the same time a Hindu India; the so-called Hindu renaissance of the Gupta period does not represent a reaction, but rather the flowering and culmination of a previous development. So far as cult and literature are concerned, this is self-evident; as regards the art, while Buddhist monuments are at first much more abundant and magnificent, this probably means that Hindu cults adhered longer to the use of impermanent materials such as wood and clay for buildings and images, as in southern India up to the beginning of the seventh century. Thus all the coins of Kadphises II. (*c.* A.D. 90–110) bear the effigy of Śiva, and amongst the many deities represented on the coins of Kaniṣka and Huviṣka the figure of the Buddha is exceptional, while that of Śiva is abundant. There is certainly no sound basis for the view that Hindu architecture and art are modelled on those of the Buddhists; the style and technical achievement of Indian art can never at any stage be described in sectarian terms, but only in terms of chronology and geography.

Indian Buddha Type.—Within the first century and a half of the Christian era the Buddha figure for the first time replaces the old symbols, which nevertheless remain in use both









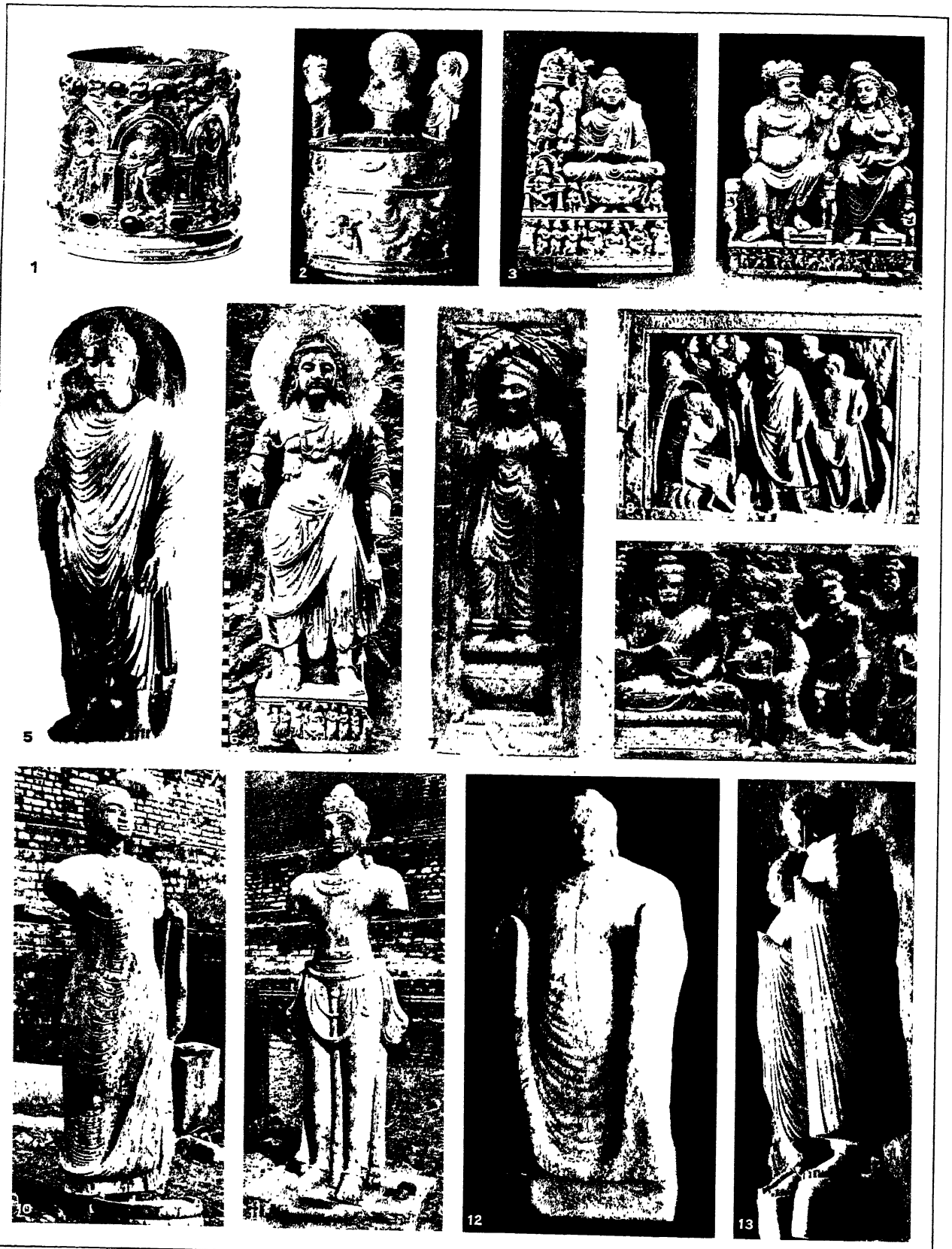




BY COURTESY OF (3, 9) THE MUSEUM OF FINE ARTS, BOSTON; PHOTOGRAPHS, (1, 4, 6, 10) THE ARCHAEOLOGICAL SURVEY OF INDIA, (2, 5) JOHNSTON AND HOFFMANN, (8) A. K. COOMARASWAMY

RED SANDSTONE SCULPTURE OF MATHURĀ ORIGIN (KUSĀNA PERIOD)

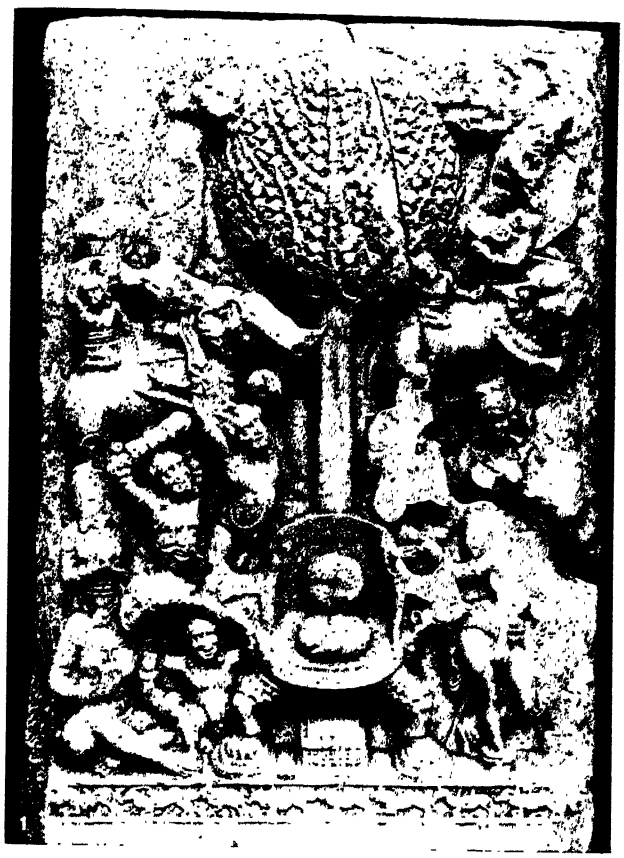
1. Pārśvanātha, Jaina teacher, protected by a Nāga. Late 1st–early 2nd century A.D. Height 5′ 4″. 2. Bodhisattva (Buddha), early Indian type. Height 2′ 3″. 3. Detail of tympanum: above, the Bowl-relic on an altar; below, the Bodhi-tree (representing the Buddha). Possibly pre-Kuṣāna. 4. Yaksa. 5. Portrait statue of Kaniṣka (whose name is engraved on the skirt). Height 5′ 4″. 6. Bodhisattva (Buddha) set up by Friar Bala at Sārnāth in the 3rd year of Kaniṣka; early Indian Buddha type. Height 8′ 1¼″. 7. Bodhisattva. 8. Nāga, with flask in left hand (like the Bodhisattva Maitreya). 9. Yakṣī, under tree, with *makara* vehicle; a railing pillar. Height 29¾″. 10. Woman or Yakṣī with child; a railing pillar. Height 2′ 2″. 11. Goddess of Abundance, probably Srī-Lakṣmī, bringing food and water; pillar support of bowl. Benares Kala Parishad

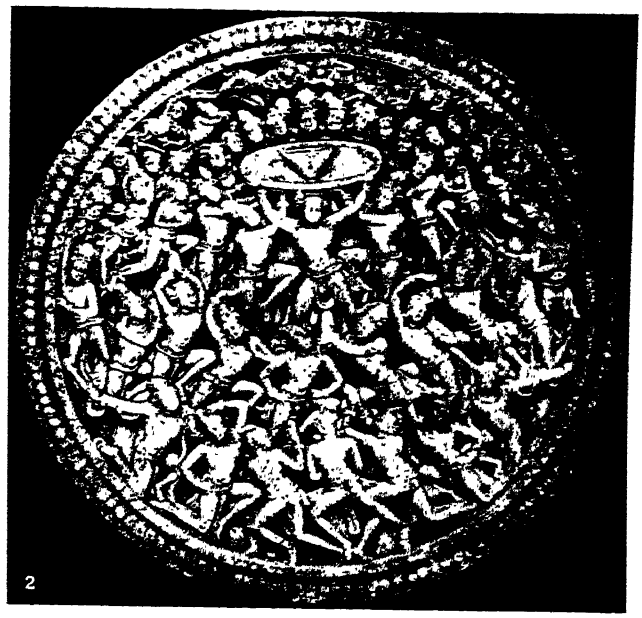


BY COURTESY OF (7) THE FIELD MUSEUM OF NATURAL HISTORY, CHICAGO; PHOTOGRAPHS, (1, 10, 11) A. K. COOMARASWAMY, (2, 3, 4, 5, 6, 12, 13) THE ARCHAEOLOGICAL SURVEY OF INDIA

GRAECO-BUDDHIST AND OTHER ART OF THE 2ND AND 3RD CENTURIES

1. The Bīmarān reliquary; Afghānistān, perhaps early 1st century A.D. Gold 2¾ in. 2. The Kaniṣka reliquary made by Agiśala (Agesilaos). 7¾ in., *c.* A.D. 120–130. 3. Buddha preaching, Yakubai. Peshāwar Museum. 4. Pāñcika (Kubera) and Hārītī; from Sāhribahlol. 5. Buddha. Gandhāra. 6. Bodhisattva. From Sāhribahlol. 7. Yakṣī. Gandhāra. 8. Visit of Buddha to a Brahmanical hermit. Gandhāra. 9. Buddha's bath in the Nairañjanā, by Gandhāra. 10. Buddha, Ruwanweli Dāgaba, Anurādhapura, Ceylon; marble, *c.* A.D. 200. 11. King Duṭṭha-Gāmaṇī, or a Bodhisattva; as (10). 12, 13. Buddhas. Amarāvatī; marble, *c.* A.D. 200









PHOTOGRAPH (3) A. K. COOMARASWAMY

MARBLE SCULPTURES OF THE LATE ĀNDHRA PERIOD (ABOUT A.D. 200) FROM AMARĀVATĪ AND DISTRICT

1. The assault and defeat of Māra, and temptation by the daughters of Māra. From Ghaṇṭasālā. Musée Guimet, Paris. 2. Elevation of the Bowl-relic; railing medallion. At Amarāvatī. Madras Museum. 3. The nativity of Buddha. From right to left: above, the Dream of Māyā and its interpretation; below, the Miraculous Birth in the Lumbinī garden, and the Presentation before the Yakṣa Sākyavardhana. From Amarāvatī. British Museum. 4. Circle: visit of the gods to the Bodhisattva. Below: three scenes from a Jātaka (in central compartment, an ideal world emperor). Amarāvatī, British Museum







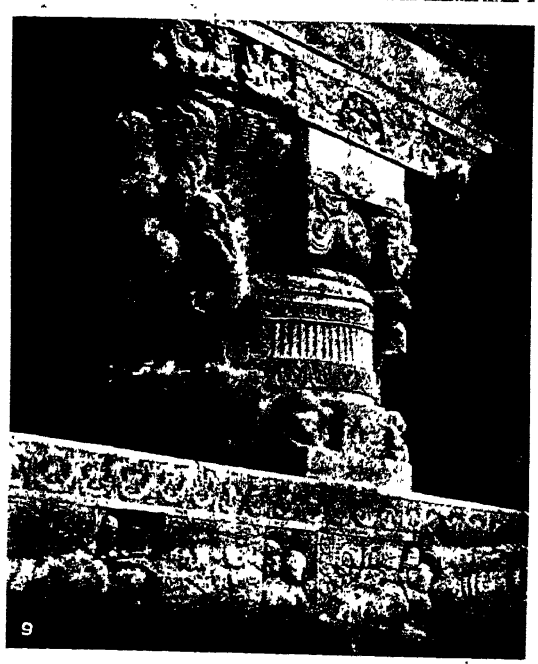














PHOTOGRAPHS, (3, 6, 7, 10) THE ARCHAEOLOGICAL SURVEY OF INDIA, (4) A. K. COOMARASWAMY, (8) JOHNSTON AND HOFFMANN

EXAMPLES OF GUPTA ART (A.D. 320–C. 600)

1. Varāha Avatār, Udayagiri, Gwalior. Sandstone, colossal. Gupta. *c.* A.D. 400. 2. Nāgarāja and queen, of Cave XIX., at Ajaṇṭā. Late Gupta, 6th century. 3. Scene from the *Rāmāyaṇa*, from the Gupta temple at Deogaṛh, 5th century. 4. Detail of a pair of flying figures (Gandharva and Apsaras). Sandstone. Gupta, 5th century. 5. Yakṣa, Ataria Khera, Nāgoḍh State. Sandstone. Gupta, 5th century. 6. Paraśurāma, Gwalior. Sandstone. Gupta, *c.* A.D. 400. 7. Brahmā from near Mīrpur Khās, Punjab. Bronze. Gupta, 6th century. 8. Buddha. Sandstone. Mathurā. Height, 7′ 2″. 9. Verandah of Rāmeśvara Saiva temple, Elūra. 7th century. 10. Siva-liṅgam (mukha-liṅgam), Bhurmara. Sandstone. Gupta, 5th century

in Gandhāra and at Amarāvatī considerably later. Images of other deities had long existed, and the influence of current devotional tendencies acting on Buddhism and Jainism must have led to a similar development. The fixing of a date for the earliest images of Buddhas or Jinas is more difficult. Palaeographic evidence would seem to place those of Jinas from the Kankālī Tīlā, Mathurā, as early as the middle of the first century. The only certain date for an early image of Buddha is that of the colossal image set up by Friar Bala at Sārnāth in the third year of Kaniṣka's reign, thus A.D. 123. This Buddha type is distinguished by certain peculiarities not found after the Kuṣāna period (with one exception of fifth century date), and rarely met with even after the middle of the second century. The seated figure is always on a lion throne, never on a lotus. Many other images, both standing and seated, in the same vigorous style derived from that of the early Yakṣa types, have been found at Mathurā, or are of Mathurā manufacture, exported and set up at sacred sites widely distributed in the Pañjāb and Ganges valley.

The earliest Buddha (and Jina) type shows the ends of the shorn hair forming a single conical spiral on the top of the head, bearing no resemblance to the *uṣṇīṣa* in the sense of a cranial protuberance such as characterises the Buddha figure at Amarāvatī, in the Gupta period, and subsequently, both within and beyond the boundaries of India proper. When this cranial protuberance appears, it together with the rest of the head, is covered with innumerable short and tight curls, curling to the right. According to the Buddha legend, the Bodhisattva when first adopting the homeless life of an ascetic, cut off with one stroke of his sword both his long hair and the turban which covered it, when they were received by the gods and worshipped by them as the Great Crest relic (*cūḍā maha*), the remaining hair, two inches in length, curled tightly to the right, and so remained throughout the Buddhas life, never again needing to be shorn. This could have been understood to mean either a single curl or many curls; this ambiguity seems to be reflected in the two varieties of the Buddha type above referred to, the interpretation in the sense of many curls very soon supplanting the other. The question of the cranial protuberance is more involved. As in the case of other images of deities (the Buddha even in his own lifetime is more than man, he is recognized as "God of gods" when, at the Presentation, the Tutelary Yakṣa of the Śākyas bows before him, and as the object of a cult he must be called a deity) the Buddha image represents a dogmatic conception; the essential element in this conception is that of the idea of the Mahāpuruṣa (Great Male, also a designation of Viṣṇu) and Cakravartin (Universal Emperor, or alternatively, World-teacher). Buddhist texts take over from Brahmanical sources the lists of physical peculiarities which characterize such a being; for example, the soles of his feet and palms of his hands bear stigmata of the wheel, and there is a tuft of hair (*ūrṇā*) between his eyebrows, and all these peculiarities are commonly found in Buddha images. Most of the other marks are relatively inconspicuous or not externally visible. One is of particular importance for the present enquiry; the infant Bodhisattva is said to be *uṇhīsosīso, uṣṇīṣa*-headed. In interpreting this and other of the marks (in all thirty-two major *lakṣaṇas* and eighty minor signs) it should be borne in mind that they must originally have been conceived as characterising an adult. Now *uṣṇīṣa* in early Indian literature is the regular word used for the turban, which headdress is a mark of rank, worn by kings or by others on special occasions. *Uṣṇīṣa*-headed can only mean (1) having a head like a turban or (2) having a turban on his head. Inasmuch as the thirty-two marks really characterise a Cakravartin as an adult being, and as the turban is actually a mark of rank, the latter interpretation is to be preferred, in the sense "destined to wear the turban," as we have to do with a child. But as the Bodhisattva became, not a Universal Emperor, but a Buddha, and abandoned his turban and long hair, he had to be, as always, represented (with the exception of certain crowned types which may be Dhyāni Buddhas) as bareheaded. In the early Mathurā figures the problem seems to be ignored. It would appear that after these had been for some time in vogue a necessity was felt to embody the *uṇhīso-sīso* idea in the canonical image, and this was done by making the *uṣṇīṣa* a cranial protuberance, and this took place (in the second century A.D.) at the same time that many curls were substituted for one.

The figure of Indra as Śānti, of the Bodhgayā railing (*c.* 100 B.C.), has the hair represented in schematic curls, with the appearance of a cranial protuberance, and many representations of Yakṣas as having curly hair; the existence of such prototypes may have contributed to the formation of the Buddha image as ultimately accepted.

Next in abundance to the Buddhist remains are those of the Jainas. The site of the Vodva stūpa, founded in the second century B.C., has yielded figures of Jinas, similar to those of the Buddha, except that in the case of Parśvanātha the Jina's head is sheltered by the hoods of a Nāga rising above it. Highly characteristic for Jaina art are the *āyāgapaṭas* or votive slabs bearing reliefs representing stūpas, or elaborate designs, with a central seated Jina, quadruple *triśula* symbol, and the Eight Auspicious Symbols.

Figures of Hindu deities are found chiefly on the coins of Gondophares, Kadphises I. and II., Kaniṣka, Huviṣka, Vāsudeva. The variety of types of Śiva is especially noticeable. Many-armed and many-headed types appear for the first time in the second century; Śiva is then four-armed, and sometimes three-headed (Maheśa), the latter type being evidently very popular, as it spread quite early to Gandhāra and Central Asia, where it occurs in sculpture and painting. Many of the Yaudheya coins bear a six-headed Skanda. On coins of Kaniṣka a very great variety of deities appears, Greek, Zoroastrian, and Indian. The figure of the running Wind god is original and remarkable; it corresponds to that of his son Hanuman, the monkey god, the servant and worshipper of Rāma, in later sculpture and painting. The Buddha appears first on a coin from Ujjain, then in three types on coins of Kaniṣka.

Jaina and Brahmanical Types.—Many detached railing pillars, pediments, door jambs, architraves, lintels, and brackets excavated at Mathurā and dateable for the most part in the first or second century A.D. are proved by the subject matter of their reliefs to be derived from Buddhist or Jaina stūpas, temples, or monasteries. The Brahmanical temple site at Māt has yielded the famous inscribed statue of Kaniṣka, and other royal effigies. We learn of a *devakula* (temple) of the Nāga Dadhikarṇṇa.

GANDHĀRA

Graeco-Buddhist Sculpture.—The prolific Graeco-Buddhist school of the North-West Frontier (Afghanistan and part of the Pañjāb, including Peshāwar and the site of Taxila) has always attracted the attention of archaeologists. Its subjects, as in Indian Buddhist art, are drawn from the Buddha legend, and we meet with countless images of Buddhas and Bodhisattvas, and of other deities such as the Tutelary Pair, Kubera and Hāritī. The influence of the school is widely extended in Central Asia, affecting China, Korea, and Japan to a less degree.

Very few Gandhāra images bear dates, and no one of these dates is in a known era. According to some interpretations these dates indicate a beginning of the art in the first century B.C. But at Taxila, where excavations have been scientifically conducted, Graeco-Buddhist art is entirely absent from the Scytho-Parthian and very early Kuṣāna levels of the city of Sirkap, and only appears a little before the time of Kaniṣka. In any case the period of greatest production coincides with the reigns of Kaniṣka (acc. A.D. 120) and Huviṣka, in the second century A.D. Grünwedel dates Kaniṣka A.D. 78 and makes the Gandhāra school begin in the second century, thus later than the establishment of the Mathurā type. But, the Buddha image may have come into use, as the result of a common religious necessity, simultaneously in both areas; though the priority for Gandhāra, even if established, would not affect the fact that the Indian Buddha image of the Gupta period is derived directly from the early Mathurā type, as this in turn is derived from that of the Yakṣa types of the earliest Indian school. It may be safely said that the influence of the Graeco-Buddhist school in India has been much exaggerated.

The Gandhāran type differs from Indian types in more than one way; iconographically by a different treatment of the hair, and in the seat, which is in Gandhāra nearly always a lotus, in India is at first always a lion throne, despite the fact that the lotus seat as a divine symbol had long been known. Stylistically, the differences are more profound. Gandhāran is "late," and belongs to an age of aesthetic decadence in its own cycle; it is naturalistic by intention, although its appearance of realism is no longer based on any structural reality; its graces are deliberate and languid; the solid folds of the drapery are carefully represented. The Indian type has still all the energy and volume of primitive art; it makes no pretensions to grace, is without naturalistic intention, and the drapery is schematic and clinging. It would hardly be possible to juxtapose two contemporary styles more distinct in kind.

The Gandhāran art in its own environment is gradually Indianised, and its productivity ends with the Hūna invasions of the fifth century.

LATER ĀNDHRA

School of Amarāvatī.—The reliefs of Amarāvatī, dating from the close of the second century A.D., once adorned a great stūpa, with the largest and most richly decorated stone railing ever constructed surrounding it. This stūpa was one of numerous Buddhist monuments erected or enlarged by the later Āndhra kings in the Kistna-Godāverī delta, their seat of government. This later Āndhra art is the most intimate and most enchanting of any in India. Just as in literature, epic form is passing into "poetry" (*kāvya*), so here for the first time sculpture is becoming "art."

The subject matter of the reliefs has not changed; the principal compositions represent *Jātakas* and scenes from the life of Buddha (in accordance with traditions earlier than that of the *Lalita Vistara*). Vital moments of the Buddha epic are now more dramatically and emotionally conceived; the gestures, especially those of women, possess a peculiar poignancy, reminding us of such contemporary Buddhist literature as the *Bodhicaryāvatāra* and the work of Sānti Deva. This poignancy, survives indeed at Ajaṇṭā, and Gupta art is very closely related to that of the Āndhras in the third century; but very soon, in so far as it belongs to life, it passes into the formalities of chivalry, and in so far as it belongs to art, into deliberate emphasis and even exaggeration. The same is true of the decorative motifs; a sense of organisation already long perfected is here applied to traditional motifs, with an inimitable delicacy and firmness. The ornament, in fact, is of precisely the same quality, and has the same value as the reliefs with figures. An art which had been entirely corporeal now acquires a spiritual content, becoming Buddhist in a more than formal sense.

As regards the Buddha figure at Amarāvatī, and the similar early types found in Ceylon, the use of a cult image is still new, and the figure therefore retains more of the austerity and massive individuality of primitive art than in the reliefs and ornament.

GUPTA

A.D. 320–c. 600.—In early Gupta art the spirit is still at the height of its vitality, but maturer, more intellectually conscious, more introspective; at the same time the expression is less reserved. Gupta art is characteristically logical, sophisticated, gracious and sensuous. Early Gupta art is important in the history of Indian art, as representing a completely unified national style within the limits of India proper, and at the same time embodying the types of which the influence predominates in the south-eastern and far-eastern developments of Indian iconography and architecture. The Gupta style is unmistakably recognizable in the sculpture and architecture of fifth to seventh century date in Burma, Siam and Cambodia. (*See* FURTHER INDIA and INDONESIA.)

The Buddha figure of the Gupta period is characterised by its definition and refinement; the diaphanous robe, covering one or both shoulders clings closely to the body, almost without folds ("wet drapery"); the hair is invariably arranged in short curls, the *uṣṇīṣa* is indicated as a cranial protuberance, and there is a lotus or lion pedestal, usually with figures of donors. The finest examples have been found at Sārnāth and Mathurā, in relief at Ajaṇṭā. One colossal copper figure, weighing over a ton, found at Sulṭāngañj is now in the Birmingham Museum and Art Gallery. Brahmanical sculpture is represented by *mukha-lingams* (Śiva) of admirable workmanship from Bhumara, Khoh and other sites in Bundelkhaṇḍ; reliefs of Viṣṇu, Narasiṁha, and Durgā, and the magnificent Varāha Avatār at Udayagiri, Gwalior; *Rāmāyaṇa* scenes from the basement of the late Gupta temple at Deogaṛh; sculptures of the Rāmeśvara cave, Elūrā; and the stucco reliefs of the Maṇiyār Maṭha at Rājagṛha.

The famous paintings of Ajaṇṭā and Bāgh, all on the walls of excavated Buddhist temples and monasteries, the so-called "Caves," belong for the most part, to the Gupta period, though none appear to be immediate products of Gupta patronage. Those of Caves IX. and X. date about the beginning of the Christian era or even earlier, those of Caves XVI. and XVII. about A.D. 500, those of Cave XIX. about the middle of the sixth century; those of Caves I. and II. date from the seventh century, and thus Early Mediaeval. The subjects are all Buddhist, representing *Jātakas* and scenes from the Life of Buddha, with the popular mythology of Yakṣas and Nāgas as incorporated in Buddhism.

EARLY MEDIAEVAL

Harśa: Nālandā.—Harśavardhana in the first half of the seventh century revived the glories of the diminished Gupta empire. He may be regarded as responsible for the restoration of the great monastery at Nālandā, and for the transition from Gupta to mediaeval art in Magadha generally. He also took possession of the Valabhī kingdoms of Kāṭhiāwār and Gujarāt; but was defeated by the Cāḷukyan king Pulakeśin II. A more detailed account can be given of early mediaeval art in the Dekkhan and the far south.

Pallavas.—The Pallavas originated in the Kistna-Godāverī area, inheriting the artistic tradition of the eastern Āndhras. Forced to move southward about 600, the sudden appearance of architecture and sculpture in stone is due to the accomplished Mahendravarman I. (600–625); we know from one of his inscriptions that up to this time structural temples had been built of brick, timber, copper and mortar, and the implied absence of stone construction corresponds to and explains the appearance of Pallava art already fully evolved in the 7th century. All the sculpture at Māmallapuram, including that of the excavated and monolithic temples (the "Seven Pagodas"), and also the great rock-cut relief representing Bhagiratha's penance and the Descent of the Ganges belong to the first half of the 7th century. The sculpture here, Paurāṇik in theme, for the Pallavas were Hindu kings, is of a very high order. In the early 8th century the sculpture develops in more strictly architectural application, in connection with the great structural temples at the Pallava capital, Kāñcipuram, passing in the 9th into that of the Coḷa period. Painting which has been assigned to the time of Mahendravarman I. has been found in a Jaina excavation at Pudokoṭṭai.

Early Cāḷukyan.—Some temples with sculptures at Bādāmī antedate Pulakeśin I. (550–566), founder of the dynasty. Later artistic history shows a mixture of northern and southern elements, but is mainly a development of Pallava forms. The Brahmanical caves at Bādāmī and Aihole (especially Cave III., date A.D. 578) contain a series of large and important reliefs illustrating Paurāṇik mythology and legend. Worthy of special mention also are the sculptured roofing slabs from Aihole, dating from the early 7th century, and now in the Prince of Wales Museum, Bombay. The Virūpākṣa, most important of the structural temples at Pattadkal was built about 740, probably by architects and masons brought from Kāñcipuram, and shows a corresponding Pallava character in the sculptured reliefs. The Buddhist caves at Aurangābād, dating from the late 6th and early 7th century contain many important figures. At Elūrā, the Das Avatāra, Rāvaṇa kā Khāī, Dhumar Leṇā and Rāmeśvara caves appear to range from 650 to 750.

Rāṣṭrakūṭa.—The Rāṣṭrakūṭas succeeded the Cāḷukyas in the Western Dekkhan in 753. Their most important monuments are at Elūrā and Elephanta; the latter are easily accessible in an









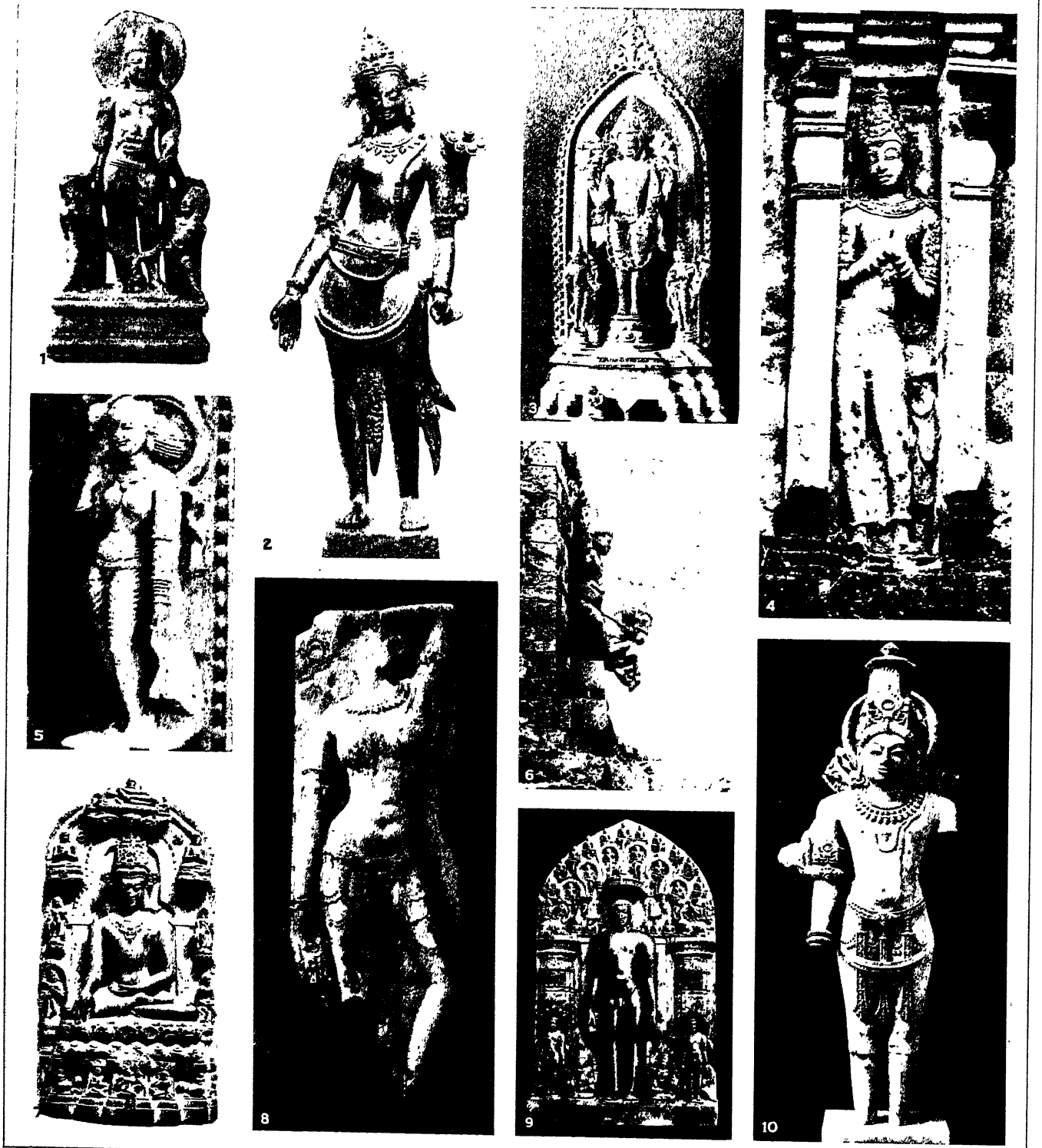




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SCULPTURE OF THE PALLAVAS AND RĀṢṬRAKŪTAS

1. Viṣṇu reclining upon ananta, a relief in the Mahiṣa-maṇḍapam, Māmallapuram. Pallava, 7th century
2. Detail from the Descent of the Ganges, a rock-cut relief at Māmallapuram. Pallava, 7th century
3. Siva and Pārvatī on Mt. Kailāsa, with Rāvaṇa imprisoned below. In the rock-cut temple Kailāsanātha at Elūrā. Rāṣṭrakūta, 8th century
4. Siva dancing, in Rāvaṇa kā Khai at Elūrā. Rāṣṭrakūta, 8th century
5. Durgā, ten-armed, standing on the head of Mahiṣa. Pallava, 7th century
6. Right face of the rock cut triple bust of Maheśa (Siva), at Elephanta. Rāṣṭrakūta, 8th century



BY COURTESY OF (1) THE MUSEUM OF THE UNIVERSITY OF PENNSYLVANIA, (2, 7, 10) THE MUSEUM OF FINE ARTS, BOSTON, (3, 8, 9) THE ARCHAEOLOGICAL SURVEY OF INDIA; PHOTOGRAPHS, (4, 5) JOHNSTON AND HOFFMANN, (6) A. K. COOMARASWAMY

SCULPTURES AND SCULPTURAL DETAIL

1. Viṣṇu. Stone. Height 8¾ in. Kashmīr, 9th century
2. Avalokiteśvara, Bodhisattva. Copper, gilt and jewelled. Height, 12⅜ in. *c.* 11th century
3. Viṣṇu. Copper. Height 25½ in. Bengal
4. Bodhisattva. Brick and stucco. Northern temple, Polonnāruva, Ceylon, 12th century
5. Devatā, detail from the Rājrānī temple, Orissa, *c.* 1150 A.D.
6. Deity on horse, detail from the Sūrya Deul, Koṇārak, Orissā, 13th century
7. The Eight Great Events (in the Life of Buddha); Slate. Pāla, 10th century. Bihar or Bengal
8. "Rukmiṇī." Sandstone. Height 5 ft. 4½ in. Nokhas, Etah District, *c.* 10th century
9. Mahāvīra (founder of Jainism). Soft schist. Later Cāḷuyka. *c.* 11th century. Aminbhavi, Mysore
10. Viṣṇu. Sandstone. Height 4 ft. Etah District, *c.* 1000 A.D.

afternoon from Bombay. At Elūrā the famous rock cut Kailāsanātha temple, a huge and complete monolithic shrine excavated in the side of the hill, is in a purely Dravidian style, immediately derived from that of the Virūpākṣa at Bādāmī; of the very numerous sculptures illustrating Śaiva subjects, the finest represents Śiva and Pārvatī seated on Mt. Kailāsa, with Rāvaṇa imprisoned within the mountain below, endeavouring to cast it down, and succeeding in causing a tremor; this, and the Varāha Avatār of Udayagiri, above alluded to, are the finest examples of reliefs which deal with what may be described as cosmic or geotectonic themes. Remains of painting on the ceiling of the porch of the upper storey are of two periods, in part no doubt of the eighth century and nearly contemporary with the actual shrine; these are the oldest surviving Brahmanical frescoes, but literary references show that painting had been practised both as a religious and secular art from time immemorial.

At Elephanta, the most famous, and perfectly preserved sculpture is a colossal relief in the main excavation, a three-headed bust, which has often, though incorrectly been called a Trimūrti; it is actually an icon of Śiva in the form known as Maheśa, and many other examples exist, of which one of the best is a later relief in the Pennsylvania University Museum.

Kashmīr.—The old town of Vijrabror has yielded early sculptures in which the influence of the Graeco-Buddhist art of Gandhāra is still apparent; the most interesting of these are representations of the goddess of Fortune, Lakṣmī, seated with a cornucopia, and these types can be followed well into the mediaeval time, gradually becoming completely Indianised. The remains of a tiled cock-pit of about the 5th century at Haṛvan are unique; the devices on the moulded tiles represent men seated, and in balconies; equestrian archers in chain armour; deer, fighting cocks, lotuses, and a fleur-de-lys motif; in technique they recall the so-called Han but probably later grave-tiles of China.

The Vāntipor temple sites of early 9th century date have yielded small and admirably executed stone figures of Viṣṇu in a style peculiar to Kashmīr and the neighbouring States of Cambā and Kuḷū, and with these there appear also Śiva types, including a three-headed Maheśa, and an Ardhanārīśvara. Similar Vaiṣṇava images of brass inlaid with silver and copper have been found in Kuḷū, together with a Buddha image in the same technique, but of earlier (late Gupta) date. Buddhist "bronzes" found in Kashmīr, and ranging from the 6th to the 11th century, show that Buddhism survived to a late date, although it had already declined by the end of the 8th century, all the foundations of Avantivarman in the 9th being Brahmanical. The stone sculpture architecturally associated with the great temples in Kashmīr is unfortunately almost all in a ruined state.

MEDIAEVAL (FROM ABOUT 850 ONWARDS)

The Mediaeval art again falls into three main divisions, corresponding to the geographical classification of the architecture as *Nāgara* (Northern and Eastern), *Vesara* (South Central and Western) and *Drāviḍa* (Southern). The character of Indian art has now definitely changed and hardened; the sculpture is no longer distinguished by plastic volume, but has acquired a linear character; that is, the form appears to be conceived from the standpoint of outline, and all the features are sharply defined; its application is primarily architectural, and one might say decorative, were it not for the fact that it retains a precise significance in all its details; its forms are more complicated, partly because the theological development has brought in a greater variety of many-armed forms (these appeared first in the second century, and are already common in Early Mediaeval work), and partly because of the tendency, innate in all late art, towards great intricacy and elaboration of detail, and an overvaluation of merely technical skill, displayed as an end in itself.

Northern and Eastern.—The main schools are those of Bihar and Bengal (Pāla Dynasty); Orissā; and Bundelkhaṇḍ and Rajputana. Under the Pālas (750–1200) the main centre of production was at the important monastery and university of Nālandā in Bihar. The characteristic Buddhist images, together with Buddhist and Brahmanical examples from other sites in Bihar and Bengal are executed with the utmost technical proficiency in a kind of black slate, and are represented in all large collections; and in recent years very numerous and exquisitely made copper images have been excavated here or found elsewhere in Bengal (Rangpur and Chittagong). The themes are at first Buddhist, but the Buddhism is greatly mixed with Hindu elements, and acquires as time passes a more and more Tāntrik character. The names of two painters and sculptors, Dhīmāṇ and Bitpālo, are mentioned by the historian Tārānātha as having been masters in the Eastern School in the 9th century. The Bihār school exercised a powerful iconographic and stylistic influence on Nepal, Tibet, Burma and Java and Sumatra. Not only sculpture, but also painting was practised; a number of Buddhist palmleaf manuscripts from Bengal and Nepal, with painted wooden covers, and illustrations in the text have been preserved from the 11th and 12th centuries. The style is most closely related on the one hand to the slightly later painting of the Gujarātī school, and on the other to the contemporary frescoes of Burma (Pagan). The Pāla school of painting in the 12th century was known even to the Chinese.

Sculpture in Orissā is typically Brahmanical, and occurs in connection with the series of great temples at Bhuvaneśvara, Koṇārak, Puri, etc., ranging in date from the 8th to the 13th century. The monumental horses and elephants, and the erotic architectural sculptures of the Sun Temple at Koṇārak are especially noteworthy.

Bundelkhand and Rajputana.—The magnificent temples of Khajurāho are literally covered with Brahmanical sculpture in a hard creamy sandstone; and isolated fine examples have been found at Mahoba, another Candela capital. Jaina sculptures too occur in abundance, but Buddhist works are relatively rare. To enumerate the sculpture in Rajputana would be impossible; there is much of excellent quality.

South Central and Western.—An enormous revival of building and sculpture took place in the Dekkhan under the later Cāḷukyas after 973, the Hoyśalas of Mysore in the 12th and 13th centuries, and in Gujarāt under the related Solaṅki dynasty (10th to 15th century). The sculpture of the Dekkhan and Mysore is executed in a fine-grained dark chloritic schist, which is comparatively soft when first quarried, and lends itself to an unlimited elaboration of detail more appropriate to metal-work than stone. Almost all the work is of architectural application, and unbelievably rich in quantity and detail. Especially characteristic are the elevated temple basements, with tier upon tier of sculptured friezes, and the huge turned cylindrical pillars of the porches, with luxuriously developed bracket figures of dancers. In Mysore, Belūr, Halebīd, Doḍḍa Gadavaḷḷi, Somnāthpur and Śravaṇa Belgoḷa are amongst the most famous sites. At the latter place there is a remarkable monolithic image of Gommaṭeśvara (son of the first of the 24 Jinas of the Jaina mythology); one of the largest freestanding figures in the world, 57 feet in height, this was carved *in situ* for Cāmuṇḍa Rāja in A.D. 981. Another figure at Ilivālā is over 20 feet in height.

In Gujarāt, Kāṭhiāwāṛ and parts of Rajputana there exists another extensive development in a related style. In Gujarāt proper, most of the temples are in ruins. At Girnār, Palitāna and Taranga, Jaina temple cities and places of pilgrimage, there is much sculpture still *in situ*. The most famous and remarkable examples of the style, however, are to be seen at Mt. Ābū (Dilvāṛā, in southern Rajputana), in the temples of Vimala Shah (*c.* 1032) and Tejahpāla (*c.* 1232); these are domed shrines with pillared halls.

Gujarātī (Jaina) Painting.—A Gujarātī school of manuscript illustration flourished from the 13th to the 17th century, after which it is more or less modified by Mughal and Rajput influences. One manuscript dated 1237 is on palm-leaf, all others are on paper, with earliest date 1427. The majority of the manuscripts are Jaina scriptures, but there is one secular example, a *Vasanta Vilāsa*, dated 1451. Although the colouring is brilliant, the style is really one of pure draughtsmanship; the outline establishes all the facts, and this outline, though very facile and almost careless, is extremely accomplished.

Rajput Painting.—The tradition of mural painting, exterior

and interior, even at the present day survives sporadically all over India; a good deal may still be seen in Rajputana, for example in the Old Palace at Bīkāner. Paintings on canvas and illustrated manuscripts are very rare. But as paper gradually came into use. the older methods of painting on walls and panels or cotton cloth were employed on the new material; the technique of Hindu painting on paper is in fact identical with that of the older mural art as seen at Ajaṇṭā and described in the technical treatises. The themes of Rajputa painting are religious (dealing especially with the Kṛṣṇa cycle, but also with Śaiva and Vaiṣṇava mythology in general), Epic (*Mahābhārata* and *Rāmāyaṇa*), lyrical and rhetoric (*Rāg-mālās*), and, less typically, secular (portraiture). The Kṛṣṇa cycle and themes illustrating treatises on rhetoric (classification of heroines, and emotional analysis), given a contemporary environment in court and village life, permit an exquisite delineation of every phase of love. The Epic subjects, especially in early Jammū works, are treated on a large and almost mural scale. Especially characteristic are the sets of illustrations of the *Rāg-mālās*, vernacular poems describing the situations which are appropriate to each of the Rāgas or musical modes; these are usually 36 in number, and each has its particular hour and specific sentiment (*see* INDIAN MUSIC). Stylistically Rajput paintings can be classified both geographically and in historical sequence. Very few of them show any approximation to the Gujarātī style. The early examples from Rajputana and (or) Bundelkhaṇḍ are most distinctive; here we find a robust analytical method of drawing, an indication rather than a representation of forms, and an intensely brilliant colouring, like that of enamel or stained glass, by which the planes are established. A modified tonality gradually appears, partly due to Mughal influences; but even in the 18th century, when the outline has become more meticulous, the work of Jaipur artists can be recognized by its brilliancy, and by its marvellous decorative treatment, especially of flowers and trees. The earlier Jammū productions too are strongly coloured, while the drawing is more provincial throughout. In some respects the most exquisite, and certainly the most refined, if not the most powerful, phase of Rajput painting is that of the Kāṅgrā school, developed in the latter half of the 18th century under Raja Saṁsāra Cand; connected with this school are its offshoot in Tehri-Gaṛhwāl, and its early 19th century secular development in Sikh portraiture. The Kāngrā school declined during the 19th century and is now to all intents and purposes extinct. Related schools existed in Bengal and Oṛissā. By far the finest collection in the world is to be seen in Boston; other examples are in the Lahore and British Museums, and in private collections.

Ceylon.—The artistic culture of Ceylon is at all times very closely related to that of Southern India, but can be more conveniently treated as a consecutive development. One of the oldest documents is a carnelian seal representing a seated king, probably of the second century B.C., from the Yaṭṭhālā Dāgaba in the south, now in Manchester. It is difficult to say whether any or how much of the sculpture surviving at Anurādhapura dates before the beginning of the Christian era; the greater part in any case belongs to the period ranging from the 1st to the 9th century. Among the finest sculptures in Ceylon, previous to their restoration and virtual destruction by pious Buddhists, were the Buddha figures, and one traditionally known as Duṭṭha Gāmaṇi (r. 1st century B.C.), at the Ruanwęli Dāgaba site; the Buddha figures show a close relation with those of Amarāvatī and must date from about A.D. 200. Relief sculpture may date back to the first century B.C. or but little later; this applies especially to the Nāga reliefs and formal trees rising from "lucky vases," represented on stelae at the Eastern (so-called Abhayagiriya) and Ruanwęli Dāgabas, for these are still in flattened relief, and distinctly related in style to the Sāñcī and early Sārnāth reliefs of the 1st century B.C. The "moonstones" or stone doorsteps of monasteries or palaces are of various dates, and consist of half lotus medallions with friezes of animals (horses, lions, elephants and bulls, or geese carrying floral sprays; the steps above them are flanked by solid balusters (*ālamba bāhu, hasti-hasta*) consisting of heads and trunks of elephants, or *makara* heads spouting vegetation; while at each side stand reliefs representing Nāgas, holding "lucky vases" and cornucopiae. The rock-cut reliefs of elephants and a seated sage ("Kapila") at the Isurumuniya Vihāra, the elephant reliefs by the Tissawęwa lake are in Pallava style and evidently of 7th century date.

At Poḷonnāruwa, the rock-cut statue traditionally regarded as a representation of Parākrama Bāhu I. (1153–1186) is a magnificent work; not so fine, though impressive in scale and design are the seated and reclining Buddha figures of the Gal Vihāra, where there is also a colossal standing figure of the disciple Ānanda. Some of the brick and stucco figures of the Northern temple are extremely elegant.

There exist colossal Buddha figures of the Poḷonnāruwa period also at Sęsēruwa, Āwkana and Kon Węwa.

A limited number of small bronzes or rather copper images of very high quality have been found in Ceylon. One of the largest is a fine seated Buddha from Badullā, of about 6th century date, but the finest of all are a well-known seated Avalokiteśvara with figures of Vajrapāṇi and Jambhala, of 8th and 9th century date, now in Boston; there is a fair collection of similar figures in the British Museum. Brahmanical bronzes apparently of Coḷa date have been excavated at Poḷonnāruwa and are now in the Colombo Museum.

Remains of painting have been preserved at a number of sites. There are a few traces of decoration at Anurādhapura, including some figures of dwarf Yakṣas. More remarkable are the Apsarases of the painted rock pockets at Sīgiriya, dating from the 5th century, and still in excellent preservation; these are voluptuous female figures, cut off by clouds at the waist in accordance with a characteristic convention, and casting down a rain of flowers upon the mortal world below them. At Hindagala near Kandy there is a fragment of fresco regarded by some as of rather early date, but probably mediaeval. By far the most extensive remains, though now almost destroyed by neglect since their first discovery, are those of the inner walls of the Northern Temple at Poḷonnāruwa; these illustrate *Jātakas,* but can only be inadequately studied in the bad copies exhibited in the Colombo Museum. The Sinhalese chronicles (*Mahāvaṁsa*) contain innumerable references to painting, but nothing more survives until we come to the 18th century, when Kīrti Śrī Rāja Siṁha, one of the last Kandyan kings, restored many shrines in the Kandyan provinces. Mention must also be made of the admirable decorated ceilings of Kelaṇiya, Kandy, and some other places; these are often masterpieces of design.

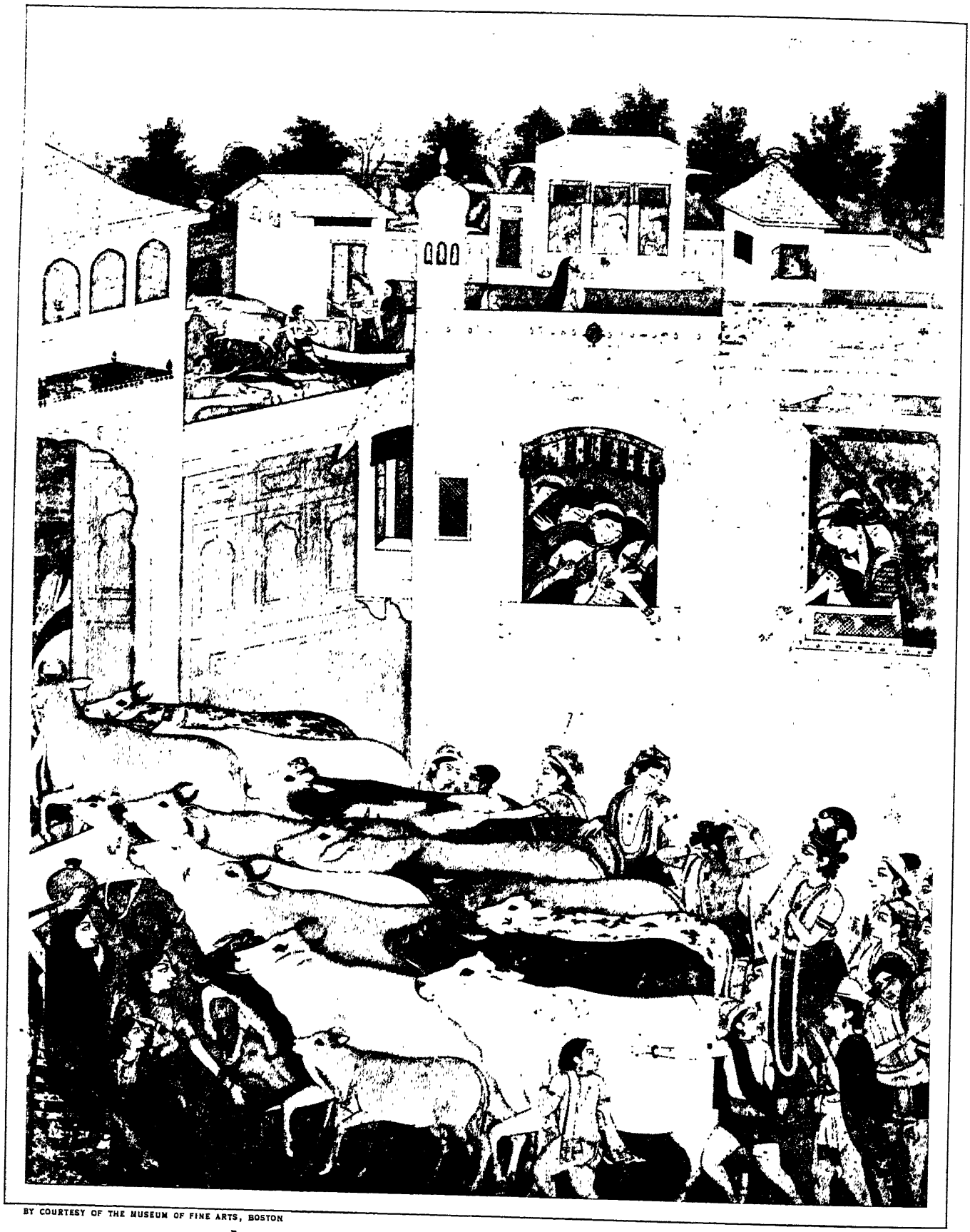
During the 19th century little of note in sculpture was produced in Northern India. In Southern India the indigenous tradition has been preserved in greater purity; copper images, sometimes of large size, and little inferior in quality to those of the 17th and 18th centuries are still made, and hereditary craftsmen still work in stone. In the present century a reaction against Western mannerisms has taken place, and especially in Calcutta, where a considerable (Bengal) school of painters is at work, a very large number of pictures, mostly water-colours, has been produced. The pictures are delicate and often very charming, but hardly powerful; the movement is comparable in some respects to that of the Pre-Raphaelites in Europe. Amongst the chief artists who have been or are still at work may be mentioned Gogonendronath Tagore, who works mainly in monochrome, and has flirted with Cubism; Nanda Lal Bose; Asit Kumar Haldar, now Principal of the School of Art in Lucknow; Samarandranath Gupta, now Assistant Curator, Pañjāb Museum, Lahore; and many younger men, and some women.

(*See* also INDIAN ARCHITECTURE, including FURTHER INDIAN and INDONESIAN; INDONESIAN and FURTHER INDIAN ART.)

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BY COURTESY OF (1, 2, 3) C. T. LOO, (4, 6) THE MUSEUM OF FINE ARTS, BOSTON; PHOTOGRAPHS, (7, 11) THE ARCHAEOLOGICAL SURVEY OF INDIA

1. Siva manifested in the lingam, Brahmā seeking its summit, Viṣṇu its base. Tanjore district, southern India, 10th century. 2. Siva, four armed, the two upper arms holding the skull-club and mendicant's drum. Tanjore district, southern India, 10th century. 3. One of the Seven Mothers, perhaps Brahmāṇi. Tanjore district, 10th century. 4. Avalokiteśvara, Bodhisattva. Bronze. Height 3½ in. Ceylon, 8th century. 5. Sundaramūrti Svāmi, devotee of Siva. Copper. Height 24½ in. From Pojonnāruva, c. 13th century. 6. Pārvatī. Copper. Height 23¼ in. South Indian, c. 17th century. 7. Siva (Gajahāmūrti) dancing on a slain elephant, the skin being behind him. Perūr, c. 17th century. 8. Māṇikka Vāṣagar, Saiva saint. Copper. Height 23¼ in. From Pojonnāruva, c. 13th century. 9. Siva as Naṭarāja, Cosmic dancer. Copper. Height, about 4 in. South Indian, 16th–17th century. 10. Pārvatī. Copper. Height, 16½ in. South Indian, c. 15th century. 11. Veṅkaṭapatiraya, Vijayanagar king, early 16th century. Copper. Veṅkaṭeśvara temple, Tirumala



BY COURTESY OF THE MUSEUM OF FINE ARTS, BOSTON

RAJPUT PAINTING OF THE LATE 18TH CENTURY

The Hour of Cowdust; showing Kṛṣṇa returning with the herds to Bṛndāban at sundown. Kāṅgrā school

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INDIANAPOLIS, the capital and largest city of Indiana, U.S.A., on the White river, at about the exact geographical centre of the State; a port of entry and the county seat of Marion county. It is on Federal highways 31, 36, 40 and 52; has a municipal airport; and is served by the Baltimore and Ohio, the Big Four, the Chicago, Indianapolis and Louisville, the Erie, the Illinois Central, the Indianapolis Union, the Nickel Plate and the Pennsylvania railways, and by inter-urban trolley and motor-bus lines radiating in every direction. In 1920, when Indianapolis ranked 21st among the cities of the United States, the population was 314,194, of whom 34,678 were negroes and 16,958 were foreign-born white (over half from Germany, Ireland and England). The census bureau estimate for 1928 was 382,000.

Indianapolis prides itself on being the largest city in the world not situated on navigable water. Transportation facilities by rail and highway are exceptionally good. The first union railway station in America was built here, and the present Union Depot (vastly enlarged since 1917, when work was begun on the elevation of all the tracks) is one of the most commodious and well-arranged stations in the country. Some 160 mail trains enter and depart daily, and the belt line connecting the several railways carries over 2,000,000 freight cars annually. The traction terminal and the motor-bus terminal are the largest in the country.

The city occupies 49·5 sq.m. on a level plain surrounded by low, gently sloping hills. It has the beauty of wide, well-planned streets, winding streams, trees, lawns, gardens and shrubbery. In the exact centre of the original tract of four "sections," surrounded by a circular park, is the Soldiers' and Sailors' monument. It rises to a height of 284·5ft. above the street level and is surmounted by a figure of Victory 38ft. high. An elevator runs to a balcony at the top, which commands a panoramic view of the city and many miles of surrounding country. At the base of the monument are fountains with a capacity of 20,000gal. per minute. From this central circle four avenues radiate to the four corners of the city. The other streets run at right angles to one another. The main street (Washington) is 120ft. wide; most of the others, 90 feet. There are 18 public parks, with a total area of 2,544ac.; 46 playgrounds; and 53m. of boulevard, including a 60ft. driveway on the top of the concrete levee (40ft. high) which was constructed (1914–16) along the west bank of the White river.

North of the Circle is the World War memorial plaza (constructed at a cost of $10,000,000), covering five blocks given by city, county and state, and containing, among other public buildings, the national headquarters of the American Legion. The State house, in a square of 8ac., has a ground area of 2ac. and a central tower and dome 240ft. high. Many of the public and business buildings are constructed of the famous Indiana limestone, from the Bedford district in the southern part of the State. North-west of the city is the motor speedway, where races are held annually on Decoration Day (May 30), attracting 150,000 visitors from all parts of the country. The home of James Whitcomb Riley, 528 Lockerbie street, is a literary shrine.

Indianapolis was one of the first cities in America to adopt electric street-lighting. A city-plan commission (1919), and a zoning ordinance, adopted in 1922, outlined a scheme for rea-

dential, commercial and industrial districts. The assessed valuation of property for 1927 was $666,461,290.

The public school system of the city comprises 83 grade and 4 high schools, and employs over 1,500 teachers. The public library, a beautiful example of Greek architecture, on a site presented by J. W. Riley, contains over 400,000 volumes. The private charitable agencies (about 40) are financed by a joint community fund. There are three daily newspapers: the *News*, established in 1869; the *Star* (1883); and the *Times* (1888).

Indianapolis is the seat of the School of Medicine and the School of Dentistry of Indiana university; of Butler university (chartered 1849), Indiana Central college (1904), the Benjamin Harrison Law school, Indiana Law school, the Indianapolis college of pharmacy, the Teachers college of Indianapolis (a private institution), the John Herron Art institute and school, a private school for stammerers, the School of Printing of the Typothetae of America; of the Central Indiana hospital for the insane, the State schools for the blind and deaf, the State prison for women (the first in the United States, opened in 1873), and (at Clermont, 10m. out) the State reformatory school for girls, which was a department of the prison until 1899. Ten miles north-east of the centre of the city is Ft. Benjamin Harrison, an important United States army post, named after President Harrison, whose home was in Indianapolis. The State fair grounds and the State fish hatcheries are within the city limits. Around the Indiana university school of medicine has developed one of the important medical centres of the country. The school itself was formed in 1908 by the union of the Indiana Medical college of Purdue university and the earlier medical department of the State university, which together incorporated six institutions founded between 1869 and 1906 at several different points in the State. Its new building (completed 1927?) is on the spacious grounds of the Robert W. Long hospital (completed 1914) which is a part of the school's equipment. Near by is the James Whitcomb Riley Memorial hospital for children, built by private subscription and conveyed to the university on the day it was dedicated (1924); and the William H. Coleman hospital for women (opened 1927), also under the university's management.

The transportation facilities of Indianapolis and its position in the midst of the corn belt, near large coal-fields, and with populous markets in every direction, have combined to make it an important commercial and industrial centre. It has a large trade in grain ($75,000,000 annually) and its elevators have a capacity of over 1,000,000 bushels. First place is held by automobiles, valued at $75,000,000 annually. Other important manufactures are automobile accessories, malleable iron, foundry and machine shop products, agricultural implements, sewing machines, railroad cars, upholstery and furniture, cotton and woollen goods, glass, flour, canned vegetables, organs and pianos. The printing and publishing business has an annual output valued at $16,000,000. In 1925 the aggregate factory output was valued at $344,924,907. Bank debits in 1926 amounted to $2,207,379,000. The crops produced within 10om. of the city are valued at $500,000,000 a year.

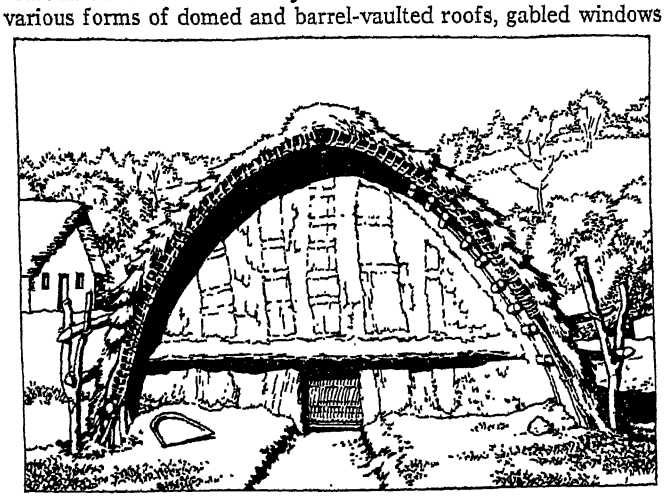
History.—When Indiana was admitted to the Union (1816) Congress gave it four sections of public land for its capital. The commissioners appointed to select the site placed it (1820) almost exactly in the geographical centre of the State, at the cabin of John McCormick, on the White river, in the midst of dense forests and without any means of communication with the rest of the State. A town was laid out in 1821 (the "original mile square," bounded by north, east, south and west streets) and some activity in land speculation followed; but when the seat of government was moved here from Corydon in 1824 there was but a single street and 600 inhabitants. The legislature met in Indianapolis for the first time in 1825. It was incorporated as a town in 1832, with a population of 1,000. The first State capitol was completed in 1836. Some impetus was given to the city's growth by the completion of the National Road, and later, beginning in 1847, by the coming of the railways, but the development was slow until after the Civil War. The city was chartered in 1847, and in the same year a free public school system was inaugurated. In 1850 the population was only 8,091. By 1860 it had grown to 18,611, and in the following decade it increased to 48,244. In the next 20 years (1870–90), and again between 1890 and 1910, the increase was considerably more than 100%, and in the single decade 1910–20 it amounted to 34%.

In the years following the World War, Indianapolis suffered severely from the domination of State and city politics by the Ku Klux Klan (*see* INDIANA), until exposure of the methods of the Klan (largely through the initiative of the Indianapolis *Times*) led to a weakening of its power.

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INDIAN ARCHITECTURE, like Indian sculpture, is essentially of native origin, belonging to the Drāviḍian rather than the Āryan race. The Vedic ritual required neither images nor temples, but the non-Vedic cults, such as those of the dragons (*Nāgas*), the tree-spirits (*Yakṣas*) and the goddesses, may have had permanent shrines with images and wooden temples. References to images and temples begin to appear in the literature from about the 4th century B.C. onwards, and numerous types are represented in the reliefs from the 2nd century B.C. In Hindu worship (*pūjā*, the service of a personal deity with offerings of food, lights, incense, etc., as distinguished from *yajña*, the Vedic sacrificial ritual) the first essential is an altar, with or without a symbol or image, serving to receive offerings of flowers. Such an altar beneath a sacred tree, for example, constitutes a *Yakṣa caitya*. The term *caitya* denotes a shrine of any kind, but has often been used (erroneously) to designate exclusively the *stūpa*. The next step is a god's house (*devālaya, devāgāra, āyatana*, etc.), a simple roofed enclosure containing the altar and symbol or image.

Origins.—The fundamental elements of temple architecture are indigenous and of great antiquity. Early Indian architecture was almost entirely of wooden construction, and the forms thus established were later closely imitated in brick and stone. The various forms of domed and barrel-vaulted roofs, gabled windows



BY COURTESY OF THE FIELD MUSEUM, CHICAGO

TODA HUT, RESEMBLING A BARREL-VAULTED TEMPLE

and roof ends, pillars and cornices are developed from wooden prototypes; the Toda hut, for example, even at the present day presents a striking likeness to a barrel-vaulted gable-ended temple.

A part of Indian architecture, especially at an early period when the use of impermanent building material was otherwise still general, may be described as monolithic; that is to say, the shrine is excavated in solid rock, either by hollowing out the necessary chambers (so that only the internal architecture is brought into being), or by cutting away the exterior rock so as to leave an entire temple of solid rock. Very remarkable works of both

kinds exist. The former, the cave temple type, is best illustrated by the early Buddhist *caitya* halls (Kārlī, Nāsik, Ajaṇṭā, Bāgh, etc.), in which the interior of an apsidal temple of wooden construction is reproduced in stone in every detail, and by such great Hindu excavations as those of Elephanta, near Bombay; the latter by the famous Kailāsanātha at Elura, near Aurangābād, the Masrūr temple in Kāngṛā, the "Seven Pagodas" at Māmallapuram south of Madras and the Veṭṭuvankoyil at Kalugamalai in the far south.

Arches and Domes.—As both the arch and dome were known to the Sumerian builder in the fourth millennium B.C. there is nothing surprising in the fact that both appear in India long before the Mohammedan period, and in fact from the Maurya period onwards. One of the earliest temple types is that of a square or circular domed structure, with a roll cornice below the dome. Structural stone buildings of this kind can be traced back at least to the second century.

Special Forms.—Some special forms characteristic of Buddhist and Jaina usage should be briefly described. The most familiar of these is the stūpa (*tope, dāgaba*), an elaboration of the old Indian funeral mound, later carried out in solid masonry, provided with enclosing walls or railings, and decorated with sculptures. The essential parts of the stūpa are the dome (*aṇḍa* or *garbha*), solid but for a small relic-chamber near the ground level in the centre, and inaccessible after completion; one or more platforms, supporting the dome, provided with stairways for access, and serving for circumambulation; a small pavilion (*harmikā*) on the summit, and rising from this a mast (*yaṣṭi*) bearing one or more symbolic umbrellas (*chatrāvalī*); one or more railings (*vedikā*) surrounding the dome or the whole structure. In the earliest types of the Buddhist Stūpa the dome is hemispherical; but a more aspiring type is gradually developed, until we reach such tall pointed forms as that of the beautiful Burmese Shwe Dagon. In some Burmese forms the basement is developed to a great height, and is provided with chapels within its mass, for which an Indian prototype can be cited at Mīrpur Khās in Sind. At Borobuḍur in Java the basement platforms are seven in number, forming a massive pyramid; this plan in a somewhat simpler form occurs earlier in the Punjāb, Kashmir, and Turkistan. The stūpa is almost exclusively of Buddhist or Jaina significance, and as a symbol represents the death or final release of the great teacher, the Buddha of Mahāvīra, as the case may be.

Highly characteristic, also, are the aisled apsidal churches best known from the early Buddhist rock-cut "*caitya* halls," but also represented by structural examples in brick or stone of Gupta and later date (Ter, Chezārlā, Aihole; and in Pallava and later Drāviḍa architecture, where the number of storeys is increased, as the crowning member of a tower).

Another special form peculiar to India is that of the hypaethral tree temple, usually a pillared hall, square or circular, with a gallery and vaulted roof, but open in the centre, and surrounding a sacred tree; nearly a dozen examples are represented in Buddhist reliefs, where the tree is the Bodhi-tree, the symbol of the Buddha's Great Enlightenment, but there is every reason to suppose that the type was a very ancient one, developed in connection with the worship of Yakṣas (*q.v.*), or tree-spirits.

Doorways of early buildings are provided with decorated tympanums, reproducing wooden forms, and with a gable or ogee arch above. Entrances to sacred areas were provided with *toraṇas* (resembling Japanese *torii*, where there may be a genetic connection); these consist of upright pillars bearing one or more architraves, of which the elaborate examples at Sāñcī afford the best instances, though many others are represented in reliefs. Applied, as it were, to a wall surface, the same form may be used in rock-cut or structural shrines (*e.g.*, Nāsik, Cave iii.), the pillars becoming jambs, the lower architrave the lintel, brackets being still represented, though no longer functional. In later southern architecture the gateway of the enclosing walls becomes an immense structural tower, called a *gopuram*, often completely dwarfing the main shrine.

The gable or dormer windows (*Gavākṣa, Kūḍu*) which are found to be most characteristic as constructional elements in the early architecture, and as ornament in the later, have been commonly designated "horseshoe arch," from the form, and "*caitya* window," from the large and conspicuous examples that pierce the façades of the early excavated churches. In many cases the two ends of the arch spring from a pair of *makaras* (crocodiles), situated immediately over the capitals of the supporting pilasters, and constituting a *makara toraṇa*. The summit of the arch is pointed, making it an ogee arch. This dormer arch is not confined to India, but reappears in the earlier architecture of Cambodia and Java. Cusped forms are early developed and survive in Muḥammadan usage.

Columns.—Indian columns are of two kinds according to use, either single pillars (*stambha* or *lāṭ*) bearing a symbol appropriate to the deity of the temple beside which they are placed, or structural pillars (*khambha*) of temples or secular buildings. Both occur in a great variety of form, but as regards the shaft, chamfering and an octagonal section are highly characteristic. All types are monolithic. Capitals, too, are very varied. The typical early form has three members: below, an inverted lotus bell; in the middle, four addorsed animals (generally bulls or lions); and above, a trapezoidal cushion with small corner volutes (Assyrian rather than Greek in character). Typical of later northern mediaeval types is a ribbed cushion capital like an *āmalaka*: this form is perhaps to be connected with that of Viṣṇu's mace. Another common form would be rectangular, but that the lower outer angle is rounded, and sometimes ribbed. A very usual form in mediaeval art is that of the "brimming vase," or jar with overfalling lotus foliage, often developed into arabesque. Brackets, often decorated with figures of Yakṣīs, are characteristic at all times.

Walls.—A sacred structure is usually surrounded by a wall (*prākāra*) or railing (*vedikā*). Such a wall consisting of plain slabs mortised into pilasters has been found in connection with a Vaiṣṇava shrine of Śuṅga date at Besnagar; and others, similar, but sculptured, and of the same period are represented by fragments from Amarāvatī and Jagayyapeṭa. The railings of the early Buddhist and Jaina monuments are remarkable; these consist of plinth, upright pillars, cross bars, and coping, evidently based on wooden forms; the best preserved are those of the topes at Sāñcī and that at Bodhgayā, both about 100 B.C.; the most elaborate is that of Amarāvatī represented by remains now mostly in the British and Madras Museums.

Influences of Indian Architecture.—The architecture of Farther India and Indonesia is largely of Indian origin, and this is particularly evident in the earlier phases (pre-Khmer, etc.); but the forms appear to be developed from older Indian types, rather than directly imitated from those of the Gupta and Pallava styles. Some Indian architectural forms are recognizable also in Gandhāra, Central Asia, China and Japan. Some others are traceable in European architecture, having passed via Alexandria early in the Christian era to Rome and Spain; these include possibly the loggia, galleries, horseshoe and mixtilinear arches, ogee arch and *cyma reversa*, decorated tympanums and jambs, all of which are to be seen in India, and perhaps also the circular and apsidal plans of domed buildings. For a discussion of these interesting problems *see* Rivoira, *Moslem architecture*, 1918; Beylié, *L'Architecture hindoue en Extrême-orient*, 1907; Strzygowski, *passim*, and other sources cited in *HIA*, pp. 20, 149; for China *ib.* p. 53, 152 and Taki, *The Indian type in the temple building of North Wei*, the Kokka, Nos. 356, 357; for Cambodia, Parmentier, *L'Art khmer primitif*.

Technical Literature.—Before proceeding to a description of the architecture of successive periods and styles, it should be mentioned that there exists in India a vast technical literature (known as *śilpa-śāstra*) on the subject. The most important of such treatises has only recently been made accessible by Professor P. K. Acharya (*see* Bibliography). Such technical works date back in part to the Gupta period, perhaps much earlier; the mediaeval compilations are still in use by Indian architects, the *sthapatis* of modern buildings using either the Sanskrit originals or vernacular versions. No more valuable contribution to the study of architecture as a practical art could be made than a detailed

description of building methods still in use in India. It has been shown that the Indian *śilpa-śāstras* must have been used by Indian architects in Java and Cambodia.

INDUS VALLEY CULTURE TO THE GUPTA PERIOD

Pre-Maurya.—The oldest architectural remains in India are the remains of cities at Mohenjo-Daro and Harappa, dating from the fourth millennium B.C. onwards. Here the buildings are of well-burnt brick, laid in mud or gypsum mortar. They include temples; a sacred tank lined with bitumen, and provided with a drain over six feet high, with a corbel-vaulted roof; and substantially built and well-drained dwelling houses and shops.

The only surviving monuments that have been attributed to the Vedic period and culture are the burial mounds at Lauriyā-Nandangaṛh, the source of the gold plaque of the nude goddess; and certain very ancient rock-cut tombs in Malabar. The Cyclopean walls of old Rājagṛha are certainly pre-Maurya, but there is no reason to connect them with the Vedas or the Āryans; their character is rather Polynesian than typically Indian.

As with design, so in the case of architecture, there is every reason to suppose that the same forms which are represented so admirably in the reliefs of Bharhut, Sāñcī, and Amarāvatī were already current during many centuries before the Maurya period. The special forms, indeed, are nearer to those of western Asia of the sixth or seventh century B.C., than they are to those of contemporary Persia, and it can hardly be doubted that they represent the Indian development of a widespread early Asiatic tradition. The forms include storied buildings supported on pillars with volute capitals resting on addorsed animals (bulls or lions), often with pot-shaped bases, and having barrel-vaulted roofs with gabled or arched ends and windows; battlemented brick walls; circular shrines with double-domed roofs; pillared barred-vaulted apsidal temples; hypaethral tree-temples; monasteries, of cells opening onto a central court; burial or memorial mounds (stūpas) on platforms; monolithic pillars; and walls and railings.

Maurya.—The most ancient excavated cave shrines, those of the Barābar Hills, which are finely polished, date from the time of Aśoka. The entrance façade of the Lomas Ṛṣi [Rishi] cave is the earliest example of a decorated tympanum, with ogee arch, finial, curved beams, and resting on sloping jambs, all in imitation of purely wooden forms.

The remains of Aśoka's capital at Pāṭaliputra (Patna) have a rather special character, and perhaps reflect contemporary Persian influences. There have been excavated here parts of a very massive wooden city wall; a timbered flooring extending for three hundred and fifty feet; a series of wooden platforms apparently intended to support a stupendous superstructure; evidences of a pillared hall with eighty polished stone columns; a magnificent stone capital, a stone voussoir from an arch, a stone griffin bracket, and other fragments. It is thought that the plan of the palace was identical with that of the Achaemenid palaces at Persepolis; Arrian speaks of Aśoka's palace as no less magnificent than those of Susa and Ecbatana.

Suṅga, Kuṣāṇā and Andhra.—Numerous reliefs from Bharhut, Mathurā and Amarāvatī, foundations of ruined buildings, and excavated churches (*caitya*-halls) and monasteries (*vihāras*) prove the existence of an architecture now advanced in scale and magnificence. The most remarkable examples illustrated in reliefs are the Sudhammā Sabhā and Vaijayanta palace from Bharhut (Plate I., figs. 4 and 5), the exquisite early shrine from Jagayyapeṭa, the tree temples from Bharhut, Sāñcī, Mathurā and Amarāvatī, and a little structural domed shrine from Amarāvatī. Of the "caves," the *caitya*-hall and *vihāra* at Bhājā, the great *caitya* halls at Kārlī and Nāsik and the Jaina monasteries of Udayagiri and Khaṇḍagiri in Oṛissā, are most noted. Of stūpas, those of Bharhut, Sāñcī, and Amarāvatī; while in Gandhāra, both at Taxila and in Afghanistan and extending thence to Turkistan a little later, there are countless remains of stūpas richly decorated with Graeco-Buddhist sculpture, and many ruined monasteries. Connected with the stūpas are their railings and gateways, of which those at Sāñcī are perfectly preserved, and those of Amarāvatī are well-known from the British Museum series. Most surprising is the evidence of a seal discovered at Patna, with a Kharoṣṭhī inscription of not later than the second century A.D.; this seal represents a very tall straight-edged *śikhara* shrine, doubtless of brick construction; a true arch above the entrance doorway is clearly shown, and the *cella* contains a seated image of Buddha. The representation closely resembles the well-known Buddhist temple at Bodhgayā, and may be it. In any case it provides a strong corroboratory argument for a dating of the Bodhgayā temple, substantially in its present form, from the reign of Huviṣka in the second century A.D., as originally suggested by Alexander Cunningham.

A famous structure often referred to at a later date by the Chinese pilgrims was the "stūpa" of Kaniṣka near Peshawar. From the foundations of this great building has been recovered an inscribed silver reliquary made for Kaniṣka himself, and containing relics purporting to be those of the Buddha. According to the Chinese account the basement rose in five stages to a height of a hundred and fifty feet, the wooden superstructure to four hundred more, and the iron mast with twenty-five copper umbrellas eighty-eight feet more.

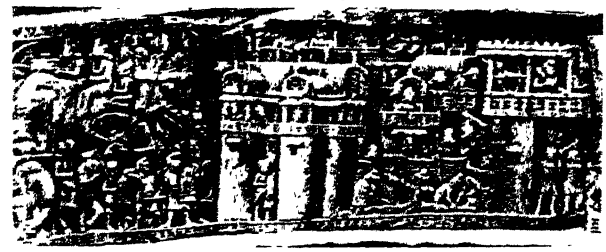
Gupta About A.D. 320–600.—Of this period both Buddhist and Hindu buildings in stone or brick and excavated shrines are characteristic. The most distinctive temple type is that consisting of a square cella, with plain walls and flat roof, and either surrounded by a pillared hall, as at Bhumara, or preceded by a small and graceful pillared porch as at Sāñcī. Tigowā, Pithaora and Nāchnā-Kutharā. The little temple at Sāñcī well illustrates the fine proportions and appropriate use of ornament characteristic of the early Gupta period. The most important related groups of excavated shrines are those of Udayagiri in Gwalior State (Hindu), and Elūrā (Viśvakarmā *caitya* hall) and Bāgh and Ajaṇṭa (Caves XVI., XVII., XIX., especially the last, with its well-known magnificent façade). Farther south, at Bādāmī, Aihoḷe and Paṭṭadkal three of the earliest Cālukyan buildings are of Gupta date or a little later. The Lāḍ Khān, *c.* A.D. 450, is constructed of slabs and pilasters in archaic style; the Durgā temple, about a hundred years later, is apsidal like a *caitya*-hall, combined with a northern Nāgara *śikhara*. Very interesting apsidal brick temples survive at Ter in the Sholāpur District, and Chezārlā in the Kistna District.

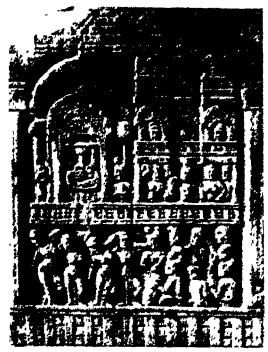
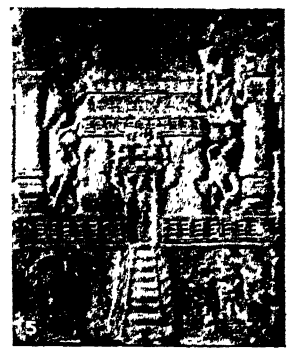
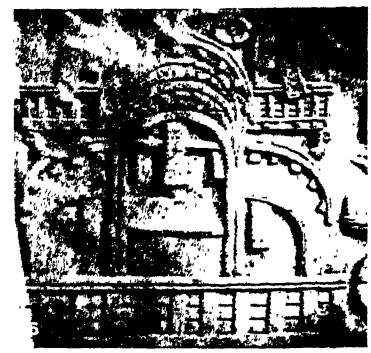
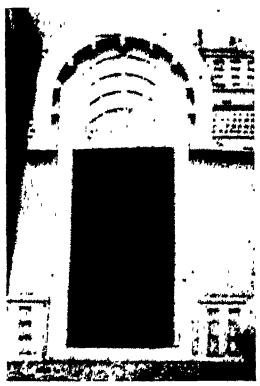
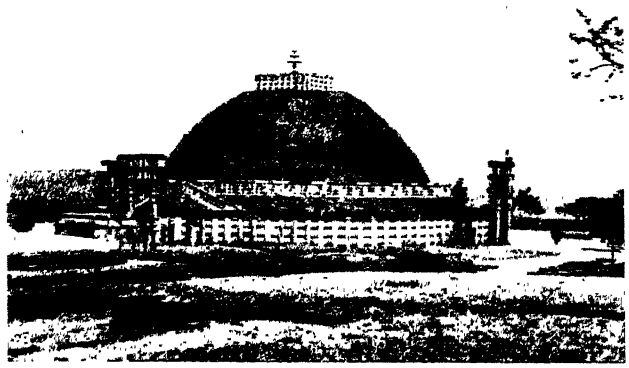
The northern *śikhara* shrines, usually brick towers with stone doorways, are beginning to appear. For the most part the earliest examples are straight-edged, or nearly so, and with angle *āmalakas* at every course, or every second or third course. The example at Deogaṛh is entirely of stone; not less important is the brick tower at Bhitargāoṅ, with a recessed frieze of carved brick, and terra-cotta panels of Brahmanical subjects. A little later than the Gupta period, but suitably mentioned here, is the brick tower at Sirpur, probably the most exquisite example of a richly decorated brick structure to be found in all India. The monastic university of Nālandā was found by Bālāditya at the close of the fifth century. Hsūan Tsang saw there a great brick temple over three hundred feet in height; and at Bodhgayā, the temple above referred to as of Kuṣāna date. The great Hindu temple at Konch, very near Bodhgayā and similar in many details, though the spire is curvilinear, may well be of Gupta date.

MEDIAEVAL

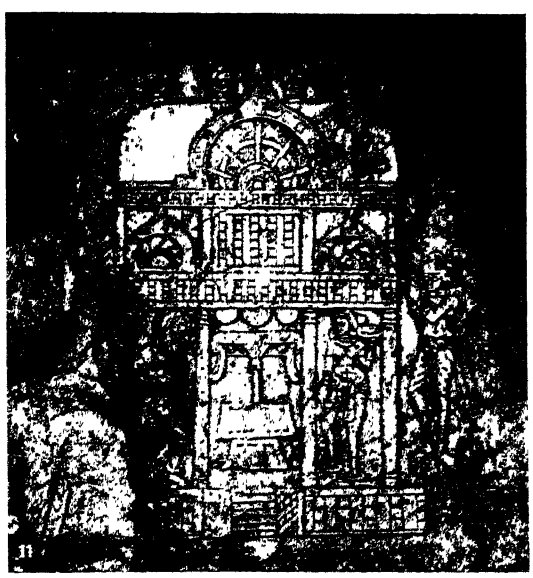
From the Gupta period onwards it is convenient to describe the architecture in terms of the three great styles, Nāgara (northern or "Indo-Āryan"), Vesara (later Cāḷukya, Hoyśala and Solaṅki, of the Dekkhan, Mysore and Gujarāt), and Drāviḍa (southern Dravidian) with separate mention of Kaśmīr, and of the civil architecture of Rajputāna.

Nāgara.—Here the most conspicuous feature is the curved outline of the *śikhara*, which is composed as in the south of many storeys representing reduplicated cornices and roofs; but owing to the great compression of each storey, the vertical lines of the whole form are far more conspicuous, at least in the later types, than are the horizontal lines of the successive cornices. The tower, usually square, rarely circular in plan, is corbelled inwards until the sides nearly meet, the whole is crowned by a huge ribbed lenti-







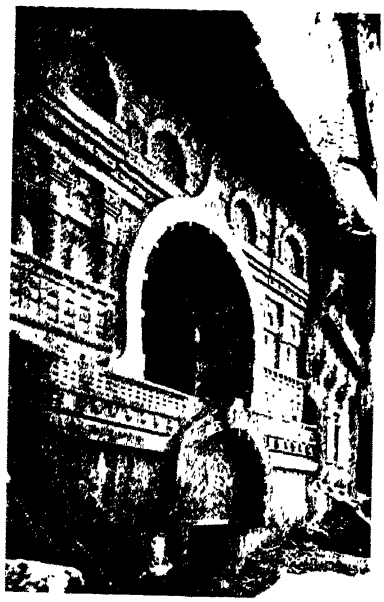

PHOTOGRAPHS, (1, 5, 10) THE ARCHAEOLOGICAL SURVEY OF INDIA, (3) JOHNSTON AND HOFFMANN, (8) A. K. COOMARASWAMY

INDIAN ARCHITECTURE FROM THE 3RD CENTURY B.C. TO THE 1ST CENTURY A.D.

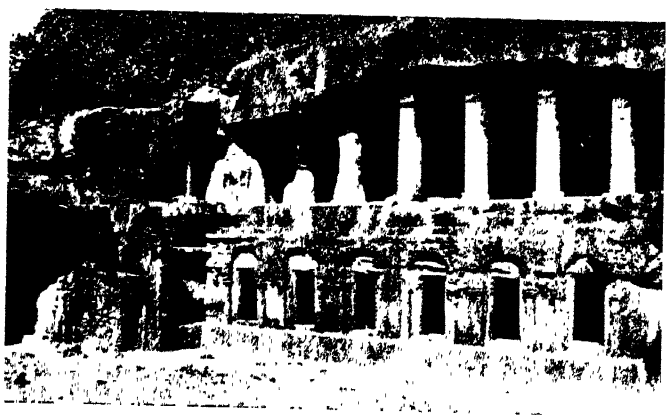
1. War of the Relics; Architrave detail, Mathurā, *c.* 1st cent. A.D. 2. War of the Relics; (siege of Kapilavastu). Architrave detail, Sāñcī, south *torana*, *c.* 100 B.C. 3. A Buddhist shrine (*caityaghara*). Railing pillar detail, Bodhgayā, *c.* 100 B.C. 4. Festival of the Buddha's Crest-relic (*cudā-maha*); above left, the Sudhammā Sabhā; right, the Vaijayanta Palace of Indra; below, apsarases dancing. Detail of railing pillar from Bharhut, *c.* 175 B.C. 5. Jaina votive slab (*ayagapaṭa*) with stupa, worshippers, and angels. Mathurā, late 1st cent. B.C. 6. A Buddhist shrine (*caitya-ghara*). Architrave detail, Bharhut, *c.* 175 B.C. 7. Doorway of rock-cut Buddhist *caitya-ghara*, Bedsā, *c.* 175 B.C. 8. The Great Stupa, Sāñcī, 2nd and 1st cent. B.C. 9. The Lomas Rishi, Ājīvika shrine, Barābar Hills, late 3rd cent. B.C. 10. Railing pillar, with Buddhist shrines, Bodhgayā, *c.* 100 B.C. 11. Structural three-storeyed Buddhist shrine. Jaggayyapeta, 2nd cent. B.C. 12. Domed pillared three-storeyed Buddhist shrine. Detail from a pillar (*cetiya-khabha*) Amarāvatī. Probably 1st cent. B.C. 13. Representation of a stupa, pillar with lion capital to left, in a sacred grove. Railing pillar detail, Bharhut, *c.* 175 B.C.

INDIAN ARCHITECTURE



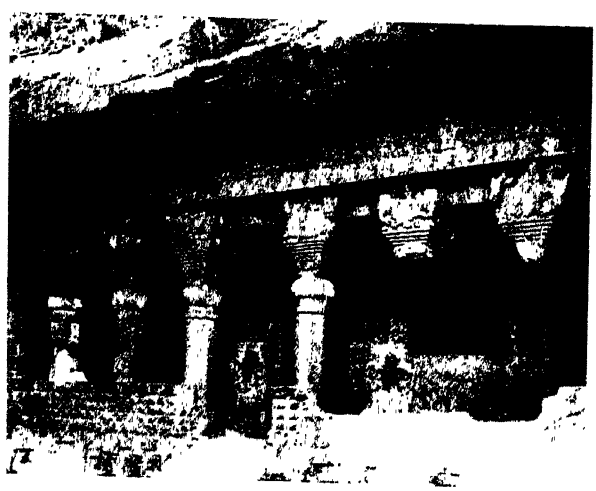














PHOTOGRAPHS, (3, 4, 5, 6, 8) JOHNSTON AND HOFFMANN, (7) THE ARCHAEOLOGICAL SURVEY OF INDIA

ROCK-CUT SHRINES AND MONASTERIES OF THE 1ST CENTURY B.C. TO THE 1ST CENTURY A.D.

1. Rock-cut Buddhist shrine (*caitya-ghara*) at Bhājā. 2nd century B.C.
2. Buddhist shrine at Nāsik. Early 1st century B.C.
3 & 8. Interiors in the Buddhist shrine at Beḍsā. 1st century B.C.
4. Jaina monastery, Rāṇī Gumphā Khaṇḍagiri, Oṛissā. c. 100 B.C.
5. Interior in the Buddhist monastery at Beḍsā. 1st century B.C.
6. Buddhist shrine at Kārlī. Late 1st century B.C. or early 1st century A.D. It is 126 ft. long and has a ribbed teak roof
7. Cave III. at Nāsik, a Buddhist shrine of the 1st century A.D.

cular stone, the *āmalaka* which supports the usual vase finial; at successive stages along the edges of the tower will be found quarter- or angle-*āmalakas*, one at each stage in early types, more widely separated later. These angle *āmalakas* are clear evidence of the roof-like character of each stage; and indeed, nothing is more characteristic of Indian architecture, nor more valuable for the elucidation of its history, than that the ornamentation consists essentially of reduced, simplified, or archaic forms closely related to those of the whole building. The porch or *maṇḍapa* is usually open and pillared, sometimes roofed with a dome, more often with a pyramidal roof composed of repeated cornices. In the Nāgara style, a barrel-vaulted roof is very rare, but examples are to be seen at Gwalior (Teli-ka-Mandir), and in Oṛissā (Vaital Deul at Puri). The early capital with addorsed animals disappears after the Gupta period, to be replaced by square cushion capitals of various kinds or by a development of the pot-shaped capital into a brimming vase (*pūrṇa kalaśa*) with lotus flowers, and foliage falling from the mouth onto the four corners; in cave temples, *e.g.* the great Śaiva shrines at Elephanta, near Bombay, a globular *āmalaka* capital is highly characteristic; there may be a derivative connection between this form and that of Viṣṇu's mace.

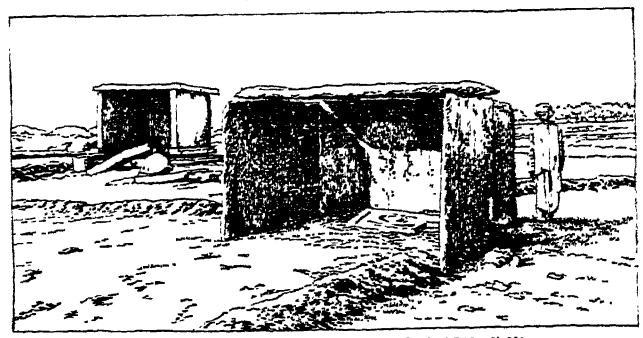
The most southerly extension of the style is found at Bādāmī, where the apsidal Durgā temple, perhaps of Gupta date, has already a northern *śikhara*. Here, and in several other places, the two styles can be seen side by side. It is however in Oṛissā, Bundelkhaṇḍ and Rājputāna that the finest and most continuous series is to be found. In Oṛissā the series shows a continuous development from the 8th to the 13th century; the Paraśurāmeśvara and Lingarāja temples at Bhuvaneśvara, the Sun temple at Koṇārak, and the Jagannātha at Puri are most remarkable, and the beauty and grandeur of most of these it would be difficult to exaggerate. At Khajurāho in Bundelkhaṇḍ there is another magnificent series, dating between 950 and 1050, *e.g.*, the Kandārya Mahādeva temple is the finest; the effect of height, actually 116 feet over all, is increased by the great depth of the basement, and by the vertical lines of the reduplications of the main form upon itself. Here, as well as in Oṛissā, and elsewhere, the temples are covered with figure sculpture.

From Bengal and Bundelkhaṇḍ the style extends through Rājputāna (where the Siddheśvara at Nemawāṛ, Indore State, is of prime importance and one of the best preserved mediaeval monuments extant) to the Pañjāb (Āmb and Kāfir Kot), Kāṅgṛā and Kuḷū (Baijnāth, Masrūr, and Bājaurā). Modern temples in the Nāgara style include the Viśveśvara at Benares, the funeral chapels at Gwalior, the Jugal Kisor and Madan Mohan at Brindāban, and amongst the many alms-halls, *ghāṭs*, wells and temples built by Queen Ahalyā Bāī (1765–95), the Gṛṣṭaneśvara temple at Elūrā.

Vesara, Hoyśala and Solanki, 10th–13th Century.—After the recovery of the old Cāḷukyan territory by a later branch of Cāḷukyas or Solaṅkis in 973, a new style of architecture came into being in the Dekkhan and flourished during the 11th and 12th centuries. Another branch of the Solaṅki family held Gujarāt from the 11th to the end of the 13th century. During the 12th and 13th centuries the Hoyśala dynasty ruled Mysore. The Vesara style of architecture is found throughout the area referred to. Conspicuous features are low elevations (contrasting with those of the high Nāgara and Drāviḍa *śikharas*) and wide extension, the star-shaped plan of the cella, the grouping of three shrines about a central hall, low pyramidal towers, elaborated pierced windows, elevated basements with very richly decorated courses, and in general an excess of ornament. In the Dharwār district, the Doḍḍa Vasavanna is perhaps the most elaborate building in western India. In Mysore the most celebrated shrines are those of Doḍḍa Gadavalli, Somnāthpur, Belūr, Balagami, and Halebīd, and the Jaina *bastis* at Śravaṇa Belgoḷa.

In Gujarāt the most famous temple was that of Somnāth (Kāṭhiāwār), wrecked by Maḥmūd of Ghazni in 1024. At Aṇahilpaṭṭana the greatest royal builder was Siddha-rāj (1093–1143). Here as at Vāḍnagar and Mudhera are the ruins of important shrines. A special characteristic of the local style is the erection of *kīrttistambhas*, or "Towers of Glory"; the finest of these, in the Chitor Fort, was built in 1440–48, to commemorate the erection of the Kumbhasvāmi temple.

More famous are the Jainā temples at Mt. Ābu in Rājputāna, particularly those of Vimala Shhāh and Tejahpāla respectively, A.D. 1032 and 1232. These are domed shrines with pillared halls, built entirely of white marble, carried up the mountain with infinite labour from the plains below. The most remarkable



BY COURTESY OF ARCHAEOLOGICAL DEPT., SOUTHERN CIRCLE, MADRAS, INDIA

TWO DOLMEN SIVA TEMPLES AT KAMBADUNI, ANANTAPUR DISTRICT

features are the domed ceilings, with deeply undercut, fretted marble which has been compared to "frozen lace," with a central pendant.

Deservedly famous too are the Jainā temple cities of Girnār and Śatruñjaya, with buildings ranging from the 13th to the 19th century. These cities of temples built on hill-tops were exclusively places of pilgrimage, never otherwise inhabited. Of ordinary cities there are well preserved remains at Dabhoi and Jhiñjuvāḍ. At the somewhat later capital of Ahmadābād the architecture is almost entirely Mohammedan; but it was executed in the same style and by the local craftsmen, adapted only to Muslim necessities by omission of figure work from the niches.

Drāviḍa.—In southern India, as the Maṇḍagapattu inscription of the great Pallava king Mahendravarman I. (600–625) informs us, temples had been built of brick or timber, reinforced by metal and mortar; only from the seventh century onwards do we meet with excavated monolithic and structural temples in stone. It is difficult to characterise the style in detail, on account of the continuous development, of which the best account has been given by Jouveau-Dubreuil (*see* Bibliography). Markedly contrasting with the Nāgara style of the north, are the conspicuous horizontal lines of the towers or spires, produced by a repetition of heavy roll cornices, dividing one storey from the next; each storey is decorated with little pavilions (*pañcaram*) or dormer windows (*kūḍu*). The walls are often plain, with narrow pilasters, gradually elaborated as the style develops. The pillars are at first supported by lions, and polygonal in section, with a thin flat abacus and roll brackets, later a pendent lotus. The summit of the roof is always a square, circular or polygonal dome (*stūpī*), or barrel vaulted and apsidal, in the latter case appropriately designated as *gajaprṣṭhā* ("elephant's back"). The temple is always enclosed by a high wall or walls (*prākāra*), pierced by four gateways (*gopura*); in some cases, as at Madura, the enclosure becomes a veritable sacred temple city wherein all the activities of life are carried on.

The early Drāvidian style (Pallava and early Caḷukya) is admirably illustrated in the Pallava temples of Māmallapuram (the "Seven Pagodas") and Conjeevaram in the east and early Cāḷukya shrines at Bādāmi, Aihoḷe and Paṭṭadkal in the west. The visitor should make every effort to visit the "Seven Pagodas" at Māmallapuram, which are easily accessible from Madras. The earliest monuments are cave temples at Uṇḍavalli; then come the Seven Pagodas and cave temples in the seventh century, and in the eighth, the structural temples of Conjeevaram, and the "Shore temple" at Māmallapuram, after which the style passes gradually into that of the Coḷa period. In the west, at Bādāmī and Aihoḷe, there are six cave temples, two Jainā and four Brahmanical, one dated 578. The structural Mālegitti Śivālaya, *c.* 625, magnificently situated on the summit of a hill, is perhaps the purest and

best example of the style; it is small and massive, but finely proportioned. Much larger, and magnificent both in design and execution are the two great temples due to the queens of Vikramāditya II., datable about 740. Of these the Virūpākṣa, still very massive, was probably built by workmen brought from Conjeevaram, where the Rājasiṁheśvara (or Kailāsanātha) temple had been built not long before the city fell to the Cāḷukyan invaders; we know from an inscription that Vikramāditya was so much impressed by that great shrine (which still stands, unused, but in almost perfect preservation) that he not only refrained from destruction, but himself made offerings and overlaid the images with gold. In A.D. 753 the Rāṣṭrakuṭas invaded and occupied the Cāḷukya territory. No doubt as a result of this invasion workmen were carried off, and this probably explains the form of the great Kailāsanātha rock-cut shrine at Elūrā which is evidently modelled closely on that of the Virūpākṣa at Bādāmī. This wonderful temple, cut out of the side of a hill, is a complete model of a structural building, and together with the somewhat later and very similar Jaina Indrasabhā also at Elūrā, marks the farthest limit of the northward extension of the Drāviḍa style. The Bhoganandīśvara temple at Nandi, *c.* A.D. 800, affords another important example of a Rāṣṭrakuṭa building in Drāviḍa style.

Coḷa and Pāṇḍya.—In the Coḷa period the tower of the central shrine is typically developed to a great height, by a reduplication of the corniced storeys, as in the great *vimānas* at Tanjore, the centre of Coḷa power, and at Gaṅgaikoṇḍapuram, both of early eleventh century date. The former is 190 feet in height. There are also good examples of the style at Poḷonnāruva in Ceylon, built during the Coḷa domination. The Pāṇḍya period is characterised by the development of the great gateways, with a lower storey of stone and super-structure of brick, covered with brick and stucco images plastered and painted. They have the aspect of veritable sky-scrapers, and completely dwarf the main shrines.

Vijayanagar and Madura.—These later phases of the southern style are characterized by the development of the great pillared halls (*maṇḍapam*). The monolithic pillars are cut into groups of slender columns, or are provided with elaborate brackets, nearly the full size of the pillar itself, and representing leogriffs (*yālis*), or horsemen on rearing horses attacking leopards, or consisting of dancers, deities or effigies of founders. Of the earlier series, the great shrines at Vijayanagar, Āvaḍaiyar Kōyil and Tāḍpatri are the most remarkable; of the later, the great buildings of the Nāyyaks of Madura, dating from the seventeenth century are well-known to all travellers in India. It is perhaps rather unfortunate that the Drāviḍa style is best known by one of the latest examples, the Mīnākṣi shrine at Madura; the whole complex is indeed impressive, but it gives little idea of the earlier purity of Drāviḍa design. Temple building and restoration continue in southern India, and in Ceylon, today.

Kāśmīr.—In Kāśmīr, which had been a dependency of the Kuṣāna empire, and later an independent kingdom, the prolific building period extended from the 8th to the 13th century. The style has local peculiarities; the double pointed pyramidal roof, pediments enclosing a trefoil niche, lantern ceilings, fluted columns with Doric or Ionian capitals, and large peristyles are very characteristic. The architecture here preserves a certain quasi-classical character derived from Gandhāra, and not seen in the rest of India, though often recognizable in Central Asia. At Parihāsapura a large Buddhist stūpa with a double platform, and stairways on each side is contemporary with the Javanese Borobuḍur; and there are temples of extraordinarily massive construction, one flooring stone consisting of a single block 14×12×6 feet. Two great temples at Avantipur are due to Avantivarman. The court of the Mārtāṇḍa Sun temple is about 220×142 feet; that of the Pāṇḍu-kuṇḍ in Jammū about 191×121 feet. Related architectural forms are found at Malot in the Punjāb, and at Gop and some other places in Kāṭhiāwār. But the trefoil arch, derived from the section of a *caitya*-hall, while confined to Kāśmīr as an important architectural form, occurs also at Sārnāth, Sirpur and elsewhere.

Rājput Civil Architecture.—Twenty or thirty royal residences, a number of cities, and ghāṭs, preserve from the 15th century to the present day a civil architecture of extraordinary grandeur and beauty; the architecture of Faṭḥpur Sikri, too, is almost purely Hindu in character, and essentially Rājput adapted to Mohammedan requirements (*see* MOHAMMEDAN ART). The Rājput style is less intricately ornamented, but of more monumental dignity than the better known Mohammedan palaces of the 17th century.

The earliest well preserved palaces are those of Chitor and Gwalior, the latter magnificently situated on the edge of a great flat-topped hill, with several great gateways guarding the approach, and a small palace, the Gujari Maḥall at the foot of the hill. Begun under Mān Siṅgh in the 15th century it was completed during the Mughal occupation in the 17th. Bir Singh Deva's 17th century palaces at Datiā and Orchā are almost equally splendid. The palace at Amber, 17th century, is more nearly like Mughal work, and so too the lovely marble pavilions by the lake at Ajmere. The whole city, palaces and island palaces of Udaipur (*c.* 1600–1740) are of romantic beauty. The Jodhpur palace, 17th century, is situated on the top of a rock dominating the city below, and guarded by bastions of tremendous size. The modern city of Jaipur, the Benares ghāṭs (with buildings mainly of the 18th century), the ghāṭs at Maheśvar and Ujjain, the modern work at Bulandshahr, Mathurā, etc. (*see* Growse, and Sanderson, in Bibliography) and the cenotaphs of Rājput princes in many capitals, are all evidences of an architecture by no means lost, but still practised. The little modern railway station at Alwar shows how this tradition can be adapted to present day requirements; the new city at Delhi is a monument of the neglect of indigenous resources. (*See* DELHI; NEW DELHI.)

CEYLON

The earliest buildings in Ceylon are dāgabas or stupas, those of Tissamahārāma dating from the 3d or 2d century B.C., the Yaṭṭhāla Dāgaba being the most important of the series. At Anuradhapura, the capital from the middle of the 3d century B.C. to the end of the 8th A.D., the Thūpārāma was the first dāgaba to be erected, and like the Maha Seya at Mihintale it was built by the great Devānampiyatissa, the contemporary of Aśoka, and recipient from him of the branch of the Bodhi-tree which was planted with great ceremony at Anuradhapura, and may now be called the oldest living historical tree in the world. To Duṭṭha Gāmaṇi, early in the 1st century B.C. are due the Ruanweli and Miriswetiya Dāgabas, and to Waṭṭa Gāmaṇi in the same century the Abhayagiri Dāgaba, later confused with the Jetavana built by Mahasena at the end of the third century A.D. All these dāgabas can be seen at the present day, but they have suffered both from ruin and from restoration. The famous Lohapāsāda, the Brazen Mansion, built by Duṭṭha Gāmaṇi as a monastery is now represented only by the monolithic pillars of the basement, twelve feet high and covering an area 250 feet square; the pyramidal superstructure was of wood with a brazen roof; originally of nine storeys, it was later burnt and rebuilt with only five.

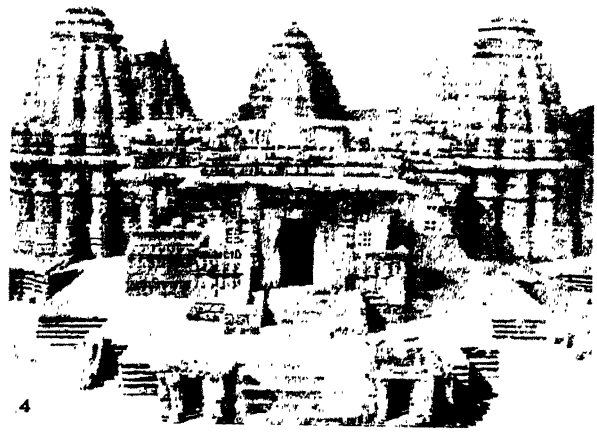
The natural fortress of Sīgiriya was occupied in the 5th century by a parricide king who built a palace on the summit, and a remarkable walled gallery, still usable, as a means of access.

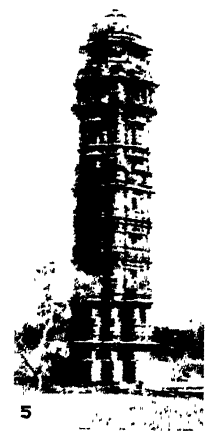
As a result of the Tamil invasions the capital was removed to Polonnāruva which became the capital from 781 to 1290, which period includes a short interlude of Coḷa occupation. The most remarkable and important buildings are due to Parākrama Bāhu in the 12th century (1153–86). The Thūpārāma is a rectangular brick temple in Dravidian style, but with vaulted arches and narrow triangular windows like the early towers in northern India. The Northern Temple (so-called Demala Maha Seya) contained frescoes (*Jātaka* subjects). In the Jetavana group at the other end of the city, the Laṅkātilaka is the largest Buddhist temple in Ceylon. The Potgul Vihāra is a circular building in which Parākrama Bāhu used to sit and listen to the reading of the *Jātakas* by his chaplain. The Sat Mahal Pāsāda is a solid pyramidal seven-storeyed brick structure like the traditional representations of Mt. Meru; on each storey are niches with brick and stucco

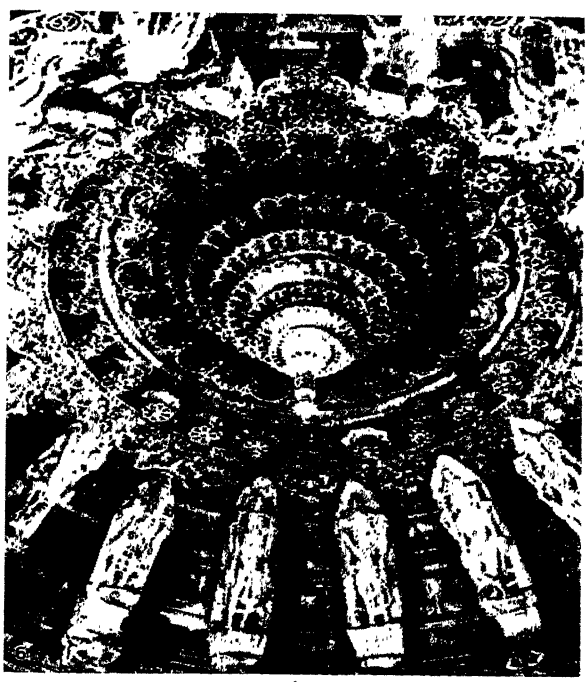


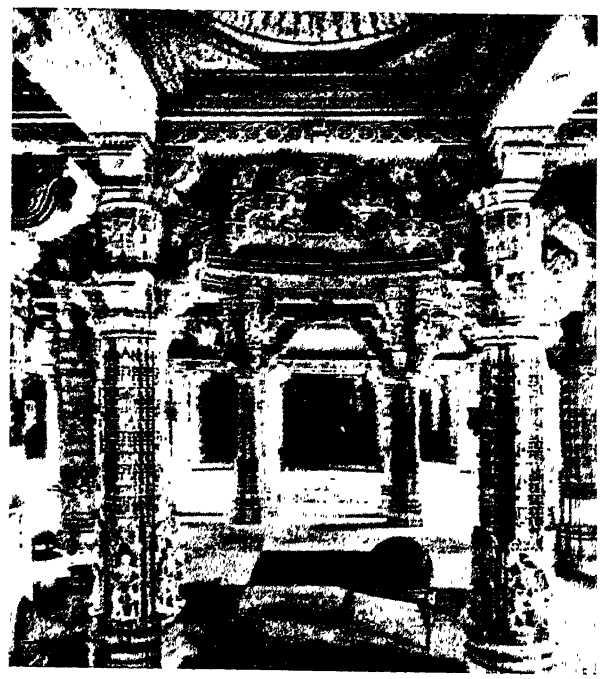












PHOTOGRAPHS, (1, 6, 7) JOHNSTON AND HOFFMANN, (2, 4, 5) THE ARCHAEOLOGICAL SURVEY OF INDIA

INDIAN ARCHITECTURE FROM THE 1ST TO THE 13TH CENTURY

1. Interior of Cave II., Ajaṇṭā, showing pillars and painting. Early 7th century. 2. Meruvardhanasvāmin temple, Pāndreṇthan, Kashmir. Early 10th century. 3. The city gate at Dabhoi, Gujarat, *c.* 100 A.D. 4. Kesava temple at Somnāthpur, Mysore, built in typical Vesara (later Cāḷukya) style. A.D. 1268. 5. Kīrttistambha, raised at Chitor; 1440–1448 A.D. to commemorate the erection of the Kumbhasvamin temple. 6 and 7. Ceiling and porch of Tejahpāla's temple (Jaina) at Dilwāṛā on Mt. Ābū. Rajputana, A.D. 1232

INDIAN ARCHITECTURE



BY COURTESY OF (7, 10, 11) DENMAN W. ROSS, (13) THE BUREAU OF UNIVERSITY TRAVEL; PHOTOGRAPHS, (1, 6, 8, 12) A. K. COOMARASWAMY

EXAMPLES OF FURTHER INDIAN AND INDONESIAN ARCHITECTURE

CAMBODIA: 1. Aṅkor Wāt, 12th cent. 9. Slab-built shrine, Prēi Kuk, early Khmer, 7th cent. 12. Aṅkor Wāt, galleries, early 12th cent. 13. Aṅkor Wāt, Tower, early 12th cent. JAVA: 2. Borobuḍur, 8th cent. 3. Caṇḍi Puntadewa, Diēng, 8th cent. 4. Caṇḍi Bīma, Diēng Plateau, early 8th cent. 11. Porch at Caṇḍi Sewu, 10th cent. 15. Caṇḍi Jābung, A.D. 1354.

BURMA: 6. Mahābodhi temple, Pagān, 13th cent. 7. Mingalazedi pagoda, Pagān, A.D. 1274. 8. Ordination Hall, Pagān, 13th cent. 10. Temples at Pagān, 11th cent. and later. ANNAM: 5. Temple at Mīson, Campā, 7th cent. SIAM: 14. Temple at Lopburi, Siam, 11th cent.

images. To the next king, Nissaṅka Malla (1198–1207) are attributed the Nissaṅka Malla Maṇḍapaya, a railed enclosure containing eight graceful curvilinear lotus pillars which originally supported a roof, forming a pavilion; and the Waṭa-dā-gē, a terraced circular shrine which is perhaps the most beautiful example of Buddhist stone architecture in Ceylon. The Hindu temples (devāles) were built in the time of Cola occupation, and so too the Geḍigē at Nālandā, *c.* 1040, in *gajaprṣṭhā* style, and of mixed Hindu-Buddhist dedication.

Later, the capital had to be moved again, and finally to the last site, Kandy, where an independent Sinhalese kingdom survived till 1815. The beautiful buildings there still in use are due to the last kings, especially Kīrtti Śrī Rāja Siṁha. The style is mainly a wooden one, but some use is made of stone. The Daḷadā Māligāwa, the Temple of the Tooth Relic, is familiar to all visitors. Near Kandy there are fine temples at Laṅkātilaka (stone foundations, brick structure and a very handsome roof), and Gaḍalādeniya (a porch with old stone pillars, and a stūpa with a roof supported by four pillars, making a veritable *cetiya-ghara*). (*See* CEYLON.)

(*See* also ARCHITECTURE; INDIAN AND SINHALESE ART AND ARCHAEOLOGY.)

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FARTHER INDIA AND INDONESIA

There can be traced in each area, first of all, an Indianesque period, when the local art is closely related to that of India in which the forms of Indian art were reproduced, then a classical period (A.D. 800–1200) in which local national formulae are evolved and crystallised; and finally a local national phase no longer in direct contact with India, and passing into a stage of folk-art which has survived up to the present day. It is at all times an injustice to apply to the local schools the name of Indian colonial art, for although the structural and decorative elements are all originally of Indian origin, the originality and energy of the local forms derive from indigenous sources, and the expression of local ethnic character is everywhere apparent. (*See* INDONESIAN AND FARTHER INDIAN ART.)

BURMA

Ruined buildings and sculptures of a Gupta type have been found at Tagaung, Prome, Thāton, and elsewhere. Further north, remains of the old city and a gateway dating from the 9th century can be seen at Old Pagan. Amongst other structures dating from the 10th century at Pagan are the Nat Hlaung Gyaung Vaiṣṇava temple (A.D. 931), and the cylindrical Ngakywe Nadaung, a stūpa recalling the Dhamekh at Sārnāth.

But it is only with the unification of Burma, accomplished by Anawrata (1040–1077) that a great building era was initiated. Remains of no less than 5,000 "pagodas," mainly stūpas, but also Buddhist temples, can be traced in the Pagan area. Two types are especially characteristic. In one the basement terraces of the chapel or stupa are developed to a great height, giving a cubical effect, and provided with chapels and galleries in their mass, for which an early Indian parallel is afforded by the stupa at Mīrpur Khās in Sind; the Ānanda, Thatbinnyu, and Shwegugyi pagodas are examples. The other is that of a stupa supported by a high pyramidal terraced basement provided with four median stairways as a means of access, and often with smaller stupas at the angles, thus repeating a type already established at Borobudur, which in turn derives from the terraced stūpas of the Punjāb, Kashmīr, and Turkistān. Other structures exhibit special peculiarities, for Anawarata and his successors were in touch with all parts of the then Buddhist world, and built in various manners. Connections with northern India, Bengal and Nepal were especially close. The Mahābodhi stupa is clearly a direct imitation of the ancient Indian shrine of the same type at Bodhgayā, described above, and which was itself in turn restored by pious Burmese Buddhists in the 12th century. Active construction at Pagan continued well into the 13th century, after which the unity of the country was for a time destroyed by Shan invasion.

The unfinished Mingun pagoda, begun in the 18th century, was to have been the largest in Burma, and what remains is still over 140 feet in height, though this represents only a third of the proposed elevation. It is highly characteristic that ancient stupas of small size were again and again enclosed within larger structures, and thus lost to view, so that huge pagodas like those at Prome and Pegu, while really representing ancient foundations, are in their present aspect comparatively modern.

Mandalay was founded only in 1857, and occupied by Mindôn, the last great Burmese royal patron of Buddhism. The palace, a wooden structure in which material from an older palace at Amarapura (the previous capital, near Pagan) is employed, like most wooden palaces consists of connected halls, pavilions and galleries within a walled enclosure. The main features of the style are the use of immense teak columns, lacquered and gilt multiple roofs and spires with flamboyant crockets, and an interior decoration in which glass mosaic plays an important part. Other fine examples of late Burmese wooden architecture are afforded by monasteries such as the Myadaung Kyaung at Mandalay and the Sangyaung at Mandalay, due to the piety of various queens. Still more modern is the famous Shwe Dagôn pagoda (stūpa) at Rangoon; its tapering form, the outline of the spire being almost continuous with that of the body, contrasts conspicuously with the more monumental hemispherical and cylindrical types of early Indian art. There is a general tendency to the development of more refined and aspiring, and less massive types in all the later stages of Indian architecture wherever it is found. (*See* BURMA, INDONESIAN AND FARTHER INDIAN ART.)

SIAM

The architecture of Siam is not well known. No edifice of importance survives from the Dvāravatī (Mon) period, but the Brah Paṭhamacetiya reliefs have decorative representations of buildings with caitya arches (*kūḍu*), suggesting, as in the case of the contemporary pre-Khmer architecture of Cambodia, direct connections with Indian originals. At Labapurī and Ayuthiā, up to the 14th century, the architecture is of directly Khmer inspiration; Wāt Mahāthat at Labapurī is a good example. Simi-

larly at Svargalok and Sukhodaya, buildings dating before the establishment of an independent Thai kingdom, *e.g.*, the Wāt Mahādhatu at Svargalok, and Wāt Braḥ Bāy Hluang at Sukhodaya, are equally Khmer, and the sculptures found in them are analogous to those of the Khmer school at Labapurī. The 13th century Wat Kukut at Lāmbūn (a pyramidal tower apparently related to the Sinhalese Sat Mahal Pāsāda at Polonnāruva) and the Wat Chet Yot at Xieng Mai (modelled either directly after the Indian temple at Bodhgayā, or more likely on the 13th century Burmese copy at Pagan) belong to the last days of Mon government in the north. The remains of the Wat Keo at Jaiyā in the far south belong to the school of Śrīvijaya. It is only after the foundation of Ayuthiā that a distinctively Siamese architecture develops, and as seen at Ayuthiā and Bangkok, this is characterised by slender, aspiring, and pointed forms. (*See* SIAM.)

CAMBODIA

Pre-Khmer or Khmer Primitive.—The history of Indian architecture in south-eastern Asia can be followed in Cambodia better than anywhere else; here, despite the fact that with the disappearance of wooden architecture more abundant than that in stone, the sequence is relatively complete. In the Khmer primitive, or pre-Khmer (as different authors interpret it) architecture of southern Cambodia, dating from the 6th and 7th centuries (when permanent material such as brick, laterite, and stone were just coming into use), we find a series of buildings which exhibit striking analogies with those of the early Cāḷukyas of the western Dekhan, as well as with those of the Pallavas, and even with the earlier style of the Āndhras. M. Parmentier, in his two fine volumes entitled *L'Art khmer primitif*, has argued, probably rightly, that both these early Cambodian and the contemporary Indian forms are developed locally from common earlier Indian sources. A slab-built cella at Hanchei recalls the small shrine on the roof of the Lāḍ Khān at Aihole; it was once perhaps surrounded by a pillared hall as at Bhumara. Another very elegant square cella at Préi Kuk has shallow pilasters, and characteristic Indian cornices with dormer-arches framing Gandharva heads, and is quite Pallava in appearance. Here also, and at Bayang there are high brick towers suggesting such Gupta types as Deogarh or Bhitargaon; at Mahā Roséi there is a granite shrine of Pallava type.

Classic Period, Khmer.—From the 9th to the 12th century and even later, Cambodian architecture develops still in brick and laterite, but more characteristically in stone. Indian forms are departed from, or freely modified, and local features appear, so that a truly national architecture comes into being. Unlike anything in India are the half-vaulted arches with curved stone sloping roofs imitating tiles, and so too the huge faces or masks on the sides of the early towers of the Bayon and Angkor Thom gateways. On the other hand the later towers develop as in India by a reduplication of storeys, vertically compressed, and many motifs, seemingly novel, for example the Garuḍa caryatides of the Prāh Khān walls and the Angkor Thom terrace have really older Indian prototypes. The classic Khmer architecture is widely distributed in northern Cambodia, perhaps the original seat of the Khmers. The best known monuments, out of hundreds still in existence, are the city of Angkor Thom and the neighbouring temple of Angkor Wāt ("Angkor" is a corruption of Sanskrit *nagara*, city or capital; Wāt or Vāt, a later Siamese term for any Buddhist monument). The city, occupied about A.D. 900, is of great extent, and contained within a moat, crossed by five causeways with parapets consisting of gods and giants holding the body of a giant Nāga; these causeways lead to triple gateways large enough for the passage of elephants, and from these proceed five roads to the heart of the city. Near the city are the previous capital of Prāh Khān, and other shrines such as the Néak Péan, and Phnom Bakeng, and Angkor Wāt, and many artificial lakes. The city is situated in the plains, among the rice-fields and near the great lake, both necessary sources of food supply for a great population. There the most important structures are found to be the great terrace running along the public square in front of the palace site; and numerous temples, of which the Bayon is the most remarkable, others being known as the Baphuon, and Phimānakas. The Bayon, intended to be Buddhist, was adapted to Śaiva usage before its completion, and ultimately contained the statues of Hindu and Buddhist deities, the Deva Rāja (a lingam representing the king's divinity), and statues of deified royal ancestors. Its most conspicuous feature consists of the towers with enormous masks (representing Lokeśvara) on each face; but equally interesting are the reliefs in which almost every aspect of contemporary life is depicted. The Baphuon, *c.* A.D. 1000, is a typical, terraced, pyramidal structure (*prāng*), with median stairways leading to a stone gallery above. Of the many other temples built in less accessible sites, the Prāh Vihéar may be mentioned; it is magnificently situated on a spur of the Dangrek range, overlooking a rolling panorama of uninhabited jungle. Angkor Wāt is the later Siamese designation of the most famous and most beautiful of Cambodian shrines, of which the true name is unknown, though there is reason to think the dedication was to Viṣṇu. The date is the early 12th century.

The 14th century temple of Īśvarapura at Bantéi Sréi is proof that the capacities of the Khmers were not destroyed by the earlier Siamese invasions. But the country had certainly been devastated and Angkor Thom abandoned by the 15th century, and when later inscriptions appear, they belong to the Siamese period, and Hīnayāna Buddhism has replaced the mixed Mahāyāna Buddhism and Hinduism which formed the state religion of the Khmers in the classical period.

CAMPĀ

Eastern Indo-China, now Annam, once the seat of great Cam kingdoms, must have been Hinduised at an early date, for we find traces of Hindu kingdoms both in the north and south as early as the end of the second century A.D. All the early, and much of the later architecture was wooden. The remains are of two periods, one classic from the seventh century to about 1100, the other that of the decadence. The sacred city of Mi-son was founded about A.D. 400, but the great brick tower now surviving was built on the site of the original wooden shrine soon after 600. The plan is square, but the cella is twice as high as it is wide, and the effect of height is increased by the narrow decorated pilasters which emphasize the vertical lines; the pyramidal roof consists of three diminishing storeys, repeating the form of the cella on a smaller scale. The decorative motifs include makara niches, geese with extended wings, both old Indian motifs, and acroteria silhouetted against the sky; on the whole we are reminded of Indian Gupta towers, and the pre-Khmer towers of Cambodia. In addition to this main shrine there are six great halls for the accommodation of pilgrims; for Mi-son was a sacred city rather than a place of habitation. Later, about 800, a great temple and monastery, the only important Buddhist buildings in Campā, were erected at Dong-duong by Indravarman II.; but the place was soon ravaged by the Annamites, who were continually pressing downwards from the north and ultimately accomplished the ruin of Cam civilisation. Sanctuaries were built again near the new capital of Binh-dinh at the beginning of the 11th century; the colossal towers of Duong-long, and those known as the Towers of Gold, Silver and Copper, are striking monuments. But it was no longer possible to build up great temple cities in honour of the gods. The Annamites penetrated even as far as Nha-trang, and took possession of the temple of Po Nagar; only Po Klong Garai remains in Cam possession, and here worship is still conducted.

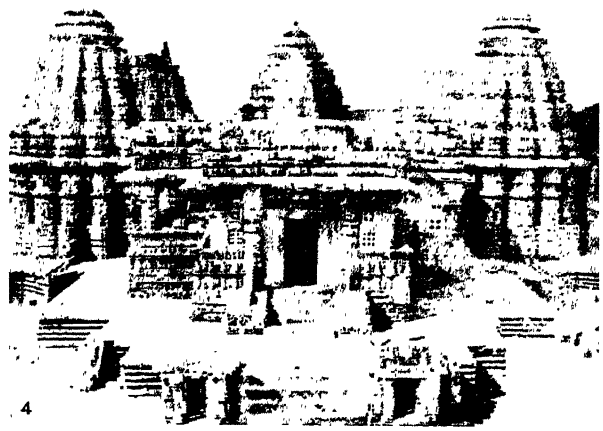
SUMATRA

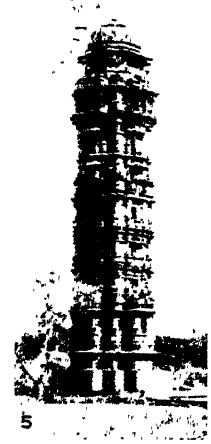
Sumatra, Suvarṇabhūmi, the "Land of Gold," Yavadvīpa of early Indian literature, received Indian colonists probably before the Christian era; in the 5th century Māhāyana Buddhism was officially adopted as a result of a royal mission from Kaśhmīr. Ī Ching passed by Palembang about 690 and found here a great centre of Sanskritic Buddhist learning. Before this time the great Malay kingdom of Śrīvijaya held for many centuries by the Śailendra dynasty had been established with the capital at Palembang, controlling thence the Malay Peninsula and probably Siam as far as Prapathom; this was the greatest maritime power in south-eastern Asia (Madagascar had been colonised by Hinduised Malays early in the Christian era).

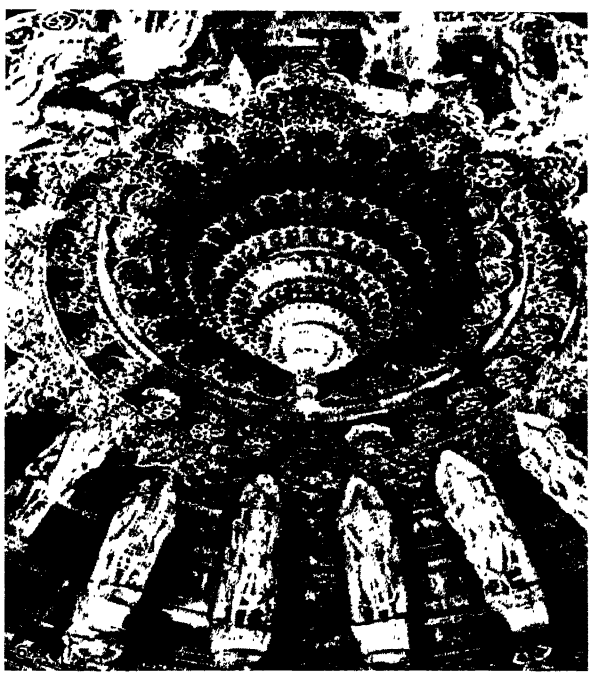


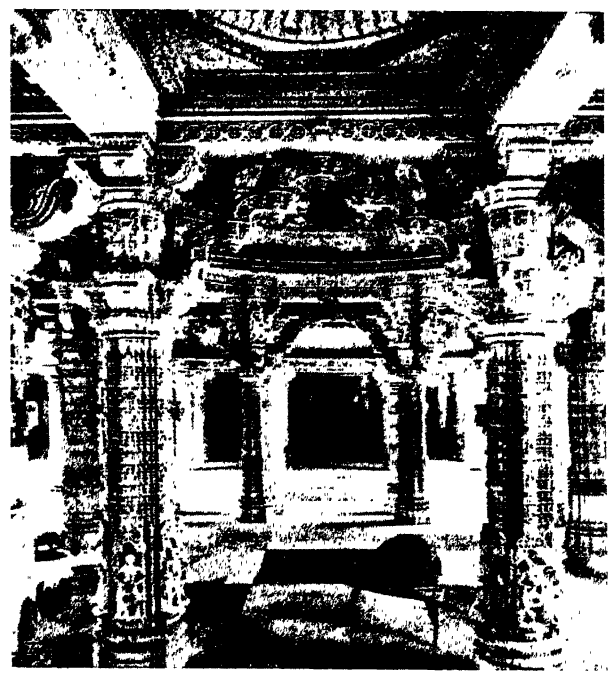










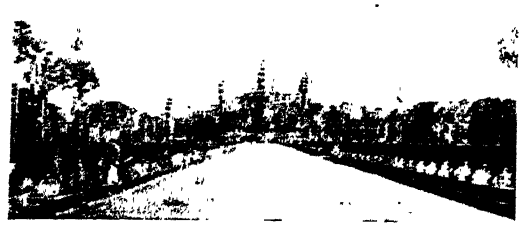


PHOTOGRAPHS, (1, 6, 7) JOHNSTON AND HOFFMANN, (2, 4, 5) THE ARCHAEOLOGICAL SURVEY OF INDIA

INDIAN ARCHITECTURE FROM THE 1ST TO THE 13TH CENTURY

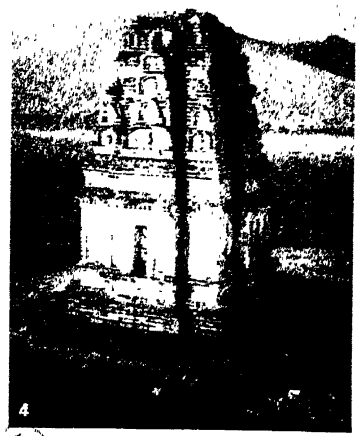
1. Interior of Cave II., Ajaṇṭā, showing pillars and painting. Early 7th century. 2. Meruvardhanasvāmin temple, Pāndreṇthan, Kashmir. Early 10th century. 3. The city gate at Dabhoi, Gujarat, *c.* 100 A.D. 4. Kesava temple at Somnāthpur, Mysore, built in typical Vesara (later Cāḷukya) style. A.D. 1268. 5. Kīrttistambha, raised at Chitor; 1440–1448 A.D. to commemorate the erection of the Kumbhasvamin temple. 6 and 7. Ceiling and porch of Tejahpāla's temple (Jaina) at Dilwāṛā on Mt. Ābū. Rajputana, A.D. 1232

INDIAN ARCHITECTURE

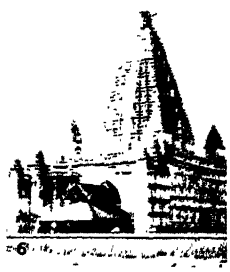


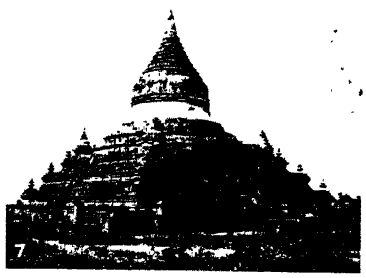


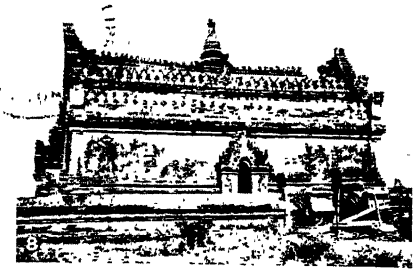


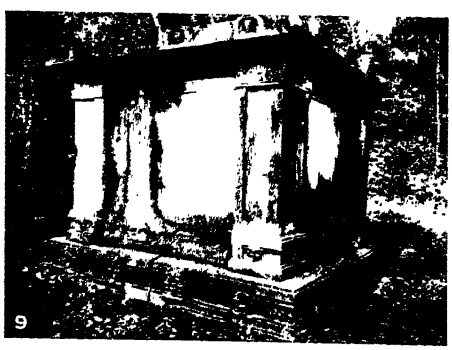




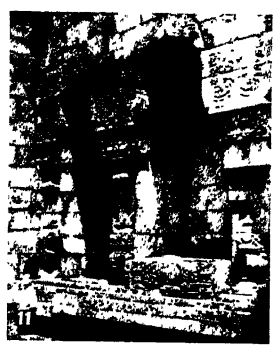




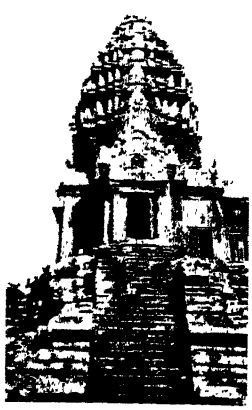


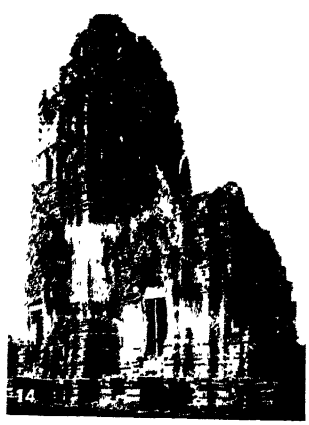


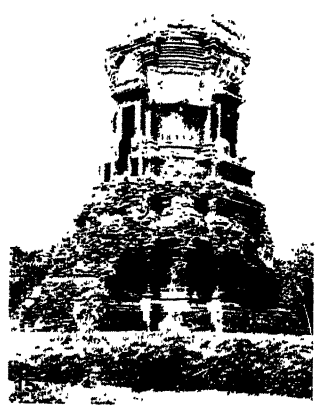












BY COURTESY OF (7, 10, 11) DENMAN W. ROSS, (13) THE BUREAU OF UNIVERSITY TRAVEL; PHOTOGRAPHS, (1, 6, 8, 12) A. K. COOMARASWAMY

EXAMPLES OF FURTHER INDIAN AND INDONESIAN ARCHITECTURE

CAMBODIA: 1. Aṅkor Wāt, 12th cent. 9. Slab-built shrine, Préi Kuk, early Khmer, 7th cent. 12. Aṅkor Wāt, galleries, early 12th cent. 13. Aṅkor Wāt, Tower, early 12th cent. JAVA: 2. Borobuḍur, 8th cent. 3. Caṇḍi Puntadewa, Diēng, 8th cent. 4. Caṇḍi Bīma, Diēng Plateau, early 8th cent. 11. Porch at Caṇḍi Sewu, 10th cent. 15. Caṇḍi Jābung, A.D. 1354.

BURMA: 6. Mahābodhi temple, Pagān, 13th cent. 7. Mingalazedī pagoda, Pagān, A.D. 1274. 8. Ordination Hall, Pagān, 13th cent. 10. Temples at Pagān, 11th cent. and later. ANNAM: 5. Temple at Mīson, Campā, 7th cent. SIAM: 14. Temple at Lopburi, Siam, 11th cent.

An inscription at Vień Srāh in the northern part of the Malay Peninsula records the erection there of brick towers and stupas. That of Kota Kapur in Bangka speaks of a military expedition to Java, and in fact, from before the middle of the eighth century the whole of central Java was subject to the Śailendras. The buildings there erected, however, will be discussed under Java (*see* below); in Sumatra proper the architectural remains are little known and not well preserved. (*See* SUMATRA.)

JAVA

The old Hindu kingdom of Tārumā in western Java is known only by inscriptions of 4th and 5th century date. The earliest architectural remains are those of the Dieng Plateau, where in the seventh or early eighth century stone was for the first time employed in Java as a building material. The plateau was not an inhabited city, but a place of pilgrimage, a temple city comparable with Girnār and Mi-son. Out of many more, eight temples survive; they are known by the names of the heroes of the *Rāmāyaṇa*, but these appellations have nothing to do with their original dedication to Śiva. The Indian character of the architecture is conspicuous, and in all probability Indian architects were at work here. The construction is generally cubic, with strongly emphasized vertical and horizontal lines; the temples are two-storeyed, the roof repeating the form of the cella. The plan is square, and the walls are divided by pilasters into niches or panels with sculpture; a grotesque makara face crowns the doorways. This description applies to the four temples of the Arjuna group; but Caṇḍi Bhīma is a pyramidal tower in the northern Indian *nāgara* style with successive horizontal stages repeating the fundamental forms, cornices with dormer-arches framing *Gandharva* heads, and angle-āmalakas at the fourth and fifth stages; no doubt a single āmalaka crowned the now ruined summit. East and south of the Plateau and at Mt. Ungaran there are numerous other small temples of the same period and style, but rather more freely, and exquisitely decorated.

We come now to the great monuments of the Śailendra period (*see* above; SUMATRA) which are easily accessible to visitors from Djokjakarta. In Caṇḍi Kalasan, a lovely but ruined building dedicated to Tārā, we find the first Buddhist temple on Javanese soil; the date is A.D. 778. This is a building of the Dieng Arjuna type, but the lateral niches are developed into side chapels, the ornament is more elaborate, and there are delicate strips of floral tracery between the plain pilasters. Near by is the three-storeyed rectangular Caṇḍi Sari. Caṇḍi Mendut which is near Borobuḍur is similar in plan, but there are no side chapels; on the other hand there is an open sculptured vestibule, and the exterior walls of the cella are richly decorated with figure reliefs. (*See* JAVA; *see* BATIK.)

Borobuḍur.—Borobuḍur ("Many Buddhas") is wonderfully situated on an eminence commanding an extensive view of rice-fields and more distant towering volcanoes; it is a hill that has been terraced and clothed with stone. It is in fact a low pyramid composed of successively receding platforms with re-entrant angles. The structure is thus exactly analogous with that of contemporary buildings in Kāśmīr, and that of earlier stupas in the Panjāb and Afghanistan, and the Rawak stupa in Turkistan, which are similarly provided with extensive basements having median stairways on one or four sides, though none of the Indian examples has more than two terraces, so that Borobuḍur represents a more developed type. (For the sculptures *see* INDONESIAN AND FARTHER INDIAN ART.) Borobuḍur cannot be exactly dated, but was probably built at the close of the 8th century.

Caṇḍi Sewu Prambanam is a Buddhist temple which dates from the early 9th century. The large central shrine represents a further development of the Caṇḍi Kalasan design, with side chapels open to the exterior, and niches containing images. Around it, within the large area enclosed by the *prākāra* are two double series of small independent chapels, about 250 in number. The order and formality of the design are conspicuous.

After the "Restoration," *c.* A.D. 860, the Hindu kings of Central Java erected other great buildings at Prambanam. The Caṇḍi Loro Jongrang group consists of three large terraced temples dedicated to Brahmā, Śiva, and Viṣṇu, and some smaller shrines, within the same enclosure. The Śiva temple is typical; the actual shrine occupies the summit of a steep truncated terraced pyramid with median stairways on three sides leading directly to the main shrine and side chapels above. The whole site may have been a royal mausoleum as well as a place of ordinary worship. Nearby is the Buddhist Caṇḍi Plaosan.

These temples were no sooner built than abandoned, for about A.D. 915 Central Java was deserted, and the further development of Javanese architecture must be studied in the East and in Bali.

At Caṇḍi Lalatunda and at Belahan there are sculptured bathing places built by Udāyana and by his great son, Erlanga. The best known monuments, however, belong to the 13th and 14th centuries, the time of the great capitals at Singasāri and Majapahit. At Singasāri, Caṇḍi Kidal is a Śaiva, and Caṇḍi Jago a Buddhist temple, but there is a mixture of the two cults amounting almost to fusion, as was also the case in Cambodia; a like condition survives in Bali at the present day. In far eastern Java the great Buddhist shrine of Caṇḍi Jabung dates from 1354; the circular tower, unique in Java, stands on the usual high rectangular terraced basement, the transition from base to tower being skilfully effected. At Panataran near Blitar there is a large Śaiva temple complex, recently excavated and partly restored; the basement of the main temple is square and terraced, with the usual recessed corners. The associated gates and the sculpture are already in a style forecasting that of Bali.

Bali.—Bali, where alone in Indonesia Hinduism and Buddhism survive as practised cults, most probably had early and direct relations with India; but we have also to reckon with the migration of Javanese exiles to Bali at the close of the 15th century, by which time practically the whole of Java had received Islam. In Bali the only important early remains are the royal tombs at Tampaksiring, dating from the 11th or 12th century, and the Pura ye Ganga temple, more or less in Panataran style, dating from the 14th or 15th century. The more modern temples of Sangsit, Bangli, Batur, Kesiman, Den Pasar, etc., consist of groups of small independent shrines enclosed by walls having high roofed gateways; with rich sculpture in limestone, in fantastic forms and high relief.

(*See* also ARCHITECTURE; INDONESIAN AND FARTHER INDONESIAN AND INDIAN ART.)

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INDIAN DESERT, THE. Between the ancient Aravalli mountains and the wall-like front of the recently folded arcs which carry the Indo-Baluchistan frontier, and from the shores of the Arabian sea to within an average distance of *c.* 80 m. from the Himalayas, extends a lowland exceeding 200,000 sq.m., with an annual rainfall of less than 15 in. and a population of about 15 million. At one extremity it touches the northern tropic; at the other it passes beyond 32° N. lat. It includes most of that part of the Punjab which constitutes "The Land of the Five Rivers," together with the adjoining trans-Indus districts of Dera Ghazi Khan and Dera Ismail Khan; the whole of Sind and, to the immediate north, Kachhi (Kalat). The western hem of south-east Punjab must be added also. Native States territory constitutes a solid block extending from the Sutlej-Indus line, east of Sind, to the Aravallis, including Bahawalpur (*q.v.*), and to the south the Rajputana States of Bikaner, Jaisalmer, and Jodhpur (*qq.v.*). Native territory touches the Indus again for a short distance below Sukkur where Khairpur State, hinging on to the west of Jaisalmer, breaks across Sind to the river. Finally Cutch State passes down from Jodhpur to the seaboard south of Sind.

A range of 10° of lat. implies considerable climatic diversity, and the area embraced leaves room for topographical variety. Yet it remains a major natural entity, the character of which is conveyed in the title "Arid Lowland." The tract has a general slope from the Himalayas to the Arabian sea, *i.e.*, north-east to south-west. Along its inner margin, in Punjab, the land between the rivers (*doabs*) rises to *c.* 700 ft.; but the western portions of the *doabs* and south of the Sutlej, almost all Bahawalpur, lie below the 500 ft. contour line. The 250 ft. contour line cuts the Indus river as it enters Sind, the heart of which province is well below this; the rest, with the conspicuous exception of the Kohistan, not much above it. To the south-east towards the Aravallis, the lowland attains a general level of over 1,000 ft. whence it grades down north-westwards, *i.e.*, traversing the prevailing slope at right angles. Except for a fringe of Jaisalmer, and the basin of the Luni river draining south-east to the Runn of Cutch, all Rajputana stands well above 500 ft. and betrays its physical "betweenness." Its deep mantle of aeolian deposits allies Rajputana superficially with the alluvial expanse upon which it encroaches. But it is not so completely destitute of solid rocks, and these, rising as low heights above the sandy surface, indicate a deep-seated unity with peninsular India as a coastal margin shelving from the Aravallis towards the seas, persisting to the north until late geological time.

Climate.—Climatically the tract is one of extreme temperature range, daily and seasonal. This is tempered somewhat along the coast but increasingly marked northwards. November to February is warm, with a mean daily temperature of 55°–70° F. The minimum falls in January. The designation "Cold Season," which is applied to this period (particularly the latter half), serves to emphasize the contrast with conditions prevailing during the rest of the year; namely, the low night temperatures with liability to frequent frost in the Punjab (Khushab mean min. Jan. 41·5° F, lowest recorded 25·0° F) and north Sind, though elsewhere such occurrences are very rare; the limitation imposed upon agriculture by the exclusion of essentially tropical plants at this season; and, lastly, the relief, which its duration affords to Europeans. Pressure is high in relation to the neighbouring seas, and only light winds blow from north-west and west. Except during the passage of shallow cyclones from across the North-West Frontier, toward the south-east, bringing a little rain to the Punjab fringe (rarely elsewhere), cloud is absent. March to October is hot. From May to July the mean daily temperature exceeds 90° F, with the maximum in June. Afternoon readings of 110° to 120° F are registered (Jacobabad 127° June 1919; highest ever recorded in India). The rising temperature initiates a reversal in pressure and amid the changing conditions duststorms are generated.

Winds from the west and south-west are well established by April and persist until October, blowing with increasing strength as the depression deepens over the land until they reach their final expression in the south-west monsoon proper. But the air currents now entering the lowland on this side emanate from the dry land belt about the head of the Arabian sea. Hence they are not saturated like those, which, originating over a broad ocean, impinge on the Bombay coast; but only "stray" just north of the Aravallis. They confer even scant benefit to the immediate coast fringe; beyond, they desiccate. Since also the Bay of Bengal branch of the advancing monsoon, which enters the lowland from the east on a downhill journey to its barometric goal, has already served the whole Gangetic plain, its remaining moisture is soon exhausted. Thus of the 213,110 sq.m. actually under review 47,590 receives less than 5 in. per annum; 95,560 5 to 10 in., 69,960 10 to 15 inches. The following illustrates briefly the salient features of distribution, and how precipitation shrinks north, south and east towards Upper Sind and Kachhi:

Stn.	June-Sept.	Var.	Oct.-Feb.	Var.	Mar.-May	Total (in.)
Shahpur .	9·6	33	2·5	44	2·2	14·3
Sirsa .	11·4	37	1·6	72	1·3	14·3
Pachbhadra .	11·3	33	·7	81	·8	12·8
Bikaner .	9·2	67	1·0	75	1·1	11·3
Jaisalmer.	5·9	53	·5	80	·4	6·8
Multan .	4·9	51	1·1	58	1·1	7·1
Karachi .	6·1	80	1·3	71	·3	7·7
Jacobabad	2·7	75	·9	71	·5	4·1

Var. (variability) indicates departure from average seasonal rainfall as registered in half the years during 1890–1923, expressed in percentage. It is one way of illustrating the violently fluctuating régime. In general, March to May returns are insignificant.

Water.—It is a truism that natural boundaries are zonal not linear; and generalizations concerning the biological effectiveness of rainfall are dangerous. Space forbids qualifications, yet it may be accepted that over the lowland precipitation is such that it precludes the transformation of the surface by permanent cultivation, and that over those parts which lie beyond the sphere of running water a desert landscape prevails. At once, therefore, it claims a continuous area of just over 100,000 sq.m. cut off from effective water circulation. This involves Bikaner, with Jaisalmer and nearly all Jodhpur; Bahawalpur practically to the north-west railway which runs parallel to the Sutlej; the Runn of Cutch, and north of it as much of Thar and Parkar district (Sind), Khairpur State, and Sukkar district (Sind) as lie east of the Nara river (properly canal). Its name "Thar" refers to the sandhills accumulated by the prevailing winds which transport thither the saline dust picked up over the Indus delta and the Runn. Two types of sandhills are recognized. (*i*) Longitudinal (Sindhi *Bhits*), parallel ridges aligned north-east south-west, *i.e.*, parallel to the prevailing winds. The bhits are restricted to the west, *i.e.*, Thar and Parkar south of Umarkst, eastwards to the Luni basin. They reflect greater wind force than (*ii*) Transverse type, to which they give way, through intermediate forms, north-east of Umarkst. These lie at right angles to the wind but are less regularly aligned than (*i*). The marginal dunes rise to about 200 ft. above the general sandy surface and are relatively permanent. Further inland they are lower, in constant motion, and the landscape tends towards a low plateau of deep, loose sand, reminiscent of a billowy sea.

Deserted by a "westering" parent, the feeble monsoon streams which struggle across south-east Punjab, between the Sutlej and Jamna rivers, succumb before the sand ere the Rajputana border is reached. The Luni river is the only significant watercourse within the area. It receives several Aravalli streams from the south-east and is at least a support to the subsoil water within its bend; but it loses itself in sand at the head of the Runn.

Salt.—The salinity of the soil, characteristic of the whole low-

land and here very marked, is sufficiently accounted for throughout Thar by the action of the wind, bringing material from the seaboard. The evaporation of subsoil brine is common over Rajputana (particularly Pachbhadra neighbourhood) and also beyond south-west of Delhi, in Multan and Muzaffargarh. The Rajputana salt lakes, representing the fixation of salt washed into basins of internal drainage, are marginal to the desert. Of these, Sambhar, on the Jodphur-Jaipur boundary is the largest. It lies in a closed depression in the Aravalli schists (1,184 ft.). Its maximum spread is 90 sq.m. and during a normal monsoon it averages 4 ft. deep in the middle, but is dry the greater part of the year. The upper 12 ft. alone of saliferous silt forming its bed represents a salt reserve of about 54,000,000 tons. The lake is worked on lease by the Government of India, and the salt extracted is railed to Sambhar at the eastern end of the lake, whence it is distributed (average annual yield 1918–19 to 1922–23, 230,340 tons). Lesser lakes, of scant importance, occur to the north-west.

Gypsum, also occurring on the margins of some of the lakes, may prove more important in the future. In Sind and Khairpur, where the floor of alluvial clay remains uncovered or only thinly mantled with sand, shallow though often large expanses of water known as *dhands* are common in the hollows (*talis*) between the sandhills. They are fed by rain water percolating through the sand and emerging as a spring (*sim*) above the clay. Prior to the controlling of the Nara river many *dhands* were replenished by its flood spills, but these have now mostly dried up. *Sim* water is often sweet, and gives rise to fresh pools close to where it emerges and lying a few feet above the *dhand* proper, which is either alkaline or saline, rarely fresh, its particular nature being recognizable from its fringe of vegetation. All *dhands* shrink seriously after rain; the smaller ones dry up. The mineral *trona*, from the alkaline *dhands*, supports the soda (*chaniho*) industry of Khaipur State and Nawabshah district (Sind). Saline *dhands* yield salt and gypsum.

Flora.—A varied, open, shrubby and coarse herbaceous vegetation is characteristically present, salt lovers being conspicuous. On sweet, damp bottoms, and after rain, good grass abounds. Thus fodder exists for large numbers of cattle, sheep, goats and camels; villages are scattered everywhere.

When rain is propitious, millets (principally bajra) are raised and husbanded to eke out a milk diet supplemented otherwise only by such imported grain as the profits of the pastoral industry and associated crafts, such as the making of blankets, felts, *lohis* (coarse shawls), ropes, bags, brushes and leather goods render possible. Typical desert *talukas* of Sind show a population density per square mile of less than 20 (*cf.* Diplo. 12; Chachro 18); Jaisalmer the "core" of the desert has an over-all density of 4 per sq.m.; Bikaner gives 28 (Bikaner city 69,410); Jodhpur 53 (Jodhpar city 73,480), but a heavy allowance must be made for that part of the State outside the essential desert. Roughly, Thar carried *c.* 2½ millions, largely marginal.

The Runn of Cutch (Rann of Kachh), embracing *c.* 8,000 sq. m., while an integral part of the desert, possesses a distinctive character. It is a low-lying salt-impregnated alluvial tract. Seemingly uniformly level, it has a general imperceptible slope seaward, while minor irregularities give shallow surface depressions. When the surface is dry it is hard and polished, "even a horse's hoof hardly dents it in passing." During the south-west monsoon, however, it is flooded by the waters of the Luni, Puran, Banas and other rivers assisted by rain remaining on the hard surface, but the view that at this season the sea invades it (the sea level is raised 4 to 5 ft.) has been disproved and abandoned. During flood the water varies in places from a few inches to some feet, but after it subsides evaporation proceeds until only salt remains.

Lying in a belt liable to pronounced seismic disturbance, the Runn suffered severe displacement in 1819; depression increased the "rann" proper, but aeolian deposits have diminished it since. It is a range for wild asses. The impoverishment of the Runn and much of what is now Thar reflects the "westering" of the Indus and associated Punjab rivers. A map shows that the streams making for Rajputana across the low Sutlej-Jumna watershed converge towards a large dry water course (the Ghaggar), which runs parallel to the Sutlej and is traceable beyond through Sind to the Runn, roughly via the east Nara and Puran. This is the Hakra, or "Lost River," fed formerly by the Sutlej (possibly at one time by other Punjab rivers), and in its lower course (as the Mihran of Sind), by the Indus. Such was the known condition in the 8th century A.D. Subsequent probably to phenomenal flooding in north Punjab, placed in the 14th century, a rearrangement of drainage initiated the decline of the Hakra. First a "westering" Indus ceased to feed its lower reach; eventually the Sutlej completely deserted it and passed to the Indus via the Beas. By 1790 the Hakra was dead. The tapping by bunds of the waters latterly feeding the Puran from an Indus distributary assisted to complete the dereliction of the abandoned delta (the Runn).

Irrigation.—Outside Thar, the immediate valleys of the rivers sustained by the snows of Himalayas, tree-lined and recuperated by inundations, break the arid continuity, while as a result of irrigation achievement the desert survives only in fragments. Consequent upon the melting snows, the Indus and rivers of Punjab begin to rise in March, and normally spill over the land in mid-June. Floods culminate in August, and the rivers fall fairly rapidly to a minimum about February. From antiquity channels have been dug to utilize the rising waters. Such inundation canals are necessarily restricted to the lower marginal lands, *i.e.*, mainly newer alluvium (*Khadar*), which in Punjab lies 10 to 50 ft. below the older alluvium (*Bhangar*) comprising the *doabs*, and varies from 4 to 10 m. wide. Hence they occur mainly where the "Five Rivers" converge to form the single artery continued in the line of the Indus, and attain their maximum development in Sind, where the widening *Khadar* merges into truly deltaic land. Many of these canals existed prior to British rule; they have been improved and others added. Since inundation canals function only during the floods and fluctuate with the natural level of the water in the river their shortcomings are obvious. Yet they play a big part. At present they are virtually the only form of irrigation in Sind, and they serve *c.* 1½ million acres in the Punjab. Thus (average annual area irrigated 1923–24 to 1925–26, in acres): Upper Sutlej canals, 320,237; Lower Sutlej canals, 342,972; Indus Inundation, 234,-945; Muzaffargarh Inundation, 333,694; Chenab Inundation, 185,-440. In addition, the Sutlej serves *c.* 900,000 ac. in Bahawalpur and there is a small canal in Dera Ismail Khan.

Agriculture.—It is, however, to the expansion of great perennial systems over the broad backs of the Punjab *doabs*, and the development of model agricultural colonies thereon, that the elimination of the desert between the Jhelum-Chenab on the one hand and the Sutlej on the other is due. Details of what this has meant must be omitted, but the following Punjab census (1921) return is noteworthy: "In 1891 the population density contour line, 100 per sq.m., which enclosed the oasis of Multan was no less than 160 m. distant from the general 100 per sq.m. density line. Since 1891, however, due to the development of the Lower Jhelum, Lower Chenab and Lower Bari *doab* canals the line has advanced at an average rate of *c.* 10 m. per annum, and in 1911 Multan had been turned, from the point of view of population, from an island into a narrow-necked peninsula." Agriculturally it has meant the establishment of *c.* 1 million acres of acclimatized American upland cotton with a staple of *c.* 1 in., and a great wheat expansion.

The following gives the area now being served; canals marked* lie entirely in the arid zone, the others affect its margins (average annual acreage 1923–24 to 1925–26): Lower Chenab*, 2,478,210; Lower Jhelum*, 868,064; Upper Jhelum, 326,786; Upper Bari *doab* 1,254,234; Lower Bari *doab** 1,165,109. The Sutlej valley project, now in hand, will convert certain inundation canals dependent on that river into perennial, and assure the flood supply of the rest, while extending irrigation into the Bahawalpur and Bikaner fringes of Thar. When complete it will irrigate 5,108,000 ac., including 2,075,000 perennial and 2,033,000 non-perennial; 3¾ million acres at present waste, will be available for colonization. Representation by the Bombay Government has led the Government of India to hold up further undertakings by Punjab pending investigations into Indus river supplies; the position is difficult and a Central Indus Board is mooted.

Projects.—Punjab is anxious to carry out two big tasks at

least. Firstly, to reclaim the Sind-Sagar *doab* by the Thal project, which would carry water from the Indus at Kalabagh over Mianwali and Muzaffargarh above its inundated "tail." Secondly, to construct the Bhakra dam on the Sutlej where it emerges from the hills, with a canal to supplement the Sirhind and west Jumna canals (feeding 728,953 and 1,591,629 ac. respectively), and to extend irrigation in Hissar and Bikaner. This would give sorely needed protection to the arid skirt of south-east Punjab, at present served only by the lower reaches of the canals mentioned (assisted by the small Ghaggar inundation canals), and also nibble a little off east Thar.

The recession of the western mountain wall enables the Indus, after receiving the united volume of the Punjab rivers, to enter Sind as a south-west flowing river. Near Schwan it turns south in the presence of the Laki range but manifests its "westering" tendency again in its final struggle seaward. The bifurcation of the Ochito and Haidari is quoted as the head of the delta; but, of course, throughout Sind the river is really deltaic, flowing on a ridge above the land on either side, restrained in parts by embankments, but requiring more to curb its devastating moods, while the lower part of the province is riddled with its dead channels. Only in the gorge between Sukkur and Rohri, where it traverses a gap at the north extremity of low hills running for 40 m. south from its left bank, and in the Kotri neighbourhood is its channel constant. Its sphere of influence, between the mountains on the west and Thar on the east, defines settled Sind. The cultivable area commanded by canals dependent on it approaches nine million acres of which, in 1924–25, 2,168,682 ac. were irrigated under the right bank systems and 1,557,201 under the left. As the Indus is not yet weir-controlled, technically all its irrigation is by inundation, its canals functioning only during the flood season (June to early October). One or two, however, receive a little water in the "cold" season, and the Jamrao canal, weir-controlled and fed from the east Nara supply channel (linked with the Indus but not weir-controlled itself), is truly perennial. In order to afford an assured supply at all times, the Sukkur Barrage project, after long years of discussion, has recently been undertaken. The barrage is to be placed 3 m. below the Sukkur gorge. Briefly, four canals will take off the left bank and three (one a purely rice canal) off the right bank. They will take up the area south of Sukkur at present under inundation irrigation, and in addition will enable a considerable area of waste to be cultivated. Actually 6½ million acres of cultivable land will be commanded, and it is hoped to feed 5⅓ million acres annually, of which two million represents existing inundation irrigation to be given an assured supply. Of improved cotton alone 700,000 ac. per annum are anticipated. The project will take *c.* 40 years to complete, but big developments are expected in ten years' time.

Westwards beyond the sphere of the Indus, the desert landscape is at once established, and the irrigated patches of *daman* (clayey soil) created and sustained by flood torrents searing the mountain wall, only throw the naked hideousness of the limestone rampart into bolder relief.

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(A. V. W.)

INDIAN HEMP (*Apocynum cannobinum*), a North American plant of the dog-bane family (Apocynaceae), native to fields and thickets from Quebec to British Columbia and southward to Florida and Lower California. It is an erect, often much branched perennial, 1 to 4 ft. high, with smooth, oblong, opposite leaves, and small, clustered, greenish-white flowers, from each of which develops two very narrow fruit-pods (follicles), about 4 in. long, containing numerous downy-tufted seeds. The tough bast fibres of the inner bark were utilized by the Indians for cordage. (*See* APOCYNACEAE; DOG-BANE.)

INDIAN INK or **INDIA INK:** *see* INK.

INDIAN LAW. The law in force in British India may conveniently be divided into six heads: (1) The law expressly made for India by the British parliament, or by the sovereign. (2) English law in force in India though not expressly made for India. (3) The law made by persons or bodies having legislative authority in India. (4) Hindu law. (5) Burmese Buddhist law. (6) Mohammedan law. The first three of these are frequently described as Anglo-Indian law. They are with rare exceptions territorial, *i.e.*, they apply generally, either to the whole of India, or to a given area, and to all persons within those limits. The last three are personal, *i.e.*, they apply only to persons who answer a given description.

Law Expressly Made for India by the British Parliament or Sovereign.—There are in existence many Acts of parliament relating to India. Many Acts were concerned with constitutional law, the powers of the East India Company, of the Board of Control, and of the governor-general, and, after 1858, with those of the Crown, the secretary of State and his council, the governor-general in council, and the other Governments of presidencies or provinces. These have now been consolidated in the Government of India Act 1915 as largely amended in 1919. This Act deals also with the high courts. Such courts have been established by charter at Calcutta, Madras, Bombay, Allahabad, Patna, Lahore and Rangoon, and some of the clauses of their charters are legislative in effect.

English Law in Force in India Though Not Made Expressly for India.—Before the wars with France in the middle of the 18th century the East India Company's possessions had been little more than trading posts, and the mayors' courts established by charter at the larger ones, such as Calcutta, were not generally concerned with anything but matters inside the settlements, and endeavoured to adjust these on the basis of English Law where British subjects were concerned. But, as shown in the historical section of INDIA (*q.v.*), by 1760 the company had become responsible for more or less of the administration of considerable territories in Bengal and southern India. Under Acts of parliament commencing with the Regulating Act of 1773 supreme courts were established, originally at Calcutta, and then, superseding recorders' courts, at Madras and Bombay. And it was held that they were to administer English law within those presidency towns, unless by their charters directed to administer some other law. The charters did direct them to apply to Hindus and Mohammedans their own laws in regard both to all matters of inheritance, succession and family law, and to matters relating to religion and caste. It was soon found that the law of succession and inheritance could not be administered without also administering that of marriage. Outside the presidency towns, when the company did finally take up the administration of justice, it did not at first purport to alter the law. It administered Hindu law to Hindus and Mohammedan law to Mohammedans, and retained, at least in Bengal and Madras, Mohammedan criminal law as the criminal law. Gaps in the law, and adaptations to new needs, had to be filled in by recourse to the principles of "justice, equity and good conscience" which Sir Henry Maine (*Village Communities*, 1881, p. 299) surmises to have often been, in the case of the subordinate courts, "applying some half-remembered legal rule learned in boyhood." And thus a good deal of English equity, and some English common law, came into the practice of the company's courts. And when the supreme courts at last recognized Hindu wills, they had to apply the methods of the English court of probate.

Legislative Law.—As a general proposition it would be true to say that wherever a British authority has legislated in India it has been largely influenced by the English law, and until 1909 British influences were predominant in the legislative councils. The present legislative authorities in India are:

(1) the central legislature, *i.e.*, the council of state and the legislative assembly, (2) the legislative council of each "governor's

province," and (3) (only in emergency) the governor-general. Their Acts deal with topics of every sort suitable for legislation. No legislative enactments of any kind passed in India before 1793 are now in force. In Bengal in the year 1793, 48 regulations, as they were then called, were passed in a single day, and it was assumed that all previous legislation in Bengal was thereby superseded. Similar regulations were passed about the same time, and the same assumption was made, in Madras and Bombay. As new territories were acquired by the Government of India, the existing regulations were in some cases extended to them, but in other cases this was not thought to be convenient, and for these territories the governor-general in council issued general orders, not in the regular way of legislation, but in the exercise of his executive power. Hence the distinction between "regulation" and "non-regulation" provinces. Any doubt as to the validity of the orders so made was removed by the Indian Councils Act 1861. The term "regulation" was dropped after the passing of the 3 and 4 Will. IV. c. 85 (1833), and since that time the word "Acts" has been in use. Acts are referred to by their serial numbers in the year of the sovereign's reign in which they were enacted by parliament.

At times since 1833 commissions have been appointed to draft laws prior to their introduction into the governor-general's legislative council, but this practice ceased before 1870. To the earliest of these commissions we owe the Indian penal code, much of the original draft of which was made by Macaulay. It was finally passed in 1860 and came into force in 1862. It leaves procedure to be dealt with in a separate code. It is based upon English criminal law, but in many points simplifies it and renders it easier to administer, while somewhat altering it in others. What is commonly called larceny in England and the United States is broken up into theft, criminal misappropriation and criminal breach of trust, for instance; and all offences are defined in language which is capable of plain interpretation. The best testimonial to the penal code is that, though it has needed some additions, it has stood without substantial alteration for about 65 years. Other parts of the law which have been codified are criminal procedure, civil procedure, contracts, wills of Hindus in the presidency towns and the old province of Bengal, wills and intestacy of Christians and of Parsees, probate and administration of all wills and of intestate estates, specific relief, registration of title, transfer of property, trusts and evidence. Sir J. F. Stephen was the draftsman of the Indian Evidence Act, which was passed in 1872.

The law relating to land revenue has been the subject of innumerable regulations and Acts of the Indian legislatures. A description of the revenue systems prevailing in India will be found in the article INDIA. The law which governs the relation of cultivators to those, whom for want of a better term we must call landlords, has grown to a considerable extent out of the revenue system. The view which was at first taken of this relation was unfortunately affected by English notions of the relation of landlord and tenant, but this view has been considerably modified in favour of the tenant by later legislation. Tenancy rights vary from province to province, and each province has its tenancy law, or perhaps two or more such laws applicable in different parts of the province. The scope of this article does not admit of an examination of them. The tendency is to encourage hereditary occupancy tenure at rents to be fixed periodically by the courts, or at least life-tenure. In Madras and Bombay much land is owned by the actual cultivators. And in northern India most small landholders cultivate some of their lands while tenants hold the rest of it.

The legislative acts of the governor-general in council from 1834 to date have been published by the legislative department of the Government of India. They are revised from time to time, and an annual volume published of each year's acts. The Madras code, the Bombay code, the Bengal code, the United Provinces code, the Punjab code, the Burma code, the Central Provinces code, the Bihar and Orissa code, the Assam code, and the codes of the small provinces have been published by the legislative department and revised editions are published from time to time. *See* also Baden Powell, *Land Systems of British India* (1892).

HINDU LAW

The Acts establishing courts of civil justice in the various provinces enjoin that Hindu law, or Mohammedan law, or (in Burma) Buddhist law is to be applied to the adherents of those faiths in such matters as succession, inheritance, marriage, divorce, dower, guardianship, minority, family relations, caste or any religious usage or institution. The actual lists vary in the different Acts. Indeed in Bombay the words used are "the usage of the country in which the suit arose; if none such appears, the law of the defendant." In Bombay, the Punjab and Oudh, custom, if proved, overrides law, and in Madras, the Central Provinces and Burma it is given the same force as law. Of course a saving is made of anything actually repealed by a statute or Act, and of all things contrary to public policy. For many purposes Jains and Sikhs are Hindus.

The section on legal literature in the article SANSKRIT (*q.v.*), mentions the written sources of Hindu law. The more ancient of these are regarded as sacred, and, as it is sacred, Hindu law is theoretically unalterable. But in fact it has changed, by admitting peoples wholesale into Hinduism who brought their customs with them, by slow local and family changes, and by adaptations to historical, political, economic and social changes. As to custom, indeed, Manu's code says "immemorial custom is transcendant law." In actual practice, and apart from modifications by custom, Hindu law as administered in the courts is substantially derived from the commentaries of the great commentators. For most purposes the chief among these are the *Daya Bhaga* of Jimuta Vahana in Bengal proper only, the *Mitakshara* of Vijaneswara all over India, and the *Vayavahara Mayukha* of Nilakanta in western India. The *Daya Bhaga* in Bengal, and the *Mayukha* in Bombay overrule the *Mitakshara* where they differ from it, and in the case of the *Daya Bhaga* the differences are so far-reaching in the matter of family property and in the theory of inheritance that it is rightly held that there are two main schools of Hindu law, the *Mitakshara* school and the *Daya Bhaga* school. The former is divided into the Benares school (Upper India generally), which prefers the *Mitakshara* to all other commentaries at all points, the *Mithila* school (northern part of the province of Behar and Orissa), the *Maharashtra* school (western India) and the *Dravida* school (southern India). The effects of decisions of the judicial committee of the privy council and of the various high courts on Hindu law are similar to those of the English courts on English common law and statute law.

The Joint Family.—The striking feature of Hindu society and Hindu law is the joint family. It is the form, no doubt, in which the Aryan patriarchal family has survived in India. The joint family is seen at its weakest in Bengal, the region where Brahmanical ecclesiasticism has had its greatest effect, for the *Daya Bhaga* is based upon it. Brahmanical influence on law probably increased at the post-Buddhist Hindu revival, but seems to have had little or no effect in the Punjab, or among the Aryan, or Aryanized, peoples of the Himalayas. Among some of the Himalayan clans, who undoubtedly have Aryan blood in them, the joint family is more like the Roman family than it is among Hindus of the *Mitakshara* school in India generally. The joint family is so much taken for granted in the *Shastras* and the commentaries that it is scarcely described in them.

As the question of whether a family's land could be validly alienated probably did not arise until comparatively recent times, the distinction between the right to manage, on the one hand, and ownership with the right to alienate on the other, probably did not become an important point of law for many centuries. When it did arise, two conflicting theories emerged. One is that of the *Mitakshara,* that down to the great-grandson of a living ancestor a male Hindu acquires by birth a right of ownership as a coparcener in the ancestral family property. The other is that of the *Daya Bhaga,* that the living ancestor is the sole owner, with unfettered control and power to alienate, even for personal purposes, and that on his death his descendants in the direct male line who have no ascendant living inherit the property in distinct and specified shares, and may either divide it up or retain it as a jointly worked and managed property. Under the *Mitakshara*

no co-parcener's share is a definite thing, even if he has no ascendant living, until a partition is called for. Until that event occurs each co-parcener's share can, in a manner, be said not to be ascertainable. And when a co-parcener, even the common ancestor, dies his rights pass by survivorship, and not by inheritance. Under the *Daya Bhaga*, then, when the common ancestor dies the ownership passes in immediately ascertained shares to his heirs under *Daya Bhaga* law. But in such a case under the *Mitakshara* the ownership, that of the family, is unaltered, but in the family there is one co-parcener the less, and the distribution on a partition made after his death will differ from that on one made before it. And, while the property remains joint, there is no passing of it by inheritance. The nature of the ownership of joint property is not discussed in either the *Mitakshara* or the *Daya Bhaga*.

If a family of brothers governed by the *Daya Bhaga* keep their property undivided, then, upon the death of one of them, his share goes to his heir or heirs, who, in default of agnate descendants, may be his widow, his daughters, or the sons of his daughters, and in this last case his share will pass into another family, but it need not therefore be separated off by a partition. In a like case under the *Mitakshara*, if the deceased brother had any agnate male descendants they were already co-parceners in the family property, while his wife, his daughters, and the sons of his daughters could not be co-parceners. Upon his death there was one co-parcener the less in the family, and the distribution on a partition would be somewhat altered. As long as two or more co-parceners remain in a *Mitakshara* joint family, such property as it may own cannot pass out of it by inheritance.

There is a standing presumption that Hindus nearly related to one another by agnation form a joint family. When they are so far apart in blood as second cousins that presumption is not very strong. And there is some presumption that anything in the possession of a member of a joint family belongs to the family. However, Hindu law now recognizes self-acquired property, though it took a long time to do so, even as the *peculium* of Roman law was of slow growth. Gains of valour, science and learning made without help from family resources are the chief source of self-acquired property, apart from what is styled "obstructed inheritance." But when self-acquired property passes by inheritance to agnate descendants it at once becomes ancestral, and under the *Mitakshara* the inheritors, unless they have already separated from one another, hold it as an ordinary joint family co-parcenary. Under the *Daya Bhaga* the fact that each co-parcener has a known and particular share of which he can dispose in his lifetime as he pleases by sale or gift or in any other way, without being answerable to anyone, greatly simplifies questions arising out of alienations. But under the *Mitakshara* the dealings by a co-parcener with the share which would fall to him on a partition, and the rights of his personal creditors against that share, both while he is alive and after his death, have given rise to legal difficulties.

Non-inheritors.—A joint family will usually have among it members who are not co-parceners. Under the *Daya Bhaga* the wives of co-parceners, the male agnate descendants of co-parceners, and the unmarried female descendants of co-parceners or of their agnate descendants come into this category, as well as those who might in time be co-parceners but that Hindu law debars them from inheriting, *e.g.*, those born deaf, dumb, blind or insane. Under the *Mitakshara* the dependent members will not include qualified sons, grandsons or great-grandsons of the senior generation of living co-parceners, for these are co-parceners themselves by right of birth, unless disqualified by any defects which debar from inheritance. But among the dependents there will be widows of deceased co-parceners. Under the *Daya Bhaga* such a widow without sons or agnate descendants will herself be owner, at least for her life, of her deceased husband's share. Under both schools these dependents must be maintained, out of the shares of their respective branches of the family in the case of the *Daya Bhaga*, and out of the general family fund under the *Mitakshara*. And, in theory, under the *Daya Bhaga* each actual co-parcener, which here means the owner by inheritance, or possibly by purchase, of a share, can claim, at least approximately, that a corresponding share of the family income be allotted to him. In a *Mitakshara* joint family there is no such right. No one can claim more than that he is to be maintained, with his wife and other dependents, on a scale suited to the family's resources. Only if fraud or embezzlement or the like is alleged, will current accounts be gone into. When a partition has to be made a capital account is, of course, necessary.

Partition.—To the ancient Hindu lawgivers and commentators partition and inheritance are different aspects of the same subject, and, in fact, in their view partition was the dominant aspect. This was because a Hindu ought to have at least one male agnate descendant, obtained in the last resort by adoption, and therefore ought to die a member of a joint family, if governed by the *Mitakshara*. And, even under the *Daya Bhaga*, when two or more sons succeed their father, they do not get definitely marked out shares absolutely their own until they effect a partition. Partition is in theory simple enough under the *Daya Bhaga*. Each co-parcener has a known share, all that has to be done is to lay out metes and bounds in the immovable property, and to make a fair division of the movables. But when the *Mitakshara* applies the first thing to be done is to determine the share of each co-parcener. The division is made by branches. And when there is a division between a living ascendant and his descendants the ascendant gets the same share as goes to each of his sons. Thus a father and his four sons make a partition, and each gets one-fifth of the property. If any of the sons had predeceased the father, leaving sons or agnate grandsons, these latter between them take what would have been his share. If four brothers divide, whose father and other ancestors are dead, each takes one-fourth.

Ancestral and Separate Property.—In case of dispute it will be necessary under either school to decide what is, and what is not, family property. What is claimed and proved to be either self-acquired or separate property has to be excluded from the hotch-pot, and there may have to be special provisions about the right to use wells, rights of way and other things which cannot be split into parts. There is a general Act applying to the making of partitions (Act IV., of 1893). It should be added that in most provinces partitions of land assessed to land revenue are made by the revenue courts, and in those cases the joint owners often are not members of a joint family.

A father or other ascendant governed by the *Daya Bhaga* is sole owner as against his sons and other descendants, yet there are texts indicating that if he make a partition among his sons he must divide the property equally. However, he undoubtedly can make a series of gifts to his sons or other descendants, and by them dispose of the estate in very unequal portions. At the back of this anomaly is the theory that a gift needs acceptance by the donee, and actual transfer of possession, to make it complete and cognizable in law, whereas a partition does not.

If a member of a *Mitakshara* joint family obtains a partition of his share, and has then no sons or other agnate descendants, the share is his sole and separate property. But it remains "ancestral," and as soon as he has a son born to him, or adopts one, that son becomes a co-parcener in it with him, and so with all his sons born subsequent to the partition and their sons and grandsons.

Very often the question arises "Has there been a partition or not?" The answer may affect the rights of a third party to whom a member of the family purports to have transferred property. The presumption as to jointness has already been mentioned. But whether there has been a partition or not is a question to be decided on the evidence. A fully united family is joint in house, food, worship and estate. But a family can easily be joint in house and worship and yet separated in food and estate, or it can be joint in estate, and yet to some extent separated in house and in food.

On effecting a partition provision must be made for the dependents, *e.g.*, unmarried daughters or sisters, mother whose husband is dead, and incapables. When a dependent belongs plainly to one branch of the family, and that branch does not itself split up,

the liability of course attaches to that branch, for instance one of several brothers who separate remains responsible for his own daughters. But when brothers separate who have unmarried sisters or incapable brothers, either a special assignment must be made, for instance to meet the expenses of a girl's marriage, or one member accepts responsibility and receives some sort of compensation. If it is a mother who has to be provided for, it is not uncommon under the *Mitakshara* for a part of the estate to be assigned to her. On her death it will be divided among her sons or their descendants.

As in a *Daya Bhaga* joint family each co-parcener has a definite share which descends by inheritance; when the estate of such a joint family is the subject of a partition what has to be ascertained is what portion thereof has devolved under the rules of inheritance to each present member since the death of the person who once held the whole of it. For under the *Daya Bhaga* all property goes by inheritance when its owner dies, whereas under the *Mitakshara* the rights of a co-parcener, even if he be one of two only, go by survivorship on his death. So a Hindu governed by the *Mitakshara* risks losing all chance of inheritance to the rest of the family property when he separates by partition, for as long as two or more members remain joint even their nearest relations, once separated from them by partition, cannot inherit their joint property, as survivorship precedes inheritance. Under the *Mitakshara* only separate property and self-acquired property can pass by inheritance.

Impartible Estates.—There are impartible estates. Apart from provincial legislation, which in parts of India may have enabled large landholders to entail their estates, there are many estates, mostly the residue of suppressed sovereignties or quasi-sovereignties, which are impartible by family custom. The junior members of the family are entitled to be maintained out of the estate, and may even have portions of it assigned for their maintenance, such assignments usually being revocable. When an owner of such an estate dies without descendants, and *Mitakshara* law applies, the question may arise whether the succession goes by strict primogeniture, in the sense of English law, or by a rule which first ascertains the nearest male agnates, and then among those equally nearly related gives the preference to him entitled as against the rest of this class by the rule of strict primogeniture.

Inheritance.—We now come to the rules of inheritance. Here there is a divergence of principle between the two schools. The *Mitakshara* prefers all male agnates, however remote, to any cognate, however near, except the daughter's son. And, except under the *Maharashtra* sub-school in western India, which does place some women in a more favoured position, the only women it brings in as near heirs are the widow, daughter, mother, grandmother and great-grandmother. The basis of the scheme is preference by nearness of agnate relationship. The scheme of the *Daya Bhaga* is based upon efficacy of offerings made to the deceased, in fact it holds that the heir gets the estate because he makes the offerings. No doubt the ancient rule, as Mayne surmises, was that the duty to make the offerings fell upon the person taking the estate. But, for the benefit of the priesthood, the later ecclesiastical theories of the Brahmans put all the stress upon the offerings, and said that the estate followed them. This theory brings in some cognates in preference to more remote agnates.

There are three grades of offerings, the full cake, or *Pinda,* those making it being called *Sapindas,* the offerings of crumbs made by *Sakulyas,* and the offerings of water made by *Samanodakas.* The cake offering is made for three generations, and the crumb offering for three more. A man is *Sapinda* to his sons, to their sons, and to their grandsons, as well as to his three direct ancestors. And he is *Sapinda* to the three generations in the direct male line from his *Sapinda* ancestors, paternal and maternal. Except in the case of the daughter's son, the claims of all connected with the deceased through a woman on the ground of sapindaship are rejected by the *Mitakshara* in favour of agnates however remote. But the *Daya Bhaga* admits these claims with the result, so far as the inner circle of heirs are concerned, of bringing into it sister's son, father's sister's son, and grandfather's sister's son. This inner circle includes those related to the deceased by being descended from a common great-grandfather, or nearer relation, by agnation, and when we get beyond it the differences between the two schools become much greater, for then the *Daya Bhaga's* preference of all who offer the full cake over all who offer only crumbs, and its doctrines about mutual sapindaship, and about the effects of sapindaship to the same person, have more far-reaching effect.

Order of Inheritance.—Now as to the order of inheritance. The first heirs are sons, agnate grandsons and agnate great-grandsons. Grandsons and great-grandsons between whom and the deceased a son or grandson survives do not take directly, but representation is allowed in the case of those the links between whom and the deceased are already dead. But for this case representation is nowhere allowed in Hindu law, *e.g.,* a brother excludes sons of deceased brothers. After the three generations of descendants come the widow, then the daughter, and then the daughter's son. Daughters' sons take *per capita,* and a living daughter excludes all sons of deceased daughters. Next come the parents, of whom the *Mitakshara* places the mother, and the *Daya Bhaga* the father, first of the two. Then brothers, sons of brothers, and agnate grandsons of brothers. Here the *Daya Bhaga* interpolates the sister's son. Then the grandparents and a like three generations from them, with the father's sister's son interpolated by the *Daya Bhaga.* Then the great-grandparents and the three generations from them. For the complications beyond this point, especially under the *Daya Bhaga,* the reader should consult the works of Mayne and Trevelyan.

Wills.—There can be no doubt at all that in its beginnings Hindu law knew nothing of wills. There is no Hindu word for a will. A legacy can be regarded as a gift to take effect after death, and according to both Hindu and Mohammedan law a gift is of no effect until the donor has transferred possession to the donee. And, when dead, the donor is no longer there to do so. But undoubtedly Hindus were struggling towards a right to bequeath in the days before British rule, especially in Bengal. There property had become individualized, for the jointness of family rights was destroyed by the doctrines of the *Daya Bhaga.* And ecclesiasticism always favours gifts and bequests for pious purposes, and Bengal law is dominated by ecclesiasticism. Reluctantly, and by progressive rulings, the supreme courts came to recognize that a Hindu can make a valid will, first in Calcutta, where an opinion was formally sought from the East India Company's Sadr court, and afterwards in Madras and Bombay. Now it is settled law that a Hindu can dispose by will of all that he can unrestrictedly alienate in his lifetime, *i.e.,* in case of a male, of all his property under the *Daya Bhaga,* and of all his separate and self-acquired property under the *Mitakshara,* and in the case of a female of certain classes of her property. The courts felt themselves compelled to deny to a testator the right to create anything approaching a perpetuity. The limits during which final vesting can be delayed are now laid down by legislation passed in 1916. Except in the presidency towns, and in Bengal, Behar and Orissa, where the Hindu Wills Act applies, a Hindu will may be either written or nuncupative, and does not require to be attested.

Debts.—Hindu law undoubtedly recognized that debts ought to be paid, and had its methods of compelling payment. And the religious view of debt in Hinduism is that he who dies in debt suffers torment or degradation in the next life, which can be ended only by payment of the debts. We have seen that Hindu law is a branch of Hindu religious teaching. Hence we have the principle that a son or grandson is under an especial obligation to pay the debts of his father or grandfather. As, in the ordinary way, he is the heir, this is fair and equitable. It is now settled by legislation that no one, whether he take by inheritance or by survivorship, is bound to pay debts to a greater amount than the benefits he receives by the passing of the estate of the deceased. First, of course, it has to be ascertained what property the deceased left. So far as concerns the estate of a Hindu governed by the *Daya Bhaga,* or the separate or self-acquired property of one governed by the *Mitakshara,* all debts which could have been recovered from him in his lifetime rank for payment. It is when the deceased died as a co-parcener in a *Mitakshara* joint family that difficulties arise over the "pious obligation" of sons and grandsons. A debt

may have been incurred for joint family purposes, recognized as such by Hindu law. Then all the family property is liable for it. It may have been incurred for the debtor's personal purposes, and if the particular purpose of a debt was not illegal or immoral the doctrine of pious obligation will generally make all that share of the family property liable for it which on a partition would have gone to the debtor and his descendants. Or the debt may have been incurred for illegal or immoral purposes. If the creditor knew, or ought to have known, of such purposes, the family property is not liable for it at all. As the father can burden the sons by his indebtedness, if it be not due to illegality or immorality, so too he can sell or mortgage their potential shares with his, especially to pay a debt already existing. And it is decided that the creditor can implead the sons and grandsons when suing the original debtor in the latter's litetime. The effect of failure to implead them, or of failure to state distinctly that their shares are attached when execution of a decree is taken out, has been the subject of numerous rulings of the high courts.

Alienation and Maintenance.—Originally, no doubt, a member of a *Mitakshara* joint family could not alienate his share of the property for personal purposes, until he obtained a partition. Now, not only can he do so according to rulings of the high courts at Madras and Bombay, but his personal debts can be enforced against it, provided always that a decree is obtained and attachment of the share effected during the debtor's lifetime. On his death his rights vanish, and, as they go by survivorship and not by inheritance, they cannot be followed into the hands of the survivors unless the doctrine of "pious obligation" applies to the latter.

The right of certain persons to be maintained out of family funds, or by their living agnate ancestors under the *Daya Bhaga,* has already been mentioned. But Hindu law also envisages other rights of maintenance. Quite independently of inheritance of ancestral or other property, wives, minor sons, unmarried daughters, and infirm and penurious parents must be maintained by a Hindu who has means or can work. And widows and daughters of deceased members of a *Mitakshara* joint family, and under either school of law widows of persons whose property is inherited by their sons, grandsons or great-grandsons have a definite right to maintenance. By decree of court that right can be charged upon the property, and under the *Daya Bhaga* a widow whose sons or other descendants divide up the property of their deceased father or ancestor, can claim the allotment to herself for life of a share equal to that obtained by each son. So, too, when brothers succeed to their father, and there is a widow of a predeceased brother to be maintained. In some circumstances family property can be followed into the hands of a subsequent purchaser to enforce a claim for maintenance. A widow's right to maintenance ceases on re-marriage, and any woman's ceases if she leads an immoral life.

Women's Property.—In some respects, and as regards some kinds of property, the ownership of women under Hindu law differs from that of men. These differences depend on the source from which the property is derived. If a woman has inherited property from a male, or has obtained it as a gift by her husband or as a share on partition, she does not own it in the same way as a man would do; she obtains only a kind of restricted ownership. She has the full enjoyment and management of it, but she cannot sell it, or give it away, or dispose of it by will; and at her death it goes not to her heirs but to the heirs of the person from whom she obtained it; her ownership simply comes to an end. If she obtained it by inheritance from a male it will go on her death to the heirs of that male; if as a share on partition it will be divided amongst the other sharers; if as a gift from her husband, it will go to the heirs of her husband. In those parts of western India where the *Mayukha* prevails, by exception full rights of property are given to a woman who inherits from a male who belonged to the family in which she was born, *e.g.,* to a daughter inheriting from her father, or to a sister inheriting from her brother. On her death such property devolves as if she had been a man.

The estate of a woman who inherits only for her own life is one of the difficult problems of Hindu law. It is by no means the same as a "life estate" in English law. The woman represents the estate. She can absolutely dispose of it for a necessity or with the next reversioner's consent. She can surrender it to the next reversioner. And a purchaser or mortgagee dealing with a woman owner is especially put to inquire into the necessity or into the real consent of the reversioner, as the case may be, and is bound to act with the very utmost of good faith, because of the habitual seclusion of women of good social standing. An alienation by a woman, not otherwise justified, is good for her lifetime, apart, of course, from fraud and the like, and a widow with power to adopt devests herself of the estate in favour of the adoptee. A woman owning an estate for life is absolute owner of savings she effects out of income, and unless she deliberately adds them to the estate they go to her heirs.

There is also *Stridhana,* the absolute property of women. The rules of schools and localities as to this vary. The chief sources of it are gifts from blood relations and gifts at marriage, besides the personal earnings of an unmarried woman. Generally *Stridhana* is at its owner's complete disposal. The rules as to the inheritance of *Stridhana* vary with the school, and even with the locality, and with the origin of the particular property. They favour women more than do the rules of inheritance to males.

Marriage.—The code of Manu enumerates eight kinds of marriage, some of which are barbaric or even savage. Four were "approved" and four "disapproved." Two only still survive, the *Brahma,* an approved form, nominally a gift of the bride by her father to the bridegroom, and, among the lower castes, the *Asura,* a disapproved form, nominally a purchase of the bride by the bridegroom. Marriages are often celebrated when both parties are very young. Many Indian statesmen are considering or proposing legislation to stop this. The essential part in a Hindu marriage is the seven steps taken together by bridegroom and bride round the sacred fire. Among the higher castes the relationships within which marriage is forbidden are extensive. The parties should not belong to the same *gotra* or large family, and they must not be related within six generations on the father's side or within, probably, five on the mother's. Marriage must be within the caste, and sometimes, by custom, within the sub-caste. Strictly speaking there is no divorce in Hindu law. But divorce is practised by many of the lower castes, and an unchaste wife forfeits all rights except that to "starving maintenance." A Hindu man may marry any number of wives, and may have any number concurrently. A Hindu woman can have only one husband, and strict Hindu law forbade the re-marriage of widows, even of virgin widows. Many of the lower castes always allowed widows to re-marry, some of them imposing conditions on such re-marriage; and by Act XV. of 1856 any Hindu widow may validly re-marry. She forfeits on re-marriage any property inherited by her from her first husband or from a predeceased son, unless she belongs to a caste which, before 1856, permitted re-marriage accompanied by retention of such property. Equally she forfeits all rights of maintenance as widow of her first husband.

By Act XXX. of 1923 amending Act III. of 1872 a Hindu man and a Hindu woman of different castes may lawfully marry. Act III. of 1872 originally provided for the marriages of persons of whom neither professed the Christian, Jewish, Mohammedan, Hindu, Jain, Sikh, Buddhist or Parsee religion. Marriages under it are monogamous, and are subject to divorce on the same grounds as are marriages between Christians. And the parties come under the rules of inheritance for Christians, and go out of a joint family, and cannot originate one.

Suttee.—The custom for a Hindu widow, especially in the higher castes, to have herself burned alive on the funeral pyre of her husband was prohibited and made an offence under Lord William Bentinck's administration in 1829. In consequence Suttee is certainly no longer customary, and educated Hindus would revolt from it. But there have been sporadic cases, even as lately as 1927. Those who help the widow to immolate herself are guilty of culpable homicide not amounting to murder, under the Indian penal code; if she is above the age of 18 years, the fact that she suffers death with her own consent then reducing the nature of the offence. If she is under 18 the offence is murder or abetment of murder, punishable even with death. The widow's

own insistence on becoming Suttee is a feature of all present-day cases.

Sonship.—In very ancient Hindu law the son would seem to have been his father's property, much as he was in ancient Roman law. In Manu eight kinds of sons are enumerated. Most of them are "sons" because at the moment of birth the woman who bore them was owned by the "father." Some are bought or self-surrendered. Now only two kinds are recognized, legitimate sons born in marriage, and adopted sons. (Adoption of daughters is mostly unknown to Hindus.) There are two extant forms of adoption, the *Dattaka* and *Kritima*. The former is used all over India. The connection between heirship and the duty of performing obsequies and ceremonials has already been noticed. To secure a Hindu's happiness hereafter the ceremonials should be carried on by his descendants for at least three generations. A grandson or a great-grandson can, however, make up for the absence of a son or grandson or both. But it is a grave misfortune for a Hindu to have no such descendants at all, so a male Hindu who has no son, agnate grandson, or agnate great-grandson may adopt a son. The adopter may be married, a bachelor, or a widower. Among the higher castes the boy must not have been invested with the sacred thread (possibly this will not apply when the child is a brother's son of the adopter, or otherwise in the family) and must be the child of a woman whom the adopting father could have married had not someone else done so. So a brother's son and a wife's sister's son are obviously eligible. And the adoption must be within the caste. The child must be willingly given by his natural parents (a boy cannot be re-adopted) so an orphan cannot be adopted.

Because of the importance of having a son, the widow of a deceased Hindu can sometimes adopt for him. Of course the condition of sonlessness must exist. Given that, in western India a widow can adopt unless her husband has forbidden her to while he was alive. In southern India she can adopt if in his lifetime he authorized her to, or if after his death his near agnate relations approve of the adoption being made. In Mithila she cannot adopt at all, and elsewhere she can adopt if in his lifetime her husband authorized her to. These are the varying interpretations of the text "Nor let a woman adopt a son without the consent of her lord." A married man who adopts does not need his wife's assent to the act, though she may become the adoptee's legal mother. Adoption removes the child entirely from his own family (except that he still cannot marry within its prohibited degrees) and makes him for all legal purposes, including inheritance from and by collaterals, the son of his adoptive father. Ceremonies are necessary, for an adoption is a religious act. Handing over by the natural parent or parents, with a sacred fire at the place, is the principal ceremony, and the absence of evidence of this would throw doubt upon the validity of an adoption, were this disputed. Among some of the lower castes even a married man can be adopted, and the rule about the mother being a possible wife of the adopting father does not hold. A son adopted to a deceased Hindu by his widow becomes the former's heir at once. If there is membership of a *Mitakshara* joint family, or if the adopting widow has succeeded to, and still possesses, her deceased husband's estate, things are simple enough. But adoptions by widows fail where their effect, if they were valid, would be to devest the estate of someone (other than the adopting widow) who holds it as heir of some deceased male, other than the person to whom it is sought to make the adoption. This rule is not a mere piece of theory, for if a son adopted dies without male issue, there may be authority to adopt one in his place, yet he may have married, in which case his widow, and not his adoptive mother, will be his heir. And an authority to adopt remains effective throughout the life of the widow to whom it is given, so long as she does not exhaust it. Cases have been known where a widow made a valid adoption more than 50 years after her husband's death.

Kritima Adoption.—The conditions stated above, other than that of sonlessness, apply in the case of *Dattaka* adoption only. The system of *Kritima* adoption is much looser. It is followed now only in Mithila, where, as we have seen, a widow never can adopt to her deceased husband. In *Kritima* adoption a sonless man or woman can adopt a son to himself or herself. The adoptee must consent to the adoption, and must be of full age. No ceremony is required, only mutual consent. The adopter and the adoptee succeed to each other, but neither succeeds to the other's collaterals. The adoptee is not taken out of his own family. The adoptee performs the obsequies of the adopter if the latter predecease him. Any person within the caste, even for instance the adopter's brother, or his sister's son, can be adopted, and the adoptee may even be older than the adopter.

Lack of space forbids any discussion of the interesting matriarchal system of the Nairs of Malabar, and of some other castes in that part of India. The joint family is there found in its strongest form, and the only kind of adoption ever necessary is that of a daughter.

See Sir E. J. Trevelyan, *Hindu Law* (2nd ed. 1917); J. D. Mayne, *Hindu Law and Usage* (9th ed. 1922, edit. by Sir V. M. Coutts Trotter).

(W. Mar.; A. Sab.)

BURMESE BUDDHIST LAW

Burmese Buddhist law, which is the body of customs and usages of the Burmese, has its sources in India, but belongs to a social system from which caste, seclusion of women, child marriage, the joint family and other features of the Hindu system are absent. It has been collected at various times in the last 700 years into books called *Dhammathats*, of which the *Manugyè Dhammathat*, compiled in A.D. 1756, overrides the others where it is clear and unambiguous. A collection of the *Dhammathats* made by a high official under the late Burmese kings has been published, with a translation, under the name of the *Kinwun Mingyi's Digest*.

Marriage is a purely civil contract, and is evidenced by the parties openly living and eating together as man and wife. A social entertainment celebrates the marriage of a youth and a maid, but is dispensed with in other cases. Consent of parents or guardians —which may be given or implied after the event—is required to the marriage of a youth under 16 or a spinster under 20. Monogamy prevails, but polygamy is legal; polyandry is unknown. Husband and wife are joint owners of all property acquired by their joint efforts during marriage, and of the profits of separate property brought by either to the marriage. The last may in time become merged in the joint estate. Hence it is usual for husband and wife to execute business documents together and to be joined together in litigation. In recent times there are legislation and rulings of court relating to the marriage of Burmese Buddhists with people of other races and religions.

Divorce is by *bona fide* mutual consent, as a rule before elders, including openly living apart as no longer husband and wife. Divorce can also be had by decree of court on such grounds as cruelty, desertion, or adultery of the wife. In the former case the parties, generally speaking, divide the property with reference to their rights in it during coverture; in the latter case the guilty party is more or less severely mulcted. Generally also, children inherit from the parent whom they follow and not from the other.

Any married couple, or anyone who has attained majority, may adopt one or more sons and daughters, whether already related to them or not, who on adoption sever all rights in their natural family and become co-heirs with the children, if any, of their adoptive parent or parents. To stop vexatious and expensive litigation between rightful heirs and others claiming to have been so adopted, the Burmese legislative council passed an Act in 1926 (not to come into force till notified) declaring that no dispute as to the rights of any person to inherit as or through an adopted child shall be entertained by any court unless the fact of the adoption is evidenced by an instrument executed, attested and registered as required by the Act.

Succession and Inheritance.—The estate of a deceased person devolves upon those entitled to it under Burmese Buddhist law. It follows that a Burmese cannot make a will. On the death of one spouse, the rule is that the surviving spouse takes the whole of the property absolutely. But an *orasa* child, *i.e.*, first-born child who is of age and competent to assist in the family affairs, can claim one-fourth from the surviving parent of the opposite sex, *i.e.*, from his mother if the *orasa* is a son, and from her father if a daughter. Also, if the surviving parent re-marries, the children

can claim a one-half partition, and this right survives, with modification, against the step-parent if the natural parent dies.

If the deceased was not married at death, the main principles are that the inheritance shall not ascend when it can descend; that it shall not ascend more than is necessary; and that the nearer excludes the more remote. Hence, children come first, sharing equally; failing them, grandchildren; failing direct descendants, brothers and sisters; and next in order, parents, grandparents, nephews and nieces, uncles and aunts, grandnephews and nieces, cousins and so on. Where the heirs are children, and offspring of deceased children, such offspring divide among them what would have been their parent's share if he was the *orasa*, otherwise one-fourth only of their parent's share if he or she had lived to inherit, the remaining three-fourths reverting to the estate. Where only grandchildren, born of different children, are left, the whole body divide the estate equally *per capita, e.g.*, ten of such secure each one-tenth of the estate. It is possible here to give a few examples only; for a fuller discussion, and for the subject of Burmese Buddhist law generally, *see* S. C. Lahiri, *Principles of Modern Burmese Buddhist Law* (2nd ed. 1927).

(A. Mr.)

MOHAMMEDAN LAW

To Mohammedans much of Mohammedan law is at least as sacred as are the texts of the *Shastras* to Hindus. The sources of Mohammedan law, its growth and progress, and how it has come to divide into two schools and some sub-schools are set out in the article discussing Islamic Law (*q.v.*). For Sunni Muslims the Koran, the traditions (*Hádith*), the agreement of those who had known the Prophet (or possibly the agreement of the body of the faithful) (*Ijmá'a*) and analogy (*Qiyás*) are the sources of law, but the Hanafites use *Qiyás* more freely than do the others. The school of Sháfei has followers in India to an appreciable number, but the vast majority of Indian Sunnis are Hanafites, followers of Málik and Hanbal scarcely existing in the country. There were commentaries or digests well known in India, called the *Hidáya* and the *Fatáwa Alamgiri*. A translation of the former by Hamilton, and Neill Baillie's work based on the latter, were the only books in English to which the courts could resort for guidance on Mohammedan law for some considerable time.

Succession.—The Sunnis and the Shiahs differ widely as to the law of succession, this much being common to both, that the ordinarily bequeathable portion of a person's estate is one-third, the rest going by the law of inheritance. Shiah law will be treated of later, at present our concern is with the Hanafi law of inheritance. There are three primary classes of heirs, who in current usage are loosely spoken of as sharers, residuaries, and distant kindred. Sharers are those who are mentioned in the Koran as entitled to shares. Residuaries are male agnates who are not sharers (some are both sharers and residuaries) and the full and consanguine sisters. Distant kindred are all blood relations neither sharers nor residuaries. Sharers have the first claim on the estate, subject to this, that some sharers are liable to be completely ousted by some residuaries. The shares of some sharers vary according to circumstances. Other sharers, *e.g.*, grandparents, daughters of sons, and sisters, can be excluded by the mere existence of nearer relations. The Prophet almost certainly modified the pre-existing Arabian customs by giving a right of inheritance to many women. The sharers are: husband $\frac{1}{4}$ or $\frac{1}{2}$, wife or wives $\frac{1}{8}$ or $\frac{1}{4}$, daughter $\frac{1}{2}$, daughters $\frac{2}{3}$ (son's daughter or daughters replacing daughters if there be none), father $\frac{1}{6}$, mother $\frac{1}{6}$ or $\frac{1}{3}$, full sister $\frac{1}{2}$, full sisters $\frac{2}{3}$ (in their absence consanguine sister $\frac{1}{2}$, consanguine sisters $\frac{2}{3}$), uterine brother or sister $\frac{1}{6}$, uterine brethren $\frac{1}{3}$, true grandfather $\frac{1}{6}$, true grandmother $\frac{1}{6}$. A "true" grandfather is an ancestor in the direct male line, and a "true" grandmother is an ancestress between whom and the deceased there is no "false" grandfather. Thus both actual grandmothers are "true," as are three great-grandmothers and four great-great-grandmothers. "How high soever" and "how low soever" are technical terms of Mohammedan law, "father's father how high soever" being the same as "true grandfather." "Son's son how low soever" means a male agnate descendant. "Child of a son how low soever" means a child of a son or of a male agnate descendant. "Consanguine" means "related through the father only" and "uterine" means "related through the mother only."

The share of either spouse is on the lower level if there be a child or a child of a son h.l.s. The share of the mother is on the lower scale if there be a child or a child of a son h.l.s., or two or more brothers or sisters. It is also subject to diminution when the heirs are father, mother, and a spouse, in order to give the mother half what the father gets, according to the rule of "double share to the male." A daughter or daughters become "residuaries with their brother or brothers" when there is a son or sons. A son (or son of a son h.l.s. of higher rank than herself), or two daughters, exclude a daughter of a son h.l.s. If there be merely a daughter and a daughter of a son, the former gets $\frac{1}{2}$ and the latter $\frac{2}{3}-\frac{1}{2}$, *i.e.*, $\frac{1}{6}$. Full sister is excluded as sharer by a child or a child of a son h.l.s. and by father and true grandfather, and, when there is a full brother or brothers who take as residuaries, is residuary with them. Consanguine sister bears much the same relative position to full sister as son's daughter does to daughter. Full sister is not excluded as sharer by consanguine brother, but, of course, consanguine sister is, though she may be residuary with him. True grandfather is excluded by father, and true grandmother by mother, by nearer true grandmother, or by any heir in the line between her and the deceased. Uterine brethren are excluded by all who exclude full sister from being a sharer.

Residuaries.—If there be sharers who by the application of these rules would get the whole estate, the residuaries get nothing. If the sharers are entitled to take more than exhausts the estate (*e.g.*, wife $\frac{1}{8}$, two daughters $\frac{2}{3}$, father $\frac{1}{6}$, mother $\frac{1}{6}$, total $\frac{27}{24}$) the shares are diminished proportionately. If there be a surplus and there are residuaries the latter get it, but in such case if there be no residuaries the sharers, other than the spouses, divide it proportionately.

As noted, residuaries, if there be any, take what is left. They are those who, in addition to father and true grandfather, would have had a right of inheritance under pre-Islamic Arabian custom, and in some instances the Prophet gave their sisters a right of inheritance along with them. First come sons, with daughters, each son taking twice as much as each daughter. Then, if there be no sons, sons of sons with daughters of sons, each son of a son taking twice as much as each daughter of a son, there being no division *per stirpes*. Then agnate great-grandchildren in the same way. A son excludes all grandchildren and a son's son excludes all great-grandchildren. After agnate descendants comes the father. Then the true grandfather, with brothers and sisters. One section of Hanafites allows true grandfather to exclude brothers and sisters entirely. Another brings him in with full (or in default of full with consanguine) brothers and sisters under rules which give the grandfather some advantage in certain cases. Full brother excludes consanguine brothers and sisters. Sisters, full or consanguine, come in with brothers of their own kind, each brother getting twice the share of each sister. These sisters are the last female residuaries. Then come sons of full brothers, then sons of consanguine brothers, then agnate grandsons of full brothers, and then agnate grandsons of consanguine brothers, and so on to each generation of the descendants of the deceased's father.

The nearer excludes the more remote, and the full blood, other things being equal, is preferred to the half. Similarly with the agnate descendants of the deceased's father's father till they are exhausted, and then similarly with those of the deceased's father's father's father, and so on, as long as any agnates can be traced. Exceptionally full sister or consanguine sister can take as a residuary though she have no brother living. This is when daughters have taken the $\frac{2}{3}$ "allotted to women" and the nearest residuaries come later in order than true grandfather, *e.g.*, nephew, uncle, or more distant relations. Then the full sister, or in default of her the consanguine sister, comes in in place of brother.

Lack of space forbids discussion of the rules applying to distant kindred. Distribution between them has been elaborately discussed by Muslim jurists, even the case being imagined where the heirs are cognate great-great-great-grandchildren, all the links between whom and the *propositus* had pre-deceased him. But descendants have a preference, and, other things being equal, one

who is the child of a possible sharer or of a possible residuary has preference over others.

An infidel, whether by birth or by apostasy, cannot inherit from a Muslim under strict Mohammedan law, but that bar is removed in India by Act XXI. of 1850. Hanafi law forbids a person to inherit from one whom he has killed, even when the killing was by accident or misadventure.

Wills.—Some power of bequest seems always to have been recognized by Mohammedan lawyers, but it extends, ordinarily, only to one-third of the estate as remaining after payment of debts and funeral expenses. But, after the succession has opened, the heirs may validate a bequest or bequests exceeding one-third. A bequest to an "heir," *i.e.*, to one who on the death of the testator happens to be entitled as a sharer or as a residuary, is void unless similarly validated by the other heirs. There are rules about the abatement, proportionately or otherwise, of legacies which between them exceed the disposable one-third. Preference is given to those for pious purposes mentioned in the Koran. Gifts made in what is called "illness of death" are on nearly the same footing as bequests, as are purchases or sales made during such an illness on terms actually intended to confer an advantage on the other party out of the dying person's estate, as, for instance, the sale of property for half its real value. But acknowledgments of a debt in "illness of death" are good, even in the absence of all other evidence of the debt, except when such acknowledgment is in favour of an heir, when it is void. And debts of which there is other evidence have the preference, if the estate is insufficient to meet all.

A will may be in any form, written or oral, and, if written, need not be attested. A *Wasi*, who is in much the position of an English executor, may be appointed by a testator. In default of there being a *Wasi* the estate vests at once in the heirs. But, optionally, probate of a will, or letters of administration, or a certificate to collect debts on succession, may be applied for to a court having jurisdiction.

Fictitious Relationship.—Ancient Mohammedan law allowed the creation of fictitious relationship, principally when a tribesman stood surety to his tribe for the behaviour of a refugee from another tribe. This is obsolete in India. Therefore the courts in India do not have to take account of what Muslim lawyers designate "the residuary for special cause." But, by custom, Mohammedans in many villages in the Punjab can adopt, as Hindus can. And, equally by custom, in the Punjab and elsewhere women are often excluded from succession, contrary to strict Mohammedan law. When slavery existed the acknowledgment by a master of the paternity of a child born to one of his female slaves was a matter carrying considerable legal consequences. Nowadays if the child of a maidservant were so acknowledged the courts might have to consider the legal effects, if any.

Marriage is essentially a civil contract in Mohammedan law, based upon the consent of the parties, or of those entitled or authorized to represent them. Certain legal results must follow from a marriage, but as to other incidents the parties have some freedom in fixing the terms of the marriage contract. For a minor, *i.e.*, a person under puberty, a "guardian for marriage" is necessary. The preferable guardian for marriage is the father (or father's father h.h.s.). A marriage at which he is such guardian is final and complete as regards his ward. But when by reason of the death or unavoidable absence of the father or grandfather another guardian for marriage acts, the ward, whether husband or wife, can repudiate the contract on attaining puberty. But once it has been explicitly or implicitly ratified after attaining puberty there can be no repudiation. There can also be an "agent for marriage." He is a person commissioned either to marry for his principal a certain definite person as husband (or wife) or to find and marry for his principal a suitable husband (or wife). The principal can make the discretion left to the agent as narrow or as wide as he chooses. But to enable the agent to contract with himself or herself, or with his or her ward, as spouse for the principal, direct and unequivocal permission to do so must have been conveyed by the principal. And an agent generally empowered cannot marry a woman client to a social inferior, and cannot render a male client liable for more than suitable dower. But if it be no transgressing of his authority, he can marry his client A, a man, to his client Z, a woman, taking the place of each party in the contract. A marriage must take place in the presence of Muslim witnesses, two men, or one man and two women. The parties must say words by which it is made clear that they agree that a marriage between them is called into being from that moment. And the first speaker's proposal (which may be in the form "I have married thee") must be answered and assented to practically then and there, "at the same meeting" as it is called, by the other party.

Bars to Marriage.—Marriage is forbidden, on grounds of consanguinity, with ascendants, descendants, brother and sister and their descendants, and brothers and sisters of ascendants. It is forbidden on grounds of affinity with ascendants and descendants of a present or former spouse, and with any person who has been the spouse of an ascendant or descendant. There can, in some circumstances, be a bar through fosterage. A woman can have only one husband at a time, but a man can have four wives at any one time. So a man's marriage may be void by reason of "unlawful conjunction," *i.e.*, because the wife married makes a fifth, or because she is too nearly related to one of his existing wives. For a man may not simultaneously be husband of two women so related to one another, that if one of them was a man they could not marry each other. This does not of necessity prohibit marriage with the second when the first has died or been divorced. A Muslim's wife must be a Muslim or a *kitábia, i.e.*, a Jewess, or a Christian, or (possibly) a Zoroastrian. A Muslim's husband must be a Muslim. A marriage may be voidable, and not flagrantly void, in which case children born of it before a court pronounces against it are legitimate.

Divorce.—A Mohammedan husband may divorce his wife, or any of his wives, at any time, and he cannot divest himself of this right. The approved method of this divorce, or *táldk*, is a pronouncement of divorce (which, if not repeated, is not immediately effective) followed by abstinence from marital relations for three of the wife's periods. A second and a third pronouncement can be made at suitable intervals. Until either three pronouncements have been made, or the three periods have run out, the divorce is revocable at the husband's option, and he can revoke it (thus wiping out any pronouncement or two pronouncements already made) either explicitly or by renewal of marital relations, and the wife is not entitled to any say in such matter of revocation. But the three pronouncements may be made at any shorter intervals, even in one breath, so to speak, and though this is disapproved, a divorce so made is at once irrevocable, and takes effect when the *iddat* or three periods has elapsed. The *iddat* lasts until delivery if there be a pregnancy. The divorced couple are free to marry again when the divorce takes effect, and can re-marry one another, unless the divorce has been triple, in which case such a re-marriage cannot take place unless the wife has in the meantime been the wife of some other man. The check on this power of a husband to divorce his wife is in practice the fact that he generally owes her a good part of her dower, and that that becomes payable to her as soon as the divorce takes effect.

There can also be a divorce by reason of imprecation followed by cessation of marital relations, or by reason of accusation of the wife of adultery by the husband on oath, denied by her on oath. A husband can empower an agent to divorce his wife for him, and can limit the agent's power, *e.g.*, to one pronouncement only, and can make the wife herself such agent. Such power is sometimes exacted by the wife in the marriage contract, for use if the husband takes a second wife. There can, of course, be divorce by mutual consent on whatever reasonable terms, as to money or otherwise, the parties may agree to.

Dower.—Payment by the husband to the wife of a sum of money, or other lawful and material consideration, as her dower is a necessary feature of a Mohammedan marriage. The dower must not be below a certain small minimum, and either is fixed when the contract is made, or is the "proper" dower appropriate to a woman of the family and social position of the wife. It may be wholly "prompt" or wholly "deferred," or partly the one and

partly the other. Prompt dower is payable at once, and the wife may refuse to enter upon marital relations till it is paid, but having entered upon them cannot refuse to continue them because it remains unpaid. Deferred dower is payable at the husband's option at any time during the marriage, and if not paid during it becomes payable on divorce or on the death of either party. It must be remembered, in the case of the wife's death, that though her husband will be one of her heirs, yet her parents, if they survive her, will also be among her heirs, even if she has left children. A wife is legally quite independent of her husband. She can sue him for prompt dower, or for anything else he owes her, and he is not liable for her debts incurred outside her reasonable maintenance, or for her torts.

Pre-emption is not mentioned in the Koran, but this "right to acquire by compulsory purchase, in certain cases, immovable property in preference to all other persons" (as defined in Wilson's *Anglo-Mohammedan Law*) is undoubtedly a part of Mohammedan law. The possible pre-emptors in order of preference are (a) co-sharers in the property part of which is sold, (b) persons who own a property to which the property sold is servient in respect of an easement, or a property which is jointly dominant with the property sold over some third property in respect of an easement, and (c) owners of contiguous property, unless the estates be large. The pre-emptor is required by Hanafi law to make a demand of pre-emption immediately upon hearing of the sale, and then, without unreasonable delay, to repeat the demand in the presence of two witnesses to the vendor, or to the vendee, or on the property, stating simultaneously that he has made the first demand. By custom a right of pre-emption has attached to sales of immovable property in various districts, towns and villages, and Hindus and others are then subject to it as well as Muslims. The law of pre-emption has been codified into Acts in the Punjab, the North-West Frontier Province, Oudh and Agra. Pre-emption is recognized to prevail in parts of Behar and Gujarat. It is not recognized at all in the greater part of the presidency of Madras.

Schools Other Than That of Hanifa.—Sir W. Markby in contributing to earlier editions of the *Encyclopædia Britannica,* noted that "Mohammedan law as applied to any Mohammedans except those of the Hanafite school has as yet been comparatively little studied by modern lawyers." But since he wrote, the writings of French administrators and judges on Máliki law have become available by Major Ruxton's translation for use in Nigeria (*Máliki Law*), and Van den Bergh's rendering of Nawáwi's *Minhâj-ut-Tálibin,* used in the Dutch Indies, has been put into English by Howard, a judge in the Straits Settlements. This last is the standard work of the school of Sháfei. Similarly Ameer Ali's work on *Mohammedan Law* has set out Shiah law in equal fulness with Hanafi law. There are many Shiahs in India, especially in Oudh, though Sunnis very much outnumber them.

Inheritance Under Shiah Law.—The Shiah law of inheritance differs much from that of the Sunnis. The sharers and their shares are found unaltered, for the Koran prescribes them. But agnates and cognates rank together as heirs, so "residuaries" and "distant kindred" disappear. Apart from husband and wife, the Shiahs arrange all heirs in three classes: (1) parents and descendants, (2) ancestors, brothers, sisters and descendants of brothers and sisters, and (3) all other relations. Any person in the first class entirely excludes all in the second, and any in the second entirely excludes all in the third. It will be seen that brother and sister are entirely excluded by either parent, or by any descendant agnate or cognate, but under the Hanafite system mothers need not entirely exclude them, and they themselves entirely exclude all descendants of daughters. Also the nearer excludes the more remote, and no one can take between whom and the deceased a living link survives. So a daughter will exclude all descendants of sons or daughters, both male and female. And there is some representation. If the heirs be the descendants of two deceased sons and of two deceased daughters, then $\frac{1}{3}$ is allotted to the children of each son, and $\frac{1}{6}$ to those of each daughter, and distribution is made again on the principle of the double share to each male among each of these four groups of grandchildren of the deceased. If the heirs are great-grandchildren the process is carried a step further. If there are parents and descendants (any descendant, agnate or cognate, diminishing the mother's share under Shiah law), in imagination the sons and daughters who have left descendants are restored to life, if there be no living sons or daughters, in order to see how the distribution is to be made.

With the second class the governing rule (subject to possible exception by reason of a single uterine brother's or sister's share being only $\frac{1}{6}$) is $\frac{2}{3}$ to the father's side, and $\frac{1}{3}$ to the mother's. And the nearest ancestor ranks with, and as if he or she were, the nearest brother, sister, or descendant of a brother or sister; *e.g.,* mother's father would come in with uterine brother, or uterine brother's son. There is a similar governing rule for the third class. The rule that the nearer excludes the more remote applies always to the second and third classes as well as to the first, and full blood excludes equally near consanguine half-blood. Space does not permit of a full exposition of this interesting scheme of inheritance. If the only persons entitled to inherit (and the rule of exclusion by classes must be remembered) be sharers, and their shares do not exhaust the estate, the surplus is divided proportionately among them. But if the shares more than exhaust the estate, then, in the first class, daughters must bear all the loss. Bequests to an heir or heirs, if they come within the disposable third, do not need the consent of the other heirs, and any bequests exceeding the third can be validated by the heirs not only after the inheritance opens, but even in the testator's lifetime.

Shiah Marriage.—The most notable difference between Sunni law and Shiah law in the matter of marriage is that the latter permits temporary marriage. Husband and wife can agree to marry for any time, say for an hour, or for a millenium. If both are alive when the time specified runs out, the marriage then terminates automatically, but it can be renewed by the consent of both. There must be a proper dower when a temporary marriage is entered into. A husband may have as many temporary wives as he chooses. A husband cannot divorce a temporary wife by *tálák,* so among people of position "temporary" marriages for 100 years are not unknown, as they secure the wife against the indignity of being divorced. But the husband can virtually terminate the marriage by making the wife "a gift of the rest of the term." For marriages generally the presence of two witnesses at the making of the contract is not so absolutely necessary as it is with the Sunnis, and possibly among at least some Shiahs something in the nature of a religious ceremony should be added to the civil agreement. Some Shiahs, it appears, would prohibit the marriage of a Muslim man with any non-Muslim woman, and some would go so far as to prohibit marriages between Shiahs and non-Shiahs, especially when the Shiah party is a woman. But the restriction against the marriage of a Shiah man with a non-Shiah or non-Muslim woman does not apply if the marriage is a temporary one.

Shiah Pre-emption.—Shiahs allow no right to pre-empt because of vicinage, and regarding easements, allow such a claim only in one complicated and unusual case. And if there are already three or more co-sharers in the property there is no right of pre-emption on the ground of co-ownership, at least according to some Shiah sub-schools. The two demands which Sunni law requires are not necessary, for with the Shiahs the pre-emptor must merely make his claim to those interested with due diligence, upon hearing of the sale.

See M. Nawawi, *Minhaj et Talibin,* trans. from ed. of L. W. C. van den Bergh by E. C. Howard (1914); Syed Ameer Ali, *Mohammedan Law* (4th ed. 1917); Sir R. K. Wilson, *Anglo-Mohammedan Law* (5th ed. 1921, rev. by A. A. Yusuf Ali). (A. Sab.)

INDIAN LITERATURE. In Europe literature is, as regards its subjects, largely international, and any new fashion, such as romanticism, pessimism, the psychological novel, the detective novel, is quickly propagated. The individual qualities of prominent writers are soon known, directly or through translations, and evoke responses more or less obvious. Moreover, the similarity of social conditions and outlook lends interest to the same problems everywhere, and international science causes them to be approached from the same points of view.

In India the bulk of the educated public is acquainted with English; new English publications are quickly available in the

libraries and reading-rooms; any new book which has obtained a vogue in England will soon be reviewed in India and be a subject of articles in magazines. Moreover, India has in England, America, France, Germany and elsewhere numerous students, and some journalists, who are living the lives of those countries. Consequently, there is a very large output of writings which in spirit and manner, and often in subject, are not properly Indian, but either international or what may be termed "colonial." In Bengal alone over 1,000 publications in English (irrespective of bilinguals) are produced annually, and there are over 100 English periodicals of different kinds. We might mention in addition the large number of works by Indians and officials or ex-officials in India which are actually published in England.

A second department of Indian literature consists of writings in Indian languages which are based upon European models or deeply affected by such. Here we have a great mass of fiction, biography, history, much drama, lyric poetry, travels, political and social pamphleteering and an immense magazine literature, modes which are simply copied from European models. In this sphere we should not overlook the considerable number of actual translations or adaptations of individual works in English, French and so forth. This might be described as the vernacular literature of absorption.

A third stage is represented by that vernacular literature which, while it has absorbed European influences, has yet recovered an Indian outlook and temper, whether in the course of nature or in obedience to the strong reactionary feeling. Already in the '80s of the 19th century Bengal had produced a novelist, Bankim Chandra Chatterjee, whose work exhibits a creative synthesis of the new and the old; and at the present day the Bengālī language has, irrespective of its outstanding representative, Sir Rabindranath Tagore, a modern literature conscious of an independent inspiration.

A fourth department is constituted by the continuance of ancient modes and conceptions.

Linguistic Distribution.—Apart from the influence of particular centres, such as universities, the literature is very unevenly distributed. The matter must be stated in terms of languages. In the field of Assamese, Oriya, Bihārī, Panjābī, Sindhī, Nepālī and Kāshmīrī, the Rājasthānī dialects and Malayālam of southern India, the old modes may be said to prevail with little innovation. High Hindī, in regard to which the same might have been said a few years ago, is rapidly equipping itself with literary and scientific compositions on modern lines. Urdū, the chief organ of Mohammedans in Hindustan, the Punjāb and Central India, is further advanced in the same direction. The two chief languages of the Bombay Presidency, Gujarātī and Marāṭhī, more especially the former, have a considerable modernizing literature. The Telugu of Madras is perhaps not so far advanced; but Tamil has a large productivity, hardly second to Bengālī. Special educational efforts have led to the publication of a fair number of manuals in Kanarese (Mysore), as also in Gujarātī (Baroda) and Urdū (Bhopal and Hyderabad); but other Indian States are not productive on modern lines.

For publications in English about the same proportions hold as for modernized vernacular literature. English works are, indeed, far more prevalent in the provincial capitals, whereas those in the vernacular abound in the less anglicized districts, Gujarātī, for instance, favouring Ahmadābād, Marāṭhī Poona. The non-modernized literature is also published in all considerable places.

The chief classical language of India, Sanskrit, is represented by editions of two kinds, those on old Indian lines with or without commentaries in Sanskrit or in modern vernaculars, and those with commentaries in English. The former are very widely published in the Deva-nāgarī character, or in Bengālī, or in Gujarātī or in the south Indian alphabets, sometimes even in the Panjābī or Urdū; and there are various combinations of these scripts. Editions on European lines appear for the most part in the provincial or State capitals or in the university towns. New original works in Sanskrit are not infrequent in the sphere of oriental philosophy, philology, science and religion; occasionally there appear new poems and dramas of considerable extent and literary merit; and there are also Sanskrit periodicals, including even a newspaper.

Other classical languages are: (1) Prākrit, usually that of the Jains and published in the Bombay province or in the Hindī- or Mārwārī-speaking areas; (2) the Buddhist Pāli, rare in India; (3) the Tibetan, published at Calcutta and Darjeeling; (4) the Pahlavī of the Parsees, published in Pahlavī or Gujarātī script in the Bombay Presidency; (5) the Arabic, appearing chiefly in Delhi, Lucknow, Hyderabad; (6) the Persian, more occasional. Many of the vernacular languages also have their old or classical periods, and prominently the Dravidian group. Tamil, Telugu, Kanarese and Malayālam; re-editions of their classical works are very frequent, and for the most part are published within the areas of the respective vernaculars.

Translations of Sanskrit works are innumerable in nearly all the vernaculars, the *Bhagavad-gītā* for instance being reproduced many times every year; and some degree of the same favour extends to some of the local classics, the Hindī poems of Tulasī-dāsa, and the Hindī *Bhaktamāla*. Among modern Hindu writers Swāmī Vivekānanda, Bankim Chandra Chatterjee, Sir Rabīndranāth Tagore, Romesh Chunder Dutt and Haraprasād Shāstrī have also a vogue in several languages; and popular novels, in particular the favourite *Chandrakāntā* (from the Hindī), and its imitators, are frequently translated. Portuguese publications appear at Goa, French at Pondicherry and Chandernagore; the Roman Catholic missions print some brochures in Latin, and there is even an Italian periodical issued from Mangalore (*La Missione di Mangalore*).

The literature of India is, therefore, highly polyglot, while individual publications are very often bilingual at least. The alphabetic aspect of the matter has also been partly indicated. In spite of the attention which has been given to the possibility of a common script for India, some advocating the Roman, some the Deva-nāgarī (which has a Hindī periodical devoted to its interest), there is no evidence of progress toward simplification; there is a certain amount of Roman-Urdū, and Roman is usually employed for the Konkanī form of Marāṭhī and for the rendering of previously unwritten languages. But in general each leading language holds to its traditional script. Sometimes it has more than one; for the Mohammedan writes his Panjābī or Hindī or Malayālam or Tamil (not, however, his "Musalmānī-Bengālī") in the Urdū character, with any necessary modifications. The Sikh may write his Sindhī in the Gurumukhī of the Punjāb. Bilingual books are therefore usually also bialphabetic (except as regards the above-mentioned case of the Sanskrit, or similar cases with Pahlavī and Gujarātī, or Arabic texts with Persian or Urdū); and this adds to the multiform appearance of the Indian literary output, already sufficiently variegated, even if we overlook such characters as the Multānī, Modī, Kaithī, Savara, which indeed are rarely printed, or the numerous old writings appearing in philological works. The format of the book is not seldom that of the old Indian *pothī*, sometimes (in Bengal) even printed on palm leaves; while the Punjāb Gurumukhī and the Mohammedan Arabic are much less often printed than lithographed from handwritten originals.

Popular Literature.—To begin with the lowest stratum, we must note the existence in India of an extensive, really popular, literature in verse. In all parts of India, but especially perhaps in the Punjāb, in the Kanarese country and in the Tamil area, there is a constant production of songs and ballads, provoked by any notable occasion, such as a prize-fight, a flood or calamity, a crime, a tragedy, a personality, a social event, an act of administration; these have a real, though probably in general a brief, life upon the lips of the people, who sing them over their work or in their social gatherings. Of late years this form has been largely used for political propaganda, innumerable small collections of "national songs" appearing in all the chief languages. There are also many collections of songs for special occasions; *Garbhī* songs for women, marriage songs, songs for the Holī (spring) festival and other celebrations, boat songs for aquatic sports in Orissa and Bengal and so forth. At certain times of the year the Mohammedans put forth vast quantities of "verses"

in honour of Mohammed or dirges for Hasan and Husain. Religion has a large share in this poetic activity: songs in honour of Kṛishṇa (especially in Hindustan, Bengāl and Orissa, but also in Gujarāt and southern India, of Caitanya (*kīrttans* in Bengal), of Kārttikeya, Ganeśa, Dattātreya, Vithobā (in the Marāṭhī area); songs for pilgrims to or at the various shrines (innumerable in the Telugu and Tamil country); songs for temple rites; collections of Jain hymns; and the many publications of Christian sects, which in some cases (Roman Catholic) even deign to follow Indian models. Not all this popular literature is in verse, since there are occasions when sacred stories in prose (*Hari-kathās* and the like) are narrated in or near the temples.

An oral existence appertains also to a good part of the various classical writings of India. This is the case not only with Sanskrit works such as the Mahābhārata and Rāmāyaṇa, some parts of the Purāṇas, and some stories such as those of Sāvitrī and Hariśchandra, but also with the classics of the several vernaculars. Not to mention the substance of stories and legends, the texts of such poets as Kabīr and Tulasī-dāsa in the Hindī area; Vidyāpati, Govind Dās and many others in Bengal; Narsinh Mehta, Mīrā Bāī and Prēmānand in Gujarātī; Nāmdēv and Tukārām in the Marāṭhī country, Ḷallā in Kashmir; the Sūfī poets of Sindh; the Vaishṇava and Śaiva saints and moralists of the Tamil country, are very familiar on the lips of ordinary people in their respective areas, and, besides being used in education, are frequently re-edited. In the Punjāb some parts of the Sikh *Granth* are similarly used.

On the borderland between the oral and the literary we have the drama. In India it was indigenous in many forms, from the heroic down to the morality, miracle play, the farce, the shadow or puppet show. Except in the extreme south of India, it would seem that the popular forms of representation have been more or less levelled out. The ordinary play, produced chiefly in Calcutta, Bombay and Madras, is similar to the European forms —melodrama, social sketch, burlesque, problem play (the old man and the young wife, the modern young man or woman and so forth), love story: it is generally interspersed with verses, and these are often separately published for popular use. The more literary drama, still sometimes in Sanskrit, takes its subjects chiefly from old Indian poetry and legend, and is not seldom an adaptation of a particular Sanskrit work (the *Śakuntalā*, the *Mahābhārata* and *Rāmāyaṇa* or episodes therein, and so forth). The choice is to some extent affected by local celebrity, and occasionally a political application may be suspected.

The pabulum of the ordinary reader in India is furnished by the magazine, containing essays, biographies and descriptions, short stories and serials, notes and not rarely illustrations. The total output is enormous; for in addition to the diversity of languages we have to reckon with the division of the Hindus into castes with their separate interests and claims. Important castes prefer an organ (or competing organs) of their own, which, along with the ordinary magazine material, will ventilate any matters having a communal bearing. This literature, therefore, presents no ordinary problem to the bibliographer; somewhere in India it should be sedulously collected and preserved, on account of the special biographical and sociological items which it contains. Schools and colleges have their organs (usually, however, in English). The missionary agencies, including the Salvation Army, issue innumerable periodicals of all grades, both in English and in the vernacular. Trades and the business world, professions (teaching, medicine, law, astrology, and so on), and grades of official service all contribute to the mass of vernacular matter. There are further a *Hindī Punch*, a *Hindī Graphic*, a Gujarātī and Marāṭhī *Tit-Bits*, and short story magazines; music and the stage are also represented by popular periodicals. Special interests, such as the cause of women, social service, co-operation, labour, economics, business, arts and sciences, travel, boy-scouting, are similarly equipped. The chief vernaculars have usually at least one literary periodical of a fairly high type. In some cases these have flourished during long periods: the *Sentamil* of Madras is in its 24th volume, the Hindī *Sarasvatī* in its 25th, the Bengali *Bhāratī* in its 49th, the Gujarātī *Samālochak* in its 30th, the Marāṭhi *Vividhajnānavistara* in its 56th. The Urdū *Humāyun* also is of some standing.

Modern Indian poetry, excepting translations and adaptations of old Sanskrit works and themes, is usually in the form of short lyrics issued in small volumes. Larger productions are for the most part collected works of single authors, or anthologies, or the outcome of literary Eisteddfods. In the Hindī area the ballad of old style attains a greater length, as do Tamil *Kāvyas* on classical models. The poetry is generally erotic, ethical, philosophical or religious; but the satirical and controversial, and also, as we have seen, the political, claim a place. The verse-forms are usually the traditional ones: only Bengālī, it appears, manifests original power in this direction.

Fiction on European lines is making rapid headway in India, and is supplanting the old romantic tales, at least so far as prose is concerned. The Punjāb may still reprint its *Hīr* and *Ranjhā*, *Rājā Rasālu*, etc., the Sindh its *Sassī* and *Punnūn*, the Urdū language its *Laitī* and *Majnūn*, and Hindī the tales of *Bhartharī* and *Gopīchand*. The novel is popular both in the form of the short story and of more substantial narratives; and it reflects all the varieties of subjects which have a vogue in English, historical, social, romantic, adventurous (including the detective novel). A new feature is the translation of well-known (including English) novels into several languages and the immense vogue of such popular stories as that of the Hindī *Chandrakānta*.

Religious Literature.—Indian religious literature, in so far as it is not lyrical, philosophical, argumentative or philological, consists mainly of manuals of ritual for daily life (*dina-caryā*) or for particular occasions (marriage, burial, times and seasons, pilgrimages, vows), and of the stories therewith associated; for instance, the story of the Tulasī plant and that of Satya-Nārāyaṇa are constantly reproduced. Benares takes a prominent part in such publications. Since each section, from the Vedic *Śākhās* downwards, must have its separate rituals, it results that the number of such publications is very great.

We pass to a consideration of the activity in the reproduction of old canonical texts, with or without commentaries, for the purpose not of ritual, but of study and edification. This accounts for a great mass of republication: in the Punjāb, for instance, there is a steady stream of thick volumes of *Selections from the Ādi-granth*. There are some valuable series of such canonical texts; the Jains have several, and the Madhva doctrine of south India and the sect of the Mahārājas in Bombay have thus made accessible their chief writings. Important groups have usually one or more periodical organs, which, amid other matter, publish and comment upon their authoritative books. Many religious texts are, of course, not the property of any particular sect, and are therefore variously reproduced; and from these we can hardly separate those which are of a philosophical rather than of a religious character: such are the Vedānta writings, the Madras periodical *Vedānta-dīpikaī*, and other philosophical journals; of wider scope, the *Siddhānta-dīpikaī* and the Marāthī *Tattvajnāna-vistara*. There are English periodicals belonging to one or the other of the above two groups: such are the *Vedāntakesarī* of Madras, the Ahmadī *Review of Religions* and *The Theosophist* (which also has vernacular allies). Modern philosophy is represented by the Calcutta Philosophical Society, and by a now extinct *Indian Philosophical Review* published during several years in Baroda.

Philology.—Philology of a more general character is no longer in India restricted to one or two classical languages, Sanskrit, Prākrit, Tamil, Pahlavī, Persian, Arabic. There are societies which devote themselves to the publication of old texts in the existing vernaculars. The Bangīya Sāhitya Parishat, with its *Pattrikā* and its series of separate old Bengālī texts, has a very honourable record. The Tamil Sangam of Madura (which issues the *Sentamil*) is likewise distinguished. There are now other Sāhitya Parishats in the province of Bengal, and for Telugu also there is the Āndhra Sāhitya Parishat. For Hindī there are the Nāgari-prachāriṇi Sabhā and certain Mandalas; for the Punjāb the Khālsā Tract Society; in Gujarāt, where societies for publication seem to flourish, the oldest is the Gujarāt Vernacular

Society, while there is also a Sāhitya Parishat, and a Sāhitya-vardhana Society; in Marāṭhī an important series of editions of old poetry was published under the title *Kāvya-saṃgraha.* In literary history there are very important and extensive works by Rai Saheb Dineschandra Sen (Bengālī); Sir G. Grierson and the Misra brothers (Hindī); G. M. Tripāṭhī and K. M. Jhāverī (Gujarātī); Prof. W. B. Patwardhan (Marāṭhī); and Vīresalingam Pantulu (Telugu).

As regards general philological activity of India, it is hardly possible to draw any clear line between indigenous scholarship and that affected by European methods: the main aim and procedure of scholarship are the same everywhere, and whether a commentary is in Sanskrit or Bengālī or English seems to make little essential difference. Only comparative philology is new to India. This philological activity, wherewith is associated the investigation of archaeology and pre-British history, and from which we may exclude the astounding output of educational work up to the level of university textbooks, is connected chiefly with organizations of some kind. The Government of India itself maintains an Archaeological Survey, which publishes annual reports in the several provinces and at headquarters, and splendid special monographs, as well as a periodical relating to Epigraphy (*see* INDIAN AND SINHALESE ART AND ARCHAEOLOGY). This example is followed by Indian States, Mysore, Travancore, Hyderabad, Kashmir. Several provincial Governments have published catalogues of Sanskrit mss. (Bengal, the United Provinces, Bombay, Madras, the Central Provinces); States, small and great, Kashmir, Nepal, Baroda, Mysore, Travancore, Alwar, under the title *Bibliotheca Indica* a vast collection of Sanskrit, or Arabic texts, too, are officially edited in Bombay, Mysore, Travancore, Kashmir, Hyderabad, Baroda.

After the Governments we may mention the universities, colleges and libraries as active in the publication of texts and researches (the universities of Calcutta, Madras, Lahore, the Benares Sanskrit college, the Maharajah's college, Vizianagram, the Bankipur public library). Important journals are issued by societies (the Asiatic Society of Bengal, which has also published under the title *Bibliotheca Indica* a vast collection of Sanskrit, Arabic, Persian and Tibetan texts; the Bombay branch of the Royal Asiatic Society, the Mythic Society of Bangalore, the Bihar and Orissa Research Society, the Hyderabad Archaeological Society, the Bhandarkar Oriental Institute); and some, like the *Sanskrit Research,* the *South Indian Research* and the Jain *Purātattva,* are occasionally started independently or by religious bodies. The books issued by authors, editors, or individual publishers are, however, more numerous, and on the whole the Indian publication of philological, historical and archaeological matter relating to pre-British India quite dwarfs in bulk all that is done outside. Much is highly meritorious, and some of it is fully equal to the best production of Europe. The monumental *Linguistic Survey of India,* edited by Sir G. Grierson for the Government of India, is now completed (*see* PHILOLOGY).

History and Biography.—For educational purposes and general reading many short histories of India, of England and of other countries are produced both in English and in the vernaculars. But original research and independent judgment will be found chiefly in the few first-hand histories of particular States and dynasties; and with a few exceptions (such as the Marāṭha researches of Rai Bahadur, D. B. Parasnīs and the volumes of Marāṭha records published by the Marāṭha Historical Society of Poona; the volumes of Prof. Sarkar concerning Aurangzeb; the biography of Jahāngīr and the *Journal of Indian History,* published by the Allahabad university school of Indian history; the works on south India by Prof. Kumāraswāmy Aiyangar, Subrahmanyam Aiyar and a few others) in the works of Englishmen. The valuable monographs produced in Europe or India by Indian scholars relate for the most part to ancient times, and are less historical than philological. Many volumes of records and calendars in English have been published by local Governments; the gazetteers also are replete with historical information not absorbed in formal histories; and there are several societies, the Bengal Historical Society, the Punjāb Historical Society and the United Provinces Historical Society, whose journals are composed of original matter.

Biography, including autobiography, is now popular in India, taking chiefly the form of short memoirs, which in the case of princes and of important religious leaders such as Debendra Nāth Tagore and Dayānanda Sarasvatī, may attain a considerable length: so also in the case of historical personages, Śivājī, Jahāngīr and others. A very favourite form, of which there are old examples, is the serial biography, containing lives of saints, lives of famous women, hierarchical, dynastic and family biographies. Valuable work of this kind has been done in regard to the Tamil and Telugu saints and poets, and the poets of Bengāl and Gujarāt. Small volumes of "prison reminiscences" have been published by political offenders, and the number of short "lives" of popular heroes, such as Tilak, Gokhale and Gandhi, is beyond counting. The old form of biography in verse is still favoured in relation to saintly and historical characters: naturally, it has aims other than information and research. Many Indians, from princes downwards, have written accounts of their travels, whether in England, on the continent of Europe, in America or in other countries, including the Far East. But India itself furnishes rich material and occasions for travellers' experiences, especially in connection with its shrines and pilgrimages, so that such titles as *Bhārata-bhramaṇa* quite naturally recur.

(F. W. TH.)

INDIAN MUSIC. The music of India has a threefold interest. It offers the most complete example, in theory and practice, of melody untouched by harmony; hence, it provides a key to the problems of ancient Greek music, which have fascinated scholars and musicians; and it has for an Englishman the appeal that it concerns a majority of his fellow-subjects.

Musical literature refers not seldom to the "laws of melody," but makes no attempt to formulate them, because European melody is always harmonized, and it is nearly impossible to say what part of it belongs to harmony and what to melody. From a system innocent of harmony, like the Indian, we realize (1) that melody swings, in the first instance, on two pivots—the vocal tonic (*amsha*), a sort of "Ecclesiastical" Dominant, at a pitch that varies with the mode, and the tonic in our sense of the word supported by a drone (kharaj) and, secondarily, on notes related as fourth or fifth to either of these. On this varying distance between the two tonics depends mainly the character of the mode (*rāg*), poignant, if the *amsha* is high, festive or placid, if low. (2) There is a general contrast of major and minor, but the third of the scale is no more decisive of this than the seventh, sixth, or second; the *ethos* of the minor is not so much sad as elaborate and reflective, and is graduated or intensified by shades of intonation which we do not possess. (3) a melody is conceived as lying within, or round, the tetrachord, though the second part of it may spring to the upper octave, just as, with us, it would adjourn to a key of contrast. (4) The motion is mainly conjunct; intervals which strike us as odd (augmented second, or augmented fourth) are justified as motion to or from the *amsha.* (5) The octave contains, like ours, seven notes (it is called *saptaka,* a set of seven) with, possibly, an eighth or ninth as alternatives, not additions. The "quartertones" (*shruti*) have been entirely misconceived by European writers. They do not provide a scale of 22 notes through which the voice threads its precarious path, but are in use as increments of intervals well-known to us, and lend them an exhilarating or pathetic colouring. (Thus, from a tonic C, the sixth, A, will have 884 accents in one mode, 906 in another; B flat, similarly, 996 or 1.018.) The Indians have, in fact, preserved distinctions which we have merged by our "temperaments," and now employ them for a musical purpose; just as grammar will sometimes employ different forms (*nosco,* and *novi; ken, can,* and *know*) for different meanings. (6) Melody centres in the mode. The amateur knows a dozen of them, the professional at least five, perhaps ten, dozen. (It is customary to say that we have only two modes, major and minor; but for those who consider the history and the implications of the "Neapolitan" sixth, the "German" and "diminished" sevenths, etc., there are more than two.) The modes are differentiated

by (*a*) their *amshas*. (*b*) the flat (*komal*) and sharp (*tivra*), or the very flat and very sharp notes (*atikomal, atitivra*) and (*c*) the amount of transilience, *i.e.*, whether they are of five, six or seven notes in all. The various admixture of these elements gives each mode its flavour (*rāga*), and this is emphasized by assigning the mode to a particular hour of the day or season of the year.

We conceive musical times as multiples, they as sums. We take $\frac{6}{8}$ as 3×2. and $\frac{9}{8}$ as 3×3; they, as $3+1+2$ and $5+2+2$ (or $4+2+3$. or in some other way). In these three instances, to go no farther, they are representing the dactyl (– ∪ ∪) of their prosody, and allowing for (*a*) different lengths of short syllable and (*b*) different proportions of long to short. They have dealt similarly with trochee (– ∪), iambic (∪ –) and anapaest (∪ ∪ –). The tribach (∪ ∪ ∪) they treat as three crotchets and a crotchet rest, thus arriving at common time, which they call "three-time." Such procedure soon becomes far too elaborate to follow out here, though, in practice, they confine themselves to only a dozen kinds of time.

But, in whatever time it may be, the essence of an Indian melody it that it employs cross rhythm. Singer and drummer converge upon a point; one sings seven bars of ten units perhaps, while the other drums ten bars of seven units; or the drummer's two hands beat different times, one $2+2+2$ and the other $3+3$; or one hand starts at the beginning and the other in the middle of the bar, in different times, and they converge half a dozen bars later. The audience appreciates such a point, and waits for it.

In the absence of harmony, grace-notes are important, to emphasize one moment as against another. The couple of dozen graces that are practised are, in principle, two—the slide (as on the violin) and the "deflect" (as produced by the tangent of a clavichord). The eminence of a performer is largely decided by his skill in these, and he uses them to accentuate the essential notes of the mode.

The chief instruments are (1) *vīna*, with three drone strings, and four fretted strings on the finger board, plucked like, and with the tone of, the guitar; (2) *sitar*, a simpler form of guitar, more easily played, with less noble tone, native to Bengal; (3) *sārangi*, an elementary violin, used for the nautsch; (4) *surnai*, a hautboy of strident tone; (5) various drums, the most important being the *tabla*, a small pair, played one by each hand; and, in the jungle (6) the *banshri*, bamboo flute, of varying size, scale and compass. Concerted music, vocal or instrumental, is rare, and is in unison. (A. H. F. S.)

INDIAN MUTINY, THE, the great revolt of the Bengal native army in 1857 which led to the transference of the government of India from the East India Company to the Crown in 1858. This mutiny, accompanied by rebellion of the population in many parts and of some of the chieftains of India, was due to many causes, some of which remain a matter of controversy to this day. Whatever were the ultimate political and psychological reasons underlying the rebellion, the increasing of the native army to implement the holding of the newly acquired territories of Oudh, the Punjab and Sind, out of all proportion to the European garrison, added to a reduction of that small garrison during the Crimean and Persian campaigns, made a mutiny possible and sufficiently attractive to catch up into its whirlwind the discontented political elements.

During the 100 years which had elapsed since the battle of Plassey, the East India Company had risen, through the crumbling of the central power of the Mogul empire, from being the mandatory of that empire for the government of certain coastal tracts, to the control of the whole of the Indian peninsula. In overcoming the various warring principalities into which the Mogul power had broken up, the instruments were largely Indian soldiers themselves, who had eagerly followed the British who were proud to lead them. A vast army modelled on the British Line,[1] and clothed to resemble it, had sprung up, with all the complicated machinery and traditions of a regular standing army. Elated at the continual success which attended the British arms, the martial races eagerly enlisted under the Union Jack, and served gallantly and faithfully, crossing bayonets more than once with the French and sailing as far as the Mauritius, Egypt and Java to take part in the wars against Napoleon. But ever behind this great native army marched as a hammer-head European corps, some enlisted for the service of the Company, but chiefly consisting of the British Line. The European units always bore the brunt of the hardest service. This vast native army was organized in three distinct Lines, under the presidencies of Bengal, Madras and Bombay. The native army of Bengal was by far the largest, and the three armies, in addition to the Line, had developed many local corps, regular and irregular, while the larger native states also maintained contingents under treaty, trained as a rule after the manner of the Bengal army, and officered by British officers, which enlisted in many cases the same races as furnished the Bengal Line.

[1]Line—an organized regular army.

The Bengal army, and indeed the whole of India, was shaken by the disasters which, for the first time, overcame the Company's forces in Afghanistan in 1841–42. In the wars with the Sikhs, 1846–49, the fighting and the nature of the foe was far more formidable than hitherto experienced; the European troops had to bear a more forward part than ever in the great battles of that war, and the prestige of the Bengal army was to some extent threatened.

Earlier Mutinies.—There had been several untoward military incidents in the 50 years preceding 1857. As early, indeed, as 1764 it had been necessary to quell mutiny by the usual oriental punishment of blowing away the offenders from the guns, when 30 sepoys (sepoy, more properly *sipahi*, soldier, *cf.* the form *spahi* in the French African army) were so disposed of.

In 1806 a serious mutiny was brewing in the Madras army, partly born of the over-introduction of European pattern clothes and accoutrements. In 1824, the 47th Bengal Native Infantry refused to march when it was ordered for active service in Burma, and after being somewhat severely handled by European artillery, was disbanded. In 1844 no less than seven battalions of the Bengal Army broke into open mutiny over the question of allowances when garrisoning newly acquired provinces. It was to be noticed that the sterner measures of earlier days were not taken and the corps involved for the most part remained in the service.

Discontent and Danger Signals.—But there were not wanting those who saw farther and thought harder. Lord Ellenborough often said that a general mutiny of the native army was the only real danger with which the British Empire in India was threatened. His warning was solemnly repeated by Sir Charles Napier, when Commander-in-chief, basing his warning on the many defects of the military system which had gradually crept in. General John Jacob of the Bombay Army uttered still more forcible warnings during the years immediately preceding the Mutiny. Sir Henry Lawrence, than whom no greater authority existed, frequently warned all and sundry that things were not right, and that what had occurred at Kabul might happen at Delhi.

There can be little doubt that the social reforms of Lord Dalhousie and his predecessors had disturbed many men's minds. The prohibition of *suttee* and female infanticide, the subordination of Brahmans to the ordinary criminal laws, all tended to cause bitterness and alarm. The landowning class, especially among the Mohammedans, found that British rule meant curtailment of inordinate privileges, and fair treatment for the poor, while at times British zeal for justice pressed unduly on these ancient classes.

The Greased Cartridge—the Chappattis.—To this accumulation of inflammatory material, a spark was put in 1857 by strange but intelligible oversight on the part of the authorities responsible for the manufacture of ammunition. The use of the Minie or Enfield rifle involved a cartridge with a heavily greased patch at the end. The use of the cartridge for muzzle loading muskets had always demanded the biting of the end and the pouring of the powder thus released into the barrel. Then occurred an altercation at Dumdum, between a high-class Bengal sepoy and a low-caste employé of the arsenal, and the hurling of a gibe by the latter as to the utter defilement involved in the use of the

new cartridge. The news spread like wild-fire. Officers, as soon as they heard of the trouble, took the matter up, and whatever material had been used, clarified butter was to be the future ingredient. It was also arranged that men should grease their own materials. But the mischief had been done, and the clever brains which had been plotting against the British, found a stimulant. In India no story is too wild for belief if connected with religion. There is no doubt that the first cartridges did contain material that would be entirely unclean, and there is no doubt that the fears of the sepoys were perfectly genuine.

At this time, too, when half India was agape and looked for a portent, the strange phenomenon of the *chappattis* occurred. The ordinary unleavened cakes of household use seemed to be passing round. A village watchman arrived at a village, distributed a cake, saying, "To the north, the south, the east and the west," with injunctions to make four more and increase the snowball. No one knew why they came. The watchmen only knew that someone had brought them. But it was known that in the past similar appearances had taken place in time of trouble.

The first signs of the approaching upheaval were displayed at the great military station of Barrackpore, 16m. from Calcutta, in Jan. 1857. The rumour regarding the cartridges which had originated at the adjacent Dumdum, had much inflamed the minds of the sepoys quartered there. The well-known sign of unrest, incendiary fires, broke out in the lines. Fortunately Gen. Hearsey was perhaps the best known and most experienced sepoy general in India, and active withal. Trouble was for the time laid by his judicious handling, but he warned the Government that he was sitting at Barrackpore on a mine ready for explosion. A month later the 19th Bengal Infantry at Berhampur refused to receive their percussion caps, on the ground that to use the new cartridge meant defilement. The absence of any European troops necessitated a temporizing policy. The battalion was, however, ordered to march to Barrackpore for disbandment. Two days before its arrival, on March 29, a sepoy named Mangal Pandy,[1] drunk with *bhang* and religious enthusiasm, endeavoured to provoke an outbreak in his regiment, the 34th Native Infantry, shooting the adjutant who interfered, and cutting down the European sergeant-major of the battalion. The regimental guard failed to take action, but General Hearsey, who happened to be riding by, rode at the mutineer.

At this juncture, the gravest which had ever befallen the British in India, the commander-in-chief and his office, with all the military heads, were separated from the governor-general and the government by many hundreds of miles. Calcutta was the headquarters of government, and though on occasion the governors-general had summered at Simla during the wars with Afghanistan and the Sikhs, the offices and the ministers did not move. The commander-in-chief, finding the major portion of his army was in the north, had made Simla his headquarters. The absence of the commander-in-chief and the adjutant-general from the seat of government at this period made any concerted policy impossible.

The Outbreak at Meerut and Delhi.—By May 10 the situation developed in grim earnest, and what had fizzled at Berhampur and Barrackpore broke into flame at Meerut. Meerut was the largest station south of the Punjab, commanded by Major-Gen. Hewitt, and containing a considerable European garrison, viz., the Carabineers, the 60th Rifles and two troops of Bengal Horse Artillery, with the headquarters and principal depôt of the Bengal Artillery, commanded by Brigadier Archdale Wilson. Meerut was originally instituted to watch Delhi and the Mahratta frontier. The native troops were the 3rd Light Cavalry (a regular and non-silladar corps), and the 11th and 20th Bengal Native Infantry.

The officer commanding the cavalry, who had lately returned from leave, decided that the cartridge question must be faced, and ordered the sharpshooters of his regiment to receive the cartridge and practise the new loading drill. Eighty-five of the men refused, were tried by a native court-martial and sentenced to long terms of imprisonment for mutiny. At a general parade of the garrison the convicts were degraded and put in irons.

Just before dusk on the day succeeding the punishment parade, a Sunday, the native garrison broke out into open mutiny. The cavalry saddled and mounted and galloped to the gaol to release their comrades. The 11th Infantry shot the colonel of the 20th and fell on any of their own officers who came their way. As so often happens in large Indian cantonments, the European and Indian barracks lay some distance apart. At Meerut the two portions of the cantonment divided by a deep watercourse, were especially distinct. While the mutineers were murdering all Europeans they came across, aided by all the ruffians who always inhabit an Indian bazaar, the British troops, unaware of what was happening, were about to turn out for church parade which, at that season, was held in the evening, when the sound of firing broke on their ears. Fortunately the Rifles were not in church, and hurried to get under arms. The regimental sergeant-major ordered the men to exchange from white cotton to their invisible green clothing. When the British troops marched to the scene of the conflagration the mutineers were gone. A few rounds in the direction of the native lines cleared out any stragglers. The scenes of outrage did not continue. The cantonment was surrounded with woods and villages, and there were large numbers of women and children to be collected in a central place of refuge. The Carabineers themselves were hardly a regiment in being. Just out from Europe to replace a regiment sent to the Crimea, full of young soldiers, their horses were young walers,[1] as yet half trained. No one thought that the excited rabble of soldiers without their leaders was going to march straight to face the orderly brigade at Delhi, or that anyone could think of restoring the Moghul dynasty.

Whether, had the situation been grasped and correctly interpreted, Delhi could have been saved, can only be a matter of opinion. It has, however, been said that matters had gone too far for any local action to prevent the rebellion, and that Delhi, acting as a focus of the disease in the north, served a valuable purpose and contributed to its eventual suppression in a manner that could not have been foreseen. Early in the morning the mutinous cavalry reached Delhi, to be followed by parties of tramping redcoat sepoys. Attempts were made to prevent them entering the city and palace, but troops sent cheering from the cantonment three miles away, soon fraternized with the mutineers, and officers were shot down on all sides. The city and palace rabble hastened to massacre all Europeans and Christians. Those who took refuge in the palace were soon butchered. The whole of the civil lines which lay within the city wall became a shambles. Up on the ridge which lay between the cantonment and the city the brigadier with half his garrison stood to arms till dusk, the Europeans clustered at a small tower, the troops muttering and restless. Within the city walls, one of the most famous incidents in British history was taking place. Between the Kashmir Gate and the fortress-palace stood the great arsenal of upper India, left by some strange folly entirely in the hands of Indian troops, and within the city. Sir Charles Napier, when commander-in-chief, had protested, and the magazine itself had been moved to the end of the ridge in the cantonment. Within the arsenal there was an immense park of cannon, with a small "*expense*" magazine in which small-arms ammunition was made up. After defending the arsenal for as long as possible the resolute young artillery officers and warrant officers of the arsenal establishment, under Lt. Willoughby, blew up their magazine, causing great damage to their assailants, and sending a thrill of glory and defiance through the whole of India. This glorious act, however, had not the effect generally supposed, for unfortunately Sir Charles Napier's forethought in moving the main magazine had but resulted in its falling into the mutineers' hands. Without its contents (3,000 barrels of powder) the defence of Delhi by the mutineers would have been impossible. At sunset the remnant of the Europeans left Delhi for Meerut and Umballa as best they could. The ex-Moghul king was proclaimed by the soldiery and was put at the head of the rebellion.

A hundred and twenty miles north of Delhi lay the great mili-

[1] From whose name, a common patronymic of Oudh Brahmans, the mutineers became known as "Pandies."

[1] Australian horses from New South Wales.

tary station of Umballa, the headquarters of a large military district commanded by Major-gen. Barnard of Crimean fame, which being in the newly occupied Punjab had many European troops. Of these, three battalions of European infantry were in the Simla hills for the summer, 60 to 80m. farther away. At Umballa itself were the 9th Lancers and two troops of European artillery with several native units. The commander-in-chief, General the Hon. George Anson, at once ordered all the Europeans in the Simla hills to march to the plains and the commander at Umballa was to get ready his force to march to Delhi. It was some days before the troops could be got down from the hills and supplies and transport collected. It must be remembered that there were practically no railways in India in 1857, and that the mutiny occurred in the height of the hot season. On May 17, six days after the outbreak at Delhi, the leading portion of the commander-in-chief's forces left Umballa for Kurnal, some 50m. down the Grand Trunk road, followed by a stream of detachments. The commander-in-chief proceeded to Kurnal on the 23rd and died there of cholera four days later.

With the rising at Delhi and the proclamation of the ex-king of Delhi to the throne of his fathers, the whole of the Bengal army, from Calcutta to Delhi, broke into revolt. At some stations the influence of individual officers held the regiments for a time, but with a few exceptions the whole of the Bengal Army and the contingents of the central Indian states caught the contagion. Scenes of tragedy and horror were enacted all over the Bengal presidency, especially along the great waterways of the Ganges and the Jumna. But from Calcutta to Meerut, a marching distance of 1,000 miles, the European garrisons were extremely small. At Lucknow, with one British battalion, Sir Henry Lawrence kept his troops in hand for weeks. At Cawnpore, Sir Hugh Wheeler, experienced but aged, tried to maintain a bold face with a few Europeans sent him by Sir Henry Lawrence. At Agra, one European battalion held the great fortress, and became a refuge for all the neighbouring provinces. As soon as the gravity of the situation was realized by Lord Canning, the governor-general, attempts were made to apply the only remedy, reinforcements of European troops. A battalion from Burma had been brought over when the trouble at Barrackpore had occurred. An expedition on the way to China was now summoned to help, and the European portion of the Persia expedition now returning to India was hurried to Calcutta. With the upper provinces isolated and telegraphs cut, with the commander-in-chief dead at Kurnal, it was necessary to organize a new chief command. General Sir Patrick Grant, the most famous of the Bengal sepoy officers of the day, was summoned from Madras, where he was provincial commander-in-chief. The pacification of the lower provinces first demanded the despatch of such small columns as could be organized to relieve the two places in the greatest danger—Sir Hugh Wheeler, at Cawnpore, Sir Henry Lawrence, at Lucknow.

To help the small stations was impossible. The restoration of order at the centre would automatically relieve them. Only in the Punjab, the most important of all the provinces, was the situation reassuring, and this for four reasons. First and foremost, the presence of a far larger number of European troops in the newly acquired provinces; secondly, the commanding character of the ruler, Sir John Lawrence; thirdly, the fact that the Punjabis had recently been handsomely beaten by the British and liked their new masters; fourthly, the pick of the young men of the Indian services were in civil and military employment in the north. Major-Gen. Reid, the senior general in the Punjab, though too old and unfit to cope with the situation, gallantly went off to Delhi to assume the provisional chief-ship when Anson died, to break down immediately from his exertions. But at Peshawur, the Brigadier, Sidney Cotton, was a tower of strength.

The eagerness, indeed, of Lawrence caused him to overlook the problem of moving Europeans in the Punjab summer and the want of carriage and equipment, nor did he at first realize the character of the revolt. Seeing that Delhi was the focus and should be recovered at all costs, and finding that even the combined Meerut and Umballa force could not take the city, he poured his British troops down, raising also innumerable levies to replace the Bengal troops, who were disarmed at many stations. His boldness and that of Sidney Cotton, Neville Chamberlain and John Nicholson, charmed the wild Afghan and frontier tribes, who flocked to serve and share in the loot of Delhi. The Amir of Kabul, contrary to expectation, held by his alliance and refrained from attacking the British. Lawrence gambled and won. But it required every man he could raise before Delhi could be taken.

The Siege and Capture of Delhi.—By June the combined forces from Meerut, under General Barnard, the commander of the Umballa division, and Brigadier-General Wilson from Meerut, defeated the rebels in three engagements, and found themselves once again in the cantonment of Delhi.

The final reinforcements reached the ridge from the Punjab late in August—under Brigadier-General John Nicholson, who had hitherto passed rapidly up and down the Punjab disarming Bengal garrisons. With him came the last supplies of siege guns and ammunitions. The siege batteries then opened an intense fire on a short front of wall and bastion. At dawn on Sept. 14, three storming columns moved against the city, two entering up the breaches and the third blowing in the Kashmir Gate. The walls on the ridge side were soon in British hands, but with the price of Nicholson mortally wounded. Days of severe fighting were necessary to clear out the city and gain the fortress-palace. This finally done, the ex-king was captured at Humayun's Tomb outside Delhi, and the sons shot to avoid a rescue. The fittest of the troops then started south to relieve Agra.

The Coming of Reinforcements and the Relief of Lucknow.—The course of the Mutiny had four distinct phases:—(1) that of the outbreak, and the recapture of Delhi with the British garrison and Punjab troops which were chiefly stationed in the north of India; (2) the coming of reinforcements and the restoration of order along the course of the Ganges, with the relief of Lucknow; (3) the final capture of Lucknow in the spring of 1858 and the destruction of the second great centre of rebellion, and (4) the pacification of the country.

Sir Patrick Grant on his arrival had found a government in a military crisis, with no military headquarters. Not one single high official of the staff of the army nor any of its machinery was available. It was necessary to improvise and reconstruct an army machinery which would handle the large forces arriving for what was now clearly seen to be the re-conquest, not only of Bengal, but of most of Central India, to which the conflagration had now spread. Very soon came the news that government at home had appointed Sir Colin Campbell to succeed Anson, and Grant could only occupy himself with making a machine for Campbell to use. He did, however, push forward as soon as possible a column to relieve General Sir Hugh Wheeler at Cawnpore, and Sir Henry Lawrence at Lucknow, pushing up first Colonel Neil and his Madras Fusiliers, and then, as soon as he arrived, Gen. Havelock with more reinforcements.

The trunk road up country from Calcutta led straight across country to Benares on the Ganges, a distance of some 380m., of which the first 100 could be travelled on the recently opened commencement of the railway. Eighty miles farther lay the Moghul fortress of Allahabad at the junction of the Ganges and Jumna, and 120m. farther on lay the important military centre of Cawnpore, which had long watched the adjacent state of Oudh. At Cawnpore was Sir Hugh Wheeler's headquarters, with four native regiments and one European field battery. At Lucknow, 45m. distant, the headquarters of Sir Henry Lawrence and the administration of Oudh, was a European battalion and a large native force. Wheeler, greatly experienced in the sepoy army, realized that his troops were likely to mutiny, and that it must be a race against time. He was encumbered with a large number of women and children. It was essential to find a place of refuge, and choice lay between a fortified magazine a long way from the cantonment at the other side of the native city, or of fortifying some disused hospital buildings on the parade ground. Because of the difficulty of moving to the magazine, and of the importance of being easily reached by reinforcements expected early from the south, he decided on the latter. A company of the 32nd Foot from Lucknow came in to help garrison the

entrenchment, into which most of the Europeans moved on May 21. On May 31, about 150 men of the 84th Foot from Burma and a few Madras Fusiliers arrived. Believing that the crisis was passing, Sir Hugh sent a company of the 84th on to Lucknow. The total force of possible combatants in the entrenchment now was some 450 men, including civilian Europeans and Eurasians, with six guns, but there were 330 women and children. On June 4 and 5, the sepoys mutinied and marched for Delhi. But there lived, near Cawnpore, one Dundoo Punt, the Nana Sahib, adopted son of the ex-*Peishwa*,[1] who prevailed on the mutineers to return and attack the entrenchment, which they did on the 6th.

From the 6th to the 24th the garrison held out against heavy bombardment, and at last, worn out with heat and sickness, surrendered on promise of safe conduct by boat to Allahabad. Then followed the infamous massacre at the boats, and the collection of women and children to be murdered later. Neil and his Madras Fusiliers, pushing up from the railhead by bullock train and route march through great heat and heavy rain, first reached Benares in time to quell a mutiny there, and then threw himself into Allahabad, still garrisoned by a few artillery invalids and some Sikhs. Here he collected supplies, pushed parties up the road, and awaited Havelock, who was able to leave Allahabad on July 7, some of his troops moving by road and some by steamer. After several engagements with the mutineers Havelock heavily defeated their main force outside Cawnpore on the 16th, to find that all the women and children had been hacked to death in a small house known as the "Bibi-ghar" the night before. Their bodies, some still breathing, were thrown down an adjacent well, on which now stands an enduring monument. No act in the Mutiny raised so fierce a storm of anger.

At Lucknow, the headquarters of Sir Henry Lawrence and the administration of Oudh, the British still held out. Up till June 30, though there had been mutinies in Lucknow and in the neighbourhood, the garrison were not beleaguered. On the 30th Sir Henry, moving out to attack the mutineers at Chinhut, immediately incurred disaster, which not only severely crippled the force of Europeans, but compelled Lawrence to abandon outlying positions and concentrate in the group of houses known as the Residency. The garrison, 1,720 fighting men, of whom 712 were loyal sepoys, and 153 civilian volunteers, were now hotly beleaguered. Unfortunately Sir Henry Lawrence was fatally wounded by a shell on July 4, the command devolving on Brigadier Inglis. Gen. Havelock at Cawnpore was compelled to wait for reinforcements, and to collect carriage and supplies. It was not till late in September that he was able to advance to Lucknow. By the 25th he had reached the Residency, a reinforcement enabling the garrison to hold a less restricted area, but it had to remain for many weeks before the actual relief could come up.

In the meantime Sir Colin Campbell had arrived. By Nov. 3, he reached Cawnpore and was ready with 4,500 men to advance on Lucknow. That city had become the focus of rebellion of all who had not hurried to Delhi, and 60,000 armed men were collected round the devoted Lucknow garrison and its reinforcements. By Nov. 12, the force reached the Alumbagh, and by the 14th advanced on Lucknow. On the 16th the Sikandrabagh was stormed and Campbell joined hands with Outram and Havelock. The commander-in-chief had decided to withdraw the garrison and all its helpless folk at once, and to leave a strong force outside the city till he was prepared to attack the whole of the Lucknow rebel concentration. The success was marred by the death of the heroic Havelock, who was laid to his rest in the Alumbagh, in which Sir James Outram with 4,000 men was left to face the masses of the rebels till Sir Colin was ready.

The Campaign in Oudh and Central India.—Returning to Cawnpore with the rescued people, the chief was in time to save that important place from a sudden attack by the Gwalior rebels—and the second phase of the Mutiny, that of the coming of the reinforcements and the reopening of the Great Trunk road had now been accomplished. Cawnpore had been avenged and Lucknow relieved, while in the far north Delhi had fallen and the Delhi troops were marching south. It was not, however, till March, 1858, that Sir Colin had enough troops for his purpose, when Jang Bahadur, the prime minister of Nepal, had also arrived with 10,000 Ghurkas. The attack on the masses entrenched at Lucknow began on the 9th and partook of the nature of a siege, lasting till the 16th, when the city was in British hands and the whole rebel army routed. It was the brilliant campaign of Sir Hugh Rose in Central India which destroyed the last mutinous forces in being and clinched the suppression of the Mutiny.

The Central Indian Campaign.—Though the two great princes of Central India, Sindhia and Holkar, wisely and fortunately remained true to the British, troops belonging to both of them joined the mutineers. The Gwalior contingent of Sindhia's army mutinied in the middle of June, and on July 1 Holkar's troops revolted at Indore, and the resident, Henry Durand, was forced to leave the residency. The rani of Jhansi also rose in rebellion, to become known as "the best *man* upon the side of the enemy." The rising in this quarter received little attention until Jan. 1858, when Sir Hugh Rose was given the command of two brigades, to act in concert with Sir Colin Campbell, and he immediately began a campaign which for celerity and effectiveness has rarely been equalled in India. Advancing rapidly from Bombay, Sir Hugh Rose relieved Saugor on Feb. 3, after it had been invested by the rebels for upwards of seven months. On March 3, he forced the pass of Madanpur, and took the whole of the enemy's defences in rear, throwing them into panic. On the 21st he began the siege of Jhansi, the stronghold of the mutineers in Central India, with a garrison of 11,000 men. During the course of the siege Tantia Topi, the most capable native leader of the Mutiny, arrived with a fresh force of 20,000 men, and threatened the British camp; but Sir Hugh Rose, with a boldness which only success could justify, divided his force, and while still maintaining the siege of the fort, attacked Tantia Topi with only 1,500 men and completely routed him. This victory was won on April 1, and two days later Sir Hugh carried Jhansi by assault. On May 1 the battle of Kunch was fought and won in a temperature of 110° in the shade, many of the combatants on both sides being struck down by heat apoplexy. On May 22, the battle of Kalpi was won. In five months he had beaten the enemy in 13 general actions and sieges, and had captured some of the strongest forts in India. News now arrived that the rebel army under Tantia Topi and the rani of Jhansi had attacked Sindhia, whose troops had gone over to the rebels and delivered Gwalior into their hands. Sir Hugh marched against Gwalior at once, captured the Morar cantonments on June 16 and carried the whole of the Gwalior positions by assault on the 19th, thus restoring his state to Sindhia within 10 days of taking the field. This was the crowning stroke of the Central India campaign, and practically put an end to the Mutiny, though the work of stamping out its embers went on for many months, and was completed only with the capture and execution of Tantia Topi in April, 1859.

Nature of the Indian Mutiny.—The Indian Mutiny was in no sense universal. In the first place it practically occurred only in Bengal, Central India, the north-west provinces along the Ganges, Oudh and the Punjab, viz., those provinces garrisoned by the Bengal army and its off-shoots. The Madras line stood firm as did almost all that of Bombay. Seditious movements among the Mahrattas were kept in hand. Even in the affected districts the great mass of the people either stood neutral, waiting with the immemorial patience of the East to accept the yoke of the conqueror, or helped the British troops with food and service, in many cases also sheltering British fugitives to the best of their ability. The attempt to throw off the British yoke was confined to a few disaffected ex-rulers and their heirs, with their numerous clansmen and hangers-on, besides the badmashes and highwaymen who saw their way to profit by the removal of the British administration under which their peculiar talents found no outlet. The Bengal native army was their tool. But the fighting races of the Punjab saw no reason for casting in their lot with the mutineers, and the great majority of the independent princes who had nothing of which to complain, like Patiala and Jhind in the Punjab, preserved a loyal or at least an interested friendship.

[1]The deposed and pensioned chief of the Mahratta confederacy who lived in exile near Cawnpore.

The Sikhs showed their appreciation of Lawrence's admirable administration by keeping faith with their recent conquerors, and the Gurkhas of Nepal did yeoman service for their fathers' enemies.

The chief result of the Indian Mutiny was the end of the government of India by the East India company. It was felt that a system of administration which could permit such a catastrophe was no longer desirable. On Aug. 2, 1858, the queen signed the act which transferred the government of India to the crown. On Nov. 1, Lord Canning, then viceroy of India, published the noble proclamation in which the change was announced, and a full amnesty was offered to all the rebels who had not been leaders in the revolt or were not guilty of the murder of British subjects. The natives of India at large gratefully accepted the queen's proclamation as the charter of their lives and liberties, and a suitable opening to a new order.

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INDIAN OCEAN, the ocean bounded north by India and Persia, south by the northern margin of the south polar continent (Antarctica), west by Arabia and Africa and east by Farther India, the Sunda islands and West and South Australia. From 35° South latitude there are no natural boundaries on the east and west, and artificial boundaries have therefore been laid down, consisting on the west of the meridian of Cape Agulhas, and on the east of the meridian of South Cape, Tasmania.

It attains its greatest breadth, more than 10,000 km. or 5,500 sea miles between the south points of Africa and Australia and becomes steadily narrower towards the north until it is divided by the Indian peninsula into two arms, the Arabian sea on the west and the Bay of Bengal on the east, the distance from Aden to Penang (Malay Peninsula) being 6,100 km. or 3,300 sea miles. Both branches meet the coast of Asia almost exactly on the Tropic of Cancer, but the Arabian sea communicates with the Red sea and the Persian gulf by the straits of Bab-el-Mandeb and Ormuz respectively. Both of these, again, extend in a north-westerly direction of 30° N. Within these boundaries the Indian ocean covers an area of 74,917,000 sq.km. It is thus the smallest of the 3 great oceanic basins comprising only 20·7% of the area of the oceans of the globe; 29·6% being covered by the Atlantic ocean and nearly half (*i.e.*, 49·7%) by the Pacific. From a purely geographical standpoint the Indian ocean is not exclusively tropical in character, although, because the main shipping of the world only traverses the tropical portions as far as the southern coast of Africa and Australia, such is often assumed to be the case. The mean latitude may be fixed at 25° south; north of this, 34,280,00 sq.km. are in the tropical zone (*i.e.*, 45·8%) whilst to the south 40,637,000 sq.km. lie outside the tropics. The two subsidiary basins, which are always included in its area, are very small; the Red sea has an area of 437,900 sq.km. (= about ¼ of the area of Great Britain and Ireland); the Persian gulf has an area of 238,800 sq.km.

The Indian ocean receives few large rivers, the chief being the Zambesi, the Zhat el Arab, the Indus, the Ganges, the Brahmaputra and the Irawadi. Murray estimated the total land area draining to the Indian ocean at 130,080,000 sq.km. (= ⅓ the area of Europe), almost the same as that draining to the Pacific. The Pacific, however, is more than twice as large as the Indian ocean. As, besides, the rivers mentioned, the South-western and North-western monsoons in the tropical regions on the eastern side of the Indian ocean bring heavy rains, and there is heavy rainfall also in the neighbourhood of the equatorial calms, the surface water in these regions contains very little salt, particularly in the Bay of Bengal into which flow the great rivers from the mainland.

Relief.—Large portions of the bed still remain unexplored, but a fair knowledge of its general form has been gained from the soundings of H.M.S. "Challenger," the German "Gazelle" expedition, and many British cable ships, and in 1898 information was greatly added to by the German "Valdivia" expedition and in 1905 by the British Percy Sladen Trust Expedition of H.M.S. "Sealark." A ridge for the most part less than 2,000 fathoms from the surface extends south-eastwards from the Cape. This ridge, on which the Crozet islands and Kerguelen are situated, is directly connected with the submarine plateau of the Antarctic in the neighbourhood of Kaiser Wilhelm Land (Gaussberg) at 90° E. From it the depth increases north-eastward to a deep hole south of South Australia, with depths of more than 2,750 fathoms, and northward to the angle between north-western Australia and the Sunda islands.

It has been ascertained that the ocean floor at this point has a peculiar formation, consisting of two long, narrow, deep-sea depressions lying parallel to the west coast of Sumatra and the south coast of Java. The depression nearest to the coast is 800 fathoms deep between Sumatra and the Mentawei islands, and from 1,500 to 2,000 fathoms deep south of Java; then comes a submarine ridge and beyond it a depression which is over 2,500 fathoms deep west of the Mentawei islands and 3,500 fathoms deep at a distance of 250 km. south of Java. All these submarine formations are strictly parallel to one another and are also parallel to the mountain ridges of the Sunda islands. In 1924 a Dutch submarine, by means of echo-soundings, measured depths of over 3,500 fathoms north-east of Christmas island. Along the shoal coasts of Further India, Africa and Madagascar, there are no such remarkable deep sea formations. In these western regions of the Indian ocean however, the Laccadive and Maldive islands and the Chagos archipelago as far as Diego Garcia all rise from a single ridge; on another ridge lie the Seychelles with the Saya de Malha bank and the Nazareth bank as far as Mauritius. On this latter ridge the sea is, for the most part, not as much as 500 fathoms deep. Madagascar has also a submarine continuation to the south, and is moreover connected with Africa by a plateau less than 1,500 fathoms below the sea. The Persian gulf is very shallow, having a mean depth of only 13 fathoms; the Red sea is, in places, 1,000 fathoms deep.

Islands.—Like the Pacific, the Indian ocean contains more islands in the western than in the eastern half. Towards the centre, the Maldive, Chagos, and Cocos groups are of characteristic coral formation, and coral reefs occur on most parts of the tropical coasts. There are many volcanic islands, as Mauritius, the Crozet islands and St. Paul's. The chief continental islands are Madagascar, Sokotra and Ceylon. Kerguelen, a desolate and uninhabited island near the centre of the Indian ocean in its southern part, is noteworthy as providing a base station for Antarctic exploration.

Deposits.—The bottom of the Bay of Bengal, of the northern part, of the Arabian sea, of the Red sea—with the exception of a narrow strip in the centre—and the Persian gulf, and the narrow coastal strips on the east and west sides of the ocean, are chiefly covered by blue and green muds. Off the African coasts there are large deposits of Glauconitic sands and muds at depths down to 1,000 fathoms, and on the banks where coral formation occurs there are large deposits of coral muds and sands. In the deeper parts the bed of the ocean is covered on the west and south by Globigerina ooze except for an elongated patch of red clay extending most of the distance from Sokotra to the Maldives. The red clay covers a nearly square area in the eastern part of the basin bounded on two sides by the Sunda islands and the west

coast of Australia, as well as two strips extending east and west from the southern margin of the square along the south of Australia, and nearly to Madagascar. In the northern portion of the square from Christmas island and across the Cocos islands to the southern tropics, the red clay is replaced over a large tract by Radiolarian ooze.

In the higher southern latitudes, that is, south of 50° South and almost to the ice boundaries, the bottom is covered with the siliceous deposit of the diatomous ooze; on the South Polar ridge however glacial marine sediments predominate, *i.e.*, continental deposits.

Temperature.—North of the southern tropics the temperature of the surface waters is at all times higher than 20° C and in the equatorial latitudes over 25°; in the eastern half it is generally above 27·5° C; in the Red sea and the Persian gulf the temperature often rises to above 30°. South of 40° the water quickly cools so that off Kerguelen (49° S.), even in summer the temperature has been found to be no more than 2–3° C. The isotherms move mainly from west to east, and their course is not diverted by currents to so great a degree as in the Atlantic. The distribution of deep sea temperatures is very similar to that of the Atlantic if it is borne in mind that the Indian ocean scarcely encroaches on the northern hemisphere. In the Indian ocean also the water to the depth of 50 m. to 800 m. or 1,000 m. is colder in the equatorial zone (0°–10° S.) than the water of higher latitudes, *e.g.*, than the water round the Madagascar-Mauritius coasts. At depths greater than 1,000 m. the temperature tends to become equalized, and at 2,000 m. it is almost always about 3° C and at 5,000 m. 1° C.

Salinity.—The saltiest surface water is found (a) in the Arabian sea and (b) along a belt extending from south-west Australia to south Africa, the highest salinity in this belt occurring at the Australian end. In both regions the salinity exceeds 36%. In the monsoon region west of Sumatra and throughout the Bay of Bengal, owing to rainfall and the inflow of rivers the salinity is diminished to 34% and at the mouth of the Hooghly to as little as 30%. In the northern portions of the Red sea and the Persian gulf on the other hand, the proportion of salinity is sometimes as high as 40%. South of New Amsterdam and São Paulo the salinity—as also the temperature—quickly diminishes, and south of Kerguelen as far as the South Pole there is a uniform "Polar water" containing 33·7% salinity. In the deep waters of the Indian ocean the saline distribution is for the most part the same as in the Atlantic ocean (*q.v.*) and therefore the circulation of the deep-sea layers of the Indian ocean is similar to that of the Atlantic. There are horizontal movements from north to south and from south to north in the different layers.

Meteorology.—In no oceanic division does the regular half-yearly alternation of all the factors in weather conditions and particularly the winds play such an important part as in the monsoon regions from 10° S. northward of the Indian ocean. From Oct.–Nov. to March–April north-east winds prevail in the north latitude and north-west winds in the south latitude; from May–June to Sept.–Oct. south-south-west winds prevail. In the Arabian sea between Sokotra and the Maldives these south-west monsoons are very violent and are dangerous even to modern steamship traffic. From the earliest times the voyages of the native sailing vessels between India and Africa have been regulated by these alternating winds. The south-west monsoon brings rain to the whole of India; the north-east monsoon is predominantly dry. Southwards from the latitude of the Seychelles—Chagos—Cocos islands, the south-east trade-wind prevails throughout the year, and south of 30° S. the west winds which are generally particularly strong between 40° and 55° lat., and of which in the 19th century the fast sailing ships bound for Australia and China took advantage. The tropical storms, especially of Mauritius, are much dreaded; they follow a parabolic course from east to west then southwards and back to the south-east, and occur in the summer season. In the Arabian sea and the Bay of Bengal these hurricanes are, fortunately, rare and occur only once or twice a year, in April–May and Oct.–Nov., that is to say, at the periods when the monsoons change. In the Hooghly Delta off Calcutta the high waves which accompany the storms are dangerous and have caused the loss of thousands of lives.

Surface Currents.—The surface currents in nearly every case follow the winds and in the tropical regions, therefore, are regulated by the monsoons. The currents running north-east and east caused by the powerful south-west monsoon during the northern summer in these regions—as in the Gulf stream off Florida—ships may be sent from 60 to 100 sea miles, or 100 to 150 km. out of their course in 24 hours. During the north-east monsoons the water of the Indian ocean in north latitude flows west and south-west, and a contrary current between the equator and 10° S. flows eastward towards western Sumatra. In the region of the south-east tradewind the so-called South equatorial current flows on continuously westwards, and divides into two streams at Cape Amber (Madagascar). The northern half flows up to the coast of Africa and then turns south through the Mozambique channel, to form at a later stage the famous Agulhas current of the South African coast; the other half flows along the east coast of Madagascar as the Mascarene current and gradually turns to the south-east. The Agulhas current also often runs very swiftly westward off the ridge of the Agulhas bank; as the wind drives the waves in an easterly direction, this causes a highly unpleasant motion of the sea.

On clearing the land south of the Cape the waters of the Agulhas current meet those of the west wind drift of the Southern ocean, and mingle with them in such a manner as to produce, by interdigitation, alternate strips of warm and cold water, which are met with at great distances south-west and south of the Cape. Between South Africa and Australia the waters form a part of the great west wind drift. The waters of this drift are, in general, of very low temperature, but it is remarkable that the interdigitation just mentioned continues far to the eastward, at least as far as Kerguelen. The west wind drift sends a stream northwards along the west coast of Australia in a north-westerly direction, but this is not cold, like the corresponding Benguela current of the south Atlantic; in Western Australia, therefore, there is almost an entire absence of the cold coastal waters and the fogs, so characteristic of the coast of south-west Africa.

In the high south latitudes of the Indian ocean a wide stream of cold water flows from the south polar continent towards the north-west, north and north-east; this stream carries pack ice and frequently large numbers of icebergs as far as the Prince Edward islands, the Crozet islands and Kerguelen, and sometimes even up to the sea-routes between South Africa and South Australia.

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INDIANOLA, a city of Iowa, U.S.A., 18m. S. by E. of Des Moines; the county seat of Warren county. It is on Federal highway 65, and is served by the Burlington and the Rock Island railways. The population in 1925 (State census) was 3,581. It is the seat of Simpson college, a Methodist Episcopal institution established in 1867. Indianola was laid out and made the county seat in 1849. It was incorporated in 1864 and chartered as a city in 1884.

INDIAN PAINT-BRUSH: *see* PAINT-BRUSH.

INDIAN PHILOSOPHY. It is not possible to determine exactly the dates of the Indian systems of philosophy. The following, however, may be accepted as the broad divisions of the philosophic development:—I. The Vedic period (*c.* 1500–600 B.C.); II. The Epic period (600 B.C. to A.D. 200); III. The period of the six systems (A.D. 200).

I. THE VEDIC PERIOD

The Vedic literature comprises (1) the four Vedas, which consist of hymns, prayers and spells addressed to the gods; (2) the Brāhmaṇas or ritual treatises; (3) the Āraṇyakas, or the forest treatises, which constitute the concluding portions of the Brāhmaṇas; and (4) the Upaniṣhads, which form the basis of much of the later Indian philosophy. The religion of Nature of the hymns, the religion of law of the Brāhmaṇas and the religion of spirit of the Upaniṣhads correspond in a very close way to the three great divisions in the Hegelian conception of the growth of religion.

The Ṛg Veda.—The Ṛg Veda represents the thought of successive generations of thinkers, and so contains within it different strata of thought. We see in it the development of religious ideas from the animistic to the absolutistic stages. "Where is the sun by night?" "Where go the stars by day?" "Why does the sun not fall down?" "Of the two, night and day, which is the earlier, which the later?" "Whence comes the wind, and whither goes it?" These are some of the questions which harassed the mind of the early Aryan. His first efforts to answer them resulted in naturalistic polytheism. There is a deity which makes the strong wind to blow, the lightning to flash and the thunder to roll. While some of the chief Vedic deities like Indra and Varuṇa are completely emancipated from connection with the phenomena of Nature which originally suggested them, others like Sūrya (Sun) and Agni (Fire) are conceived on the lines of the actual phenomena whose names they bear. In some later hymns we have abstract deities which show no traces of connection with natural phenomena, as Prajāpati ("lord of creatures"), or personifications of pure abstractions, as S'raddhā (Faith), Manyu (Wrath). The conception of Varuṇa, the lord of physical and moral order, reaches a high level and is majestic enough both in its cosmical and ethical aspects. Varuṇa is the lord of *ṛta: ṛta* refers to the physical order in the universe, the order of the sacrifice and the moral law of the world. On account of *ṛta*, the sun pursues his daily, and the moon her nightly, journey across the sky and the silent procession of the seasons moves regularly in light and shadow, in cloud and sunshine across the earth. The doctrine of karma is a reformulation of this principle of *ṛta*.

When mythical conceptions from beyond the limits of the Aryan world belonging to a different order of thought entered into the Vedic pantheon sceptical tendencies developed. There were men who were harassed by the doubts "who is Indra? whoever saw him?" "To what god shall we offer our oblation?" (X. 121.) Some men were devoid of faith. An undercurrent of satire may be noticed in some of the hymns (RV IX. 112; X. 119; VII. 103).

Monotheism.—The crowding of gods and goddesses proved a weariness to the intellect. Attempts were made to identify one god with another or throw all the gods together. The close connection of the elements in Nature helped the growth of syncretism. An orderly system of Nature signified by the conception of *ṛta* has no room for miraculous interferences in which alone superstition and confused thought find the signs of polytheism. Besides, religious consciousness is naturally inclined to believe that the supreme is one. What is called henotheism or the worshipping of each divinity in turn as if it were the greatest and even the only god is the expression of the logic of religion. When the same functions of establishing the earth and sustaining the air and the sky are assigned to the different deities we tend to drop the peculiarities and make a god of the common functions. This becomes easy when the several gods are not clear-cut individuals but cloudy and confused concepts. The supreme is identified with Prajāpati (X. 85. 43, 184. 4, 189. 4), sometimes with Hiraṇyagarbha (X. 121), sometimes with Bṛhaspati (X. 72).

Monism.—Those dissatisfied with monotheism argue that there is one impersonal reality of which Agni, Indra, Varuṇa are the names or forms. "The real is one, the learned call it by various names." This one is the soul of the world, the reason immanent in the universe (X. 129. 2). "Priests and poets with words make into many the hidden reality which is but one." (X. 114.) Our minds seem to be satisfied with inadequate images of this reality, "the idols which we here adore."

Cosmology.—At the pluralistic stage the deities are looked upon as the authors of the universe who create it by a process of manufacture or organic development or through the power of the sacrifice (X. 123. 1). When we rise to the monotheistic level the one god creates the world with the help of pre-existent matter (X. 121). Sometimes the dualism of the creator and the pre-existent matter is overcome and God is said to create the world out of his own nature. In the *Puruṣasūkta* (X. 90) the world is produced by the gods from the sacrifice of a primeval *puruṣa* (person). This person is all that has been, is, and shall be. But the most advanced theory of creation is suggested in the *Nāsadīya* hymn (X. 129). It starts with the assertion that in the beginning there was neither being nor non-being, neither air nor sky, neither death nor immortality, neither night nor day. There was nothing else save the one which breathed breathless, of its own power. This is the poet's way of describing the primal unconditional ground of all being, which is beyond our categories. The third verse states that through the power of tapas (austerity), the first antithesis of being and non-being, the active energy and the passive matter is produced. Through desire (*kāma*), which is the germ of mind (*manasoretaḥ*), the rest of the development takes place. Desire, which is the sign of self-consciousness, is the bond binding the existent and the non-existent. We cannot say why the original being develops into an active creator and the passive chaos. The hymn concludes with an expression of doubt. Creation is a mystery. *Ko veda?* ("who knows?")

Future Life.—A healthy joy in life dominates the Ṛg Veda. The worshipper asks not for immortality or heaven but a long life for a full 100 years. There is belief in future life, a heaven for the good and a hell for the wicked. Reward follows righteousness and punishment misconduct.

THE UPANIṢHADS

The Upaniṣhads form the concluding portions of the Veda and are therefore called Vedānta or the end of the Veda. Their aim is not so much to reach philosophical truth as to bring peace and freedom to the anxious human spirit. They represent free and bold attempts to find out the truth without any thought of a system. Notwithstanding the variety of authorship and the period of time covered by them, we discern in them a unity of purpose and a vivid sense of spiritual reality. They are distinguished from the Vedic hymns and the Brāhmaṇas by their increased emphasis on monistic suggestions and subjective analysis as well as their indifference to Vedic authority and ceremonial piety.

Metaphysics.—*The Taittirīya Upaniṣhad* (III.) gives us an account of the gradual evolution of our ideas regarding the ultimate basis of things. The seeker tries to find out the one comprehensive principle from which "all things are born, by which they are sustained and into which they return at death." His first answer that matter (*annam*) is the basic principle is discarded in view of its inadequacy to vital phenomena. The second answer of life (*prāṇa*) is found unsatisfactory when sentient entities are considered. The third suggestion of mind (*manas*) is incapable of accounting for logical phenomena and the fourth formula of logical intelligence (*vijñāna*) cannot be regarded as the highest reality, since there are aspects of being which cannot be reduced to intellectual terms. Thought as ordinarily understood deals with objects viewed as beyond or other than the process of thinking. Reality can be reached in the state of highest immediacy which transcends thought and its distinctions, which is *ānanda* or bliss. Ānanda is Brahman.

Subjective Analysis. Ātman.—The *Chāndogya Upaniṣhad* (VIII. 3. 12) institutes an enquiry into the nature of the self. The body which is born, grows up, decays and dies cannot be the true self which persists throughout the changes of birth and death. The dreaming self, subject as it is to the accidents of experience, must not be confused with the true self. The self is not the unity of the evergrowing and changing mental experiences. The self in dreamless sleep cannot satisfy our need, since it is empty of all content and is a bare abstraction. The true self is said to be the universal consciousness existing both in itself

and for itself. The *Māṇḍūkya Upaniṣhad* observes that the three states of the soul—waking, dreaming and sleeping—are included in a fourth (turīya) which is intuitional consciousness, where there is no knowledge of objects, internal or external. It is the unchanged and persistent identity which continues in the midst of all change. It is the Ātman.

Brahman and Ātman are one. The inmost being of universal nature is the same as our innermost self. *Tat tvam asi:* "that art thou." The nature of this ultimate reality cannot be defined. It can be grasped, however, through intuition. This intuition is not objective like perceptual experience or communicable to others like inferential knowledge. We cannot give a formal exposition of it. To any suggested definition of reality we can only say, "not this," "not this" (*neti, neti.* Bṛh. IV. 2. 4). Contradictory accounts are given to show that negative descriptions do not mean negation of all being but only the poverty of intellect.

We cannot, however, remain long at this high level. We insist on framing intellectual pictures of the absolute. When the Ātman is identified with the self-conscious individual, Brahman is described as a personal being (*Īśvara*). When the Ātman is identified with the mental and the vital self, Brahman becomes the cosmic soul (*Hiraṇyagarbha*). When the Ātman is taken for the body, Brahman is taken for the cosmos (*Virāṭ*). Brahman is the sole and the whole explanation of the world, its material and efficient cause. The metaphors of the spinning of the web by the spider, the bearing of the child by the mother, the production of notes from musical instruments point to the oneness of Brahman and the world. There is, however, no logical deduction of the world of multiplicity from the ultimate cause. At the theistic level the world is regarded as the self-limitation of the supreme. The power of self-expression possessed by the personal *Īśvara* (God) is sometimes called *Māyā*.

The Doctrine of Māyā.—There is hardly any suggestion in the Upaniṣhads that the entire universe of change is a baseless fabric of fancy. The dominant note of pantheism goes against this view. The assertion of the sole reality of Brahman denies duality and traces all change to Brahman but does not suggest that change is illusion. The frequent emphasis on the oneness of the world and Brahman need not be repudiated as a mere concession to common-sense ideas. The texts which declare that the variegated universe is due to the development of name and form from out of the one Brahman warn us against getting lost in the world of multiplicity. The passing semblance of life is in no wise its immortal truth. The theory of the world-illusion is inconsistent with the conception of degrees of reality, or, to be more accurate, unreality which is found in the *Aitareya Āraṇyaka* (II. 3. 2 *et seq.*). When Yājñavalkya contends that duality is necessary for empirical consciousness and suggests that the world of duality is not real by the use of the particle *'iva'* (Bṛh. Up. II. 4. 14; IV. 3. 31), he refers to the non-ultimate character of the world of duality.

Ethics.—*Mokṣa* is release from the bondage to the sensuous and the individual. The morality of the Upaniṣhads is, in a sense, individualistic as it emphasises self-realization. The term "individualistic," however, ceases to have any exclusive meaning. To realize oneself is to identify oneself with a good that is not private to any one. Insistence on the knowledge of God (*jñāna*) is tempered by the recognition of the need for moral life.

When the moral striving ends in religious realization the individual is said to be freed from all moral laws. This does not mean that the free can do what they choose with perfect impunity. Laws and regulations are necessary for those who do not naturally conform to the dictates of morality. For those who have risen above the selfish ego and who have died to sin morality is the very condition of their being.

Those who have not reached the highest perfection will have other chances for striving. *Saṁsāra* offers a succession of spiritual opportunities. The hypothesis of rebirth is formulated in this period (Chān. V. 3. 10; Bṛh. VI. 2.), though there are still compromises with the Vedic views. Good and evil actions experience a twofold retribution, once in the other world and again by a renewed life on earth.

Moral striving is governed by the law of *karma*. Our life carries within it a record that time cannot blur or death erase. The soul that sinneth, it shall die. Though we cannot efface the results of our acts on the outer universe, its effects on us can be wiped away by strenuous exertion. *Karma* emphasizes individual responsibility. It is more favourable to self-culture and meditation than to prayer and petition.

In every sphere the Upaniṣhads indulged in inconsistent compromises with the Vedic views. The chaos of the Brahmanical religion reached its climax in the post-Upaniṣhad or pre-Buddhist period when truth hardened into tradition and morality stiffened into routine. The need for reconstruction was felt by the thinking minds.

II. THE EPIC PERIOD

The systems of materialism, Jainism and Buddhism, belong to the Epic period, which is the age of reconstruction.

Materialism.—Materialism is called *Lokāyata* (directed to the world), as it holds that only this world (*loka*) is real. According to it, perception is the only source of knowledge. Inference which assumes universal relations, testimony and analogy are all defective. Matter is the only reality, of which the elements are earth, water, fire and air. Consciousness is a function of matter. There are different opinions about the nature of the soul. It is identified with the gross body or the senses or breath or thought. There is no future life. As the soul is an attribute of the body, it comes into being when the body is formed by the combination of the elements even as the power of intoxication arises from the mixture of certain ingredients. When the body is destroyed the soul disappears. The world is born of itself. God is a myth which we accept—thanks to our ignorance and incapacity. Pleasure and pain are the central facts of life. Virtue and vice are conventions.

Jainism.—Vardhamāna (*c.* 599–527 B.C.), the founder of Jainism, is a slightly older contemporary of Buddha. He is said to have systematized the faith held by a succession of 23 other sages, of whom the chief was Pārśvanātha (*c.* 776 B.C.).

Theory of Knowledge.—Jainism assumes that truth is relative to our standpoints. The Jains are fond of quoting the old story of the six blind men who each laid hands on a different part of the elephant and tried to describe the whole animal. The man who caught the ear thought that the creature resembled a winnowing fan; the holder of the leg imagined that he was clinging to a big round pillar, and so on. It was he who saw the whole that perceived that each had only a portion of the truth. The doctrine of *nayas* brings out this relativity of thought. The most important application of this doctrine is the theory of *Syādvāda* or *Saptabhaṅgī*. Every proposition gives us only a perhaps, a may be, or a *syāt*. We cannot affirm or deny anything absolutely of any object, owing to the endless complexity of things. Being is not of a persistent unalterable nature. Every statement of a thing is necessarily one-sided and incomplete. If we take it as true and complete we make a mistake. There are seven different ways of speaking of a thing or its attributes according to the point of view. All things, *i.e.*, substances (*dravya*) are divided into lifeless (*ajīva*) and living (*jīva*). The former are again divided into (1), space (*ākāśa*), (2) and (3), two subtle substances called *dharma* and *adharma* and (4), matter (*pudgala*). Space, *dharma* and *adharma* are the necessary conditions for the subsistence of all other things, viz., souls and matter. Space affords them room to exist; *dharma* makes it possible for them to move or be moved, and *adharma* to rest. Time is recognized by some as a quasi-substance beside those mentioned. Matter is eternal though it may assume forms as earth, air and so on. It exists in the two forms of atoms (*aṇu*) and aggregates (*skandha*). The changes of the physical universe are traced to atomic aggregation and disintegration. The atoms are not constant in their nature but are subject to change or development (*pariṇāma*), which consists in their assuming new qualities. There are not different kinds of atoms answering to the different elements of earth, water, fire and air. Homogeneous atoms produce different elements by varying combinations. While things which we perceive are made of gross matter, there is matter beyond the reach of our senses in subtle form which is transformed into the different degrees of *karma*,

This kind of matter fills all space. The soul by its commerce with the outer world becomes literally penetrated with the particles of this subtle matter. *Karma* works in such a way that every change leaves a mark which is retained and built up into the organism to serve as the foundation for future action.

The characteristic essence of the soul is consciousness (*cetana*), which is never destroyed, however much it may be obscured by external causes. The souls are said to possess size, which varies with the nature of the bodies with which they happen to be connected. Subtle matter coming into contact with the soul causes its embodiment. Being then transformed into eight kinds of *karma* and forming, as it were, a subtle body, it clings to the soul in all its migrations. The individual soul (*jīva*) is a composite of consciousness and matter or body. Jainism believes that there are souls even in inorganic objects, though they lie dormant in them.

Jainism does not believe in God, though the souls can reach a divine status. The souls and the world are self-existent and eternal. The chief means to the end of *nirvāṇa* is the performance of austerities. By it we destroy the old *karma* and prevent the formation of the new. Right faith, right knowledge and right conduct are recommended. The peculiarity of the Jaina ethics is its insistence on avoidance of taking life of any kind.

Early Buddhism also falls within the Epic period, but is dealt with in the articles BUDDHA and BUDDHISM.

III. THE SIX SYSTEMS

The revolt of Buddhism and Jainism helped to bring about a critical point of view and led to the great movement of philosophy which produced the six systems of thought, where criticism and analysis take the place of poetry and religion. The different systems are not antagonistic but are complementary. They are regarded as an evolutionary chain, a single and gradually advancing series rather than as destructive of one another. Each of them is a metaphysics and a religion, an explanation of the world and a method of salvation.

THE NYĀYA

Logic as epistemology may be called a critical reflection on metaphysics. The *Vaiśeṣika*, which deals with the analysis of nature, is earlier than the *Nyāya*, which discusses the problem of knowledge; yet we start with the latter, as it gives the main logical principles assumed by the *Vaiśeṣika* as well.

Assuming that the account of the world which our minds afford us is, in the main, a trustworthy one, the *Nyāya* analyses the different ways in which our knowledge is acquired. They are said to be intuition (*pratyakṣa*), inference (*anumāna*), comparison (*upamāna*), and verbal testimony (*śabda*). Though *pratyakṣa* originally meant sense-perception, it soon came to cover all immediate apprehension whether through the aid of the senses or otherwise. It is knowledge whose instrumental cause is not knowledge (*jñānākaraṇakam jñānam*). In inference, comparison, etc., we require a knowledge of premises or of similarity, but such knowledge is not an antecedent condition of intuition. The word is used for the result or the apprehension of the truth as well as the process or the operation which leads to the result.

Sense-perception follows on the modification of the self produced by the contact of the senses with their objects. Two kinds of perception are distinguished, determinate (*savikalpaka*) and indeterminate (*nirvikalpaka*), which correspond roughly to knowledge about and acquaintance with an object.

Inference.—Inference operates "neither with regard to things unknown nor with regard to those known definitely for certain; it functions only with regard to things that are doubtful" (N. B. I. I. i.). It derives a conclusion from the ascertained fact of the subject possessing a property which is constantly accompanied by another. We ascertain that the hill is on fire from the fact that the hill has smoke and smoke is universally accompanied by fire. Inferential reasoning is stated in the form of a syllogism of which the five members are 1, proposition (*pratijñā*): the hill is on fire; 2, reason (*hetu*): because it smokes; 3, example (*udāharaṇa*): whatever shows smoke shows fire, *e.g.*, a kitchen; 4, application (*upanaya*): so is this hill, and 5, conclusion (*nigamana*): therefore, the hill is on fire. The first member states the thesis to be established. It is only a suggestion. It contains a subject or what is observed, which is generally an individual or a class, and a predicate which is to be proved. The subject is the minor term (*pakṣa, dharmin*) and the predicate the major (*sādhya, dharma*). The second member of the syllogism states the presence in the minor of the middle term called ground (*hetu*). The third takes us to the basis of inference, the major premise. Though Gautama and Vātsyāyana may not have regarded the example as the illustration of a general rule, later Nyāya looks upon it as the statement of an invariable concomitance between the mark and the character inferred (*vyāptipratipādikam vākyam*). The conclusion restates the proposition as grounded. Nāgārjuna is given the credit for dispensing with the last two members of the syllogism as superfluous.

Induction.—Universal propositions are reached through enumeration, intuition and indirect proof. Uninterrupted agreement (*nityata sāhacarya*) reinforced by absence of exceptions (*avinābhāvarūpasambandha*) leads to unconditional concomitances. Nature does not always supply us with positive and negative instances of the necessary type. In such cases indirect proof (*tarka*) may be used. By pointing out the absurdities in which we are landed, if we deny a suggested hypothesis, we indirectly prove its validity. Even when we observe all possible cases and strengthen our conclusion by indirect proof we cannot reach absolute certainty. Experience of sensible particulars, however thorough and exhaustive, cannot give rise to universal relations. Gaṅgeśa recognizes the nonsensuous (*alaukika*) activity involved in the apprehension of universals (*sāmānyalakṣaṇa*).

Causation.—A cause is that which invariably precedes the effect. It is not merely accessory to but is necessary for the production of the effect. Two things cannot be causally related unless there is the positive-negative (*anvayavyatireki*) relation between them, such that the presence of the cause means the presence of the effect and vice versa. Three different kinds of causes are distinguished, material (*upādāna*), non-material or formal (*asamavāyi*) and efficient (*nimitta*). The appearance of plurality of causes is traced to defective analysis. When the effect is understood in its uniqueness (*kāryaviśeṣa*) it will be seen to have only one cause.

Comparison.—By means of comparison (*upamāna*), we gain the knowledge of a thing from its similarity to another thing previously well known. Hearing that *gavaya* (wild ox) is like a cow, we infer that the animal which we find to be like the cow is the *gavaya*. This argument involves knowledge of the object to be known and perception of similarity. Comparison relates to the problem of identification.

The problem of *śabda* or verbal knowledge is mainly of theological interest. Certain questions of logical value are incidentally discussed. Regarding the import of words, the Nyāya holds that a word denotes an individual (*vyakti*), or a form (*ākṛti*) or a genus (*jāti*) or all these. It depends on our particular interest at the moment.

The validity of knowledge is not self-established but is proved by something else (*parataḥ pramāṇa*). If every cognition were self-evident there would be no possibility of doubt. We discover the truth of our ideas by the test of action.

Metaphysics.—The individual self is a real substantive being possessing the qualities of knowledge, feeling and desire and aversion. It is different from the body, the senses and the understanding. It is all-pervading though it does not cognize many things simultaneously on account of the atomic nature of *manas* or the inner sense. It is unique in each individual, and we have an infinite number of souls. The soul is an unconscious principle capable of being qualified by consciousness.

THE VAIŚEṢIKA

The system takes its name from *viśeṣa* or particularity. It is in the particulars of the world, pre-eminently in the particular imperceptible souls and atoms, that true individuality is to be found.

Categories.—The Vaiśeṣika adopts a sixfold classification of *padārthas* (objects which can be thought and named) into sub-

stance (*dravya*), quality (*guṇa*), movement (*karma*), generality (*sāmānya*), particularity (*viśeṣa*) and inherence (*samavāya*), to which later thinkers add a seventh, non-existence (*abhāva*). That something is, is the first principle; but nothing can *be* without possessing certain qualities. Some of the qualities reside in a plurality of objects, while others are confined to individuals. The former are general qualities (*sāmānya*), while the latter are distinguished into permanent (*guṇa*) and transitory (*karma*). Inherence is a special kind of relation distinct from occasional or separable conjunction. When the scheme became logical in scope non-existence was included. Later Nyāya develops this idea with great subtlety. The first three categories possess a real objective existence, while the other three are products of intellectual discrimination.

Atomic Theory.—The atomic theory is developed in connection with the substances of earth, water, light and air. The things that we experience are made up of parts. They are therefore non-eternal. Non-eternal has no meaning apart from eternal. The component particles are eternal. The atom marks the limit of division. If it were endlessly divisible, then material things would be products of an equally endless number of constitutent parts, and differences in the dimensions of things could not be accounted for. Though the atoms have no extension, their heterogeneous nature is the cause of the extension and visibility of the combinations of atoms. Though Kaṇāda is not clear about where the visibility of the combinations begins, his later followers suggest that an aggregate of three atoms (*tryaṇuka*), others of three double atoms, produces extension, and it is visible in the shape of the dust mote (*trasareṇu*) dancing in the sunlight. Answering to the four kinds of material objects—earth, water, light and air, we have four kinds of atoms producing the four senses of touch, taste, sight and smell. This is why each special sense reveals a single quality, however excited. Though the qualities of earthly things, as colour, taste, smell and tangibility, vanish on the destruction of the thing itself, they are always found in their respective atoms, though in earth and atoms of earth new qualities are produced by heat (*pākaja*). Water, light and air do not suffer a similar change. There can never come a time when there will be an utter annihilation of things. The atoms will abide for ever.

THE SĀṀKHYA

The *Sāṁkhya* is a reaction against the idealistic monism of the Upaniṣhads. It believes in a real matter and an infinite plurality of individual souls which are not emanations of a single world-soul.

The Sāṁkhya adopts the view that the cause and the effect are the undeveloped and the developed states of one and the same substance. Development is the coming to light of what is latent or hidden even as destruction is disappearance into the original cause. There is no such thing as utter annihilation. Applying this principle, the ultimate basis of the empirical universe is said to be *prakṛti* (nature). The world is the transformation of *prakṛti* (nature), which cannot be equated with any one of the stages of its evolution.

Prakṛti (nature) is a string of three strands or *guṇas, sattva* or potential consciousness, *rajas* or activity and *tamas* or restraint. They are called *guṇas* (qualities), as they are factors in the substance of *prakṛti* (nature). They represent different stages in the evolution of any particular phenomenon. *Sattva* signifies the essence or the form which is to be realized, *tamas* the obstacles to its realization, and *rajas* the force by which the obstacles are overcome. The *guṇas* are always changing, but when they are held together in a state of equilibrium (*sāmyāvastha*) there is no action. The tendencies to manifestation and activity are held in check by that of non-manifestation and non-activity. When the tension is relieved development results. *Prakṛti* (nature) evolves under the influence of *puruṣa* (subject) into the apparatus of thought as well as the objects of thought.

Theory of Evolution.—The first product of the evolution of *prakṛti* (nature) is *mahat*, "the great" or *buddhi* (intelligence). Self-sense (*ahaṁkāra*), or the principle of individuation, arises next. From this, in its *sattva* aspect, arise the *manas* (internal organ), the five organs of perception and the five of action; from the same in the *tamas* aspect the five fine elements (*tanmātras*) arise. The *rajas* element helps both. From the five fine elements, by a preponderance of *tamas*, the five gross elements are produced. The account is probably suggested by the subject's experience and transferred to a cosmic plane. In the state of dreamless sleep the self is present, though it does not apprehend the world. So, in the case of world dissolution, the selves are not distinguished and *prakṛti* (nature) is unperceived. When one wakes from sleep there is, first, the rise of consciousness, followed immediately by the sense of selfhood and the restlessness of desire. The senses begin to function until the world is perceived. This order is followed in the Sāṁkhya theory of evolution.

Plurality of Souls.—*Puruṣa* is the intelligent self, for whose experience *prakṛti* (nature) evolves. It is a mere witness, a solitary indifferent spectator. It is pure consciousness while *prakṛti* (nature) is unconscious. It is inactive, unalterably constant, and devoid of the *guṇas* while *prakṛti* is active, alterably constant and consists of them. *Prakṛti* and its products depend for their manifestation on the light of *puruṣa* (self), which does not depend on anything else for illuminating objects. The Sāṁkhya believes in a plurality of selves. If the self were one all should become free when one attained freedom, which is not the case. Freedom is not coalescence with the absolute spirit but isolation from *prakṛti*.

The empirical individual is not the pure self but the self distinguished by the conjunction of the senses, etc., and limited by the body. While the pure self remains beyond the intellect the reflection of the self in it appears as the ego. Activity belongs to the intellect, and on account of its union with *puruṣa* (self) the indifferent self appears as an actor. Though not an agent, the self appears as an agent through confusion with the agency of nature, even as the latter through proximity to the self appears to be conscious. Every ego possesses within the gross material body, which suffers dissolution, a subtle body formed of the psychical apparatus including the senses. This subtle body is the basis of rebirth as well as the principle of identity in the various existences.

The evolution of nature is adapted to the ends of the self. The spiritual centres are, however, incapable of exerting any direct influence on nature, though they are said to excite it to activity. The union of self and nature is compared to a lame man of good vision mounted on the shoulders of a blind man of sure foot.

The real self has relations with a real world on account of a fancied relation between the two. When the self recognizes its distinction from the ever evolving and dissolving world of nature the latter ceases to operate towards it. The efficient cause of the development of nature is not the mere presence of the selves but their non-discrimination. Freedom is the result of discrimination. No cause is assigned for the original entanglement of the free spirits in the bonds of ignorance.

THE YOGA

The Yoga differs from the Sāṁkhya in its insistence on mental discipline and acceptance of theism, though its connection with belief in God is somewhat loose. God does not create, reward or punish. Union with God is not the goal of Yoga endeavour. God is only a particular soul not essentially different from other souls co-eternal with him. He stands in an eternal connection with the most refined constituent of matter and is endowed with supreme power, wisdom and goodness.

Our bondage is due to non-discrimination. The true light of the spirit will shine if the obscuring mental activities are suppressed. The method of Yoga consists in the suppression of all mental activities, conscious as well as unconscious. The eightfold path is a means of it. The first two, *yama* (abstention) and *niyama* (observance), refer to the ethical preparation. The next two *āsana* (posture), *prāṇāyāma* (regulation of breath) insist on the discipline of the body so as to make it flexible. We can control involuntary muscles as well by the breathing exercises. The next step of *pratyāhāra* or the withdrawal of the senses from their natural outward functioning answers to what modern psychology calls introversion. While these five are only accessories, *dhyāna* (fixed attention), *dhāraṇa* (contemplation), and *samādhi* (concentration) are integral elements of Yoga. Through concentration we get into direct touch with the reality of the things and obtain

intuitional knowledge. The process of concentration is to be continued until the mind is dissolved and self illumination results. *Samādhi* is the perfect life of spirit.

THE PŪRVA MĪMĀṂSĀ

The Pūrva Mīmāṁsā has for its special object the ascertainment of duty (*dharma*). It is not a philosophical system, though it refers to philosophical topics incidentally. It believes in the reality of the world and the individual souls. As it deals with ritual specially, it points out how every act produces its effect sometime or other through the principle of *apūrva* or the link between the act and the result. While the earlier writings do not admit the existence of God, the later ones do.

A chief writer of this school, Kumārila argues for the theory of self-evidence (*svataḥ pramāṇa*). Truth is its own guarantee. Cognitions are by themselves valid and their validity can be set aside only by the contrary nature of their objects or by the recognition of discrepancies in their causes. When we are in doubt about the true nature of a thing perceived at a distance or in faint light, we can resolve the doubt by a second cognition obtained under improved conditions. Even in the most difficult cases we can obtain an absolutely true cognition after a series of three or four. Correspondence and coherence theories do not produce validity but only test it.

THE VEDĀNTA

The *Vedānta Sūtra* attempts to set forth the teachings of the Upaniṣhads in a consistent way. Its short aphorisms are unintelligible by themselves. Many different systems ranging from pure non-dualism to explicit dualism attempt to interpret the *Sūtra*. The chief of them are those of Śaṁkara, Rāmānuja and Madhva.

Śaṁkara's Non-Dualism (Advaita).—Śaṁkara in his system asks whether there is anything in experience which may be regarded as foundational and discusses the claims of the different factors of experience to that title. Our senses may deceive us and our memory may be an illusion. The waking tracts may not be different from dream worlds, where also we visit places, handle shadows, and battle with ghosts. Though all objects of experience may be open to doubt, there is something which is beyond all doubt. Every one is conscious of the existence of one's own self and no one thinks "I am not." The self cannot be doubted or denied for "it is the essential nature of him who denies it." Though we cannot know it by thought, it does not entirely escape us. It is the object of the notion of self (*asmat-pratyayaviṣaya*) and is known to exist on account of its immediate presentation (*aparokṣatvāt*). This self is distinct from the body, the senses, and the understanding. It is the principle of consciousness which is unaffected when the body is reduced to ashes and the mind perishes. It is one, universal and infinite.

Logical knowledge based on the distinction of subject and object is not final. The real excludes all relations, but logical knowledge is relational in character. The real simply *is*, but we attempt to characterize it in knowledge and no predicate is found adequate to it. In judgment, we equate the real with the unreal, the subject with the object. We attribute to the Ātman activity, agency and enjoyment. All our knowledge is strictly speaking non-knowledge (*avidyā*). The ascertainment of the ultimate reality by the exclusion of all that is imposed (*adhyasta*) on it is wisdom (*vidyā*). *Avidyā* is another name for our finitude. When its roots are cut our bondage is broken. Śaṁkara admits the reality of intuitional consciousness where the distinctions of subject and object are superseded.

Śaṁkara adopts the distinction between truth (*parāvidyā*) and empirical truth (*aparāvidyā*). The latter is not illusory or deceptive but only imperfect or relative. The empirical world is not self-existent or real. Yet there must be a reality on which it rests. Even if we regard the whole universe as merely imaginary there must be something which is the basis of all imagination. That reality is Brahman. As it is opposed to all empirical existence, it is given to us as the negative of everything that is positively known. We cannot even call it one (*ekam*). It is to be called non-dual (*advaitam*). It is the wholly "other" but not non-being. When we are not content with such negative accounts we describe it as the personal God (*Īśvara*). God is the absolute cast through the moulds of logic.

Doctrine of Māyā.—Every object in the world tends to pass away from itself to something else. The categories of time, space and cause which bind experience are self-contradictory. Our knowledge of the world is inconsistent. When intuitional experience arises the pluralistic universe is sublated. The term *māyā* registers the imperfection and relativity of the world. It does not mean that the world is a mere illusion. Śaṁkara's refutation of Buddhistic subjectivism is decisive on this question. While he traces the world to *avidyā* (ignorance) he takes care to point out that this ignorance is cosmic in character. The phenomenal self and the phenomenal world are mutually implicated facts. The mind with its categories on the one side and the world which it construes through them on the other hang together.

We cannot conceive the relation between the world and the absolute. The question of relation has meaning only if we have two "distincts," but the world is not distinct from Brahman. The finite is the infinite hidden from our view through certain barriers. When we intuitively recognize the absolute the relative disappears; when we discuss about the relative there is no absolute to which it has to be attached. The problem arises on account of a confusion of standpoints. If Brahman is to be viewed as the cause of the world it is only in the sense that the world cannot be explained apart from Brahman, though the latter is in no way touched by the world of appearance. Brahman is the basis of the apparent existence of the world (*vivartopādāna*).

The individual soul is different from the Ātman. Its divine nature is concealed by the external adjuncts (*upādhis*) of the sense organs and vital airs which form the subtle body. These, together with *karma*, accompany the soul in its migrations. *Mokṣa* or salvation is the lifting of the veil of ignorance which conceals from the soul the truth that it is and always has been one with Brahman. The road to realization lies not through something done or accomplished but through knowledge or the sweeping aside of the delusive veil of ignorance. Śaṁkara is clear that this insight cannot be attained without the discipline of moral life. Insight is not so much an answer to a riddle as a victory in a battle.

Rāmānuja's Theism.—Rāmānuja endeavours to show that the God of religious faith is not the unconditioned abstraction of Śaṁkara but a personal being whose reality need not be doubted simply because our knowledge of him is imperfect. The sense of personal communion with God involves a real fellowship with an other. The supreme Brahman has internal differences (*svagata-bheda*). Souls and matter are comprehended within the unity of the supreme as attributes to the substance or parts to a whole or body to the soul which animates it. Though attributes of God, souls and matter are in themselves substances possessing qualities with their own distinct modes, energies and activities. Souls, matter and God are different on account of their natural differences (*svarūpabheda*) but one on account of their identity (*aikyam*) of the modes and substance. Identity means only inseparable existence (*apṛthaksiddhi*).

For Rāmānuja, causation is only an alteration of state. The creation of the universe from Brahman is not a production of something new but only a change of condition. It is a modification of that which is subtle into that which is gross. In the causal condition Brahman has for his body or mode the conscious (*cit*) and unconscious (*acit*) entities in their subtle form, while in the effect condition they are in a gross form.

Rāmānuja does not accept the explanation of the world and of the individual souls as mere productions of ignorance enveloping the nature of Brahman. If the multiplicity is due to human ignorance, then there should be no such world for God. But Scripture tells us of God's creation, etc., which means that God reckons with the world of multiplicity. We cannot regard the world as unreal, like the mirage, for while the activity prompted by the latter is unsuccessful, that based on the knowledge of the objects is successful. The reality of the world established by perception cannot be sublated by Scripture as the spheres of perception and Scripture are different. Simply because objects do not persist we can-

not conclude that they are unreal.

While for Śaṁkara, freedom consists in the removal of a barrier and the entering into the secure realization of a permanent and inalienable truth, for Rāmānuja, it is communion with God to be reached by devotion and faith. The individual is not effaced when the goal is reached but maintains his self-identity and enjoys the fruit of his faith in unending felicity.

Madhva's Dualism.—Madhva stands out for unqualified dualism and insists on the five great distinctions of God and soul, God and matter, soul and matter, one soul and another and one part of matter and another. Reality is of two kinds, independent (*svatantra*) and dependent (*paratantra*). God is the only independent reality; matter and souls are dependent. God controls souls and matter though he does not create or destroy. He is the efficient but not the material cause of the universe. Though absolutely dependent on Brahman, the individual souls are essentially active agents and have responsibilities to bear. While God is all-pervading, the souls are said to be of atomic size. They yet pervade the body on account of the quality of intelligence. No two souls are alike in character.

This brief sketch of Indian philosophy indicates the main lines of a singularly manifold philosophic development. It has been impossible to touch in this article on all the special points of interest or doctrinal variations. For these the student must consult special articles and treatises.

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(S. RA.)

INDIAN PIPE (*Monotropa uniflora*), a saprophytic herb of the family Pyrolaceae, allied to the heaths, called also corpse-plant, American ice-plant and ghost-flower, found in moist, rich woods almost throughout temperate and warm North America and also in the Himalaya mountains and Japan. It is a smooth waxy-white plant, of unusual appearance, which grows on decaying vegetable matter and is somewhat parasitic on roots. The erect, usually clustered stems, 4 in. to 10 in. high, bear small scales representing leaves and terminate in a single nodding flower, about 1 in. long, blossoming from June to August, followed by a many-seeded capsule which becomes erect in ripening. Occasionally the flower, or more rarely the whole plant, has a pinkish or reddish tinge. All parts of the plant turn blackish in drying. There are two other species of the genus, both north temperate, one of which, *M. Hypopytis*, the yellow bird's-nest or pine-sap, with flowers in a drooping cluster, widely distributed in Europe, Asia and North America, occurs in the British Isles.

INDIANS, NORTH AMERICAN: *see* NORTH AMERICA: *Ethnology*.

INDIAN SUMMER, a season of several weeks duration in late autumn in the United States characterized by a calm translucent atmosphere and mellow sunshine, in sharp contrast to climatic conditions which precede and follow it, especially in the northeastern States and the Mississippi valley. The haziness in the atmosphere is attributed to the smoke and dust floating in the still dry air, which absence of wind and rain makes possible. Indian summer is preceded by squaw winter, a cold spell when the thermometer first dips below the freezing point.

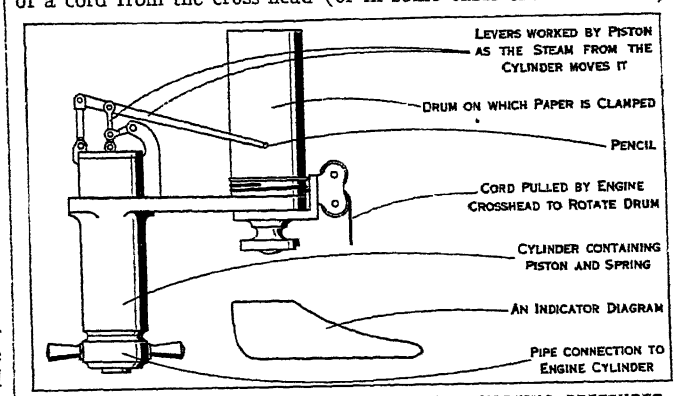
INDIA OFFICE: *see* GOVERNMENT DEPARTMENTS.

INDIA-RUBBER: *see* RUBBER.

INDICATOR. Many kinds of apparatus are included under this name, which, in general, implies a device to reveal conditions not otherwise apparent to the eye or hearing. Thus depths in a tank are indicated by a float, either showing a rod above, or moving a chain over a pulley and sliding a pointer down the outside. The depth of a cage in a mine is revealed at the winding-engine by a huge dial marked with figures, or in electric winders on a vertical scale with pointers travelling up and down. A scale is used to indicate the radius of a crane jib. Big dials on rolling-mills show the distance apart of the rolls in inches and fractions.

Some machines have indicators to signify when a certain quantity of work has been turned out. In others a bell rings when an automatic mechanism has used up a supply of raw material. A danger signal may be given by a bell in case of excess temperature. The copious forced oil-supply for the massive bearings and pinions of a rolling-mill has an alarm bell that rings should the circulation fail. A *gas leak indicator* is a very sensitive instrument, which will instantly show the presence of gas by the moving of a hand on a dial. Direction of movement is shown on some indicators where risk might arise through a misunderstanding on this point. A *speed indicator* is a small instrument with a point to press against the end of a shaft, or a roller against a rim, to show the speed; or it is a permanently fixed apparatus to indicate a rotational speed of an engine or machine, or the travelling speed of a vehicle. A *test indicator* is used in machine-tool practice. It magnifies the movement of a button-ended spindle to make records in thousandths of an inch on a dial; very fine deviations from truth are thus indicated in the parts of machines or work, or differences in thicknesses of components can be rapidly gauged in a sort of caliper, one anvil of which is at the end of the indicator spindle.

The pressure in the cylinder of a steam or explosion engine, or in a pump, compressor, or hydraulic machine, is ascertained with an indicator. This has a rotating drum turned by the pull of a cord from the cross-head (or in some cases the crankshaft)



STEAM ENGINE INDICATOR, USED TO TRACE THE VARYING PRESSURES IN AN ENGINE CYLINDER AND ENABLE THE HORSE-POWER TO BE CALCULATED

of the engine. Paper is wrapped round the drum, and a pencil connected by levers to a piston in a small cylinder traces a diagram on the paper as the drum turns. A spiral spring of known strength is placed above the piston and the cylinder is connected by a pipe to the engine cylinder. The varying pressures in the latter therefore affect the pencil accordingly. The diagram is measured to ascertain the mean effective pressure, and from this the I.H.P. (indicated horse-power) can be calculated. Refined developments have taken place in indicators for high-speed engines, including electrical recording, and optical types, which latter

use a beam of light, tracing a diagram on a photographic plate.

INDICATORIDAE: *see* HONEY-GUIDE.

INDICATORS, in chemistry, are substances which are used, in virtue of colour changes which they undergo, in order to show when a certain reaction has reached completion, or to give information as to the acidity of a solution (*see* also CHEMISTRY: *Analytical*). Thus, if a solution of a neutral chloride is being titrated with silver nitrate, a few drops of potassium chromate solution are added; as soon as all the chloride has been precipitated as silver chloride, the next drop of silver nitrate will form silver chromate (which is much less insoluble than silver chloride, but still fairly insoluble), and the precipitate will assume a faint reddish tinge whilst the liquid acquires a dull colour in place of the clear golden-yellow tint.

The indicators in general use may be divided into two classes (*a*) internal, and (*b*) external; for convenience, a large number of internal indicators used for determining acidity are dealt with as a separate class in HYDROGEN ION CONCENTRATION.

The potassium chromate in the above example is an internal indicator, because it is added to the solution undergoing titration with which it does not interfere. In titrating a solution of a ferrous salt by potassium dichromate, a very dilute solution of potassium ferricyanide is a useful indicator, but this has to be used externally, because, not only would it interfere chemically with the titration if used internally, but its colour changes could not be seen in the deep green solution. A drop of the titrated fluid is therefore withdrawn on a glass rod from time to time and mixed with a drop of the indicator solution on a white tile. As the titration approaches completion, the deep blue precipitate produced by the early drops gives place to a deep blue coloration, then pale blue, then green, then a slight dirty green, and finally no change at all, thus showing that the last trace of ferrous salt has been oxidized.

(*a*) Further examples of internal indicators are ferric alum in the titration of silver salts by thiocyanates (red coloration produced by the first drop in excess); starch solution in all iodometric titrations (blue while the least trace of iodine is present); methylene-blue in titrations with Fehling's solution (decolorized as soon as all the latter solution is reduced); diphenylamine, with phosphoric acid, in dichromate–iron titrations (purplish-blue with first drop of dichromate in excess); potassium thiocyanate in iron–titanous chloride titrations (red whilst any ferric iron remains).

(*b*) Other external indicators are uranyl acetate in the titration of zinc salts by phosphates (brown precipitate as soon as the latter is in excess); potassium ferrocyanide in the titration of phosphates by uranyl acetate (brown precipitate with slightest excess); potassium iodide and starch in titrations involving nitrites or Fehling's solution (blue with a trace of either); ferrous thiocyanate with Fehling solution titrations (red until all the Fehling solution has been reduced); tannin solution in the titration of lead salts by ammonium molybdate (brownish-yellow colour with excess of the latter). (A. D. M.)

INDICTION, a period or cycle of 15 years, the origin of which is obscure. It is thought to have originated in Egypt in A.D. 312, the year of the defeat of Mascentius. The assessment and dating of Roman tax censuses took place every 15 years (the "indiction" period), and became a recognized form of reckoning during the Middle Ages, particularly in Ecclesiastical affairs. *See* CHRONOLOGY and EGYPT.

INDICTMENT, in English law, a formal accusation in writing laid before a grand jury and by them presented on oath to a court of competent jurisdiction. The accusation is drawn up in the form of a "bill" of indictment, prepared by the officer of the court or the legal adviser of the prosecution, engrossed on parchment or durable paper, and sent before the grand jury. The grand jury hear in private the witnesses in support of the accusation (whose names are endorsed on the back of the bill), and, if satisfied that a *prima facie* case has been made out, find the bill to be a true bill and return it to the court as such. If otherwise, the jury ignore the bill and return to the court that they find "no true bill." Indictments differ from presentments, which are made by the grand jury on their own motion and their own knowledge; and from informations, which are instituted on the suggestion of a public officer without the intervention of a grand jury.

An indictment lies for "all treasons and felonies, for misprision of treasons and felonies and for all misdemeanours of a public nature at common law." And if a statute prohibit a matter of public grievance or command a matter of public convenience all acts or omissions in disobedience to the command or prohibition of the statute are treated as misdemeanours at common law, and unless the statute otherwise provides are punishable on indictment. In other words, the ordinary common law remedy in respect of criminal offences is by indictment of the accused and trial before a petty jury; and except in the case of informations for misdemeanour and summary proceedings by a court of record for "contempt of court" it is the only remedy, except where a statute creates another remedy, *e.g.*, by trial before a court of summary jurisdiction.

Until the mitigation of the draconic severity of the English law in the early part of the 19th century, little or no power existed of amending defective statements or indictments, and the courts *in favorem vitae* insisted strictly on accurate pleading and on proof of the offences exactly as charged. Since 1827 numerous enactments have been passed for getting rid of these technicalities, which led to undeserved acquittals, and from 1851 the courts had power to disregard technical objections to the form of indictment and to amend in matters not essential in case of variance between the indictment and the evidence.

The difficulties and technicalities of criminal pleading were finally dealt with by the Indictments Act 1915, which made rules as to indictments and set up a rule committee under the lord chief justice having power to vary or annul the rules in the statute and make further rules germane to the subject.

By that act it was provided (s. 3) that "every indictment shall contain, and shall be sufficient if it contains, a statement of the specific offence or offences with which the accused person is charged, together with such particulars as may be necessary for giving reasonable information as to the nature of the charge." Again, by s. 4, "subject to the provisions of the rules under this act, charges for more than one felony or for more than one misdemeanour, and charges for both felonies and misdemeanours, may be joined in the same indictment, but where a felony is tried together with any misdemeanour, the jury shall be sworn and the person accused shall have the same right of challenging jurors as if all the offences charged in the indictment were felonies."

Power is given before or at any stage of the trial to amend a defective indictment, if it can be done without injustice; to order the separate trial of separate offences if the accused would be prejudiced or embarrassed; or to postpone a trial for amendment or separate hearing. By the Vexatious Indictment Act, 1859 (save as therein excepted), no bill of indictment can be presented to the grand jury for the numerous offences to which it applies, unless (a) the person presenting it has been bound by recognizance to prosecute or give evidence; or (b) the accused has been committed to or detained in custody or has been bound by recognizance to answer the indictment; or (c) unless it is preferred by the direction or consent of certain high legal authorities. The act has since been extended to other offences.

In Scotland the terms indictment or criminal letters are used to express the *acte d'accusation*. But except in the case of high treason there is no grand jury, and the indictment is filed like an English criminal information by the lord advocate or one of his deputies: and it is only by order of the court of justiciary that a prosecution can be instituted without the general assent of the lord advocate. By the Criminal Procedure Scotland Act 1887 the form of Scots indictments is much simplified. (X.)

United States.—As a general rule, the indictment must charge but one crime and in one form, but the crime may be charged in separate counts to have been committed in a different manner or means; and where the acts complained of may constitute different crimes such crimes may also be charged in separate counts.

The form of the indictment varies more or less in the different States, because of particular constitutional or statutory

provisions. In many States the form is prescribed by statute, the object of which is to simplify the form and to do away with the strictness formerly required by law.

Since an indictment is a finding by the grand jury upon oath, and depends, for its validity, upon that fact among others, it could not, until recent times, be amended by the court without the concurrence of the grand jury that presented it. Under modern statutes, however, mistakes in the statement of time or in the name or description of any place, person or thing, may, in the discretion of the court, be cured by amendment at the trial upon such terms as the court may deem reasonable.

So, under modern statutes, an indictment is good if the crime charged is stated with such a degree of certainty as to enable the defendant to prepare his defence and the court to pronounce judgment, upon conviction, according to the rights of the case and to prevent a second prosecution for the same offence. It is not regarded as insufficient by reason of any imperfection in matter of form, which does not tend to the prejudice of the substantial rights of the defendant upon the merits.

The U.S. Constitution declares that "No person shall be held to answer for a capital or otherwise infamous crime, unless on presentment or indictment of a grand jury." This provision applies only to prosecutions in the Federal courts. But, in many of the State Constitutions, there is a similar provision applying to prosecutions in the courts of such States. Under such a constitutional provision an indictment is absolutely essential to the jurisdiction of the court to try the offender, and the accused cannot even waive the benefit of the provision by consenting to be tried without such. The court of appeals of the State of New York has recently held that a statute, which purports to permit one charged with a capital or otherwise infamous crime to plead guilty without an indictment having first been found against him, is unconstitutional as violative of the Constitution of that State.

But where the Constitution does not require an indictment, there is nothing to prevent the legislature from providing for prosecution of all crimes, even capital, by some other mode of accusation; as, *e.g.*, by information, which is a written accusation of crime preferred by the prosecuting officer without the intervention of a grand jury. And, in some States, such statutes have been enacted. (J. H. Ba.)

"INDIES, LAWS OF THE," in the colonial history of Spain, a general term for (1) certain codes for the colonies listed below, and especially the compilation of 1680; or (2) the whole body of colonial law, made up of a multitude of royal *cédulas*, orders, letters, ordinances, provisions, instructions, *autos*, dispatches, pragmatics and laws—all emanating from the crown (or crown and *cortes*) and all of equal force—that were passed through to officers and branches of the colonial administration, or between the departments of government in Spain. The transfer of Spanish law to *Ultramar* began with the Conquest; and especially the civil law was translated with comparatively slight alteration. Many things, however, peculiar to colonial conditions—the special relations of the crown and the papacy in America, the "divisions of lands" and "commendations" (a system of patronage, or modified slavery) of the Indians, the development of African slavery, questions of natural and international law, the spread of discovery and administrative areas, the sales and grants of public lands—necessitated organizing the general doctrine and a vast quantity of administrative applications, into a body of special law. The general doctrine was applicable everywhere in *Ultramar*, and difficult and inconstant communication and other considerations early counselled some codification. This was begun in Mexico in 1525; a volume was published in 1563, and other inadequate compilations in 1596 and 1628, finally the great *Recopilación de Leyes de los Reinos de las Indias* of 1680. This code has received even extravagant praise. But its minute administrative strangulation of colonial political life and its monopolistic economic principles were serious defects. Two centuries in formation, the code of 1680 was only one century in effect; for in the 1760's Charles III. began to break down the monopolistic principles of colonial commerce. This came too late to save the mainland colonies in America, but it aggrandized Cuba. It is there (also in Porto Rico and the Philippines) that the later history of the Laws of the Indies (*see* Cuba) are to be found.

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INDIFFERENTISM in philosophy has several partly disconnected and partly opposed meanings. (1) In Scholastic Logic it means the view that objects are neither particular only nor universal only, but are indifferently particular or universal according to the point of view from which they are regarded. This view was held by Adelard of Bath (about 1200) and others. (2) In the history of ancient philosophy "indifferentism" is used to denote the view common to the Stoics, Sceptics and Cynics, that all things are a matter of indifference except virtue, which is the only thing that has intrinsic worth. (3) Sometimes the term is employed to indicate the view that nothing has any intrinsic value, not even the moral life, all things being essentially "indifferent," that is asciologically neutral.

INDIGEN, the horticultural term applied to a plant species or form which originated in a natural habitat in distinction from cultigen (*q.v.*), a plant form originated in cultivation.

INDIGO, one of the most important and valuable of all dyestuffs, until about 1890 was obtained entirely from plants, mainly those of the genus *Indigofera* (Leguminosae) of which the *I. sumatrana* and *I. arrecta* have been most important, though in China the *Polygonum tinctorium*, and in West Africa the *Lonchocarpus cyanescens* find use for this purpose. In Europe, to the middle of the seventeenth century, the woad plant *Isatis tinctoria* was entirely used for the application of indigo to textile fabrics. Owing to the lower cost of the synthetical dye, natural indigo for export is now manufactured in but small amount, and almost entirely in Bengal. The plant, which is reared from seed sown in April, is cut down in June, a second crop being obtained therefrom in August. The indigo-yielding principle, present mainly in the leaf, is the glucoside *indican*, $C_{14}H_{17}NO_6.H_2O$, which is readily soluble in water. This, by the action of an enzyme also present in the plant, is transformed into glucose and *indoxyl*, C_8H_7NO, and the latter (also colourless), in contact with air, becomes oxidized with the production of indigo, $C_{16}H_{10}N_2O_2$ (*see* Glucosides, Natural).

The plant is cut early in the morning and at once transported to the factory. Here it is steeped in water for 9–14 hours in large vats, when, under the joint influence of the enzyme and of bacteria, the indican is transformed into indoxyl. The extract is now transferred to "beating" vats, which lie at a lower level, and is there submitted to intimate contact with air, employing a paddle (or so-called "beating") wheel, or a steam injector. Conversion of the indoxyl into indigo thus occurs, which settles and is collected, boiled with water, well drained, pressed into moulds, and dried at the ordinary temperature. Though the introduction of more scientific methods into the manufacture of the natural product has effected various improvements, this industry has continued to decline, and is now of minor importance. (*See* also Dyes, Synthetic.) (A. G. P.)

INDIGO-BIRD (*Cyanospiza cyanea*), a summer visitant in U.S.A. from the Missouri to the Atlantic. It extends into the provinces of Ontario and New Brunswick, being everywhere regarded with favour. The adult cock is of a deep blue nearly all over, changing, according to the light, to green. The hen is brown above and ochreous-white beneath.

INDIUM, a soft malleable metal about as heavy as tin. Chemically it is an element (symbol In, atomic number 49, atomic weight 114.8) included in the periodic group containing aluminium, gallium and thallium (*see* Periodic Law). It melts at 155° C and vaporizes above 1,450° C. Its specific gravity is 7.2 to 7.42 and its specific heat 0.05695. Indium was discovered in the zinc blende of Freiburg in 1863 by F. Reich and Th.

Richter, who detected in the spectroscope the strong indigo-blue line (λ 4,511) in its spectrum (Latin, *indicus*, Indian; *cf.* indigo). It is one of the very rare elements, occurring only in small quantities in zinc blende. It is best obtained from commercial metallic zinc, which contains small amounts of indium, by treating the metal with insufficient hydrochloric acid for complete solution, whereby indium is precipitated on the undissolved zinc. The metallic residue is dissolved in nitric acid, the solution evaporated with excess of sulphuric acid and treated with ammonia, when indium and iron hydroxides are precipitated. These hydroxides are redissolved in hydrochloric acid and boiled with excess of sodium bisulphite, when basic indium sulphite is precipitated. These processes are repeated to obtain pure indium sulphite. Indium is also separated from a mixture of anhydrous chlorides by addition of alcoholic pyridine, when the complex salt $InCl_3.3C_5H_5N$, is precipitated.

Indium oxide, In_2O_3, a yellow powder formed by igniting the hydroxide, is readily reduced on being heated with carbon or hydrogen. The hydroxide, $In(OH)_3$, a gelatinous precipitate thrown down by adding ammonia to any soluble indium salt, is readily soluble in caustic soda or potash but not in ammonia. Three chlorides are known: (1) The trichloride, prepared by the action of chlorine on the metal or of chlorine and carbon or sulphur on the oxide, is a soluble deliquescent salt; its vapour density corresponds with $InCl_3$. (2) The dichloride, $InCl_2$ (vapour density normal at 1,300° C), prepared by the action of hydrogen chloride on the metal. (3) The dark red monochloride, InCl (vapour density normal at 1.100° C), obtained by distilling the dicloride over sodium. The di- and mono-chlorides are both decomposed by water to give the trichloride and indium.

The salts of indium correspond in type with the trichloride; among them are the indium alums, $R.In(SO_4)_2,12H_2O$, where R is NH_4, Rb or Cs. Indium sulphide, In_2S_3, is obtainable by direct combination of indium and sulphur as an infusible red mass, or as a yellow precipitate on passing sulphuretted hydrogen into a solution of an indium salt; it dissolves in concentrated acids. Indium acetylacetone, $In(C_5H_7O_2)_3$, colourless prismatic crystals, melts at 186° C and sublimes with partial decomposition. It exhibits isomorphous relationships with the acetylacetones of aluminium, gallium, iron and scandium (G. T. Morgan, H. D. K. Drew and T. V. Barker, 1921) and is obtained by dissolving freshly prepared indium hydroxide in acetylacetone.

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INDIVIDUALISM, in political philosophy, the theory of government according to which the good of the State consists in the well-being and free initiative of the component members (Lat. *individualis*, that which is not divided, an individual). From this standpoint, as contrasted with that of the various forms of Socialism (*q.v.*) which subordinate the individual to the community, the community as such is an artificial unity. Individualism is, however, by no means identical with egoism, though egoism is always individualistic. An individualist may also be a conscientious altruist: he is by no means hostile to or aloof from society (any more than the Socialist is necessarily hostile to the individual), but he is opposed to State interference with individual freedom wherever, in his opinion, it can be avoided. The practical distinction in modern society is necessarily one of degree, and both "Individualism" and "Socialism" are very vaguely used, and generally as terms of reproach by opponents. *See* ANARCHISM; CAPITALISM; ECONOMICS; SOCIALISM.

INDIVIDUALITY. The individuality of organisms is a difficult problem of scientific philosophy. The common view is that each obviously separate organic entity is an individual—man, cow, beetle, oak-tree, cabbage. But difficulties arise when we take lower organisms into account, and look deeper into life-history. Many animals such as polyps form colonies whose members are attached to a common living stem. All gradations occur between single polyps, those forming temporary colonies by budding, and those with permanent colonies. In permanent colonies, all members may be alike, or there may be division of labour among different types. In extreme cases the colony behaves as a single unit (Portuguese man-o'-war and other Siphonophora), the members being entirely subordinate. (*See* COELENTERATA.)

The units of the colony are here themselves compound, consisting of many cells: but a parallel series occurs with single-celled units. The Protozoa (*q.v.*) are typically single, free-living cells. A number are colonial, and a few colonial forms (e.g., *Zoothamnium*) exhibit division of labour, one or two (e.g., *Volvox*) being co-ordinated to move as wholes. The same type of problem, but in exaggerated form, arises in regard to symbiotic organisms. (*See* SYMBIOSIS.) What we call a termite is an obligatory partnership between an insect, the termite proper, and protozoan inhabitants of its intestine which digest wood for the partnership. A lichen (*q.v.*) is a compound of a fungus and a green alga.

Equal difficulties arise with regard to reproduction and regeneration. All organisms are part of a continuous stream of life, the offspring taking origin from a piece of living substance detached from its parent or parents. The individual can therefore never be sharply delimited from the stream of life, any more than an eddy from the river. In higher animals each fertilized egg normally gives rise to a single organism; but exceptionally it divides, wholly or partially, during early stages. When it divides completely, so-called "identical" twins result; common-sense calls these two individuals. But all gradations are found between this condition, slight union as in the Siamese twins, intimate union, and various states of partial doubling. Similar partial and total duplications can be artificially produced in lower organisms. (*See* REGENERATION; EXPERIMENTAL EMBRYOLOGY.)

Hitherto we have been implicitly considering the organism as stable; but in reality no organism is at all stable—even the longest-continued adult stage is but part of a changing life-cycle. We are accustomed to think of ourselves as the same individual which we were as a child, and to extend this identity backwards to embryo and egg. This is legitimate, but involves a rather new conception of individuality. The individual thus viewed ceases to be a static *being;* it is rather, as Le Dantec says, a *history.* What breaks in this history suffice to justify us in saying that a new individual has arisen? In higher animals there are no very abrupt changes from egg through embryo to adult. In frogs the change at metamorphosis (*q.v.*) is so violent that two states receive different names—tadpole and frog. In higher insects, the organs of the grub are actually broken down during pupal life, and those of the adult arise from rudiments previously dormant. In sea-urchins the adult arises as a separate lateral rudiment in the late larva; and in Nemertina (*q.v.*), the bulk of the larva is actually thrown off at metamorphosis.

We generally call such cases transformations of a single individuality; but there is no hard line to be drawn between them and other cases, *e.g.*, liver-flukes (*see* TREMATODA), whose life-cycle consisted of a whole succession of forms, which here we usually style separate individuals. Finally, there are difficulties concerned with dedifferentiation (*q.v.*). A sea-squirt such as *Clavellina* dedifferentiates to an opaque simply-constructed mass, then redifferentiates to a normal *Clavellina.* Is it the same individual, or a new one?

In plants, difficulties are even greater, since often there is no definitely shaped body, but only a tangled felt of filaments, *e.g.*, some Algae, most fungi. Mushrooms are only fructifications; the plant's vegetative business is performed by a subterranean felt-work of wholly irregular construction. Even in higher plants this sort of thing may hold. Many trees grow by suckers, so that one "individual" may be in organic connection with several others. The climax is reached in the case of the banyan tree, in which the branches let fall aerial roots which turn into new trunks, so that a many-trunked colonial tree is produced.

These examples will show the impossibility of defining an individual in any absolute way, or of believing that individuality is ever complete or perfect. We must rather say that there are degrees of individuality, and that it is very poorly exhibited by plants and many animals.

An individual must be in some degree a unitary whole with interdependence of parts; it must have a history of appreciable

duration, singleness and continuity; it must be rather sharply marked off from other individuals; its working must be directed at least partly to continuing either itself or other systems like itself. In so far as portions of living substance exhibit these characters, they are individuals. The more definite the unity, the more obvious its continuity, the greater the interdependence of its parts, the greater its independence as a whole, the more individuality must we ascribe to it.

During the course of evolution, two, in a sense contrary, tendencies have been at work—*aggregation* and *individuation*. Individuation is the tendency towards making a given unit more of an individual. Aggregation is the tendency to fit together a number of individuals to make an aggregate, or unit of higher order (which may then be progressively individualized). We can distinguish individuals of three orders or grades. The lowest are single cells, *e.g.*, free-living protozoa, bacteria. These first-grade units may become aggregated to form colonies; the colonies may show division of labour between their cellular units and may even be so co-ordinated as to behave and move as wholes (*e.g.*, *Volvox*). When this stage is reached, we may properly speak of a second-order individual. All multi-cellular animals are second-order individuals: and the evolutionary history by which a simple coelenterate has been transformed into specialized creatures like insects or mammals is the history of the individuation of such units. These units, however, may again undergo aggregation. Colonies without division of labour are seen in Polyzoa, corals, etc.: colonies with some division of labour are frequent among hydroid polyps; and colonies which can be called third-order individuals are found in siphonophores.

The bonds holding the parts of such units together are physical; but with the development of efficient sense-organs and brains, the parts can be held together by psychical bonds. This, without division of labour, is seen in gregarious animals; with division of labour, in the communities of social insects and of man, which thus also are incipient third-grade individuals.

As a general rule, where a unit of higher grade acquires more individuation, the lower-grade units composing it become less independent and more subordinate, and so lose individuality. The only exception to this occurs in human communities, in which the presence of language and conceptual thought has transformed the method by which the second-grade individuals (men and women) enter into relation with each other and with the whole.

In man for the first time mental life can become organized into a continuing unity with interdependent parts. Superposed upon (but interwoven with), the physical individuality is the mental individuality, which we call *personality*. Obviously degrees of individuation of the personality are possible, both as regards the integration of the different emotional tendencies and the intensity to which any one capacity is developed.

It is not necessary that personality should be intensified by living in a highly-organized society—indeed, the reverse is often the case—but it is true that only in highly-organized societies do the highest levels of individuation become possible. High degree of individuation undoubtedly seems to be a progressive characteristic of life. It is thus important to notice that the individuation attained by the state or any other human community is, and apparently must always remain, far lower than that possible to its component members; and that therefore, biologically speaking, the community exists for the individual more than the individual for the community. Since both, however, are intimately interdependent, there are, from the purely biological point of view, many cogent duties of the individual to the community.

What we have said about the aggregation of similar units to form units of higher grade, applies also to the aggregation of dissimilar units, as in the development of symbiosis (*q.v.*). The only differences are that a good deal of division of labour is already given from the start in the difference between the two symbiotic species, but that their difference and separateness makes progress towards a higher degree of intimate union and mutual integration very difficult.

The idea of absolute individuality must thus be given up, just as much the idea of definite and unchanging objects in the inorganic world. A stone, *e.g.*, is continuously losing or gaining matter and energy to or from its surroundings, and it is not the same to-day as yesterday. It is relatively but not absolutely distinct from the rest of the world. So the individual is relatively separate, unified and independent, but never absolutely so. Among animals, the highest degree of individuation is found among second-grade units, but the greatest biological success is achieved by the combination of these to form third-grade units of low individuation (social insects, man).

Man's mental powers make it possible for him to merge his individuality with that of other individuals, with that of the community, and with general ideas; or, as it is often justly put, to lose his own individuality in something other, greater, or higher than himself.

The mental individuality (personality) is integrated out of a number of relatively separate emotional tendencies and systems of ideas; besides the central well-integrated portion, which alone has the right to be called personality, there exists a fringe of loosely-connected or unconnected mental life, and also subterranean systems of ideas gathered round emotional tendencies which have been repressed instead of integrated with the rest. (*See* PSYCHOLOGY.) Peculiar sudden enlargements of mental individuality may occur if these unintegrated or repressed systems are brought into connection with the main personality. Conversely, certain conflicts may terminate in a total splitting of the personality into two or more parts—a process analogous to the reconstitution of the halves of a bisected planarian or other low animal into complete individuals. (*See* REGENERATION.)

Paradoxically, the mental individuality attains its highest development only by entering into relation with the greatest possible number of facts and ideas outside itself (though it must of course organize them within its own system into a unified whole). If physical individualities are never at all completely separate or independent physically, mental individualities *can* only develop by the mutual interpenetration of subject and object in experience. Many ideas bearing on this last point of view will be found in A. N. Whitehead. *Science and the Modern World.*

See J. S. Huxley, *The Individual in the Animal Kingdom* (Cambridge, 1912); Le Dantec, "L'Individualité et L'Erreur Individualiste," *Science Progress;* J. C. Smuts, *Holism and Evolution* (1927).

(J. S. H.)

INDO-ARYAN LANGUAGES. This term applies to the members of the Indo-European family of languages which are spoken in India at the present time. They are all *Satem* languages.

Classification.—The oldest specimens of Indo-Aryan speech very closely resemble the oldest Iranian. The development of the two old forms of speech went on independently and followed somewhat different lines. This is most marked in the treatment of a nexus of two consonants. While modern Iranian often retains the nexus with little or no alteration, modern Indo-Aryan prefers to simplify it.

The earliest extant literary record of Indo-Aryan languages is the collection of hymns known as the Rig-Veda which probably contained many dialectic variations. As we have it now, we may take it as representing, on the whole, the particular vernacular dialect spoken in the east of the Punjab and in the upper portion of the Gangetic Doab. Later it extended between the Punjab and the modern Allahabad from the Himalayas to the Vindhya hills in the south, over the area known to Sanskrit geographers as the *Madhyadēśa* or *Midland*, also called *Āryāvarta*, or the "home of the Aryans." Here it received constant literary culture, and a refined form of its archaic dialect became fixed by the labours of grammarians about the year 300 B.C., receiving the name of *Saṁskṛta* (Sanskrit) or "purified," in contradistinction to the folk-speech of the same tract and to the many Indo-Aryan dialects of other parts of India, all of which were grouped together under the title of *Prākṛta* (Prakrit) (*q.v.*) or "natural," "unpurified." Sanskrit (*q.v.*) became the language of religion and polite literature, and thus the Midland, the native land of its mother dialect, became accepted as the true pure home of the Indo-Aryan speech.

Dialectic Variations.—In the time of Asoka (250 B.C.), there were at least three dialects, an eastern, a western and another in

the extreme north-west. The grammarian Patañjali (150 B.C.) mentions the existence of several dialects.

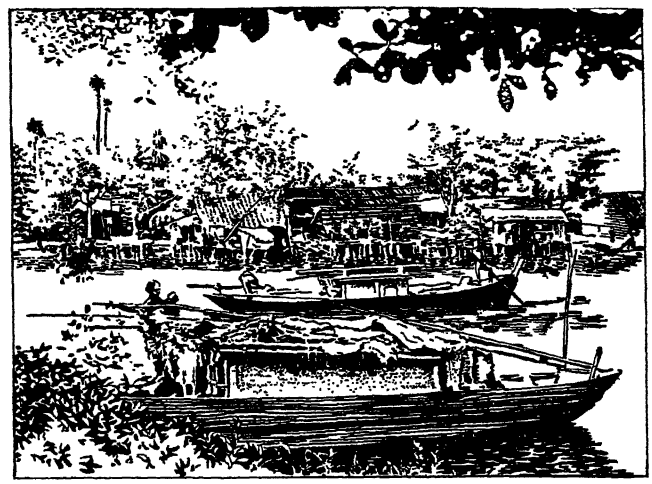
Round the Midland, on three sides—west, south and east—in Vedic times, Indo-Aryan dialects were spoken which were all more closely related to each other than was any of them to the language of the Midlands. Thus, at an early period of the linguistic history of India there were two sets of Indo-Aryan dialects—one the language of the Midland and the other that of the dialects which form an Outer Band.

As time went on, the people of the Midland conquered the eastern Punjab, Rajputana with Gujarat (where they reached the sea) and Oudh. Hence in all these territories we now find mixed forms of speech. The basis of each is that of the Outer Band, but the body is that of the Midland. As we leave the Midland and approach the external borders of this tract, the influence of the Midland language grows weaker and weaker, and traces of the original Outer language become more and more prominent. In the same way the languages of the Outer Band were forced farther and farther afield over the Maratha country, into Orissa, into Bengal and, last of all, into Assam.

At the present day, a Midland Indo-Aryan language (western Hindī) occupies the Gangetic Doab and the country immediately to its north and south. Round it, on three sides, is a band of mixed languages, Punjabi (of the central Punjab), Gujarati, Rajasthani (of Rajputana and its neighbourhood), and eastern Hindī (of Oudh and the country to its south). Beyond these again, are the Outer Languages (Kashmiri, with its Dardic basis), Lahnda (of the western Punjab), Sindhi (here the band is broken by Gujarati), Marathi, Oriva (of Orissa), Bihari, Bengali and Assamese. The Pahari languages in the Himalaya, north of the Midland belong to the Intermediate Band, being recent importations from Rajputana, while Kohistani includes the mixed dialects of the Sivat and Indus Kohistans. The Midland language is therefore now enclosed within a ring fence of intermediate forms of speech.

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INDO-CHINA, FRENCH. The geographical denomination of French Indo-China includes the protectorates of Annam, Tongking and Cambodia, the colony of Cochin-China and part of the Laos country. In 1900 the newly-acquired territory of Kwang-Chow bay, on the coast of China, was placed under the authority of the governor-general of Indo-China. French Indo-China, the eastern portion of the Indo-Chinese peninsula, lies between 8° 30′ and 23° 25′ N. and 100° and 109° 20′ E. It is bounded north by an arbitrary line which separates it from China, east and south-east by the Gulf of Tongking and the China sea; west by the Gulf of Siam and Siam, and north-west by Burma. The area is 274,385 sq.m., with a population of 19,636,137, of which 26,137 are Europeans. Indo-China is made up of several very distinct regions; two great deltas (that of the Song-Koi, which forms Tongking, and that of the Mekong, forming Cochin-China and part of Cambodia), and between them the Cordillera of Annam. To the west of this chain lie the mountainous continental regions of Laos. The relief of Indo-China is thus very uneven, the only plains being the deltas of Tongking (13,000 sq.km.) and of Cochin-China (40,000 sq.km.) and some small coastal plains. The north of the country is occupied by the mountain-knob of Upper Tongking and Upper Laos, formed of calcareous plateaux and sandstone hills, whence arises the Cordillera of Annam, which curves parallel to the coast from the Gulf of Tongking to the delta of Cochin-China, sending out seawards buttresses which bound the enclosed bays of Annam. This mountain chain has a steep slope on the eastern side, but descends in steps on the western side to the plateaux of Laos. It is through



VIEW ON THE RIVER NEAR SAIGON SHOWING HOUSEBOATS OF THE POOR, AND SHACKS BUILT OUT OVER THE RIVER'S EDGE

this plateau country of Laos that the Mekong (*q.v.*) one of the longest rivers (1,900 m.) of south-east Asia descends in steps towards its delta. The Red river descends from the mountains of Yun-nan, rising near Tali-fu between deep and inaccessible gorges, and becomes navigable only on its entry into Tongking. Means have been taken to render it available to steam launches, and in consequence of an agreement between the State and the Compagnie des Correspondances Fluviales a service of steamers is provided from its mouth to Lao-Kay. Near Hung-Hoa the Red river receives its two chief tributaries, the Black river from the plateaux of the west—the land of the Muongs—and the Clear river, one of the largest of whose tributaries issues from the Ba-Be lakes. The Black river is navigable for a considerable distance, the Clear river only from Tuyen-Kwang. The general features of the climate, of soil and of relief, give to the rivers of Indo-China certain common characteristics; they are swollen in summer and low in winter in consequence of the monsoons; rapids and cascades play an important part in limiting navigation; their erosive activity is shown in the formation of deltas. The coasts reflect the general character of the relief, being low and muddy at the edge of the deltas, sandy along the coastal plains, and scarped and dissected at the points where the mountains reach the sea. In spite of the great length of coastline (1,560 m.) it is therefore not favourable to navigation.

Geology.—The geological history is still far from clear; the region seems to have been land in the Secondary period. In Late Tertiary times the mountain chains of Tibet, prolonged towards the east and compressed between the southern edge of the massif of China and the northern edge of the Deccan, gave rise to the confused mountain masses of Upper Tongking and Upper Laos. In the peninsula these chains spread out in two arcs, one of which, the Cordillera of Annam forms the backbone of French Indo-China. In the Quaternary, river-alluvium filled the gulfs and joined to Asia the islands which formed the nuclei of Tongking, Cambodia and Cochin-China. The geological formations belong to two main series, one Archaean and Primary, which constitutes the main mass of the mountains and of the plateaux (granite, schists and metamorphic limestone), and the Quaternary, making up the plains and deltas (continental alluvium). Recent eruptive rocks are found in the north of Saigon and in the south-west of the delta of Cochin-China.

Climate.—The climate of Indo-China is that of an intertropical country, characterized by a dry and a wet season, but with diversities due to differences of latitude, altitude and expo-

sure. Cochin-China and Cambodia have very regular seasons, corresponding with the monsoons The north-easterly monsoon blows from about Oct. 15 to April 15 within a day or so. The temperature remains almost steady during this time, varying but slightly from 78·8° to 80·6° F by day, to 68° by night. This is the dry season. From April 15 to Oct 15 the monsoon reverses and blows from the south-west; the season of daily rains and tornadoes commences; the temperature rises from 80·6° to 84·2°, at which it remains day and night. April and May are the hottest months (from 86° to 93·2°). The damp, unwholesome heat sometimes produces dysentery and cholera. The climate of Annam is less regular. The north-easterly monsoon which is "the ocean-wind," brings the rains in September. The north-easterly gales lower the temperature below 59°. September is the month in which the typhoon blows. During the dry season—June, July and August—the thermometer oscillates between 86° and 95°. The nights, however, are comparatively cool. Tongking has a winter season—October to May. The temperature, lowered by fog and rains, does not rise above 75·2° and descends to 50° over the delta, and to 44·6° and even 42·8°, in the highlands, where white frost is occasionally seen. The summer, on the other hand, is scorching. The wind veers to the south-east and remains there until October. The temperature rises to over 83°; often it reaches and continues for several days at 95° or even more. The nights are distressingly airless. The Laos country in the interior, and lying at a high altitude, is cooler and drier. Its deep valleys and high hills vary its climate.

Fauna and Flora.—The fauna is abundant and varied. The wild life of Laos includes elephants, rhinoceros, one- and two-horned (rhinoceros horn is employed as a "medicine"), rare as a result of hunting; tiger, panther, bears, monkeys and rats, among which is the *nu-khi,* or rat found in the rice-fields of the highlands, in which its ravages are considerable. In the mountain districts the leopard, wild boar and deer are found, and in the neighbourhood of habitations the tiger-cat and ichneumon. The buffalo is commonly found wild in Laos; as a domesticated animal it also holds a prominent place. The zebu bull is used for transport purposes. There is an indigenous race of horses, excellent in spite of their small size—the horses of Phu-Yen. Birds are numerous. Reptiles (apart from the caimans of the Mekong, which attain a length of over 30 ft., and are much appreciated by the Annamese as food) are extremely numerous and varied in species. The rivers are rich in fish. The sole is found in the rivers of Tongking. The Mekong is fished for two species peculiar to it—the *pa-beuk* and the *pa-leun,* which attain a length of nearly 6 feet. All varieties of mosquitoes, ants and leeches combine to render the forests bordering the Mekong impracticable. Peculiar species of grubs and caterpillars destroy the cotton and coffee plantations of Cochin-China. The silkworm may be said to be indigenous in Tongking, where there are several thousand acres of mulberry trees.

The flora is inter-tropical, and comprises nearly all the trees known in China and Japan. The bamboo is utilized in building and a variety of other ways. Teak was found some years ago in considerable abundance, and plantations of it have been made. Certain hard woods are used for marqueterie and other ornamental work. Rubber is also exploited. Cotton, previously cultivated in Cochin-China and Cambodia, gives excellent results in Laos and in Tongking. Tea, of which there are a certain number of plantations in the highlands of Tongking and Annam, grows wild in Upper Laos. Cocoa and coffee are cultivated in Tongking and Cambodia. Cinnamon and cardamoms are gathered in Laos and Annam. Ground nuts, sesame, sugar canes, pepper, jute, tobacco and indigo are also grown. Rice is incomparably the most important crop. All European fruits and vegetables have been introduced into Tongking, and with certain exceptions—the grape, for example—succeed perfectly.

People.—The population of French Indo-China is very heterogeneous, owing to the situation of the country, exposed to every invasion. The Annamese form the bulk of the population in Annam, Tongking and Cochin-China and four-fifths of that of the whole country; the Khmers or Cambodians; the Chams of southern Annam; the Thias, including the Laotians; and the autochthonous tribes classed by the other inhabitants as Mois or Khas ("savages"). The last-named representatives of the indigenous peoples, survive only as strays; they were driven into the interior by the now dominant races. In the north of Tongking people of Laos origin occur—the Thōs round Kaobang, the Muongs in the mountains bordering the Red river. When mixed with Chinese the Muongs and the Thōs are known as the Hung-dans, Māns and Miens. The Muongs are bigger and stronger than the Annamese, their eyes often almost straight. They have square foreheads, large faces and prominent cheek-bones. In the centre and south of the Indo-Chinese mountain chain are found, under a multiplicity of names, people of Malayan origin mixed with all the races of Indo-China. Laos is inhabited by an essentially miscellaneous population, falling into three main groups—the Thais; various aboriginal peoples classed as Khās; and the Moos and the Yaos, tribes of Chinese origin. (For general anthropology of this area *see* the section devoted to anthropology of Further Asia in the article ASIA.)

Religions.—The Annamese religion is a somewhat vague and very tolerant Buddhism, which in practice resolves itself chiefly into the worship of ancestors. Certain ceremonies performed in Cambodia resemble distantly the Brahmanical cult from which they are derived. The Roman Catholic religion has been introduced by missionaries. There is an apostolical vicariate in Cochin-China, one in Cambodia and several mission stations in Tongking.

Administration.—Indo-China, or rather the Indo-Chinese Union, is not, properly speaking, a colony; it is an administrative scheme which comprises a colony (Cochin China), four protectorates (Annam, Tongking, Cambodia and Laos), and a special territory (Kwang-Chow-Wan). Originally Cochin-China, the only French possession in the peninsula, was a colony directly administered like other colonies, by the Ministry of Marine. As further conquests were effected, Tongking, Annam and Cambodia were subjected to the régime of a protectorate somewhat ill-defined, and in 1887 these territories were grouped together under the governor-general of French Indo-China. In 1893 the group was enlarged by the inclusion of Laos and, in 1898, by that of Kwangchow-Wan. The government of the colonies having been transferred (1889) from the Ministry of Marine to the Ministry of Commerce, and in 1894 to the newly-created Ministry of the Colonies, the control of the residences passed gradually into the hands of civil agents. Cochin-China, which already, by the decree of Feb. 8, 1880, had been endowed with a colonial council, had a municipality, a chamber of commerce and even a deputy in the French parliament. Indo-China is administered by a governor-general, who resides sometimes at Hanoi sometimes at Saigon. The functions and powers of the latter official were, however, but vaguely defined before the decree of April 21, 1891. The residents-general of Tongking, Annam and Cambodia, and the lieutenant-governor of Cochin-China, as well as the military authorities, were placed under him. But this change of policy, which put an end to the system of expeditions and minor military operations, and restricted the power of the residents whilst restoring to the mandarins a share of authority, was unwelcome to numerous interests, which, combining, secured the abrupt recall of M. de Lanessan, first governor-general, on Dec. 29, 1894. The decree of April 21, 1891, was not revoked, but the powers it conferred were restricted. After the appointment of M. Doumer (1896), successor to M. Rousseau, this decree was again put in force on the former scale, and in 1898 it was supplemented by the decree of July 3 and 31, which definitely established the political and financial unity of Indo-China. The governor-general is the sole intermediary between the Indo-Chinese Union and the Home Government, the powers of which, with few restrictions, are delegated to him. He controls the civil services, and though prohibited from commanding in the field, disposes of the land and sea forces in the country. His diplomatic negotiations with foreign Powers must be carried on under the authorization and surveillance of the home authorities. The governor-general is assisted by the Superior Council of Indo-China, which meets monthly and is composed of the chiefs of staff of the General

Government, the deputy of Cochin-China, the presidents of the chief chambers of commerce and important native members. This council has as its chief task the drawing up of the general budget and of the local budgets. The Superior Council meets not only at Hanoi, the seat of the Government, but also at Saigon, Hué and Pnom-Penh. It delegates its powers to a "permanent commission" consisting of 13 of its members, and dispensing with the attendance of the local authorities of regions other than those in which the place of meeting is situated. The *contrôle financier,* which scrutinizes and sanctions all measures of the public services involving outlay of money, is dependent on the Ministry of the Colonies and returns communicated to the governor-general.

The governor-general is also assisted by a "council of defence," comprising the chief military and naval authorities.

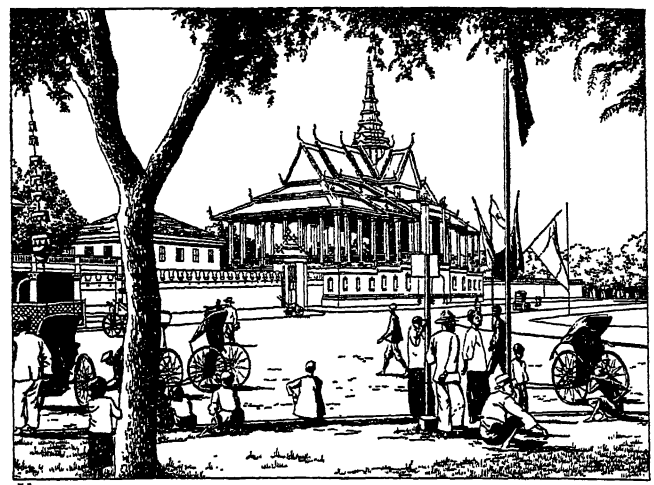
Justice.—The whole of Indo-China is, in principle, subject to French justice, represented by a court of appeal and a certain number of tribunals. The decree of Aug. 8, 1898, established one court of appeal for French Indo-China: two chambers sitting at Saigon and the other two at Hanoi. Three tribunals of commerce are established at Saigon, Hanoi and Hai-Phong. There are nine courts of first instance, one at Pnom-Penh for Cambodia, and two at Hanoi and Hai-Phong for Tongking. These courts are supplemented by *juges de paix* in Cochin-China, and there are *juges de paix* at Nam-Dinh (Tongking) and Tourane; elsewhere in the protectorates the residents perform judicial functions. There are four criminal courts in Cochin-China, at Hanoi in Tongking and at Pnom-Penh in Cambodia. In Cochin-China Annamese law is administered in the French courts in suits between natives, but native tribunals have been superseded. In Annam-Tongking, outside the sphere of the French tribunals, the natives are subject to Annamese justice, represented in each province by a mandarin called the *An Sat* and in Cambodia the natives are subject to the native tribunals. At the same time, whenever a French subject or European or other foreigner is a party in an affair, French justice only is competent.

Public Works.—The order of Sept. 9, 1898, placed the public works of Indo-China under the "direct authority of the governor-general as regards works entered to the general budget account." There is a director of public works in Indo-China at Saigon, a director of engineering in the other countries. In 1895 a "special service" was created in Tongking to consider railway business.

Posts and Telegraphs.—The country is divided into two sections for the purposes of this service, the one comprising Annam, Tongking and Upper Laos, the other Cochin-China, Cambodia and Lower Laos.

Education and Culture.—The educational movement is parallel to the political, but as the province has over 2,000,000 children of school-going age much remains to be done. In 1924–25 primary and secondary French schools had an attendance of 2,525 (about half natives); the 3,395 Franco-native official schools, an attendance of 213,977; the private schools (native and missionary) one of 99,790, the expense of education being 6,000,000 piastres (1924). The 1917 public instruction code laid down the principle of the teaching of French, even in elementary schools, but there are reservations, defined in the *arrêté* of Sept. 18, 1924. The "University of Indo-China" at Hanoi, is a high school with many branches giving practical and theoretical training; it aims at turning out competent native assistants for the different French administrators, and training lawyers, planters, traders and manufacturers. Most of the students are Annamese. The *École Française d'Extrême Orient* at Hanoi, under the patronage of the *Institut de France,* conducts valuable research work in native art, history and language. It has a fine library and museums in Hanoi, Tourane, Saigon and Pnom-Penh, and has done epoch-making work in its *Inventaire* of Cambodian and Cham monuments, its excavation of the ruins of Angkor, etc. (*See* its two vols., *L'École Française d'Extrême Orient depuis son origine jusqu'à 1920* [1922] and its semi-annual *Bulletin.*)

Defences.—The divisional general commanding troops of Indo-China (Hanoi), has under him three brigadier-generals (Tongking two, Cochin-China). Troops consist of two regiments of French Colonial Infantry (Tongking, Cochin-China); two battalions of the Foreign Legion; two regiments of artillery; two detachments of French gendarmes; two flying squadrons, which also do excellent work in mapping and fiscal service. There are four native regiments of tirailleurs in Tongking, one in Cochin-China. There are five "military territories" on the Chinese frontier and in Laos. The medical service is relatively important



VIEW OF PNOM-PENH, CAMBODIA, SHOWING THE AUDIENCE HALL. PNOM-PENH, SITUATED ON THE MEKONG RIVER, IS THE CHIEF MARKET FOR THE PRODUCTS OF CAMBODIA, LAOS, UPPER BURMA AND PART OF SIAM

and helps in the general sanitary organization. The navy is under the command of a *capitaine de vaisseau* (Saigon). The local squadron has been reduced almost to nothing since the World War. There is a question of handing the Saigon arsenal over to a private enterprise.

Finance.—The unification of the budget brought about by M. Doumer (decree of July 31, 1898) specially contributed to that of the Government. The financial scheme is based on the political. In addition to the general budget, comprising the revenue and expenditure of the supreme Government, there are several local budgets, including the revenue and expenditure incidental to the individual provinces. The general budget, under 24,000,000 piastres in 1901, was 76,466,490 piastres in 1926. The Bank of Indo-China (capital £1,440,000), besides receiving deposits and discounting bills, has the privilege of issuing notes, a privilege renewed by the French parliament in 1925.

Commerce, Agriculture, Industry.—Although there is still a plethora of French officials (about 4,600), especially in the lower ranks of the Customs and Excise and similar services, there are over 3,000 French non-officials (males), traders, manufacturers and planters. In 1922 from 250,000,000–300,000,000 fr. were invested in private French enterprises. Rice remains the staple product; 4,750,000 ac. in the Mekong delta were under rice in 1920. There were 62,500 ac. of rubber plantations, and other tropical plants were cultivated successfully. The anthracite mines of Hongay and Dongtrieu produce 1,000,000 tons annually. The production of zinc (40,000 tons) and phosphates (20,000 tons) is important. In 1925, 33,833 hands were engaged in mining (329 Europeans). The presence of coal has given birth to a rapidly expanding industry in the Red river delta, where there are large cement works, brick, tile and ceramic works, three naval yards (besides the Saigon arsenal), two important French river steamer companies, three large cotton-spinning works and minor industries. Home industry (lace-making, etc.), employs many native women. The piastre, worth 2·50 fr. before the war, was, in 1926, worth 15 fr. (the piastre is worth 2,700 sapeks, the chief native coin, of zinc or tin); but on a piastre basis, exports have increased by 77% since 1900, imports by 14% only. Imports to France from Indo-China in 1925 were 612,000,000 fr., exports 760,000,000. Total exports reached 1,771,541,353 fr., of which 62% represented rice; imports reached 1,388,593,768 fr. The customs tariff is substantially the same as that of France, severe import duties

being levied on foreign goods. French goods pay no import duty, and goods exported thither are exempt from export duty, with the exception of sugar, which is regulated by special legislation, and of various other colonial products (*e.g.*, coffee, cocoa, tea, vanilla, pepper), which pay half the duty applicable to similar foreign products according to the minimum tariff. Goods from French colonies pay no import duty. About 53% of the imports, comprising nearly all manufactured goods of European origin, come from France. China, Japan and Singapore are the other chief sources of imports.

Communications.—There are now 2,075 km. of railways. The general plan, formed in 1898, will include a great trans-Indo-China line, which will follow the coast from Hanoï to Saïgon, and from which will branch the lines penetrating China, Laos, Cambodia and Siam. An important line, 126 km. long, is planned which will run from Tanap to Thakhek and link up Central Laos with Central Annam. Tourist traffic is now possible and encouraged. Over 20,000,000 piastres were spent during the years 1919–25 on dredging, irrigation, etc., and 50,000,000 piastres on the roads, of which there are now over 30,000 km. (11,000 metalled, 9,000 made possible for motors in the dry season).

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HISTORY

French influence in Indo-China dates from as far back as the year 1787, when, through the efforts of a great French missionary, Pigneau de Behaine, bishop of Adran, a treaty was signed between the "king" (*Chua*) of Cochin-China, Nguyen phua Anh, and Louis XVI., king of France. Though the opposition of the then governor of Pondicherry, the count of Conway, and general events, such as the French Revolution, prevented the entire execution of the treaty, a number of French officers and men, conspicuous among whom were Colonels Olivier, Vannier, J. M. Dayot and J. B. Chaigneau, helped the Annamite prince to reconquer his throne, disputed by the Tay Son rebels, and to become, in 1801, the founder of the new imperial dynasty of the Nguyen. His line (under the name Gia Long) is still in possession of the power in Huê. The remains of the Vauban fortifications built by the French, who aided the Annamite prince a century and a half ago still confront the visitor to the capital and other towns.

Such was the respect Gia Long professed for the bishop of Adran that he had, at the latter's death in 1799, a tomb (temple) specially built for him, close to Saïgon, and himself composed Pigneau's epitaph, which can be read to this day. Gia Long proved a great ruler; a new Code was enacted, inspired (as are most Annamite institutions) by the Chinese Code; great public works were undertaken, and a new land-survey instituted.

Anti-Europeanism.—His successors were averse to French influence and started persecutions of the Christian missionaries and natives. For 40 years, from 1833 onward, eight European bishops and 15 missionaries were put to death; 20 others incarcerated and tortured, and several died of misery in the mountains, where they had taken refuge. Many thousands of Annamese perished among the 60,000 who had then embraced the Christian religion (they are over a million now). The French and Spanish Governments (some of the priests killed were Spaniards) only intervened in 1858 by the capture of Tourane, the port of Huê, under Admiral Rigault de Genouilly; but the real campaign in Cochin-China began in 1861, under Admiral Charner. Saigon was taken in February, and by treaty of June 5, 1862, the three eastern provinces of Cochin-China were ceded to France.

French Suzerainty.—Then began the "administration of the Admirals" (1863–79), foremost among whom was Admiral de la Grandière (1863–68).

Under this administration the first protectorate treaty was signed with Cambodia, the local administration was organized, Doudart de Lagrée and Francis Garnier's exploration of the Mekong (1866–68) was undertaken, and as a counter-move to the continual revolts in the three western provinces of Cochin-China, these were annexed in 1867.

Admiral Dupré (1873), with Luro, an ex-officer of the navy, instituted at Saigon a college for French probationary administrators. In November of the same year, Lieut. Francis Garnier, with 188 men, became master of the delta provinces of Tongking (*q.v.*). He had been sent on a mission of enquiry into the differences between the merchant, Jean Dupuis, and the Annamese authorities in Hanoi. Garnier was killed in Dec. 1873. In March of the next year a protectorate treaty was signed by France and the emperor Tu-duc. Tu-duc, however, still sent an embassy to China promising "obedience," although he had promised "to conform his policy to that of France."

This raised many difficulties in the enforcement of the treaty. An expedition being deemed necessary, in 1882 Henri Rivière took charge, and was killed in 1883. Annam united with China in a war against France, in the course of which Admiral Courbet bombarded the Foochow arsenal and defeated the Chinese at Son-Tay. Hostilities ended with the signature of two treaties (with Annam June 6, 1884, and with China April 4, 1885). The frontiers between China and French Indo-China were defined in two conventions (June 26, 1887, and June 20, 1895), and the bay and territory of Kwang-Chao-wan, in the province of Kwangtung were leased to the French (April 12, 1898).

New Organization.—After the 1884 treaty a new French protectorate was organized, with Paul Bert as first resident-general. On Bert's death, M. Constans was appointed the first governor-general of Cochin-China, Cambodia, Annam and Tongking (1887). In the succeeding years lack of harmony between the French military and civil administrations and failure to appreciate the provisions of the protectorate system, led to difficulties. These were augmented by Chinese attacks along their frontier. Under the governorship of J. L. de Lanessan (1891–94) affairs improved and the decree of April 21, 1891, gave the governor-general real powers, which were clearly defined in the decree of Oct. 20, 1911, again reinforced by a decree on Sept. 11, 1920, whereby the governor-general became a legislator. He can dissolve or suspend the Colonial Council, an elected body mainly French, but his financial measures are supervised by the director of financial control. An ordinance of the governor-general can, however, at any time be revoked by the Colonial minister in France.

In Tongking, wherever the status of the Annamese is directly concerned, the sanction of the emperor is necessary. It was an ordinance of the emperor Khai Dinh (July 16, 1917), which ordered the putting into force, both in Tongking and in Annam, of the five new *Codes* on the organization of the tribunals, commercial and civil procedure and the penal laws. The new Civil *Code* was put aside for revision by a commission where Annamese mandarins are in the majority.

There was instituted in the colony a geographical service for explorations and surveys, and splendid geodetic and cartographic

work has been done. In 1927 M. Varenne prepared a new scheme for the Council of Government to be composed of 60 members (35 Frenchmen and 25 natives), 32 of whom were to be elected by local assemblies, 12 (nine French and three natives) by the Chambers of Commerce and Agriculture, and 16 (ten French and six natives) to be appointed by the governor-general.

In Aug. 1928 Pierre Pasquier was appointed governor-general. His whole administrative career has been in connection with Indo-China, the first to enter on his task with such a preparation. There are many problems still confronting administrators in a country of 20,000,000 inhabitants of mixed race and civilization. The old self-recruited village oligarchy of headmen is dying out; attempts to combine in some measure the old and the new regime have not been conspicuously successful. So far compulsory education exists only in Cochin-China, and the general medium of instruction is *quoc ngu*, or romanized Annamese, a system devised originally by the Portuguese to avoid the use of Chinese characters.

The present emperor of Tongking, Prince Vinh Tuy, whose official name is *Bao Dai*, succeeded his father in 1926. While he is being educated in France, according to his father's wish, the regency is exercised by the president of the council of Annamese Ministers. (*See* also CAMBODIA, TONGKING, SIAM, ANNAM, subsections *History*.) (HI. BR.)

INDO-EUROPEANS. The term Indo-European appears to have been invented by the well-known physician and physicist Thomas Young. In an article in the 10th volume of the *Quarterly Review* (Oct. 1813) he uses the word without any remark as to its being a new coinage. The word was devised especially to indicate a family of languages, but from the beginning it has been found very difficult to keep apart the use of the word as indicating languages and the application of the term not only to the speakers of the languages at any given period but also to the supposed original speakers of these languages. The effect of this confusion has often been serious. It is obvious that a language may be spoken by persons who have no blood relationship with the general body of speakers of the language, and that this body itself may not be all of one and the same origin. Thus the negro in Liberia or in the Southern States of America who speaks English as his mother tongue may have no drop of English blood in his veins, and even 200 years ago Daniel Defoe was certain that there was no such person as the "true-born Englishman."

Ever since it was possible to identify a separate family of languages as Indo-European, continual efforts have been made to ascertain who were the original speakers of the language from which the surviving members of the family, or those which are recorded in literature or other monuments, have sprung, where was their home, what were their surroundings and their manner of life. The first of the elaborate statements of these problems was that published by Adolphe Pictet in 1859. The more important attempts of the same kind which have appeared since are enumerated in the bibliography at the end of this article. It is hardly necessary to say that the majority of such attempts deal mainly or altogether with the evidence derived from language. This is necessarily so, because, when the question arose, the linguistic scholars were the first who were ready to carry on the investigation; but the problem can be attacked in various other ways, and it is only by an attack converging from all quarters that a certain result will ever be attained.

Fauna.—From language it is clear what were the animals, what were the plants and what were the seasons in the country whence this language was derived. The animals still familiar amongst us were well known; the sheep, the cow, the horse, the dog and the pig. The names of the goat vary much more from language to language; but it does not necessarily follow from this that the goat was not known until a later time. Animals for which there are no early terms in the Indo-European languages are the lion, the tiger, the elephant, the camel and the ass. It may therefore be safely concluded that these animals did not exist in the original habitat. The lion, at one time, certainly roamed over a much larger area than it does now. According to Herodotus lions were found as far to the west as Macedonia and the prevalence of the representation of the lion in monuments of Asia Minor and Persia is proof to some extent, that the animal was well known. It still survives in Cutch but has lost its mane and is on the way to extinction in Asia. As there is no word for the elephant and no representation of it in the more western part of Asia or in Europe it is clear that this animal also was unknown. The same is true of the tiger and the camel and the ass. In Asia the common beast of burden was the ass. The horse, though known in Mesopotamia from the time of Hammurabi before 2000 B.C., owes its introduction to the Kassite invasion of 1926 B.C., and was called the mountain ass. Palaeolithic man was able to represent in his drawings two species or varieties of horse. The name of the cow has the same origin in almost all the languages and the same is true of the sheep, the pig, the dog and the mouse; but in their wild state the same environment is not suitable to all. The horse is an animal of the prairie; it lives in the open plain and the foal is able from the day of its birth to accompany the mare. The cow, on the other hand, in the wild state lives in countries with open spaces well provided with woods or clumps of trees. When the cow travels afield to find food, the calf is unable to accompany her and has to be hidden in some brake or thicket, as it can walk but feebly and its eyesight is still imperfect. Unless it were so hidden it would fall a prey to animals like wolves or eagles, both of which seem to have been known to the first Indo-Europeans. The grass which suits horses or cows is unsuitable for sheep which prefer the short crisp grass of upland pasture. If, therefore, all these animals were well known to the early Indo-Europeans they must have lived in an area where the landscape was diversified. The country seems to have no connection with the sea; the more widely spread meanings of the word for the sea are either moor or marsh. That open water was known is shown by the fact that there were words for water birds, the swan, the goose and probably the duck, but all of these could find a resting place in very small sheets of water. From what has been said, it will be clear that the Indo-Europeans must originally have lived in the temperate zone. The bear was known, but which species we cannot tell. It is well known that the name "bruin" meant the brown bear, being cognate with the Lithuanian word *béras*, for the Lithuanian word is used as an adjective meaning brown. Other animals known were the beaver and the hare, the word for the beaver being generally a reduplicated form from the same stem as the word for the bear and the hare, meaning originally the grey beast. Its origin was the same as that of the Latin adjective *canus* from an older *cas-nos*.

Flora.—The trees and other plants are not so easy to identify because it is found that when men migrate to a new area, they carry with them the names of plants and, to some extent, also of animals and apply them to plants or animals in the new area which bear some resemblance to the plants or animals they have left behind. Thus in England the oriental plane, so well known in Asia Minor and Persia as the Chinar, grows only with difficulty north of the Trent and in northern Scotland not at all. But the name plane is preserved, notwithstanding, and applied to the sycamore which resembles the plane in being an umbrageous tree and having a leaf somewhat similar. In the same way, the English in America have given the name of robin to a much larger bird, because it has a red breast. The trees most widely spread in the temperate zone are the willow and the birch. The birch extends from the British Isles to the farthest Himalayas. Some variety of willow is the first tree to grow near streams in a country like Siberia which has not long been freed from surface ice. On the other hand, some of the commoner trees, like the beech, do not penetrate far into the southern peninsulas of Europe. The consequence is that in Greece the word corresponding to *beech* in English and to *fagus* in Latin, means oak or sometimes possibly chestnut. In the same way in Latin the word cognate with the English birch is used for the ash, *fraxinus*. The pine in some of its numerous forms was also certainly known.

Cereals and Seasons.—More important, perhaps, for the history of the race, is the existence of cereals. Within historical times, only two new cereals have been introduced into Europe, rice and maize, though a plant of another kind, buckwheat, was

brought in by the Tatars and has received its name because its fruit was ground, and treated as a cereal. Many attempts have been made to connect the Greek *oryza* with the Sanskrit *vrihi,* which in modern Persian appears as *birinj*. But traffic down the Red Sea was mostly with southern India and the simpler explanation is to connect the Greek word with the Tamil, *arishi*. The early names for grain are very ambiguous. The word *corn* connotes in England wheat, in Scotland oats, in Sweden barley, in Germany rye and in America maize. The most widely spread name for a cereal is that which appears in Sanskrit as *yava,* in Greek as *zéa* or *zeiá,* the latter a derivative of the former, in Lithuanian *jawaī*. It may have meant originally barley, but is also used for spelt, a simple and ancient form of wheat, which, as being such, was long used in religious ritual.

The names for the seasons of the year help us somewhat. There are words widely spread for winter and for snow. The stem *hima* is found in the name of the Himalayas ("the abode of Snow") and in the Greek *kheima* with its adjective *duskhimos,* the Latin *hiems* and many others. We do not use a word from its root for winter ourselves; but notwithstanding we have a word borrowed from the Norse and much used by Cumberland shepherds, *gimmer,* a winterling or sheep one year old. There is less agreement about the other seasons but there is a fairly widely spread word for spring. In many countries summer is simply the hot season. For harvest the languages do not agree very well; the Latin *auctumnus* is simply the "season of increase," which we have introduced into English as *autumn*. The word *harvest* is probably the season of fruit gathering, not of corn harvest, the two being still distinguished in German as *herbst,* the fruit harvest, and *ernte,* the reaping time. Snow was certainly known because the stem is found in so many languages, but with lofty mountains in the neighbourhood that might well be, even in a hot climate; from the names of the animals and plants, however, as we have seen, the climate was temperate and if it was a continental climate as, from the absence of words for sea, it apparently was, the climate might be severe, even if it were tolerably far south. The areas that will satisfy the conditions require a land with a temperate climate, remote from the sea and shut off from other areas, for otherwise it seems impossible that languages with so complicated a grammatical system as the Indo-European could have developed, bearing so close a resemblance to one another and on the whole so strongly differentiated from other languages. The only area which will satisfy the conditions postulated by the languages is the great area in Europe which includes practically the former empire of Austria-Hungary. In this area are found rich corn land, great prairies for the production of horses, pasture for cattle in the plains and for sheep on the mountain slopes, while the mountains themselves contain a large supply of minerals which were later utilised by man. But when the migrations from this centre began, the use of metals had not advanced very far, the only word for metal common to many languages being that which appears in Sanskrit as *ayas,* in Latin as *aes* and in English as *ore*. The word at the time of the migration meant either copper or bronze which sometimes, as in Greek, are not distinguished, the first bronze probably being a natural alloy. From what has been said it is clear that much could be done on this subject by the geographers.

Migration.—Even when we have found a people using a certain vocabulary, it is necessary to discover, if they migrated from their original habitat, in what manner it was possible or probable that they did migrate. It is, for example, a common belief that migration from Europe to Asia or the reverse, was carried on largely by the steppes of Southern Russia, the shores of the Caspian and Turkistan. In ancient times, however, progress in this direction would not have been so easy as it is to-day. In the Caspian area very large and important changes in the earth's surface have taken place. The eastern end of the Caucasus, for example, has sunk till it is now far below the level of the Caspian. The northern Caspian is steadily being filled up by silt from the Volga. In earlier times, it extended much further north than it does at present, while eastwards its extent was very much greater, including within its area not only the present Sea of Aral and what is now the intervening desert, but also passing still further to the east to a distance which is not yet clearly determined. Scholars often talk lightly also of great hordes passing the Caucasus. This also would be very difficult to achieve. According to early Greek notions the Caucasus was a barrier without openings through it and in fact at the present day there is but one, the Pass of Dariel. Historical migrations, in fact, have taken place much more readily across Asia Minor than across the Steppes. The main movement from Asia into Europe which went north of the Caucasus was in early times that of the Scythians and in mediaeval times that of the Hungarians. That the migration of the Indo-Europeans was through Asia Minor is proved by the discovery in 1906–07 of a large mass of records dating from the 15th and 14th centuries B.C., at Boghaz Keui, an important site east of the river Halys. Here were discovered the archives of the ancient Hittite empire, recorded in eight languages of which two have a certain Indo-European element in them. The most important is called Kanisian by Dr. Emil Forrer, who has been very successful in their decipherment. The grammar of this language, its noun and verb forms, are clearly Indo-European; but only a small part of its vocabulary is so, the main part coming from an unknown tongue. The first records of this language which were discovered came not from this find at Boghaz Keui, but from two letters discovered many years before, in the archives of Ikhnaton (*q.v.*), the heretic king of Egypt at Tell-el-Amarna. The mixture of two languages might be compared to what has happened in English where the pronouns, the numerals and the few remaining inflections of noun and verb are Teutonic but the bulk of the vocabulary is of Latin, or of Greek origin. The forms of this language, particularly in the names of certain deities, and of the numerals were so like those of Sanskrit that the first investigators were of opinion that either the records proceeded from Indians advancing westwards, or that the original home of the Indo-Europeans must once more be carried back to central Asia, where it had been located by some of the early authorities. A difficulty was found in the fact that the existing remains of the ancient languages of Persia—Zend and old Persian—as represented in the dialects of the Avesta and the kindred tongue of Darius' inscriptions at Behistun were so much less archaic in sounds than either the forms of these records or of Sanskrit. The explanation, however, is simple. When the speakers of Sanskrit passed over the mountains into a new country, they found themselves faced by powerful tribes more numerous than themselves and speedily realized that if they were not to be absorbed, they must stand aloof from mixture with the native tribes. Hence the beginning of the system of caste in India, for the Sanskrit word for "caste" means colour. The changes found in the language left behind in Persia must have taken place after the migration of the emigrants to India. This is not at all unusual. In the 16th century important changes took place in Spanish, but these changes were not shared by those who had already established Spanish in America. The English settlers of New England carried with them the forms *noos* for *news* and *Toosday* for *Tuesday,* because the *y* sound before *u* had not developed when these settlers left England.

If the original home of the Indo-Europeans is really located in Austria-Hungary, we should expect a considerable number of the Indo-Europeans to have been pile-dwellers. For this country had at one time much more water in it than it has now, when the Platten See, a shallow marshy lake, is all that remains of what was at one time a vast expanse of slowly drying morass. That there were amongst them many pile-dwellers, we can be certain, because they carried into Switzerland and into Italy for the western migrations, the same form of habitation, and gradually extended it further to the West.

Anthropology.—What manner of men were these emigrants? In Germany many scholars contend that they were tall men with fair hair and blue eyes and they attribute to the Indo-Europeans all the characteristics of the ideal German. For this, however, there is no solid foundation. It is said by these scholars that when Homer talks of *xanthos Menelaos,* this should be translated "yellow haired Menelaos." This translation, however, is not accurate. To a Greek *xanthos* did not mean blond, but brown,

as is clearly shown from the use of the verb, which signifies "to change the colour of meat in roasting," so that the colour would not have been lighter than auburn. In fact, when the Greeks came in contact with German children they did not know how to describe the colour of their hair and said they had hair like old men and described them as *polioi*, "with grey hair."

The anthropologists at one time maintained that the Indo-Europeans had long heads as distinct from other people with short heads. The mixture, however, of long and short heads is not a new thing. As Sir Arthur Keith points out (*Antiquity of Man*, vol. i. p. 110 [1925]), the antiquary, Dr. R. R. Schmidt, found at Ofnet, fifty miles south-west of Nuremberg, a large number of skulls of the Azilian epoch (a period linking up palaeolithic with neolithic times), some of which were long and others short. There is no reason to suppose that the Indo-Europeans had only one type of skull. No records lead us to suppose that we can trace the Indo-Europeans back more than ten thousand years. In earlier Europe there were peoples of different types, some of a physical frame now confined to the natives of South Africa, others with features akin to those of native Australians, and others again of types which no longer exist. The Basque language in the Pyrenees is a last relic of languages which preceded the Indo-European in the west of Europe; and the characteristics of colouring, hair and eyes of natives of western Britain and western Ireland, which Huxley called Iberian, are probably the relics of this population which has been almost absorbed. In Persia, on the other hand, a short, very dark people (negrito), which survives only in the extreme south-west of Asia, apparently preceded the Indo-European stock. The value of the relation of length to breadth of head, to which the elder Retzius first referred, has been much exaggerated, for the total content must be of more importance than the relation of length to breadth. As has been emphasized in recent years by Mr. Griffith Taylor, the height of the brain-pan is worthy of consideration.

Pottery.—Still more recently the subject has been attacked from another point of view. In 1902 Professor Kossinna of Berlin undertook to show that pottery would be a more certain index to the history of peoples than any of the other methods proposed. But in the quarter of a century which has since elapsed, Professor Kossinna has withdrawn almost all the statements which he then made and his proposed new treatment of the Indo-Europeans has stuck fast after one part was published. That, however, evidence will be forthcoming from this side is certain. But a good deal more has still to be done in identifying the makers of particular types of pottery before this clue can be regarded as of more value than any of the others. At present the best chance of progress lies in the possibility of dating positively, and linking up with the linguistic evidence, the results which can be derived from the "Bell-beaker Civilization" and the Megalithic graves which extend very nearly over the same area which was covered by the early migrations of the Indo-Europeans. The probability is that the Indo-Europeans and their civilization arose from the mixture of two earlier types, a Mediterranean and a Northern type. But Schuchhardt in the second edition of his *Alteuropa* (1926) goes further and boldly assigns (p. 282) the Indo-Europeans to a mixture of the Germans coming from the north and the Celts from the Danube area, a stock in Thüringen possibly first "indogermanizing" north Germany by settlement and south Germany by conquest. To this he has added (*Sitzungsberichte der preussischen Akademie*, Feb. 16, 1928) that it was the conquest by the Thüringians of South Germany and Switzerland that created the Celtic stock; the Thüringians afterwards wandered to the Danube and were thus the original stock of the Indo-European people.

Language Classification.—Leaving these archaeological points to be definitely decided by future investigation, we may classify the Indo-European languages according to their connections. The Indo-European languages fall into two groups distinguished from one another by their treatment of certain guttural sounds. In one group, lying mainly in Europe, these sounds remain as *k*, *g*, *kh* and *gh*, whereas in the other group they change into some form of sibilant *ç*, *z* and the aspirated sounds either drop the aspiration and are treated as *k* or *g*, or appear as *h*. The causes for this distinction are not certainly known and the distinction did not mark a deep difference between the languages at an earlier period, because the Greek, which is a *k* language, resembles in its syntax Sanskrit, which is a *ç* language, more than any other. The two series are generally named from the word for 100, in Latin *centum* (*kentum*), in Zend *satem*. The languages which preserve the guttural are *centum* languages, those which change it into a sibilant are *satem* languages. Thus the Greek *kuōn* "dog," Latin *canis*, appears in Sanskrit as *çvā* (*n*) and in Lithuanian as *szuō*. The chief *centum* languages are (1) Greek, in three distinct groups of dialects, Aeolic, Ionic and Doric, with more archaic forms in Arcadian and Cyprian. (2) Latin and the other Italic languages of Italy, Oscan in Campania and the South, Umbrian on the East of the Apennines. (3) The Celtic languages, which fall into two groups according to their treatment of an original combination of a guttural with a *w* sound like the English *qu*. One group changes *qu* into *p* (ancient Gaulish, Welsh, Cornish, Breton), the other represents *qu* by *c* (Irish and its descendants, Scotch Gaelic and Manx of the Isle of Man). Thus, corresponding to Latin *quis* is Irish *cia* and Welsh *pwy*. (4) The Teutonic or Germanic languages which fall into three groups: (a) Gothic, (b) Norse (Danish, Norwegian, Icelandic, Swedish), (c) West Germanic, including English, Frisian, Dutch and Flemish, Low and High German. The most distinctive feature of this group is the "sound shifting" which the stop consonants and *s* have undergone, and which are catalogued under the action of "Grimm's Law" and "Verner's Law," in the treatment of Teutonic languages. (5) Very remote from these four sections which are all in Europe, is Tocharish, presumably the language of migrants from somewhere much farther to the west, though the records of this now extinct language are found in Chinese Turkestan. (6) The Indo-European section of the Hittite languages (*see* above).

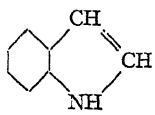
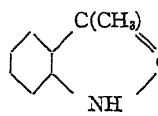
The *satem* languages are (1) in northern India Sanskrit and its descendants, and in Persia and its adjacent countries the ancient dialects called Iranian, viz., Zend (of the Avesta), Old Persian, Sogdian and North Iranian; Sanskrit and Iranian together form the Aryan branch properly so-called, though in England the word has often been applied wrongly to mean Indo-European, (2) Armenian, (3) Slavonic in its numerous dialects and Baltic (Lithuanian, Lettish, and Old Prussian, which is now extinct), (4) Albanian, more probably the descendant of the Ancient Thracian than of the Ancient Illyrian which occupied in part the same area. The relation of Illyrian to the Ancient Venetic, once spoken north of the Po and to the Ancient Messapian spoken in the heel of Italy, is not yet definitely ascertained. The other important language of Italy, Etruscan, did not belong to this family, but seems to have been related to Ancient Lydian and other languages of the Levant now extinct. (*See* also articles on HITTITES; ARYANS; MIGRATIONS, and separate articles on various languages.)

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(P. GI.)

INDOLE (BENZOPYRROLE), first prepared by A. Baeyer in 1866 and regarded by him as the parent substance of indigo. It crystallizes in colourless lustrous leaflets, melts at 52° C, boils at 253–254° C, is readily volatile in steam and easily soluble in water, alcohol, ether or benzene. Its odour is generally faecal, but after careful purification and in sufficient dilution indole possesses a not unpleasant odour of flowers. Accordingly it finds a limited application in perfumery. Indole occurs in the coal-tar fraction (*see* COAL TAR), boiling at 220–260° C; after removal of phenols and strong bases the oil is treated with sodium or sodamide to form sodium indole, which is separated mechanically and decomposed by water. It is synthesized by boiling dichloroether, $CH_2Cl{\cdot}CH\,Cl{\cdot}OC_2H_5$, with aniline and water, or by heating ethylaniline to redness. These reactions indicate its constitution (I.).

(I.)  (II.) 

Scatole (3-methylindole; II.) occurs in human faeces, of which it is the chief volatile constituent; it melts at 95° C and boils at 265–6° C.

INDONESIA, a term used to indicate the group of islands variously known as the East Indian archipelago, the East Indies and Philippine islands, etc. In Ethnologic usage the term relates to a family speaking languages of a well defined type, and having physical characteristics which are easily recognizable. (*See* Ethnology.) Geographically the term Indonesia comprises eight insular areas: (1) Madagascar, (2) the Sumatra group, (3) the northern part of the Malacca peninsula, (4) Java, Madura and Bali, (5) Celebes, (6) Borneo, (7) the Philippines and (8) the islands east of long. 120° E. The basis of the classification is mainly linguistic, and the Indonesian language family has supplied many of the links between Polynesian, Melanesian and Micronesian speech-systems. For the geography, etc., of Indonesia, *see* the articles under headings 1–7 above and PACIFIC ISLANDS.

For anthropology *see* ASIA; *Anthropology and Ethnology*, § Farther Asia. (X.)

ARCHAEOLOGY

In Indonesia there have been found remnants of human types and cultures still represented in Australia and the Pacific.

The skull fragments found by Earl in a shell-mound in the Province of Wellesley on the west cost of the Malay Peninsula were described by Huxley as Australoidic. Skulls of Melanesian type were excavated in the caverns of Tongking by Mansuy and his collaborators. The skulls and fragmentary skeletons of a man and a woman, discovered by Van Riedschoten and Dubois in 1889 and 1890 in a mountain slope above Lake Rawa Bening near Wadjak in eastern Java, belong to a dolichocephalic tall race thoroughly different from the present inhabitants of Java and resemble the skulls of recent Australians. Dubois therefore terms the Wadjak men "Proto-Australians."

PALAEOLITHIC PERIOD

The term palaeolithic is not used here as indicating that the palaeolithic civilizations of south-eastern Asia are of the same age as those of Europe. All the palaeolithic finds as yet known from Indonesia belong to the geological present.

The Palaeolithic Culture in Celebes and Sumatra.—The Lamontjong caves are situated in the interior of the south-western peninsula of Celebes, about 60km. east of Makassar in the territories of the Toala, a tribe now tilling the soil, though they probably lived till recently by hunting and collection of natural products. The caves were discovered and examined in 1902 and 1903 by Paul and Fritz Sarasin. In five of them the ash stratum forming the ground contained remnants of game animals, implements of stone, bone, teeth and shells. The stone implements mostly of quartzite, andesite, limestone, only exceptionally flint) betray a very crude manufacture. The whole stone lump was caused to burst with a blow after which the few suitably splintered flakes were selected for further fashioning and the rest were thrown away. Among the implements were scrapers, points and two-edged, more seldom one-edged knives. Especially numerous were stone arrow-heads, partly with dented edges, partly barbed. Dented stone flakes of scale-like shape were probably inserted into wooden clubs like those now used by the Toala with metal flakes. Spindle or prick-shaped arrow-heads of bone or the teeth of the wild boar were probably used, the one end serving for a point, the other one for a barb as in the South Seas and America. Small whistles were manufactured of long and phalangeal bones; pieces of shells were used as scrapers and scratchers. Perforated fragments of human bones were probably worn as amulets. Remains of domestic animals and cultivated plants are completely absent. The dog perhaps was known. All the animal species remains of which have been found in the caves still live in Celebes.

Most of the stone implements of Lamontjong at first sight resemble those of late European palaeolithic times, especially the Magdalenian, but were manufactured in a far more primitive way. The barbed arrow-heads, however, show a form which, in other parts of the globe, only occurs in neolithic times. The culture of the cave-dwellers of Lamontjong was probably influenced by some neighbouring neolithic civilization. A fragment of an earthen pot was found in the ash layer. The occurrence of stone arrow-heads in the caves is also remarkable since the bow is almost unknown at present in Celebes, and with this sole exception stone arrow-heads are not found among the prehistoric finds of Indonesia and Indo-China. Since barbed arrow-heads are frequent in the neolithic period of Japan, and arrow-heads of stone are said to have been used in the Philippine islands as late as the 17th century, these implements may be regarded as remnants of an ancient cultural current that in the neolithic period may have come from Japan through the Philippines as far as Celebes. In any case this contact must have been but slight. The culture of Lamontjong is therefore a culture of hunters and collectors of natural produce with a palaeolithic base and a slight neolithic touch. The stone implements were immediately covered by a very recent layer with iron implements and fragments of china. The present Toala may be considered the direct descendants of the stone-age cave-dwellers.

In the cave of Ulu Tjanko in the basin of the River Djambi, in central Sumatra, Dr. Tobler found a palaeolithic dwelling containing remnants of food and skeletal fragments, apparently of a slender-framed race, a number of implements manufactured of obsidian, especially knives and points of different size, and some scrapers. Typologically this Sumatra palaeolithic culture is connected with that of the Toala caves of Celebes, yet differs from it by the diverse material, the better working of the stone, the lack of the barbed and dented arrow-heads and of any perceptible neolithic influence. In both cases we have "point and blade civilizations" with rather small implements, which cannot, however, be called microliths. They are radically different from the coup-de-poing culture of India, in spite of local differences, but are probably related to the stone-age culture of Ceylon and that discovered by Nötling and Swinhoe at Yenangyaung in Upper Burma. This late palaeolithic point and blade culture must have been once widely spread over broad areas in southern Asia, possibly propagated by the small and cymotrichous race now surviving in small, scattered remnants like the Veddah, Sakai, Toala, etc.

The Coup-de-Poing Culture of Sumatra.—A culture of different character has lately been discovered by Dr. van Stein Callenfels in the country around Medan and Deli in the eastern division of north Sumatra. It is characterized by crude implements of almond-like, elliptical or pointed-oblong shape. These coups-de-poing and pick-axes are mostly manufactured by working a stone nodule with blows on only one side, the other side showing the natural unworked surface. On account of its frequency in Sumatra Dr. van Stein Callenfels termed this type which also occurs on the Indo-Chinese mainland, the Sumatra type. Traces of this civilization were found along the river courses of eastern Sumatra. In a shell mound in the neighbourhood of Medan examined in 1925–26, the stratum containing the

coups-de-poing was immediately covered by another one containing iron weapons of types identical with those still used to-day in northern Sumatra though somewhat old-fashioned. This north Sumatra coup-de-poing palaeolithic culture which began at the latest about 5000 B.C. lasted up to a late time, and was succeeded by a culture already acquainted with iron. This Sumatra culture is closely related to that from the oldest cave strata of the Malay Peninsula and Tongking, where the palaeoliths and coups-de-poing worked exclusively on one side are found in great number, but together with so-called protoneoliths, roughly worked or even unworked stone axes with ground edges. Since these protoneoliths are missing in Sumatra, Stein Callenfels regards this Sumatra culture as an earlier stage of the continental one, brought to Sumatra by a tribal and cultural wave still ignorant of stone-grinding. These coup-de-poing cultures of Sumatra and Indo-China belong probably to a great group of related late palaeolithic and mesolithic cultures once widely spread over large parts of the globe.

The "Horn and Bone Civilization" of Java.—A third, apparently preneolithic civilization of Indonesia was discovered in 1926 by Engineer van Es near Sampung, Residency of Madiun, Java, in a cave on the slope of Volcano Lawu. The very thick layer contained two skeletons of a tall-grown race (1·70m. to 1·80m.) interred as lying squatters, numerous implements of horn and bone (arrow-heads, fishing-hooks, etc.), grinding stones that had served for grinding ruddle, thousands of unworked fragments of silex, jasper and agate, but no worked stone implement.

THE NEOLITHIC PERIOD

The number of neolithic objects in the museums is very large, almost exclusively stone axes found by chance. About pottery, as yet practically nothing is known. Most of the megalithic monuments undoubtedly belong to the metal periods. The neolithic cultures of Indonesia may be divided by local criteria.

Eastern Indonesia and the Philippine Islands.—The neolithic period of eastern Indonesia (Celebes, Moluccas, Little Sunda islands, South-west and South-east islands) is characterized by two types of stone axes (a) somewhat clumsy broad-necked axes having the shape of a short rectangle or trapezium, often approaching the quadrate and square in the transverse section; (b) narrow or pointed-neck axes with lenticular or oval transverse section. The second type is very frequent in ancient Europe, is characteristic of the neolithic period of India, occurs, though seldom, in Japan, and is still present in New Guinea and Melanesia, directly derived from the ancient forms of east Indonesia. It is not known how this type came into Eastern Indonesia as, except there and in Borneo, it is not known in Indonesia or further India. It may be due to influences from India, or, with the stone arrow-heads of the Toala caves, to a cultural current from Japan. The occurrence of ancient stone hooks reminiscent of the magatama of the Japanese neolithic period possessed by some Dayaks in Borneo might thus be explained. As is shown by the shouldered celts found in Formosa the neolithic culture of this island must at some time have been in close connection with that of Indo-China. The existence of stone axes is however proved with certainty at least for Mindanao and the Visayas. Two such axes from a cave on the Island of Masbate have been published with illustrations. Of oblong-rectangular shape they resemble certain Indo-Chinese stone-axes more than those from Indonesia. In the same place numerous pottery fragments decorated with scratched waving lines and points were found. It is, however, impossible to say with certainty, whether they were coeval with the stone implements.

Western Indonesia.—The oldest neolithic type of western Indonesia, especially of Java, according to Stein Callenfels seems to be a broad-necked axe the two broad sides of which have a swell whereas the narrow sides frequently do not show a single plane but several narrow ones joining at greater or smaller angles. This axe is about as thick as it is broad. Java has furnished by far most of the neolithic material, due partly to her dense population and very extensive agriculture as the occasions for finds are thus multiplied. The neolithic civilization there seems to have reached a very high level, as shown by the beauty and perfect working of the implements of the late neolithic period, which are frequently made of precious stones: jasper, chalcedony, lydite, opal, agate. Especially characteristic of Java are thin flat-axes of oblong trapezium-shape, mostly with distinct side-planes and frequently with chisel-like edge of one-sided bevel. Frequently one side is convex, the other concave so as to make the whole head longitudinally crooked. All these types which also occur in Sumatra, show a certain resemblance to those of the Malay Peninsula and of Upper Laos. It thus seems that in late neolithic times a cultural and perhaps also tribal wave spread from the region of Luang Prabang on the Mekong southwards over Siam and the Malay Peninsula as far as Java. Besides these flat-axes and adzes,-gouges also occur in Java. The most characteristic type, however, probably found exclusively in Western Indonesia, are the pick-axes. On their upper side either they have a swell or show two planes sloping like a roof from a middle ridge. The transverse section may be semi-circular, triangular or pentangular according as they have side-planes or not. The upper side is frequently convex, the under side sometimes concave, thus making the axe head longitudinally crooked. The edge always forms a point. On the under side it is frequently ground hollow. Such pick-axes are also known from Bali and the southern half of Sumatra.

Neolithic Cultural Provinces and Chronology.—In the Malay Peninsula another kind of pick-axe occurs the upper side of which is for the most part flat and is ground to a point only in front. The under side is always flat and sometimes ground hollow at the edge. Since the neolithic civilization of the Malay Peninsula is in other respects very closely related to that of Upper Laos (region of Luang Prabang), it represents perhaps a transition or a mixture of the stone-age civilization of Indo-China and Western Indonesia. The south of the Malay Peninsula is distinctly opposed to the remaining part of Indo-China by the lack of shouldered celts and by the occurrence of the pick-axes mentioned. Thus the south of the peninsula belongs rather to Indonesia than to Indo-China.

The division between the territories of the neolithic axe-types of Eastern and Western Indonesia, seems to correspond with the division between the East and West Indonesian languages and represents to-day the limit of distribution of many important cultural elements. In Borneo Eastern as well as Western Indonesian axe-types (also pick-axes) are found side by side, and the Dayak languages are intermediate between those of Eastern and Western Indonesia. Thus the present distribution of tribes and languages in Indonesia goes in substance back to the neolithic period, at least therefore to the first millennium B.C.

More accurate criteria for the chronology of the Indonesian neolithic period are derived from the distribution of the Indo-Chinese shouldered celts. The distribution of these celts closely agrees with that of the Austro-Asiatic languages and from that it is to be inferred that they belonged to the cultural inventory of the ancient Austro-Asiatics (Mon-Khmer). They are found in Indo-China (except the south of the Malay Peninsula) in Assam, Orissa, Chota Nagpur, in the Santal Parganas and near Allahabad, in regions of India in which Mon-Khmer or Munda (Austro-Asiatic) languages are either spoken to-day or once were spoken. There was probably a tribal migration starting from Indo-China, hardly later than between 1500 to 1000 B.C. Since the shouldered celt is missing in Indonesia and the south of the Malay Peninsula, we may infer that the separation of the Austronesians (Malayo-Polynesians) from the Austro-Asiatics (Mon-Khmer) and also their migration to Indonesia took place at a time when the shouldered celt had not yet been developed, that is about from 2000 to 1500 B.C., though it may have happened earlier. Since the late phases of the Indonesian neolithic period are ascribable to these migrations, we must suppose a considerably greater age for the earlier phases.

The stone-age appears to have terminated at very different times in the different parts of Indonesia. In Western Indonesia (Java, Sumatra) the foundation of Indian expansion and rule commenced at the latest in the second century A.D., perhaps

earlier. Yet it is almost certain that mining and the manufacture of iron were known there before the arrival of the Hindus. Traces of a bronze age spread to the remotest east of the archipelago, and are especially numerous in Sumatra, Java, Celebes and Sumba. Therefore it is probable that in some parts of Indonesia the neolithic period had terminated in pre-Christian times. In other parts, however, it appears to have lasted much longer. The working of metals has not yet been fully established in every part of Indonesia, and the use of implements of stone, bone, wood and bamboo still survives.

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INDONESIAN AND FURTHER INDIAN ART. To a certain extent, and in a broad historical survey, all of Further India or Indo-China (Burma, Siam, Malay peninsula, Cambodia, Campā and Indonesia [Sumatra, Java, and Bali]) may be treated as a unit. Throughout this area the population consists essentially of Sino-Tibetan races who have occupied the river valleys (Irawadi, Salween, Menam, Mekong) and islands by successive migrations from prehistoric times to the 14th century; throughout this area Indian cultural influences began to be felt before or about the beginning of the Christian era, and by the 4th century A.D. or even earlier, Hindu kingdoms had been established in each area, using Sanskrit as an official language and a south Indian alphabet as official script. Sculpture and architecture, Hindu or Buddhist, of 5th to 7th or 8th century date are closely related to contemporary or slightly earlier Indian types, especially those of eastern, central, and western India in the Gupta period; Indian *śilpaśāstras* must have been in use, and Indian master-craftsmen at work, though local characteristics are already recognizable. After this period there develops in each area a local national culture, with an art somewhat less closely dependent on that of India; these several classical arts, in the period A.D. 800 to the 13th century, have so much stylistic originality as to make the designation "Indian Colonial" inappropriate. Finally after 1300 the culture and art in each area are either undermined by political disturbances, invasion, etc., or develop a provincial character; so far as it has survived to the present day, typically, for example, in Bali, the art becomes a folk-art, and as such deserves high respect and admiration, though it lacks some of the force and monumental qualities of earlier periods. Except in Burma, hardly any trace of painting has survived, so that our account of the most important artistic developments in each area will be essentially a study of the sculpture, the architecture having been treated in another article.

Burma.—The northern area, extending southward as far as Old Prome (Śrīkṣetra) was originally occupied by Pyus, the far south (Thāton) by Talaings, relatives of the Mon-Khmers. Indian colonies had been established in Arakan, Prome, Thāton, and other places; Pali inscriptions in a south Indian character and gold and silver Buddha images in Gupta style have been discovered, and together with other remains, partly Hindu and partly Buddhist, afford evidence of early and strong Indian influence. Burma, however, has always been predominantly Buddhist; Mahāyānist in the north, Hīnayānist in the south. In the 9th century the Talaings captured Prome and established a capital at old Pagan, farther north. Shan-Thai invasions followed, introducing the ancestors of the true modern Burmese, who have gradually replaced the Pyus and absorbed the Talaings. Pagan became an independent cultural centre, but very few of its countless temples and stupas date before the 11th century.

It is only with the unification of Burma under Anawrata (1040–77) that the great building era was initiated, which covered the Pagān plain with some 5,000 pagodas, as the Buddhist temples and stupas are commonly called. Anawrata conquered Thāton and brought Hīnayāna traditions to the north. The quantity of sculpture extant is not very great, and all that is of real importance dates from the 11th to the 13th century. The finest is the great series of 81 reliefs depicting the life of Buddha according to the *Avidura Nidāna,* set up in the Ānanda Pagoda (11th century); animated and exceedingly elegant, they exhibit already the development of a definitely Burmese style, distinct from the earlier, almost purely Gupta tradition. The Brahmanical reliefs of the Nat Hlaung Gyaung are somewhat more Indian. Most of the smaller bronzes and stone reliefs are very closely related to examples of the Pala school of Bihar and Bengal, and some may have been direct importations. A noteworthy phase of Burmese sculpture is represented by the large series of high relief glazed terracotta plaques, which decorate the Schwezigon, Petleik, Ānanda and other pagodas, and illustrate *Jātakas;* the art seems to have been introduced from the south.

Several of the Pagān temples contain contemporary paintings. Those of the Kubezatpaya and Kubyaukkyi, illustrating *Jātakas,* consist of small square panels closely grouped, but here and elsewhere there are separate representations of Buddhas and Bodhisattvas on a larger scale. The Minnanthu frescoes illustrate the Tantrik Buddhism of the Ari sects, a mixture of Buddhism and Hinduism, often quite erotic in its symbolism. Frescoes in the Kyanzitthu cave temple represent undoubted Mongols, who invaded Burma at the end of the 13th century. The stylistic affinities of Burmese paintings are with Bengal and Nepal, as exemplified in well known manuscripts of 11th and 12th century date; the outline is wiry and nervous, the hair above the brow descends in a central point, the eyebrows and eyelids are doubly curved; the three-quarter face is often seen, and the markedly projecting farther eye recalls an Indian mannerism that appears already at Elūrā and survives in the Gujarāti painting of the 15th–16th centuries.

After the 13th century the political conditions are more disturbed, the connection with India is not so intimate, and the sculpture and painting become more rigidly stylistic, until an art of purely folk character is developed, and this has survived into the 19th century. Much of the best work in this kind has been done in wood; wood-carving, indeed, became the dominant art of Burma in later times; some of the best examples occur in the elaborate decoration of the wooden monasteries of Mandalay and Amarapura, and also in the ornament of river boats.

Of the minor arts, Burma is famous for its lacquer, applied either architecturally or to small objects for personal or monastic use, the latter including books and book-covers. The smaller objects, baskets, etc., are made of finely plaited bamboo or horsehair; this foundation is varnished black, other colours are superposed, and by engraving revealed in the required designs. Much of the work is restricted to black and gold; other colours employed are red, green, and yellow. The designs may be geometrical or floral, or when more elaborate, may include figures of divinities or scenes from *Jātakas.*

Siam.—It is of primary importance to realize that the early art of the country now called Siam is not "Siamese," but includes a variety of schools; the Thais or Siamese did not themselves come into possession of the Menam delta before the 13th century, and before this time it is impossible to speak justly of "Siamese" art.

The designation "School of Dvāravatī" applies to remains, mainly of 6th century, found at Braḥ Paṭhama (Prapathom), Labapurī, Phong Tuk and other sites around the north-west angle of the gulf of Siam, an area which constituted the Mon kingdom known to the Chinese as Kan To Li and Dvāravatī. Among the sculptures are a finely decorated wheel (Dharmacakra) and standing and seated Buddha figures in stone and bronze, all in a style

closely related to that of the Gupta period in India, as seen at Sārnāth, Mathurā, and Ajaṇṭā. Brahmanical figures include statues of Viṣṇu with the cylindrical head-dress. All these types correspond in style and date with the "Khmer primitif" or pre-Khmer art of Cambodia. These early sculptures are usually made in a hard bluish limestone. The tradition of the school of Dvāravatī must have persisted until the Khmer invasions of the 11th century, and can perhaps be traced even in the earliest works of the southern Siamese kingdom of Ayuthiā.

The sculptures from Ligor and Jaiyā, in the northern Malay peninsula, a part of the Siamese territory, are now preserved in the museum at Bangkok, but they are rightfully classified as belonging to the school of Śrīvijaya, and will be referred to below under Sumatra.

Khmer influence is not felt until the beginning of the 11th century, with the foundation of a Khmer kingdom at Labapurī; to the Labapurī school belong the characteristic "Siamese" sculptures of Khmer type, dating from the 11th and 12th centuries. Most of these are executed, as in Cambodia, in sandstone; they are almost entirely Buddhist. The majority are somewhat inferior to the actual Cambodian works, but three at least (Coedès, *Collections du Musée National,* Plates XVII.–XXI.) are of superb quality, the most remarkable being the royal portrait said to be that of the legendary king Brahmadatta. In the sculpture of the Labapurī school the classical Khmer type with level brows and eyes, large mouth, and impassable serenity, is easily recognizable, but a certain provincial differentiation can be distinguished, for example in the rather longer and sharper nose, due perhaps already to a certain mixture with native or northern elements. Later Siamese art is in part founded on this Labapurī tradition, as modified by the northern Thai formulae. At this time, however, and up to the 13th century, Lāṁbūn in the north remained under Mon rule, as is proved by inscriptions.

Meanwhile Siamese (Thai) Buddhist art had been developing in the extreme north at Xieng Sen, to some extent under Indian Pāla influences passing through Burma. Almost all the northern works are in bronze. The main characteristics are the bulky form, producing an almost feminine type, the arched brows, small mouth, and fleshy chin. About the same time a similar type appears in the far south at Ligor, a fact similarly referable to the widespread Pāla influences exerted at this time.

The classical Thai (Siamese) type was created by the independent kingdom of Sukhodaya (Sukothai-Sawankalok), which came into being only in the middle of the 13th century. It exaggerates the Xieng Sen formulae, but is more refined; it is in every way the opposite of the old Khmer type of Labapurī. The Siamese type established at Sukhodaya is characterized by markedly arched brows, doubly curving upwardly inclined eyelids, an aquiline or even hooked nose, and delicate sharply moulded lips. To this Sukhodaya school and its earliest southern prolongations belong all the finest examples of Siamese art properly so called. Siṁhalese influence can also be recognized, confirming literary evidences and tradition; for example, the terminal flame of the *uṣṇīṣa,* characteristic in Siamese art from this time onwards, is of Siṁhalese origin, and the engraved *Jātaka* illustrations of Wāt Si Jum at Sukhodaya, of high decorative beauty, but really drawings on stone rather than sculpture, show a decided affinity with the contemporary painting at Poḷonnāruwa in Ceylon.

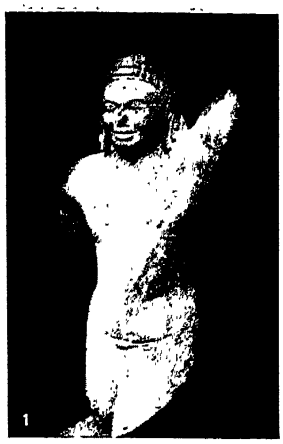
The Siamese formula extended rapidly to the lower Menam valley with the Thai advance, overlying and profoundly changing the Khmer art of Labapurī. The main developments are represented by the early transitional school of Ū Thong (late 13th and early 14th century) and the later school of Ayuthiā from the middle of the 14th century. By this time, too, the Siamese formula is beginning to exert its influence even in Cambodia. Ayuthiā remained the capital until 1757, the year of the foundation of Bangkok.

The art of the Ayuthiā period, often fine in technique and elegant in form, is on the whole that of a period of decadence; the plastic quality is gradually lost, the forms of the features are accentuated by outlines, and the modelling becomes at last insensitive. But the bronze seated Buddha at Braḥ Mongkol Bopitr, Ayuthiā, cast probably in the 16th century, and still *in situ,* is a magnificent figure, the largest bronze Buddha in the world, after the Dai Butsu in Japan. Somewhat less interesting, dating from the early 16th century, are the large brass statues of Śiva and Viṣṇu recently rediscovered at Kampeng Brej (Kampeng Phet); these illustrate an occasional tendency to "Khmerism" which appears sporadically even in true Siamese art.

Siamese painting on walls and in illustrated manuscripts is hardly known by extant examples of earlier than 17th or 18th century date, but has a very definite ethnic character, and may be considered of high merit, regarded as a folk rather than as a classic art. Closely related to this painting is the excellent gold lacquer work applied to temple doors and windows, book covers and book chests (fine examples in the royal library, Bangkok). Siamese porcelain is mainly of Chinese origin, that is to say made in China, but in Siamese designs and for the Siamese market; it is gaily enamelled in five colours, and the wares of this type range in date from the 16th century to about 1868. Earlier, about the 13th century, the manufacture of celadon and crackled wares had been established at Sawankalok with good results, and production continued for some time. Of other Siamese arts and crafts, the silverware (filigree, repoussé and niello), jewellery and damascening on steel all maintained a high standard of excellence up to quite modern times. Another craft deserving mention is that of preparing the cut leather figures used in shadow plays.

Cambodia.—Here the record is most complete, extending at least from the 6th to the 14th century. The early or pre-Khmer or Indianesque art (as it is variously called) occurs mainly in the south (Funan), and includes many sculptures in the round and in relief, Buddhist and Brahmanical. Buddha figures of 5th or 6th century dating from Romlok are closely related to Gupta types; the drapery, without indication of folds, clings closely to the body, and the swayed pose vividly recalls the types of Ajaṇṭā and Sārnāth. A vigorous and powerful Buddha head is in some respects intermediate between Indian and Chinese T'ang types. Even more striking and distinguished are the best of the Brahmanical figures; the Stoclet figure from Phnoṁ Da and also the Harihara from Prasāt Andet may be said to rank amongst the very finest examples of any Indian school. The former is almost unique in pose, and may represent either a deified king, or possible Kṛṣṇa in the act of raising Mt. Govardhana; the figure has a concentration and living quality that are powerfully impressive. The Harihara (union in one person of Śiva and Viṣṇu), if somewhat less animated, has a like simplicity of form, and truly royal dignity. The characteristic cylindrical head-dress is directly of Indian origin; it is worn by kings at Amarāvatī, and in earlier Indian art by Indra.

Comparatively little sculpture can be assigned to the disturbed period of the 8th century. With the 9th, we reach what is known as the classical period of Cambodian (Khmer) art, covering nearly five centuries. While cult and mythology are still essentially Indian, a local ethnic type, very definite and unmistakable, is developed, characterized by broadness and straightness of the features. Two special cults are strongly developed, the one that of the worship of deified royal ancestors, represented by images in the form of their patron deity, the other that of the "royal divinity" (Devarāja), represented by a lingam. Apart from these, almost the entire Brahmanical and Buddhist pantheon is represented. Highly characteristic of the later, but not the latest phase of Khmer classical art is the representation of immense faces in relief on the towers of temples and city gateways; these most typically in the Bayon of Aṅkor Thoṁ, the city to which the seat of government was removed from the adjacent Prah Khan about A.D. 900. The Bayon, *c.* A.D. 1050, is in many respects the most remarkable, as the later *Aṅkor Wāt, c.* A.D. 1125, is the most beautiful, of all Khmer buildings. All the great towers have masks on four sides. Besides this, the various chapels held images of Buddhist and Hindu deities, deified ancestors, and the Devarāja. Few of these remain *in situ,* but in addition to those, and to rich floral decorations, the walls of the lower galleries are covered with reliefs representing divinities, epic legends, processions, naval com-















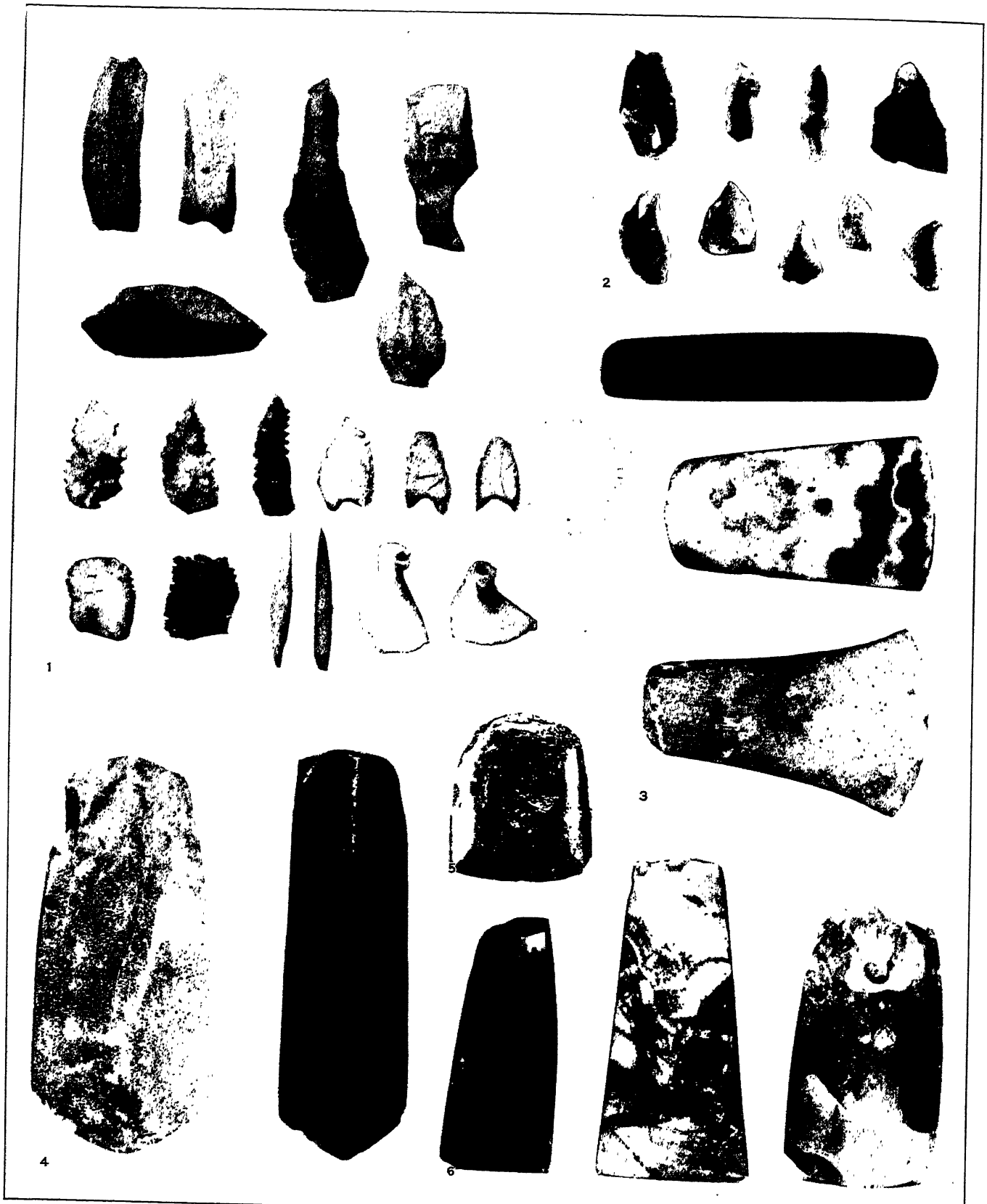


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INDONESIAN AND FURTHER INDIAN ART FROM THE 6TH TO THE 13TH CENTURY A.D.

1. Deity, Phnom Da, Cambodia, early Khmer, 7th cent. 3′ 11″. 2. A tower of the Bayoṅ temple, Aṅkor Thom, Cambodia, 11th cent. 3. Harihara; Prasāt Andèt, Cambodia, early Khmer, 7th cent. A.D. 6′ 3″. 4. Garuḍas, terrace, Aṅkor Thoṁ, Cambodia, 11th cent. 5. Buddha from Borobuḍur, Java, late 8th cent. 6. The message of the ring (Sudhana Kumāra), Borobudur, Java, late 8th cent. 7. Ganeśa, Siṅgasārī, Java, 13th cent. 8. The Bodhisattva (Buddha); Ānanda temple, Pagān, Burma, late 11th cent. 9. Bodhisattva, Diéng, Java, copper, 10th cent., 5½″. 10. Episode of the *Rāmāyana;* Prambanam, Java, 9th cent. 11. Devatā; Aṅkor Wāt, Cambodia, 12th cent. 12. Buddha; Chieng Mai, Siam, 13th–14th cent. 1′ 10½″. 13. Temptation of the Buddha, Borobudur, Java, 8th cent. 14. Gallery relief, Aṅkor Wāt, Cambodia, 12th cent. 15. Head of Siva or the sage Agastya; Cambodia, 10th cent.

INDONESIAN AND FURTHER INDIAN ART



BY COURTESY OF (1, 2) THE DIRECTOR OF THE BASLE MUSEUM (3, 4, 6) THE DIRECTOR OF THE RIJKS ETHNOGRAPHICAL MUSEUM, (5) THE DIRECTOR OF THE MUSEUM FÜR VÖLKERKUNDE

PALAEOLITHIC RELICS FROM INDONESIA

1. Objects from the caves of Lamontjong, southern Celebes. Left to right, beginning at the top: Two two-edged knives, point, scraper, one-edged knife, point, three arrow-heads with saw-like edges, three barbed arrow-heads showing neolithic influence, two flakes (probably used for insertion in wooden clubs), an arrow-head from bone, an arrow-head from the lower tooth of a boar, two scrapers made from the shell of *Nanina Toa-Iarum* (a land-snail). 2. Knives, points and flakes of obsidian from the cave Ulu Tjanko in central Sumatra. 3, 4, 6. Neolithic axe-heads from western Java. 5. Axe-head from the island of Leti, eastern Indonesia

bats, and scenes from contemporary industrial life, as though the founders of Aṅkor had wished to perpetuate a record of the glory of their state. Bronzes of the classical period have also been found in considerable numbers. Towers with masks crown the triple gateways of the city, and the causeways leading across a moat to these entrances are flanked with parapets consisting of Devas and Yakṣas of colossal proportions supporting the body of a gigantic Nāga, which takes the place of a railing. These Nāga parapets, with or without giant supporters, and terminating in elevated many-hooded heads, are most characteristic of Khmer art. Within the city, the retaining wall of the great terrace, which ran along one side of the public square and in front of the palace, is covered with a continuous series of reliefs representing lions, horses, elephants, Garuḍa caryatides, games and hunting and battle scenes; at one end there is a kind of belvedere, with a retaining wall decorated with successive tiers of seated royal or divine figures; and upon it there still remains *in situ* the nude figure known as the "Leper King," who may have been Yaśovarman, the first ruler of the city.

In the vast number of extant Cambodian temples, and in the museum at Phnom Peñ as well as in French and American museums, there survive innumerable examples of classical Khmer sculpture; amongst the few of the latter which can be localized may be mentioned the seated figure, probably of Sūryavarman I., from Phnom Chisor. The perfect application of the classical art, however, is reached at Aṅkor Wāt, the later name of the most famous Cambodian temple, a Brahmanical erection of the first half of the 12th century, due to Sūryavarman II. Most of the Buddhist images now to be seen here are of much later date; the sculptural importance of the temple depends on the two great series of reliefs, one widely distributed and decorating wall and pilaster surfaces, the other along the inner wall of the lower galleries surrounding the central mass. Of the former, the most enchanting are the figures of Devatās, often described as dancing girls, though in reality the descendants of the Yakṣīs of early Indian art. In the words of a later Cambodian poet (Fang), "one cannot see them thus, so beautifully made, and in the flower of their youth, without adoring them. The eye does not tire, the soul is delighted, the heart is never satisfied. One cannot make up one's mind to leave them. They are no longer figures made by human hands; they are living women, beautiful and gracious." On the other hand the gallery reliefs are heroic, dealing with the battle scenes of the *Rāmāyaṇa* and *Mahābhārata,* cosmic events like the Churning of the Ocean, and images of heaven and hell. In their superb vitality these reliefs are superior to the more exquisite and lovely sculptures of Borobuḍur. That Khmer sculpture maintained a high level of achievement much later is proved by the remains of the temple of Īśvarapura at Bantay Srei, distant 13 m. from Aṅkor Thoṁ, and of 14th century date. After this, the Khmer *régime* was altogether broken down by the Siamese conquerors; all that survives to the present day is the great tradition of the theatre and of the sumptuary arts. Cambodian weavers still excel in the weaving of silks in which the threads are parti-dyed before the warp is laid (*chiné* or *ikat* technique), and their productions are amongst the finest textiles still made in the East. Fine work on traditional lines in gold and silver is done, and there exist craftsmen able to cast bronze figures in admirable reproduction of ancient types.

Campā (Annam).—Although the Sanskrit inscription of Vocanh dates back to about A.D. 200, the only really early sculpture is a standing Buddha figure in bronze found at Dong-Duong, this is so closely related in style to the Indian school of Amarāvatī, and to the early sculpture in Ceylon, that it may well have been an importation. Nothing Indianesque in the Gupta style has been found. The best sculptures in stone are the Brahmanical figures (Śiva, Kārttikeya, Gaṇeśa, etc.) from Mi-son, dating partly from the 7th century, and now to be seen in the museum at Tourane. At Dong-Duong, the only Buddhist site in Campā, a colossal broken Buddha still lies amongst the ruins, dating from the beginning of the 10th century. At Po Nagara, a statue of Bhagavatī, which in the 10th century replaced an original lingam, is now worshipped by the Annamites. At Po Klong Garai, the lingam set up in the 13th or 14th century still receives the offerings of Cam worshippers.

Sumatra and Malaysia.—Little remains in Sumatra proper in the way of sculpture: and the art of the Śailendra period in Central Java (*see* below), though due to Sumatran patronage, must be regarded as essentially Javanese. Beautiful and important sculptures dating from the same period, and quite in the Śailendra style, have been found at various sites in the north of the Malay peninsula, now part of Siam. Towards the end of the 7th century, as is proved by inscriptions, the influence of Śrīvijaya (the name of the Sumatran empire of the Śailendras) was exerted in the region of Ligor and Jaiyā, and this fully accounts for the "Javanese" character of the magnificent bronze figures of Lokeśvara from Jaiyā, now in Bangkok, and for the plan of Wāt Keo at Jaiyā, so like that of Caṇḍi Kalasan in Java. But at these sites there have also been found sculptures much more like those of "pre-Khmer" art in Cambodia, and a Mon-Khmer influence in northern Malaysia must also be allowed for.

Java.—Nothing in the way of sculpture remains from the old Hindu kingdom of Tārumā in western Java; this would have been of the Gupta type. The earliest sculptures are those of the temples of the Dieng plateau, already possessing a definitely Indonesian character. The best, perhaps, are the Brahmā, Śiva and Viṣṇu reliefs of Caṇḍi Śrikandi. Immediately afterwards we come to the extensive monuments of the Śailendra or Sumatran period (*c.* A.D. 732–860) in middle Java. The earliest of these is Caṇḍi Kalasan, where there remains much beautiful decorative sculpture, but the main image, probably a bronze Tārā, is lost; at Caṇḍi Sāri, however, there are numerous figures in relief. The reliefs of the small chapels of Caṇḍi Sewu at Prambanam are perhaps more beautiful. At Caṇḍi Mendut, near Borobuḍur, the serene and lovely Buddha and Bodhisattva figures are still *in situ,* perfectly preserved, and these are probably the finest examples of middle Javanese sculpture in the round.

At Borobuḍur, sculpture in the round is represented by a great series of seated Buddha figures, placed in niches and in the hollow dagabas on the upper terrace. Varying somewhat in quality, the forms are full and serene rather than strongly energized. Most remarkable is the great series of reliefs illustrating the life of Buddha according to the *Lalita Vistara,* and edifying legends from the *Divyāvadāna, Gaṇḍāvyūha,* and *Jātakamālā,* all of which are reproduced and described in the magnificent publications by Krom and Erp. These reliefs are found along the inner sides of the terraced procession paths, and if placed end to end would extend for nearly three miles. The untroubled richness of the forms, the absence of dramatic emphasis, reflect the enormous wealth and security of the Śailendra culture; devotion itself appears rather as culture than as passion; yet the beauty of these reliefs once realized can never be forgotten.

The return of the Javanese kings to Central Java at the end of the 9th century accounts for the great Brahmanical temple complex of Caṇḍi Loro Jongran at Prambanam. Most remarkable here are the reliefs of the terrace of the Śiva temple, illustrating the *Rāmāyaṇa;* fundamentally in the same style as those of Borobuḍur, they are more animated and more dramatic, as is perhaps natural having regard to their heroic theme. After 915 Central Java was for long completely deserted, and the continuation of the art history must be sought in the east, under the kings of Kediri, Singasari and Majapahit.

A remarkable "portrait" figure of Erlanga (A.D. 1010–42) near Belahan takes the form of a representation of Viṣṇu riding on Garuḍa, a true masterpiece of vigorous sculpture. Singasari in the 13th century has yielded numerous magnificent sculptures, including figures of Gaṇeśa, Durgā, Mañjuśrī and the goddess Prajñāpārimita; the last, now in Leyden, is one of the most famous pieces of Javanese sculpture, though in reality somewhat lacking in vitality and over-refined. Really more significant, though already remote from the classic tradition, are the *wayang* (leather puppet-like) reliefs of Caṇḍi Jago, illustrating the *Kṛṣṇāyaṇa,* a rather unexpected theme in a Buddhist temple, but exemplifying the profound intermixture of Brahmanical and Buddhist cult which had already taken place in Java, as in Nepal and Cambodia,

and as still surviving in Bali. Here, and more conspicuously in the later (14th to 15th century) reliefs of Panataran, illustrating the same theme and the *Rāmāyaṇa*, there becomes apparent a passing over of the classical tradition into a purely folk art, and the emergence of an indigenous Malay-Polynesian ethnic factor in which the stylistic inheritance of India is almost overwhelmed. After the 15th century, when almost all Java had accepted Islam, this later folk art continued to flourish in Bali, and has survived there up to the present day.

Borneo.—A handsome standing bronze Buddha from Kota Bangoen has long been known, and is now to be seen in the museum at Batavia. More recently, there have been found in the Koetei district of Middle East Borneo, in the caves of Kombeng, where they were perhaps hidden about 1600 when Islam prevailed in Borneo, numerous sandstone images, both Brahmanical and Buddhist; the former include figures of Śiva, Kārttikeya, Gaṇeśa, Agastya, etc., the latter various Bodhisattvas, or perhaps deified royal ancestors. Further, amongst the crown jewels of Koetei is a gold pendant consisting of a standing figurine of Viṣṇu, four-armed, and flanked by a pair of Garuḍas. These remains show that eastern Borneo too was at one time the seat of a Hinduized kingdom.

The iconography of the images is a little confused, and their style somewhat provincial, but the best examples are of really fine quality. The bronze Buddha shows clear traces of the Indian Gupta style. Taken all together, the sculptures show a close stylistic connection with those of the Dieng plateau and Borobuḍur in Java, and they may be regarded as the products of a local school in Borneo, dating from the Śailendra epoch in Java, and for the most part referable to the 7th or 8th century. (*See* also INDIAN ARCHITECTURE; INDIAN AND CEYLONESE ART AND ARCHAEOLOGY; TEXTILES; BATIK.)

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INDORE, an Indian State in the Central India agency, comprising the dominions of the Maharaja Holkar. Its area, exclusive of guaranteed holdings on which it has claims, is 9,519 sq.m. and the population in 1921 was 1,151,598. As in the case of most states in Central India the territory is not homogeneous, but distributed over several political charges. The Vindhya range traverses the southern division of the state from east to west, a small part of the territory lying to the north of the mountains, but by far the larger part to the south. The latter is a portion of the valley of the Nerbudda, and is bounded on the south by the Satpura hills. Basalt and other volcanic formations predominate in both ranges, although there is also much sandstone. The Nerbudda flows through the state.

The state had its origin in an assignment of lands made early in the 18th century to Malhar Rao Holkar, a peasant's son who worked his way up to a cavalry command in the army of the Mahratta peshwa. Of the Dhangar or shepherd caste, he was born in 1694 at the village of Hol near Poona, and from this circumstance the family derives its surname of Holkar. Before his death in 1766 Malhar Rao had added to his assignment large territorial possessions acquired by his armed power during the confusion of the period. By the end of that century the rulership had passed to another leader of the same clan, Tukoji Holkar, whose son, Jaswant Rao, took an important part in the contest for predominance in the Mahratta confederation. At first he defeated a British force that had marched against him under Colonel Monson; but when he made an inroad into British territory he was completely defeated by Lord Lake in 1804, and compelled to sign a treaty which deprived him of a large portion of his possessions. In 1818, by the treaty of Mandason, the state transferred to the British government its suzerainty over a number of minor tributary states, and acknowledged the British protectorate. For many years afterwards the administration of the Holkar princes was troubled by intestine quarrels, misrule and dynastic contentions, necessitating the frequent interposition of British authority; and in 1857 the army, breaking away from the chief's control, besieged the British residency. In 1899 a British resident was appointed, and a change was made in the system of administration, which was from that date carried on by a council. Of its last two rulers, one abdicated in 1903 and his successor in 1926. The present Maharaja was born in 1906. His salute is 19 guns.

The CITY OF INDORE (pop. 93,091) is situated 1,738 ft. above the sea, on the river Saraswati, near its junction with the Khan. It is one of the most important trading centres in central India, with flourishing cotton-mills, a good hospital and college, besides palaces and gardens.

East of the city lies the British Residency, an area reserved by treaty under British jurisdiction. The Resident and his staff live here, and it is the site of the Daly college, a fine marble building, for the education of young Indian princes and nobles.

INDORSEMENT or **ENDORSEMENT:** *see* BILL OF EXCHANGE.

INDO-SCYTHIANS, a name commonly given to various tribes from central Asia, who invaded northern India and founded kingdoms there. They comprise the Sakas, the Yue-Chi or Kushans, and the Ephthalites or Hūnas.

INDRA, in Vedic Hindu mythology god of the clear sky and greatest and best of deities; he is lauded in some 300 hymns (or quite a fourth of the *Rig-Veda*). Unquestionably of Zoroastrian origin, the Boghaz Keui inscription (*c.* 1400 in Asia Minor) mentions Indra with Varuna and Asvins, but in the *Avesta* he appears as a demon. In the *Vedas* however his paternity is ascribed to Dyaus, the Sky, and he is almost the national god of the invading Aryans. Represented as having four arms and hands, in two he holds a spear and in a third a thunderbolt, his body is depicted as Sahasrakhsha, "with 1,000 eyes." In the epic age Indra survives as one of the eight great Devas, but is gradually subordinated to Brahma, Siva and Vishnu, and in modern Hinduism he is merely vicegerent of Swarga the heaven of the gods.

INDRE, a department of France, formed in 1790 from parts of the old provinces of Berry, Orléanais, Marche and Touraine. Pop. (1926) 255,095. Area 2,666 sq.m. It is bounded north by the department of Loir-et-Cher, east by Cher, south by Creuse and Haute-Vienne, south-west by Vienne and north-west by Indre-et-Loire. The department slopes north-westwards from the Plateau Central and is drained by the river Indre. In the north is the

Champagne, a land of corn and of sheep with fine wool; in the west is the Brenne, once marshy, now drained and afforested; the wooded Boischot is in the south, east and centre. The average annual temperature is nearly three degrees higher than that of Paris, but the winter on the higher Boischot is somewhat severe. The average rainfall is 23½ inches. Wheat and oats are largely grown, as are beetroots and artichokes. Wool-spinning and weaving and iron-working are the chief industries; felt hats and parchment are made.

The department is divided into the arrondissements of Châteauroux, the capital, le Blanc and la Châtre, with 23 cantons and 247 communes. It is in the archbishopric of Bourges, where is the court of appeal; it is in the region of the IX. Army Corps (Tours), and of the académie (educational division) of Poitiers. At Neuvy-St. Sépulchre there is an 11th century circular church with a 12th century nave; at Mézières-en-Brenne a 14th century church; at Levroux a 13th century church, and the remains of a feudal fortress; and a magnificent Renaissance château at Valençay. St. Genou has an 11th century church and a 12th century tower. There are several dolmens in the department.

INDRE-ET-LOIRE, a department of France, consisting of nearly the whole of the old province of Touraine and of small portions of Orléanais, Anjou and Poitou. Pop. (1926) 334,486. Area 2,377 sq.m. It is bounded north by the departments of Sarthe and Loir-et-Cher, east by Loir-et-Cher and Indre, south and south-west by Vienne and west by Maine-et-Loire. The department is floored by the southern outcrop of Eocene of the Paris basin, with barren shell-marl at Sainte-Maure between the Indre and the Vienne; the Loire and its affluents, the Cher, Indre and Vienne, cut valleys with fertile slopes through these Eocene deposits. North of the Loire is the barren Gâtine; between Cher and Indre the vine-clad slopes of Champeigne; between the Loire and Vienne the vine- and fruit-growing Véron sloping down to the Val d'Anjou; and in the south the Brenne (*see* INDRE). The climate is mild with average annual temperature 1·8° F. above that of Paris, and about 24 in. of rainfall. Cereals, potatoes, hemp, beetroot and the vine are grown, and many sheep reared. There are quarries of building- and mill-stones. The industries include iron and lead working, potteries, silk-spinning and weaving, important tanneries and the making of famous wines.

Indre-et-Loire is divided into the arrondissements of Tours and Chinon, possessing 24 cantons and 282 communes. The chief town is Tours, which is the seat of an archbishopric; the court of appeal is at Orléans, and the department is in the region of the IX. Army Corps (Tours) and of the académie (educational division) of Poitiers. Chinon, Loches, Amboise, Chenonceaux, Langeais and Azay-le-Rideau are also important. Montbazon has the ruins of a square donjon of the 11th and 12th centuries. Preuilly has the most beautiful Romanesque church in Touraine. The Sainte Chapelle (16th century) at Champigny is a survival of a château of the dukes of Bourbon-Montpensier. The church of Montrésor (1532) has the mausoleum of the family of Montrésor. The town of Richelieu, founded in 1631 by the famous cardinal, preserves its enceinte and many 17th century buildings. Megalithic monuments are numerous.

INDRI, the largest of the existing lemurs. Belonging to the family *Lemuridae* (*see* PRIMATES) it typifies the subfamily *Indrisinae,* which includes the avahi and the sifakas (*q.v.*). From both these it is distinguished by its rudimentary tail, measuring only a couple of inches in length, whence its name of *Indris brevicaudatus.* It measures about 24in. in length, exclusive of the tail; its colour varies, but it is usually black, with a number of whitish patches. It inhabits the forests of a small tract on the east coast of Madagascar; shoots, flowers, and berries form its food.

INDUCTION, means sometimes generalization; sometimes the whole series of steps by which a generalization is discovered and established (that is, the processes of observation, formation of hypothesis, verification of hypothesis by further observations or experiments, and formulation of the generalization in a manner that will best fit all the observations and experiments); and sometimes the term is used in a still wider sense for any attempt to discover any kind of order or connection between certain facts, whether it results in a generalization or not. Now the various methods by the aid of which the attempt is usually made to trace order and connection in phenomena are known as the methods of science, and are described in the article SCIENTIFIC METHOD (*q.v.*). Here it is only necessary to discuss some of the more general aspects and problems of induction, more especially its logical basis or justification.

Logical Basis of Induction.—Generalization is probably as old as human thought. In fact, the tendency to rash generalization would seem to be one of the original sins of mankind. It is one side of the formation of habits. When a certain number of things have been observed to have certain attributes, uncritical people form the habit of expecting all such things to have those attributes. Witness the reckless way in which such people generalize about the characters of whole peoples, after a superficial acquaintance with a very few representatives. Similarly, where certain events have been observed to occur at the same time, or in rapid succession, they are apt to be regarded as uniformly connected. It is in this way that the numerous superstitions have originated. Mankind did not have to wait for the growth of the scientific spirit to learn to generalize; it only had to wait, and still waits, for the growth of the scientific frame of mind in order to learn to check that rash tendency, and to tread warily in order to reach *legitimate* generalizations.

Early thinkers like Aristotle attempted to check the tendency to rash generalization by setting up a severe standard, and insisting that the ideal of generalization is what is still known as "perfect induction," that is, generalization based upon an exhaustive examination of the whole group or class of facts concerned. No doubt it would be a great boon to mankind if people refrained from generalizing about whole countries or communities until they knew every citizen or member thereof. But then the ideal of perfect induction has made no impression on practical people, and has proved to be worthless as a guide for scientific people. In the vast majority of cases the classes of objects and events with which science is concerned are far too numerous to permit anything even distantly approaching exhaustive individual examination of all the members. All the important inductions of science are what used to be called imperfect inductions, that is to say, generalizations based on the examination of a bare sample of the whole class under investigation. And its great problem has been, and still is, how to excuse, or to justify, such extensive generalizations after the study of but a few instances or specimens. To this question various answers have been attempted, and the most important of them may now be considered briefly.

One answer, which is rather in favour among some of the more philosophical of contemporary men of science, is to the effect that there is really no justification for induction. All inductions, and all forecasts based on them, are just more or less sanguine adventures, or speculations. And the fact that they do not always disappoint us is nothing short of marvellous. It is just like drawing a cheque on a bank and finding it honoured, although one has no reason for thinking that he has a balance there. This kind of agnostic solution, if it may be called a solution, is not really satisfactory. It practically amounts to giving up the problem as hopeless. After all, in this as in other matters, it is the business of the investigator to interpret nature in the light of the clues she affords. If a bank honours one's cheque, one does not marvel at it, but draws certain conclusions about one's balance or one's credit. If nature fulfils anticipations based on inductions, some inference might be drawn about her character or constitution.

Law of Succession.—Another answer given, and one that is much in favour among certain statisticians and other mathematically minded people, is based on what is known as the law of succession. Assuming that all generalization is essentially of the artless type mentioned above, and commonly known as induction by simple enumeration, the solution now under consideration bases itself on the calculus of probability, and correlates the reliability of the generalization with the number and kind of observations made. Each observed occurrence of an event in certain

circumstances is treated as a point in favour of expecting its recurrence in similar circumstances. However, the probability diminishes for every increase in the number of recurrences contemplated. Thus if the event in question has been observed m times and has failed to occur x times, then the probability of r recurrences will be expressed by the formula $(m+1)/(m+x+r+1)$, which is known as Laplace's Law of Succession. If the number of occurrences observed (m) is very large, and if no exceptions are known (i.e., $x=0$), and if one contemplates just one recurrence (i.e., $r=1$), then the probability may approximate certainty, for $(m+1)/(m+r+1)$ will in that case nearly $=1$, *i.e.*, certainty (*see* PROBABILITY). But now in a real scientific generalization (say, *e.g.*, the Law of Gravitation, or the Laws of Motion), the number of recurrences contemplated (r) is practically infinite, so that its probability, according to the above formula, cannot really be high, even at the best. Moreover, on what rational grounds can a previous occurrence be regarded as a reason for its recurrence, as distinguished from our spontaneous expectation of it? This solution, too, cannot therefore be regarded as satisfactory.

J. S. Mill based all induction on the principle of the uniformity of nature, but his conception of this was not very satisfactory. For, on the one hand, he regarded this assumed objective uniformity, in the character and connections of natural phenomena, as the ground of all induction, and, on the other hand, he regarded it as being itself a very comprehensive induction based upon numerous other inductions each much more limited in scope. This ambiguous attempt to make the same principle at once the foundation and the roof of this whole structure of science has not been received with favour. But it may be reasonably interpreted, perhaps, as meaning that we start with the assumption of the existence of uniformities among natural phenomena, that we justify all actual generalizations on the strength of this assumption, but that, on the other hand, the very success of the numerous generalizations made may be regarded as a kind of verification (and, in that sense, as a ground) of the principle itself. This, at all events, would afford some explanation of the unexplained marvel referred to in the agnostic answer already stated above. And, in any case, it seems impossible to dispense entirely with some such postulate as that of the uniformity of nature, even if we also admit that by itself it does not help us to discover, or to test, any actual generalization. In this respect we need also the postulate or principle of fair samples, that is, the assumption that, with reasonable care, it is possible to judge the character of a large group, or of a whole class, of phenomena by means of a sample selected with discrimination.

Perhaps the least unsatisfactory way of answering the general question as to the logical ground of induction, using this term in its widest sense for every attempt to trace order in nature, is on the following lines. The scientific search for order among natural phenomena would seem to assume the existence of order there. Science does not propose to invent it and impose upon nature, only to discover it, if possible. This search does not necessarily presuppose a definite conviction that what is sought is actually there. One may look for what is hoped for, or for what is deemed probable, as well as for what is definitely expected to be there. Moreover, to assume that there is some order in nature is not the same thing as to suppose that nature is orderly through and through.

After all the world is vast, and the field of actual scientific investigation is comparatively limited, so it is always open to the man of science to select for his field of research some class of facts in which the discovery of order looks fairly promising. On the whole, experience has shown that there is some order in nature, indeed, sufficiently so to justify and encourage the continued search for more. Turning to the question of the ground of generalization more particularly, one must, in the first place, distinguish between those which rest on induction by simple enumeration only, and those which are based ultimately on one of the induction methods, especially when these can be applied with some rigour, and not rather loosely. Inductions based on simple enumeration, and even statistical generalizations must always be regarded with a measure of diffidence. They may indicate temporary or partial conjunctions rather than general connections. It is rather different in those cases in which the inductive methods have been applied (whether in the form in which J. S. Mill has formulated them, or in some similar form).

Even in such cases, it is true, what the method applied really proves is that in the particular instance observed, or experimented with, a certain phenomenon was causally connected with a certain other phenomenon. It does not by itself prove the generalization that those two kinds, or classes, of phenomena are causally connected. But we are so constituted that, wittingly or unwittingly, we assume what has been called the principle of the uniformity of reasons, which states that "whatever is regarded as a sufficient reason in any one instance is regarded as a sufficient reason in all instances of that type." If in a particular case it appears, through the application of one of the inductive methods, that d as such was causally connected with c, then d must be assumed to be always causally connected with c, and in this way we arrive at the generalization. The extreme sceptic or agnostic may dismiss this principle as a mere prejudice or defect of human intelligence. But is it so unreasonable to suppose that human intelligence has gradually and painfully been shaped so as to fit the constitution of nature?

See SCIENTIFIC METHOD and the bibliography given there. For induction in mathematics *see* MATHEMATICAL INDUCTION.

(A. Wo.)

INDUCTION COIL, an electrical instrument for producing high electromotive force, consisting of two coils of wire wound one over the other on a core formed of a bundle of thin iron wires or a number of thin iron sheets. An induction coil is thus essentially an electromagnet with two windings called the primary and secondary coils. The action of induction coils depends upon the effect known as electromagnetic induction, discovered by Faraday in 1831. (*See* ELECTRICITY.) If an electric current in the primary coil is caused to vary rapidly, a current is induced in the secondary which, flowing to its terminals, produces temporarily an accumulation of electricity on and near them and a high potential difference between them. The variation of the primary current is usually effected by "interrupting" this current, *i.e.*, by breaking the connection between the primary coil and the source of current supply. In some applications of induction coils, however, the primary coil is supplied with alternating current, and the action is then similar to that of a transformer (*q.v.*). Induction coils are largely used in X-ray work in which very high voltage is required to produce the discharge through the tube in which the X-rays are generated. A few years ago, in the early days of wireless telegraphy, induction coils were much used for actuating the transmitting apparatus. They are still employed in connection with the production of high frequency discharges for medical purposes. Small induction coils are used in very large numbers for producing the sparks required for ignition in internal combustion engines.

The history of the induction coil begins in Nov. 1831, when Faraday described an experiment (*Phil. Trans. R.S.*, 1832; and *Experimental Researches*, vol. i.) in which two coils of wire were wound on an iron ring and insulated from each other. Faraday observed that if the terminals of one of the coils were brought near each other, short sparks appeared between them when a current was started or stopped in the other coil. Soon afterwards other experimenters began to develop this method of producing high potential effects, among them Joseph Henry, C. G. Page, N. J. Callan, and William Sturgeon. It was soon found that the effects could be obtained with coils wound on a straight iron core, and that a core made up of a bundle of thin iron wire was more effective than one consisting of a single bar of iron. Before 1840 the automatic mercury, or platinum contact, interrupter, actuated by the intermittent magnetization of the core, had come into use. No further marked improvement was effected till 1853, when Fizeau added the condenser, connected to the terminals of the interrupter, which greatly increased the length of spark obtainable with induction coils. About the same time Ruhmkorff, in Paris, introduced several improvements, especially in connection with the insulation of the secondary wire. He also increased the number

of turns in the secondary coil, and wound it on a glass tube to improve its insulation from the primary coil. Ruhmkorff also adopted in his later coils the method (previously suggested by E. and C. Bright) of winding the secondary coil in numerous flat sections instead of arranging it in layers extending over the whole length of the coil, the object being to keep as far apart as possible windings which are at a great difference of potential.

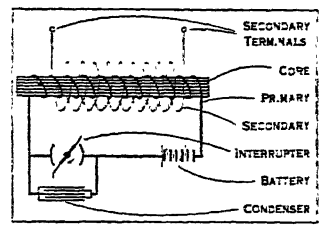
During the period 1867–1900 several very large induction coils were made by different manufacturers for the purpose of producing sparks of great length. One of these, made by A. Apps, for the old Polytechnic Institution of London, had a core of iron wire 5 ft. long, and a secondary wire 150 m. in length. This coil gave sparks 30 in. long. A still larger coil, made by Apps for Spottiswoode, and now preserved at the Royal Institution, London, had a secondary coil of 341,850 turns, the total length of the wire being 280 miles. With a battery of 30 Grove cells, sparks 42 in. long could be obtained with this coil. Very large coils have also been made by Klingelfuss, of Basle, who employed an improved method of sectional winding of the secondary coil. The wire is wound in one continuous length and, by the use of separating discs of stepped form, the thickness of the insulation between neighbouring turns of consecutive sections is graded in accordance with their difference of potential. Induction coils made by this firm are notable for their comparatively small number of secondary turns, one of them, with only 86,000 turns, producing sparks 1 metre long. A coil made by the same firm for the Paris Exhibition of 1900 gave sparks 150 cm. (59 in.) long. During this period induction coils came much into use in experimental work, especially in connection with the discharge of electricity through gases, and with the production of electrical oscillations, and they were instrumental in such important discoveries as the Hertzian waves, the cathode rays, and the Röntgen rays.

In large modern induction coils, such as those used for the production of X-rays, the cores are usually built of long strips of thin transformer sheet insulated from one another, the length of the core being 10 to 15 times its diameter. On the core, and well insulated from it, is wound the primary coil, the thickness of the copper wire depending upon the current to be used in operating the coil. The primary coil is sometimes arranged in three or four sections which, by means of a commutator, can be connected in series or in parallel. The core and primary coil are placed within a thick-walled tube of micanite or other material of great dielectric strength, upon which is placed the secondary coil of no. 36 or no. 32 silk-covered copper wire. There is considerable diversity in the method of winding the secondary coil. Some makers arrange the coil in thin flat sections only one wire thick, separated from one another by discs of insulating material. Others prefer to wind the coil in sections, three or four wires thick. In either case the separating discs should be wide enough to extend well beyond the inner and outer boundaries of the sections, so that the wire can be well surrounded by insulating material, and the whole should be thoroughly impregnated with insulating wax.

Several modern coils are arranged in only two or four sections, each section wound in layers, on the grounds that with this construction the windings are less likely to become displaced, and that the turns having the highest potential can be kept furthest away from the primary coil. As an alternative to impregnation with wax the plan of immersing the coil in insulating oil contained in a metal or porcelain vessel has come into use in recent years. Such oil-immersed coils are usually placed with their axes vertical. The dry type of coil is usually covered with a sheet of ebonite and mounted on a base board, or is cast in solid wax in a wooden case.

Improved forms of hammer break, with platinum contact pieces, are still used with small coils, but with large coils a motor-driven mercury interrupter is much more suitable. The most effective form of mercury interrupter is that known as the "turbine," or "jet" type, in which a pair of revolving jets of mercury, pumped up by the rotation from the bottom of an iron container, make contact during their rotation with two or more metal plates. The jets are diametrically opposite to each other, and the two plates with which they simultaneously make contact are connected to the source of current supply. A diagram of the circuits of an induction coil is shown in fig. 1.

In early forms of mercury jet interrupters the jet and plate were immersed in oil or alcohol, but coal gas is now generally used as the insulating medium in which the interruption takes place. As many as 150 breaks per second may be produced with this particular type of interrupter. Sometimes the motor of a mercury jet interrupter is also used for driving a rectifier, or rotating commutator, connected in the secondary circuit for the purpose of eliminating the reverse potential induced in the secondary when the primary circuit is "made." This reverse potential at "make" is usually very small in comparison with the direct potential at "break," but when the coil is operated by a battery or other source of high voltage, it may be sufficient to produce some discharge the wrong way through an X-ray tube.



FROM JONES, "THEORY OF THE INDUCTION COIL" (PITMAN & SONS, LTD.)

FIG. 1.—DIAGRAM OF THE CIRCUITS OF AN INDUCTION COIL

If very high rates of interruption are required an electrolytic interrupter, devised by Wehnelt in 1899, may be employed. This consists of a plate of lead immersed in dilute sulphuric acid, and a platinum wire protruding a short distance from a porcelain tube. When this is connected in series with the primary coil, with the platinum wire to the positive pole of the battery, the current becomes rapidly intermittent owing to the successive formation of gas bubbles, the frequency being sometimes over 1,000 per second.

A very important application of the principle of the induction coil is found in the *high tension magneto*, which consists essentially of a very small induction coil mounted on an armature rotated in the field of a permanent magnet, the current in the primary coil being generated by the rotation, and being interrupted by a contact breaker at a suitable point in each revolution. Another form of induction coil, usually called an oscillation transformer, is the Tesla coil, which is used for generating currents of high frequency and high voltage. It consists of a primary coil, having a few turns of thick copper wire, connected in series with a Leyden jar and a spark-gap, and a secondary coil having a large number of turns of finer wire. A succession of sparks is produced at the spark-gap by an ordinary induction coil, each spark giving rise to a group of high frequency oscillations which produce remarkable brush discharge and other effects in and near the terminals of the secondary coil. Similar effects are produced with the *auto-transformer*, a single coil of bare copper wire wound on an ebonite frame and having a few turns at one end connected to the Leyden jar and spark-gap so as to form the primary circuit. The remainder of the coil forms the secondary winding. In this arrangement the primary and secondary influence each other not only by magnetic action but also in consequence of the electrical connection between them.

Theory of the Induction Coil.—The theory is much simplified by the fact that the iron core usually forms a very "open" magnetic circuit, so that the magnetic flux in it is, over a wide range, approximately proportional to the current flowing in either of the coils. The self inductances, which we will denote by L_1 and L_2, may therefore be treated as constant. The mutual inductance may also be regarded as constant but, owing to the fact that the secondary current is not distributed uniformly along the secondary wire, the coefficient of inductance of the primary on the secondary is greater than that of the secondary (for unit current in its central winding) on the primary. These two coefficients will be denoted by L_{21} and L_{12}. If the capacities in the primary and secondary circuits are C_1, C_2, the relation between the potentials V_1 and V_2, in the two circuits is expressed by the equations

$$L_1C_1\frac{d^2V_1}{dt^2} + L_{12}C_2\frac{d^2V_2}{dt^2} + R_1C_1\frac{dV_1}{dt} + V_1 = E,$$

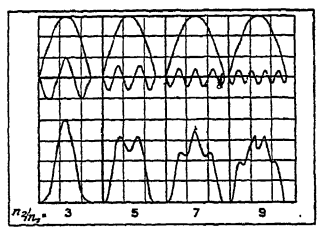
$$L_2C_2\frac{d^2V_2}{dt^2} + L_{21}C_1\frac{d^2V_1}{dt^2} + R_2C_2\frac{dV_2}{dt} + V_2 = 0;$$

where R_1, R_2, are the resistances of the circuits and E is the battery electromotive force. If the resistances are neglected these two equations can be easily solved, and the result shows that the wave of potential in each circuit, after the interruption of the primary current, consists of two simple harmonic components differing in amplitude and frequency. Each of the two frequencies of the system depends upon the inductances and capacities of both circuits.

If the frequencies are represented by n_1, n_2 (n_2 being the greater), the expression for the potential at the terminals of the secondary coil at any time t after the interruption of the primary current i_0 is

$$V_2 = \frac{2\pi L_{21} i_0 n_1 n_2}{n_2^2 - n_1^2} (n_2 \sin 2\pi n_1 t - n_1 \sin 2\pi n_2 t).$$

This expression shows that the two components of the potential wave in the secondary circuit begin from zero in the opposite phase, and that their amplitudes are inversely proportional to their frequencies. In fig. 2 are shown the potential waves for four different values of the frequency ratio n_2/n_1.

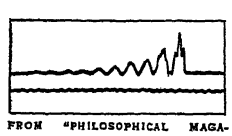


FROM JONES, "THEORY OF THE INDUCTION COIL" (PITMAN & SONS, LTD.)

FIG. 2.—WAVES OF POTENTIAL IN AN INDUCTION COIL FOR DIFFERENT VALUES OF THE FREQUENCY RATIO N_2/N_1

The upper curves show the two components separately, the lower curves the result of their superposition, *i.e.*, the actual wave of potential in the secondary circuit. It will be seen that when the frequency ratio is 3 or 7, maxima of the two component waves occur simultaneously, giving a specially high voltage at this moment. This also happens when n_2/n_1 has one of the values 11, 15, etc. When the frequency ratio is 5 or 9, a minimum of the more rapid component coincides with a maximum of the slower, resulting in a reduced value of the maximum voltage. In these latter cases there are, in fact, two equal peaks in the potential wave, one occurring before, the other after, the maximum of the slower component. The curves in fig. 2 cover only one half-period of the slower component; their continuation in the second half-period is a repetition with the ordinates changed in sign. Curves similar to the lower curves of fig. 2 can be obtained experimentally by the use of a suitable oscillograph. An example is given in fig. 3, a photograph of the wave of potential at the secondary terminals of an induction coil as indicated by an electrostatic oscillograph connected directly with them.

The instrument was of the kind in which the deflection is proportional to the square of the potential, consequently the deflections are in the same direction for both positive and negative parts of the wave. The form of the first half-wave of the curve shows that the ratio of the two frequencies was very nearly 7, as in the third of the lower curves in fig. 2. The wavy line below the oscillograph curve in fig. 3 represents the oscillations of a tuning fork, each wave in this line corresponding to $\frac{1}{768}$ second.

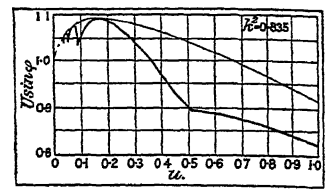


FROM "PHILOSOPHICAL MAGAZINE" (TAYLOR & FRANCIS)

FIG. 3.—ACTUAL OSCILLOGRAPH RECORD OF POTENTIAL AT TERMINALS OF SECONDARY

The foregoing expression for V_2 enables us to calculate the effect of varying one or other of the "constants" of the circuits, for example, the capacity C_1 of the condenser connected to the interrupter. The result of such a calculation is shown in the full-line curve of fig. 4, in which the abscissa is proportional to the primary capacity—it represents, in fact, the ratio L_1C_1/L_2C_2—and the ordinate is proportional to the maximum secondary potential. In this example the coupling (defined as $L_{21}L_{12}/L_1L_2$) is 0·835.

It will be seen that the curve of secondary potential consists of portions of a series of arches, all lying within and all except one touching the broken line curve which represents the sum of the amplitudes of the two potential oscillations in the secondary circuit. As the primary capacity is increased from zero, the frequency ratio n_2/n_1, diminishes from infinity, and, at the four points of contact of the full-line and broken-line curves in fig. 4, n_2/n_1, has the values 19, 15, 11 and 7. At the points of intersection of the arches the frequency ratios are 17, 13, 9 and 5. One of the points of contact ($n_2/n_1=7$) occurs at the summit of the broken line curve, and it therefore represents a very favourable adjustment of the circuits for producing high secondary voltage. Not only is the potential equal to the sum of the amplitudes of the two components, but the sum of the amplitudes also has its maximum value in this adjustment. These favourable conditions do not occur at all values of the coupling, but only at certain values, four of which are 0·571, 0·835, 0·902 and 0·931. If the coupling k^2 has one of these values, the optimum primary capacity is that which makes $L_1C_1=(1-k^2)L_2C_2$, and the maximum secondary voltage is then $i_0\sqrt{L_{21}/L_{12}}\sqrt{L_1/C_2}$. The form of the curve showing the relation between primary capacity and secondary potential depends upon the coupling. In fig. 5 is shown a curve obtained by experiment with a coil the coupling of which was 0·767.



FROM JONES, "THEORY OF THE INDUCTION COIL" (PITMAN & SONS, LTD.)

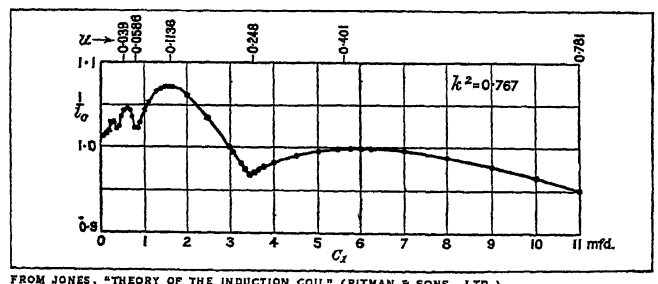
FIG. 4.—CALCULATED CURVE SHOWING EFFECT OF VARYING THE CAPACITY OF THE PRIMARY CONDENSER

Abscissae are proportional to primary capacity, ordinates proportional to maximum secondary potential. Coupling=0·835

The ordinate of this curve represents the reciprocal of the least primary current the interruption of which causes a spark to appear at a spark-gap connected with the secondary terminals, and it is therefore proportional to the maximum secondary potential for a given primary current. The extreme arch on the right of this curve is more prominent than that of fig. 4, and at values of the coupling below 0·71 the right-hand arch is higher than all the others. It follows that as the coupling is reduced the frequency ratio necessary for maximum secondary potential also becomes smaller, *e.g.*, when the coupling is 0·571, the primary capacity should be so adjusted that the frequency ratio is 3.

Damping of the Oscillations.—In this sketch of the theory we have neglected the resistances of the circuits and other causes of dissipation of energy. In practice, owing to the resistances and the leakage and core losses (*see* ELECTROMAGNET), the oscillations are subject to decay factors; they die away just as do the vibrations of a tuning fork after it is struck. This damping of the oscillations is clearly shown in fig. 3. In a good modern coil the maximum secondary voltage may be reduced by over 25% by the losses, which are, however, not sufficient to affect to any great extent the frequencies of the oscillations or the conditions in which maximum voltage is produced.

When a spark or other form of discharge is allowed to pass between the secondary terminals, the theory hitherto described, with allowance for the damping of the oscillations, is applicable up to the moment at which the discharge begins. The ordinary spark discharge of an induction coil, in air at atmospheric pressure, generally consists of an initial true spark followed by an arc. In the initial spark, which represents the discharge of the electricity accumulated on the secondary coil, and which probably contains a train of high frequency oscillations, the potential falls very rapidly to a small value, and thereafter the secondary current flows as an arc in the conducting path prepared for it by the initial



FROM JONES, "THEORY OF THE INDUCTION COIL" (PITMAN & SONS, LTD.)

FIG. 5.—EXPERIMENTAL CURVE SHOWING VARIATION OF MAXIMUM SECONDARY POTENTIAL WITH PRIMARY CAPACITY. COUPLING=0·767

spark. In the arc the current usually pulsates with a period dependent upon the constants of the primary circuit and the coupling, the approximate expression for the period being $2\pi\sqrt{L_1C_1(1-k^2)}$.

The total quantity of electricity passing in the ordinary spark discharge depends upon the length of the spark and upon the current interrupted in the primary circuit. It increases with the current, though not in proportion to it, and it diminishes as the length of the spark is increased. When the discharge takes place through a "soft" X-ray tube the secondary voltage again follows the course indicated by the foregoing theory up to the moment at which the discharge begins. During the discharge the potential falls, not with great rapidity as in the spark discharge, but much more gradually, and with fluctuation, to a smaller value at which the discharge ceases. After this the system continues to oscillate, with what energy it has left, in the two frequencies which it possesses when the secondary circuit is open. In the case of discharge through an ordinary high resistance, the discharge current consists of two damped oscillatory components if the resistance is sufficiently high; but if the resistance is below a certain value, one of the oscillations becomes replaced by aperiodic components.

Theory of the Tesla Coil.—This is somewhat similar to that of the induction coil, the chief difference arising from the fact that the oscillations are started in a different way. The potential in the secondary of a Tesla coil is the result of the superposition of two oscillations differing in frequency but having the same amplitude. The two oscillations begin in opposite phase but not from zero, *i.e.*, they begin at their maximum positive and negative values. In order to produce the highest potential at the secondary terminals of a given Tesla coil, operated by sparking across a given gap, the Leyden jar should have a capacity considerably greater than that which satisfies the resonance condition $L_1C_1=L_2C_2$, *i.e.*, the condition which makes the periods of oscillation of the primary and secondary circuits equal when they are separated. In the ordinary induction coil worked by an interrupter the primary capacity which gives the highest secondary voltage is, as we have seen, much smaller than the value which makes L_1C_1 equal to L_2C_2.

Bibliography.—J. A. Fleming, "History of the Induction Coil," *The Alternate Current Transformer* (1900) and "Construction of Induction Coils and Theory of Coupled Circuits," *Principles of Electric Wave Telegraphy* (1919); Lord Rayleigh, "On the Induction Coil," *Phil. Mag.* (1901); P. Drude, "Theory of the Tesla Coil," *Ann. d. Phys.* (1904); E. Ruhmer, *Funkeninduktoren* (1904); H. Armagnat, *La Bobine d'Induction* (1905); E. Taylor Jones, *The Theory of the Induction Coil* (1921). (E. T. J.)

INDULGENCE, a term defined by the official catechism of the Roman Catholic Church in England as "the remission of the temporal punishment which often remains due to sin after its guilt has been forgiven." This remission may be either total (*plenary*) or partial, according to the terms of the Indulgence. (Lat. *indulgentia, indulgere,* to grant, concede.)

The theory of Indulgences is based by theologians on the following texts: 2 Samuel (Vulgate, 2 Kings) xii. 14; Matt. xvi. 19 and xviii. 17, 18; 1 Cor. v. 4, 5; 2 Cor. ii. 6–11; but the practice itself is confessedly of later growth. As the primitive practice of public penance for sins died out, there grew up a system of equivalent, or nominally equivalent, private penances. Just as many of the punishments enjoined by the Roman criminal code were gradually commuted by mediaeval legislators for pecuniary fines, so the years or months of fasting enjoined by the earlier ecclesiastical codes were commuted for proportionate fines, the recitation of a certain number of psalms, and the like. The practice of Indulgences in the mediaeval church arose out of the authoritative remission, in exceptional cases, of a certain portion of this canonical penalty.

The first definite instance of a *plenary* Indulgence is that of Urban II. for the First Crusade (Council of Clermont, Mansi, *Concilia,* xx. 816): "Whoever, out of pure devotion and not for the sake of gaining honour or money, shall go to Jerusalem to liberate the church of God, may count that journey in lieu of all penance" (1095). A little earlier had begun the practice of *partial* Indulgences, which are always expressed in terms of days or years. However definite may have been the ideas originally conveyed by these notes of time, their first meaning has long since been lost. The rapid extension of these time-Indulgences is one of the most remarkable facts in the history of the subject. Innocent II., dedicating the great church of Cluny in 1132, granted as a great favour a forty days' Indulgence for the anniversary. A hundred years later, all churches of any importance had similar Indulgences; yet Englishmen were glad even then to earn a pardon of forty days by the laborious journey to the nearest cathedral, and by making an offering there on one of a few privileged feast-days. A century later again, Wycliffe complains of Indulgences of two thousand years for a single prayer (ed. Arnold, i. 137). In 1456, the recitation of a few prayers before a church crucifix earned a Pardon of 20,000 years for every such repetition (Glassberger in *Analecta Franciscana,* ii. 368); and at length Indulgences were so freely given that there was now scarcely a devotion or good work of any kind for which they could not be obtained. It must be noted that, according to the orthodox doctrine, not only can an Indulgence not remit future sins, but even for the past it cannot take full effect unless the subject be truly contrite and have confessed (or intend shortly to confess) his sins. This salutary doctrine, however, was obscured by the phrase *a poena et a culpa,* which, from the 13th century to the Reformation, was applied to Plenary Indulgences. The prima facie meaning of the phrase is that the Indulgence itself frees the sinner not only from the temporal penalty (*poena*) but also from the guilt (*culpa*) of all his sins. "The laity cared little about the analysis of it, but they knew that the *a culpa et poena* was the name for the biggest thing in the nature of an Indulgence which it was possible to get" (Father Thurston in *Dublin Review,* Jan. 1900.) It is recorded that during the Jubilee of 1300, all the Papal Penitentiaries were in doubt about the meaning of the words and appealed to the Pope. Boniface VIII. did indeed take the occasion of repeating (in the words of his Bull) that confession and contrition were necessary preliminaries; but he neither repudiated the misleading words nor vouchsafed any clear explanation of them. The phrase exercised the minds of canonists all through the middle ages, but still held its ground. The most accepted modern theory is that it is merely a catchword surviving from a longer phrase which proclaimed how, during such Indulgences, ordinary confessors might absolve from sins usually "reserved" to the Bishop or the Pope. However it originated, it undoubtedly contributed to foster popular misconceptions as to the intrinsic meaning of Indulgences, apart from repentance and confession though Dr. Lea seems to press this point unduly (p. 54, *seq.*), and should be read in conjunction with Thurston (p. 324, *seq.*). These misconceptions were widespread from the 13th to the 16th century, and were often fostered by the "pardoners," or professional collectors of contributions for Indulgences. This can best be shown by a few quotations from eminent churchmen during those centuries. Berthold of Regensburg (*c.* 1270) says, "Fie, penny-preacher! . . . thou dost promise so much remission of sins for a mere halfpenny or penny, that thousands now trust thereto, and fondly dream to have atoned for all their sins with the halfpenny or penny, and thus go to hell" (ed. Pfeiffer, i. 393). A century later, the author of *Piers Plowman* speaks of pardoners who "give pardon for pence poundmeal about" (*i.e.*, wholesale; B. ii. 222); and his contemporary, Pope Boniface IX., complained of their absolving even impenitent sinners, for ridiculously small sums (*pro qualibet parva pecuniarum summula,* Raynaldus, *Ann. Ecc.* 1390). In 1450 Thomas Gascoigne, the great Oxford Chancellor, wrote: "Sinners say nowadays 'I care not how many or how great sins I commit before God, for I shall easily and quickly get plenary remission of any guilt and penalty whatsoever (*cujusdam culpae et poenae*) by absolution and indulgence granted to me from the Pope, whose writing and grant I have bought for 4d. or 6d. or for a game of tennis' "—or sometimes, he adds, by a still more disgraceful bargain (*pro actu meretricio,* Lib. Ver. p. 123, *cf.* 126). In 1523 the princes of Germany protested to the Pope in language almost equally strong (Browne, *Fasciculus,* i. 354). In 1562 the Council of Trent abolished the office of "pardoner."

See H. C. Lea, *Hist. of Auricular Confession and Indulgences in the*

Latin Church (Philadelphia, 1896); his standpoint is frankly non-Catholic, but he gives materials for judgment; T. Brieger, art. "Indulgenzen" in Herzog-Hauck, *Realencyklopädie* and A. Boudinhon, art. "Indulgences" in Hastings' *Ency. of Religion*. The greatest orthodox authority is Eusebius Amort, *De Origine indulgentiarum* (1735). More easily accessible are Father Thurston's *The Holy Year of Jubilee* (1900); F. E. Hagedorn, *General Legislation on Indulgences* (1924); *Johannis Hus tractus responsivus*, now first edited by S. Harrison Thomson (1927); and art. "Indulgences" in the *Catholic Encyclopaedia*.

INDULINES, dark blue dyestuffs belonging to the azine class. (*See* DYES, SYNTHETIC.)

INDUNA, a Zulu-Bantu word for an officer or head of a regiment among the Kafir (Zulu-Xosa) tribes of South Africa. It is formed from the inflexional prefix *in* and *duna*, a lord or master.

INDUS, one of the three greatest rivers of northern India. Its sources are in the glaciers of the Himalayan peaks of the Kailas group, which overlook the Mansarowar lake and the sources of the Brahmaputra, the Sutlej and the Gogra to the south-east. Three affluents, flowing north-west, unite about 80° E. to form the main stream. At Leh, the Ladakh capital, the river has already run north-westerly for 300 m., except for a divergence to the south-west, which carries it through the Ladakh range, about 100 m. above Leh, to follow the same course on the southern side that had been maintained on the north. For another 230 m. the Indus pursues a comparatively placid north-western course over its sandy bed between the giant chains of Ladakh to the north and Zaskar (the main "snowy range" of the Himalaya) to the south, through magnificent mountain scenery. Then the river receives from the north the waters of the Shyok (a tributary nearly as large as itself), having already been augmented by the Zasvar from the south, together with innumerable minor glacier-fed streams.

The Shyok rises near the southern foot of the Karakoram pass on the high road between Ladakh and Kashgar, drains the southern slopes of the Karakoram range and then breaks across the axis of the Muztagh chain, before bending north-westward to run parallel to the Indus for 150 m. before its junction with that river. The combined stream still flows north-west for another 100 m., under the shadow of a vast array of snow-crowned summits, until it arrives within sight of the Rakapushi peak, midway between Gilgit and Hunza. Here occurs a change of direction to the south-west, which is thereafter maintained till the Indus reaches the ocean. At this point it receives the Gilgit river from the north-west, having dropped from 15,000 to 4,000 ft. (at the junction of the rivers) after about 500 m. of mountain descent through the northern Kashmir. It continues through mountainous country till it emerges into the plains of the Punjab below Darband, in 34° 10′ N.

There are a few native bridges in the upper course, and a wooden bridge at Leh. There are iron bridges above Bunji and at Attock, where the valley narrows almost to a gorge, 900 ft. above sea-level. Twenty miles below Attock the river has carved out a central trough believed to be 180 ft. deep. Forty miles below Attock a bridge carries the railway to Kohat and the Kurram valley; and at Mari, beyond the series of gorges which continue from Kushalgarh to the borders of the Kohat district there is a boat-bridge. Another boat-bridge opposite Dera Ismail Khan connects that place with the railway. The Lansdowne bridge at Sukkur is one of the greatest triumphs of Indian bridge-making. Kotri is connected with Hyderabad in Sind, and the Indus is now one of the best-bridged rivers in India. The river is navigated in the plain by high-sterned flat native boats.

In Sind there is much variation in the channel beds within the outside banks of the river. In prehistoric days a branch found its way to the Runn of Cutch, and the gradual shift of the river westward led later to the disappearance of many populous places which were more or less dependent upon it for their water supply. The greatest change was caused when the stream broke through the limestone ridges of Sukkur and assumed a course which has been fairly constant for nearly two centuries. These variations are due largely to the fact that the Indus carries down sufficient detritus to raise its own bed above the general level of the surrounding plains. At present the bed of the river is stated to be 70 ft. above the plains of the Sind frontier, some 50 m. W. of it.

The total length of the Indûs, measured directly, is about 1,500 m., and the area of its basin is computed at 372,000 sq.m. Even at its lowest in winter it is 500 ft. wide at Iskardo (near the Gilgit junction) and 9 or 10 ft. deep. At Attock, where the river narrows between rocky banks, a height of 50 ft. in the flood season above lowest level is common, with a velocity of 13 m. per hour. At its junction with the Panjnad (the combined rivers of the Punjab east of the Indus) the Panjnad is twice the width of the Indus, but its mean depth is less, and its velocity little more than one-third. Below the junction the united discharge in flood season is 380,000 cubic ft., rising to 460,000 (the record in August). Unusual floods, owing to landslips or other exceptional causes, are not infrequent.

The naturally arid lands of Sind depend largely for their prosperity upon the waters of the Indus. Canals from the river irrigated nearly 3,000,000 acres in 1926, but their water-supply fluctuates with the rise and fall of the river. A vast scheme was therefore undertaken to ensure a continuous supply; it includes a barrage in the gorge below Sukkur, three weirs on the Sutlej, and one on the Panjnad. The scheme is designed to command an area of 7,500,000 acres, and to irrigate over 5,000,000 in British territory, Bikaner and Bahawalpur. The Thal irrigation project, also in hand, is intended to irrigate nearly 2,000,000 acres from the Indus on and about the watershed between that river and the Jhelum.

INDUSTRIA (mod. *Monteù da Po*), an ancient town of Liguria, 20 m. N.E. of Augusta Taurinorum. Its original name was Bodincomagus, from the Ligurian name of the Padus (mod. Po), Bodincus, *i.e.*, bottomless, and this still appears on inscriptions of the early empire. It stood on the right bank of the river, which has shifted over 1 m. to the north. It was a flourishing town, as excavations (which have brought to light streets, the forum, theatre, baths, etc.) have shown, but was deserted in the 4th century A.D.

INDUSTRIAL ACCIDENTS. In the term industrial accident, the adjective implies that the accident results in injury to a person and has some causal connection with work, employment or occupation. The relevant wording of the Workmen's Compensation Act, 1923, of Great Britain runs ". . . accident arising out of and in the course of employment"; this definition has been incorporated in laws enacted in the British Dominions and the United States, while in other countries the definition though different in wording is similar in intent. There is a distinct tendency towards making the term cover several "health risks" also, for these, though "accidental" only in a limited sense, have an eminently "industrial" character. Experience shows that industrial accidents (including industrial diseases) occur with great regularity in all industries and cause a loss to persons engaged in it. They therefore constitute a risk to labour. This risk may be regarded under different aspects. First, it may be qualified as an "economic risk"; secondly, accidents imply a human cost, a "personal risk," because attended with physical and mental suffering, both on account of the injury itself and because wage earners exposed to the risk generally have a very small margin between income and necessary expenditure.

Frequency of Industrial Accidents.—The frequency of accidents is shown by relating the number of accidents to "accident exposure." The simplest measure of the exposure is the number of workers employed in the industry concerned. When the industry is large and the period covered long (*e.g.*, one year), allowance should be made for the irregularity of employment, and for this reason the accident exposure may be expressed in terms of the "number of full-time workers," *i.e.*, those who would have been employed, had all employees worked regularly during the whole possible working time (in practice, the number of man-days divided by 300). A similar result is secured by the method (devised in the United States) of expressing the accident exposure in terms of the man-hours worked; the frequency rate is then the number of accidents per 1,000 workers employed, or per 1,000 full-time workers, or per 1,000,000 man-hours.

Statistics.—It would be very instructive to compile an inter-

national survey of the number and frequency of industrial accidents in the chief countries. Unfortunately, the statistics as published to-day are still far from comparable, and in most cases international comparisons would be positively misleading. The main sources of incomparability are the following: (a) different scope of the statistics; (b) different definition of accidents covered; (c) different standards of reporting; and (d) different calculation of the accident exposure.

For Great Britain, no comprehensive statistics of all industrial accidents exist. The statistics of workmen's compensation cover seven principal groups of industries, and all accidents disabling for at least three days and for which compensation was paid for the first time during the year. It is estimated that not more than half of the employees under the Workmen's Compensation Act are thus covered by the statistics, the principal exclusions being the building industry, agriculture and domestic service. The figures for 1926 are as follows:

Great Britain: Frequency of Industrial Accidents, 1926

Industry	Number of persons employed	Number of accidents		Rate of accidents per 1,000 persons	
		Fatal	Non-fatal	Fatal	Non-fatal
Shipping, total	203,340	333	6,175	1·64	30·37
Steam vessels	198,860	311	5,922	1·56	29·78
Sailing vessels	4,480	22	253	4·91	56·47
Factories, total	5,207,735	724	165,122	·14	31·71
Cotton	550,234	34	10,226	·06	18·58
Wool, worsted, shoddy	254,472	17	3,451	·07	13·56
Other textiles	208,495	3	2,105	·01	10·10
Wood	126,821	33	5,317	·26	41·93
Metals(extraction,etc.)	330,134	79	24,096	·24	72·99
Engine and shipbuilding	382,088	113	19,677	·30	51·50
Other metal work	801,263	154	30,858	·19	46·00
Paper and printing	335,900	21	4,896	·06	14·58
China and earthenware	70,497	17	1,356	·24	19·23
Miscellaneous	2,147,822	253	57,140	·12	26·60
Docks	127,606	112	10,987	·88	86·10
Mines	772,883	787	88,770	1·02	114·86
Quarries	77,791	62	5,668	·80	72·86
Constructional work	111,705	72	7,270	·64	65·08
Railways, total	500,735	228	17,614	·46	35·18
Clerical staff	85,302	2	205	·02	2·40
Other railway servants	415,433	226	17,409	·54	41·91
Grand total, 1926	7,001,793	2,318	301,606	·33	43·08
Grand total, 1925	7,541,014	2,989	403,826	·40	53·55

In the United States, too, no statistics for all jurisdictions and all industries are compiled. Summing up the information available for 38 States in 1925, it is found that the total number of fatal cases was 10,537, and that of non-fatal cases, 1,687,957. It should be noted that these figures exclude agriculture, domestic service, maritime and railway employments in all States, and all accidents in 14 States and territories. More accurate statistics are compiled for a few important industries; the number and the frequency rate per 1,000 full-time workers in 1925 were as follows:

United States: Industrial Accidents, 1925

Industry	Number of full-time workers	Number of accidents		Rate of accidents per 1,000 full-time workers	
		Fatal	Non-fatal	Fatal	Non-fatal
Coal mines	480,227	2,234	..	4·65	..
Metal mines	123,908	321	35,132	2·99	283·53
Quarries	83,487	149	14,165	1·78	169·67
Iron and steel	445,223	207	36,465	0·46	81·90

The total number of employees killed in steam railway accidents in 1925 was 1,594, and of those injured, 118,874; the frequency rates among trainmen were 2·14 fatal and 87·66 non-fatal cases per 1,000 men in service.

The German statistics cover practically all industries except small undertakings and domestic service, agriculture being given apart. In 1926, the number of insured persons in industries was 10,794,031, the number of fatal accidents, 5,429, and that of non-fatal accidents, 826,899, the rates being 0·50 fatal and 76·61 non-fatal cases per 1,000 persons; in agriculture, there were 14,068,000 insured persons, 2,682 fatal and 176,119 non-fatal cases; or 0·19 and 12·52 cases respectively per 1,000 persons. In France, the total number of accidents in all industries, including agriculture, commerce, transport and domestic service, but excluding mines and railways, in 1926 was 2,392 fatal and 981,244 non-fatal; the number of coal-mining accidents (in 1925) was 354 fatal and 93,516 non-fatal, while the railway employees sustained (in 1923) 387 fatal and 615 severe non-fatal accidents. The situation in a small highly industrialized country is illustrated by the Belgian statistics; they covered (in 1921) 601,841 workers and recorded 209 fatal and 95,146 non-fatal accidents, *i.e.*, 0·35 fatal and 158·09 non-fatal cases per 1,000 workers.

There is one important industry in respect of which an international comparison may be attempted, viz., coal-mining. Owing to the fact that work underground involves quite particular occupational risks, and coal-mining actually is the most hazardous industry (with the possible exception of shipping), special statistics relating thereto are more developed than others. The accident exposure may be expressed for the several countries in uniform terms (though in Germany allowance is not made for overtime). Nevertheless, the reporting of accidents is different, and while the fatal accident rates are fairly comparable, those of non-fatal cases are less so. The figures for 1925 are as follows:

Coal Mining: Frequency of Accidents in Various Countries, 1925

Country	Number of full-time workers	Number of accidents		Rate of accidents per 1,000 full-time workers	
		Fatal	Non-fatal	Fatal	Non-fatal
Belgium	163,061	147	..	0·90	..
Canada (1926)	21,853	77	2,580	3·52	118·06
France	277,603	354	93,516	1·28	336·87
Germany (Prussia)	489,463	1,320	96,429	2·70	197·01
Great Britain	931,700	1,128	177,347	1·21	190·34
Saar Territory	64,343	63	2,824	0·98	43·89
United States	480,227	2,234	..	4·65	..

Finally, as regards industrial diseases assimilated to industrial accidents, the scope of the statistics is determined by the diseases compensated. The most comprehensive statistics are those for Great Britain which cover 32 diseases. The total number of cases for which first payment was made in the seven groups of industries was in 1925, 41 fatal, 8,792 non-fatal, in 1926, 27 fatal, 5,816 non-fatal. The bulk of these cases (87 and 79 per cent. respectively) occurred in the mining industry, and the considerable decrease noted in 1926 is largely due to the long coal stoppage in that year.

In Germany, the statistics refer to 11 diseases; the total number of cases reported in the year 1925–26 was 3,310, of which 2,781 (72 per cent.) were due to lead poisoning. In France, only two industrial diseases are compensated; in 1925 there were 1,343 cases of lead poisoning and 5 of mercury poisoning of occupational origin.

Severity of Industrial Accidents.—The severity of an accident means the extent of resulting incapacity for work. In order to calculate the severity of a group of accidents, it is first necessary to determine the extent of disability in each case. The main categories of disability are (i.) fatal, (ii.) non-fatal, distinguishing between (a) permanent, and (b) temporary disability.

The British statistics do not contain precise information as to the extent of disability caused by accidents, beyond the distinction between fatal and non-fatal cases. According to an estimate, based on the statistics of several other European countries, of the general distribution of industrial accidents usually reported, less than 1 per cent. result in death, about 5 per cent. in perma-

nent disability, and about 94 per cent. in temporary disability. It should, however, be remembered that both from the human and the economic point of view, the few cases of death or permanent disability of high degree are of more importance than the bulk of minor accidents. This point is the basis of the calculation of "severity rates," which show the number of working days lost on account of accidents, related to the accident exposure.

In order to know the working time lost, an arbitrary value is fixed for cases of death (6,000 days lost in the United States, 7,500 days in Sweden and Switzerland); the time loss entailed by permanent disability is assessed at a given fraction of this basic value (*e.g.*, loss of a thumb equal to 600–1,000 days lost); the time loss resulting from temporary cases is recorded directly. The accident exposure is the number of workers or "full-time workers" or man-hours, as in the case of frequency rates.

The severity rate gives a truer idea of the actual risk of industrial accident than the frequency rate; but it is rather troublesome to calculate, and has therefore as yet been employed neither in the British nor in most other statistics. The following instances drawn from the American records will illustrate the results which have been obtained by the calculation of severity rates as compared with those given by frequency rates. In the United States iron and steel industry, during the five-year period 1920–24, the total number of full-time workers was 1,839,818, and the number of cases, as well as the frequency and severity rates per million hours' exposure, were as follows:

	Number	Frequency rate	Severity rate
Death	1,345	0·2	1,500
Permanent disability	4,810	0·9	800
Temporary disability	179,128	32·5	500
Total	185,283	33·6	2,800

The United States National Safety Council has calculated on similar lines the accident experience of 13 industries employing 828,028 workers and 74,367 cases of accident for 1925. The frequency and severity rates per million man-hours were as follows:

United States: Frequency and Severity Rates, 1925

Industry	Number of accidents covered	Frequency rate	Severity rate
Mining	6,851	99·99	8,510
Quarry	744	48·56	7,640
Construction	1,778	69·54	7,570
Cement	2,541	26·08	5,000
Woodworking	3,087	44·20	2,750
Chemical	2,597	20·91	2,710
Petroleum	5,855	27·35	2,330
Paper and pulp	4,021	38·43	2,150
Metals	21,492	32·50	1,820
Packers and tanners	1,425	40·15	1,270
Rubber	5,054	29·15	1,110
Automotive	17,861	23·42	1,060
Textile	1,061	13·61	450
Total	74,367	30·60	2,020

Causes of Industrial Accidents.—The principal causes of accidents in factories and workshops are shown in the report for 1924 of the Chief Factory Inspector of Great Britain (covering 157,835 accidents) and in the reports for the same year of compensation authorities of 21 American States (covering 838,042 accidents); the figures in the table in next column represent percentages of all accidents.

As regards particularly coal-mining accidents, the statistics show that the largest part of them are due to falls of roofs (in 1926, 33 per cent. in Great Britain; 43 per cent. in the United States), haulage and explosions underground coming next. The accidents to railway employees are classed in the British statistics in (i.) "train accidents," mostly caused by collisions and derailments; (ii.) "movement accidents," the most frequent causes of which are shunting operations, including coupling and uncoupling of vehicles, working on permanent way, and attending to engines

Causes of Accidents (percentages)

	Great Britain	United States (21 States)
Machinery	23·4	17·1
Transport, vehicles	1·0	9·4
Hot or corrosive substances	6·1	4·9
Handling of tools or articles	27·7	28·6
Struck by falling body	13·2	13·3
Persons falling	12·3	9·6
Electricity, explosions, fires, gassing	1·1	..
Other	15·2	17·1
Total	100	100

in motion; and (iii.) "non-movement accidents" attributable particularly to loading and unloading of wagons, attending to engines at rest, falling of wagon doors and lamps, working on the line, etc. In the American statistics, accidents to (i.) trainmen, occur most frequently to the class of brakemen (55 cases per million hours' exposure, the general average being 30), while accidents to (ii.) non-train employees are principally attributable to handling (7·4 out of 20·7 cases per million hours). It may be noted that shunting operations present a conspicuously high risk, a fact which has given rise to the question of introducing automatic couplings for trains. Finally, the British statistics of shipping accidents for the 5-year period 1921–25 show that the yearly average of accidental deaths amongst the crews of (mercantile and fishing) vessels was 724, of which 327 were due to casualties to vessels and 395 to other accidents at sea or in river or harbour.

These classifications, however, do not refer to "causes" properly so-called. The determination of the real and most important causes is a difficult task, but it may be briefly stated that each accident is the outcome of a long train of events which is ultimately traceable to some failure of human foresight or insight. Accident statistics have attempted to find out these ultimate causes on two different lines.

Some earlier statistics classified accidents by what may be called their "moral causes" or responsibility for the occurrence of accidents. For instance, according to the German statistics for 1907, 12 per cent. of accidents were attributed to the fault of the employer, 41 per cent. to that of the worker, 7 per cent. to both of them or to a third person, while in not less than 40 per cent. of cases no fault was established.

The failure of care, attention and skill which underlies the occurrence and incidence of the great majority of accidents, results from the combined action of numerous factors, one of the most important of which is inexperience. Evidence obtained from the American metal trades shows that the accident frequency of new workers engaged diminished rapidly from week to week and from month to month, so that the accident rate during the first week was 90 times higher than six months later, while, among men having worked for six months, it was 2·5 times higher than among those employed for from three to five years. Further, accident frequency is larger during the night than the day, night work being always more or less abnormal. Experiments made in the British munition factories during the World War and in the American iron and steel industry showed that the hour-to-hour accident incidence was almost completely reversed during the day and during the night; the day accident rate reached its maximum toward the end of the shift, while the night rate fell for the most of the shift. Hence it appears that the accident incidence is influenced by the mental state of the workers rather than fatigue. Fatigue, however, also plays a part in accident causation when working hours are particularly long, *e.g.*, in docks and railway service, and when heavy muscular effort is required, especially in the case of women. On the other hand, alcoholism has been found to be a potent cause of accidents, especially chronic alcoholism, *i.e.*, excessive regular indulgence; excessive drinkers have been found to be about three times more liable to accident than other persons.

Consequences of Industrial Accidents.—The consequences resulting from industrial accidents may be studied from three

different points of view, viz., medical, economic, and financial.

In order to elucidate the medical consequences of accidents the resulting injuries are to be classified according to their anatomic and clinical character, *i.e.*, their "location" and "nature." According to the statistics of some European countries and several American States as to the location of injury, the parts of the body most commonly affected are upper extremities, viz., arms, hands and fingers (40 to 50 per cent. of all injuries) and lower extremities (20 to 30 per cent.). With regard to the nature of injury, the most usual cases appear to be abrasions, contusions and bruises (25 to 50 per cent. of all injuries) and cuts, punctures and lacerations (25 to 30 per cent.).

By the economic consequences are meant the loss of working days and loss in earning capacity of the injured persons. With a view to showing the consequences of accidents taken as a group, in this respect, these are classified according to the "extent" and "degree of disability." The main classification by the extent of disability was discussed above in connection with accident severity. The "degree of disability" is fixed according to different criteria in different groups of disabilities. In fatal cases it is indicated by the age of the killed person; moreover, these cases are classified by the number of his dependents. Non-fatal cases resulting in "permanent disability" are often classified according to the percentage of incapacity for work, total disability (*e.g.*, loss of both eyes) being taken as equal to 100. Cases of "temporary disability" which form about 94% of all accidents, are subdivided according to the number of working days lost. According to an estimate based on the statistics of a number of countries, this loss is in one-third of the cases less than a week; in two-thirds, less than a month; and in about 95% of cases, less than three months.

Finally, industrial accidents involve important financial consequences. The loss of earnings consequent upon industrial accidents affects in the first place the workers, but a part of this loss is, in practically all countries, a charge on the employers in virtue of workmen's compensation and accident insurance legislation; moreover, the State participates in many countries by bearing the cost of the administration of insurance institutions. International comparisons are still less feasible in this field than in other parts of accident statistics, and for several countries, *e.g.*, the United States and France, no information is available. In Great Britain, the regular statistics only show a part of the cost; a recent official estimate, however, puts the total charge on employers in 1925 (including compensation, administrative expenses, commissions, profits, etc.) at £12,117,000. In Germany, the total of payments of the industry and of the State to the accident insurance institutions was in the same year RM. 266,916,000 (£12,934,000). And it should be remembered that these amounts represent hardly more than one-third to one-half of the aggregate burden which industrial accidents constitute on labour and industry as a whole.

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PREVENTION OF ACCIDENTS IN AMERICA

The prevention of industrial accidents, or as it is popularly termed in the United States, "industrial safety work," is that activity undertaken by the employer or in some cases by groups of employers, to remove the physical causes of accidents and to encourage safe practices by the employees. Estimates show that between 23,000 and 25,000 persons meet their death annually as a result of industrial accidents, while approximately 3,250,000 receive non-fatal injuries from the same cause. The economic cost of accidents in industry is placed at $1,000,000,000 annually. The industrial accident situation, therefore, presents a social problem of considerable importance, as well as a great economic problem.

To the employee an accident means the loss in income equal to the difference between his pre-accident wage and his accident compensation or the wage he is capable of earning after the injury. To the employer, accidents mean the expenditure of funds for the payment of compensation awards, medical and burial expenses or insurance premiums to cover the same. They also mean the permanent or temporary loss of valuable employees; the demoralization of the working force; damaged equipment, raw material and finished product; and curtailed production. These latter items, it has been computed, represent a charge equal to at least four times the cost of compensation and medical service or insurance premiums. To the general public, industrial accidents mean an increase in the cost of living, as the expenses of the manufacturer are included in the cost of producing his product.

In the early years of accident prevention work in industry, it was considered largely a duty of the mechanical engineer in designing and erecting guards and protective devices and making provision for the greater physical safety of the workman. In some cases such activities were required by State law. In other cases, encouragement was given by insurance carriers through their plan of offering credits on premiums. It soon became apparent, however, that human defects and failures were accountable for a much larger proportion of accidents than were mechanical defects. In 1928, statistics indicated that between 80 and 85% of all industrial accidents are due to unsafe practices, while only 15 to 20% are chargeable to unsafe conditions. Methodical education, therefore, is the governing principle in the prevention of industrial accidents.

A study of successful industrial accident prevention work shows that the best results have been obtained in organizations where safety activities, both mechanical and educational, are considered as a direct function of supervision, rather than as a welfare activity, independent of production. It has been the experience of many organizations that the degree of success resulting from the safety plans is dependent in large part upon the amount of direct personal interest taken in this phase of operation by the chief executive. To the employees and supervisors, he is representative of the company and his interests and activities reflect the policy of the employing organization. In the majority of larger plants or companies, however, the chief executive cannot give personal direction to this because of many other duties. In such cases it is customary to assign this work to some other official, sometimes with a supporting staff, to direct the safety activities. In some organizations the safety engineer is placed on the staff of the personnel director. Regardless of the type of organization, however, it is considered important that the individual in charge of safety be given a position on the company's staff, which

will clearly indicate the importance with which the employer views the safety work.

A system for obtaining reliable information relative to each accident and for tabulating and utilizing this material is considered essential to a reduction of the accident rate. It is customary to obtain an accident report from the injured employee's immediate superior. Where the nature of the injury is serious or the indicated cause of sufficient importance, this initial report may be supplemented by an investigation or by a hearing conducted by the safety director and a committee of workmen or supervisors. Accident statistics are usually classified by cause in order to determine their relative importance and to serve as a guide in planning for safety. This information also provides effective material for use in educational work. Based upon the accident statistics, the accident frequency rate (usually considered as the number of injuries per 1,000,000 man hours worked) and the accident severity rate (the number of days lost per 1,000 man hours worked) are developed to measure the effectiveness of the accident prevention programme and to serve as a means of comparing the progress and standing of the various units of the organization. Accident cost figures are frequently used to keep the executives informed of the value of the safety activities.

Within the individual unit of the industrial organization, the responsibility for the prevention of accidents is placed upon the respective supervisors—the superintendents or foremen. They are charged with carrying out the safety policies of the management, with the aid and advice of the safety engineer or director. Interest in this plan is sometimes secured by including safety as a definite part of staff meetings. Information regarding the company departmental accident experience and the causes of accidents are furnished the safety supervisors. Through personal contact, participation in meetings and general or personal letters from the chief executive, the safety policy of the company and the part which supervision has to play in it are kept before those in charge of others. In the final analysis, however, the cause and prevention of accidents rests with the individual employee. It is essential that the employee be selected and placed with due consideration to his physical and mental ability to perform his designated duties in a safe manner.

Safety Methods.—The general methods of accomplishing this are fairly well standardized in American industry to-day, although the details incident to carrying them out vary considerably. The outstanding methods are given below.

Department meetings provide an effective means of developing mutual interest in safety between foremen and men. These meetings are usually called and presided over by the foreman and present an opportunity for free discussion of the past accident experience of the group and of measures for the prevention of future accidents. Safety committees of foremen and men serve to place a definite responsibility upon the committee members. Through the rotation of membership the entire force may gradually be reached and convinced of the value of safety to the employee. Advertising through bulletin boards, special messages on blackboards, safety signs, pay roll inserts, leaflets or articles in house organs aids the management to keep the idea of safety constantly before the working force. Friendly competition between plant units, plants or companies provides a definite incentive for the practice of safety. Safety rallies or mass meetings of employees and their families arouse a group interest and encourage the formation of constructive public opinion. The introduction of safety education in the grade school curriculum helps to train the future workman and also provides a splendid medium for reaching the workman through his children.

Considerable aid in connection with industrial safety work is rendered to American industry by the National Safety Council, bureaux of the U.S. Government, State departments of labour, individual insurance companies, organizations of insurance companies, trade bodies and other national and local institutions. (*See* also INDUSTRIAL WELFARE AND MEDICINE; SAFETY FIRST; DANGEROUS TRADES.) (G. W. Co.)

INDUSTRIAL ARBITRATION AND CONCILIATION: *see* INDUSTRIAL RELATIONS.

INDUSTRIAL ARCHITECTURE. This article is concerned with the design of contemporary buildings in which manufacture, purchase, sale, exchange or transport of commodities is carried on, or the financing of business enterprises is negotiated. Architecturally, it represents the most important developments of the early 20th century, which is primarily an age of industry. The number, mass and height of factories, office buildings, stores, etc., have increased, and their design has improved, more than could have been deemed possible at the close of the last century. The reader may also well consult the article ARCHITECTURE; a comprehensive list of related articles in this work appears under the heading ARCHITECTURAL ARTICLES.

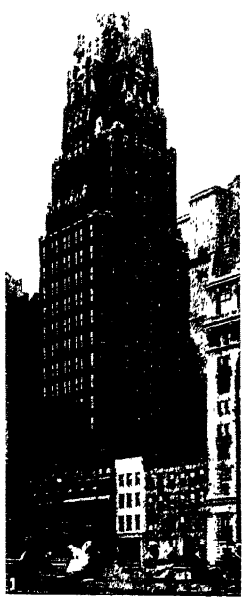
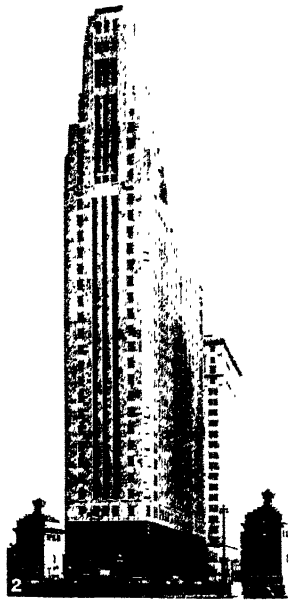
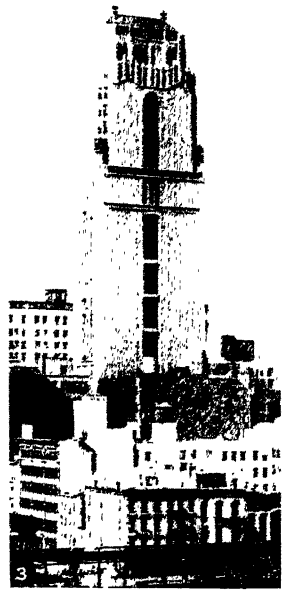
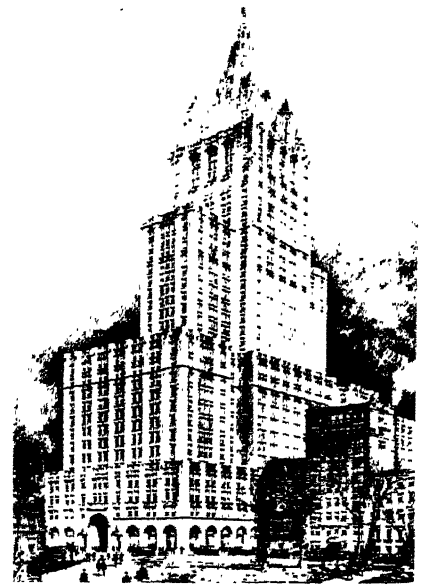
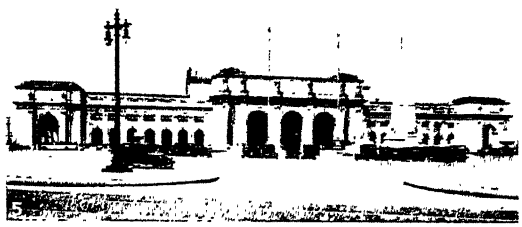
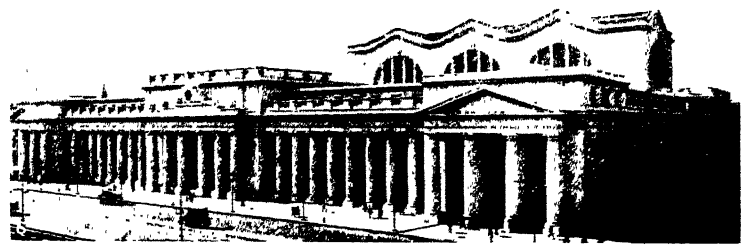
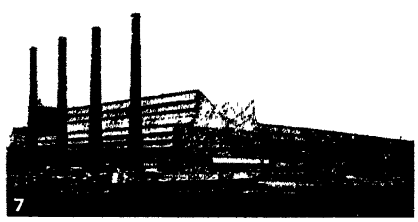
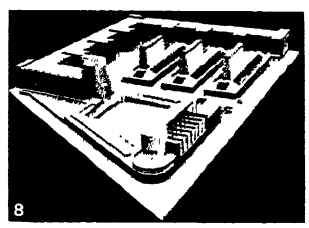
I. INTRODUCTION

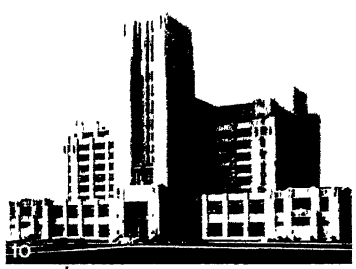
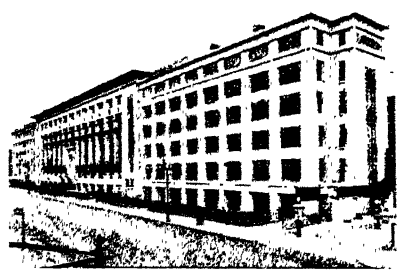
The birth of the industrial age towards the middle of the 19th century coincides with discovery of iron to be used for machinery and transport. Iron and industry, material for machinery and production by machinery, are implicit in each other. Their joint conception, namely the conception of "technique," was the symbol of a new age, of a new generation. That generation regarded industrialism as more or less their own creation, as some magnificent weapon forged for private use, as something national rather than international, fighting competitors both at home and abroad. There resulted from all this a sharp contrast between the lifeless monotony of their factories and the unproductive swagger of their administrative buildings and offices.

The World War marked the end of this first stage of development. The economic and social results of the war produced what was the beginning of a fundamental change of attitude. Industrialism began to be regarded in a clearer perspective and the essential principles of its activity to be recognized; that is, its cultural possibilities and the necessity of adjusting it to some world-embracing scheme. Hitherto science has regarded the two conceptions, material and energy, as separate from each other; we recognize to-day that they are merely different conditions of a single primary element. The modern engineer therefore is abandoning the old mechanistic theory of dead material and is again coming to believe in vitalism as the principle to which he is obliged to render service. Machinery, which till now has been the ready tool of a dead exploitation, is becoming the constructive element in a new and living organism. Machinery was born as a necessary by-product of development, and at the very moment when the need for it arose. The essential task of machinery is to satisfy, to co-ordinate, and to control the mutual relations between population and increased production, between industrialization and increased consumption of human material. In this way machinery can be regarded both as a symbol of overripe decay and as an element of a new life which is capable of ordering itself afresh.

Through the discovery of mechanical potentialities, men and cities, countries and continents have become directly inter-dependent. Each knows the other, each requires the other. This universalization of requirements is complete: never was fashion so internationally authoritative as to-day. Social distinctions are diminished, abolished; national distinctions wear each other away, cancel each other out; a supra-national point of view is formed; isolated particularities, the result of geography, climate and race, are merged in the whole. In this way the spirit of man is freed from the narrowness of the Middle Ages. No longer is the Earth a gloomy corridor, it is living reality, and a spiritual, as opposed to a material fulfillment. Reason and inspiration, the earthly and the heavenly, are at the same moment implicit in it. Thus the traditional conception of God is changed; belief and doctrine find a new basis in a conception which is at once broader and more universal than any hitherto known, and calculated to absorb those antitheses. Individualism and Collectivism, Capitalism and Socialism, divest them of their dogmatic character, and achieve a final compromise. The individual is the "first servant" of the general; the general is the basis on which leaders of men work. In other words, the new world-conception will only be shaped by a fusion of the dogmas of materialism and idealism.

As applied to the domain of architecture this realization means


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MODERN INDUSTRIAL ARCHITECTURE

Illustrations showing skyscraper office building types, railroad stations as important gateways to cities, modern examples of industrial plants and an important farm banking institution

1. American Radiator Building, New York city. Raymond Hood, architect
2. 333 North Michigan Avenue, Chicago. Holabird & Root, architects
3. Bush Building, New York city. Helmle, Corbett & Harrison, architects
4. New York Life Insurance Building. Cass Gilbert, architect
5. Union Station, Washington, D.C. D. H. Burnham & Co., architects
6. Exterior of the Pennsylvania Railroad Station, New York city. McKim, Mead and White, architects
7. Glass manufacturing building, Ford Motor Co., Fordson, Michigan. Albert Kahn, architect
8. Model of a stocking and woollen fabric factory, Leningrad, Russia. Erich Mendelsohn, architect
9. Firestone Tyre Co., Ltd., London. Wallis Gilbert & Partners, architects
10. Sears Roebuck & Co. Building, Los Angeles, California. Nimmons, Carr & Wright, architects
11. Carreras' new tobacco factory, London. M. E. & O. H. Collins & A. G. Parri, architects
12. Mitsui Bank in Tokyo, Japan. Trowbridge & Livingston, architects. From a drawing by Hugh Ferris

that pure calculation and pure inspiration when considered alone are without roots, but by their fusion Industrialism is freeing itself from materialistic limitations. The gloomy and desolate factory of older days is becoming a temple of labour, a shrine of creative reality. This affective revolution must, if it is sincere, express itself in form, and in convincing form. It coincides with the revolutionary discovery of new material for construction, of iron and reinforced concrete. The new methods of construction are leading to a revolution in the whole practice of architecture, since the application to building of iron construction with its scientific principles and its static calculus is supplanting the traditional theory of construction on the load and support principle by the principle of hinged construction of the girders. The first iron girder represented a solution of an architectural problem no less important than that by which the middle ages replaced the classic formula by the invention of vaulting. But for centuries the human eye has been accustomed to deduce the solidity of a building from the harmony of its horizontal and vertical constituents. It is thus obvious that we are making some demand on human comprehension, and one which can only gradually be satisfied, when we ask people to transfer their sense of statics from the traditional principle of load and support to the architectural methods employed in iron construction. The first architectural experiments with rolled iron date back to the middle of the 19th century, to that amazing production, the Crystal Palace in London.

Structural technique, and architectural expression simultaneously achieved a common basis when the World War enormously increased industrial production both quantitatively and qualitatively. We are to-day on our guard against wastage of human labour even as we avoid the wastage of material which was inseparable from the older methods. We rationalize a man's capacity for work even as we rationalize our bricks and mortar. They are both so much raw material. We render building an industrial production, we render the craft of building an industry of building. We thereby eliminate the contradiction between human efficiency and machine work by regarding both as a law of material and ideal self-preservation. Only by such means can the way be opened for a homogeneous form, by which the logic of our new materials can be uniformly applied to industry, transport and building. Since the products of industry, owing to the clarity and precision of their shape, are the most authentic evidence of the new capacity for form, since our modern means of communication are the purest symbols of the spirit and pulse of the age, so also must industrial building, regarded as architectural production, draw its sustenance from the same soil as has given birth to the forms and shapes of technical production. Thus it is industrial construction which is leading the way towards a new style of architecture. It was industrialism that invented, or, more correctly, necessitated, our new material: it was industrialism also that called into being the means and localities of production. It is industrialism therefore which has imposed on the craft of building its definitive tasks, from the first primitive workshop up to the large factory of the modern industrial corporation. Industrialism has thus progressed beyond its original material aims, and has become at once the womb and the nurse of a new development which will carry us over from the death of the civilization of the 19th century to the emergence of a fresh form of creative culture. This development is based upon a uniform material need and upon a uniform spiritual attitude. It is supra-national and already carries with it as its symbol the elements of a new conception of style. (E. MEN.)

II. INDUSTRIAL BUILDINGS

It was not until the World War that architects and engineers had given to this class of building any special study and the outcome of their efforts has resulted in increased production and better working conditions for the operatives. An increase in the interest in factories from the international standpoint has accrued by the fact that a great number of firms are setting up factories in countries to which they are foreign. This building abroad has been caused by the duties levied on imported articles and has had a tendency to make the industrial building a very standardized structure.

Whilst it is not possible to lay down rules applicable to all countries because building work is always governed by local restrictions such as climatic conditions, materials, national characteristics and resources, industrial buildings may be divided into two classes, the one-storey building and the multi-storey building. Most large factories embody in their sequence of manufacture both these types, the heavy components being allocated to the one-storey buildings, and the lighter to the multi-storey. For foundries, forge shops, heat treating plants and plants manufacturing articles producing in the course of their creation noxious odours, the one-storey is employed. Where ground is cheap and large areas are available for future expansion of business the modern practice, especially in the United States, is to use the single storey building throughout the entire sequence of manufacture, both for the making of light and heavy articles. This method is ideal for mass production and would be extensively used were it not for insufficient available ground area and the relative extra cost of the single storey building over the multi-storey building per square foot of floor area.

The multi-storey building is usually constructed of either steel or reinforced concrete and is designed so that extra floors may be added with the increase of business. The usefulness of this class of building has been greatly enhanced by the introduction of the continuous conveyor system as the floors are now no longer dependent upon an elevator service for vertical transportation of goods during manufacture. The multi-storey building is restricted in width by lighting and ventilation requirements which in turn are relative to an economical height from floor to floor. This ratio of width to height of floor varies little in all countries and the majority of multi-storey buildings are designed so that the glass in the side walls is not less than 22% of the floor area. The height, floor to floor, is usually between 12 and 14 ft. and the width of floor area from 50 ft. to 90 ft. The area of ventilators should not be less than 30% to 35% of the total area of the windows. In South Africa and in other countries with similar intensity of light the area of glass must of necessity be reduced to one-third of that used in European buildings and no direct sunlight must be allowed to enter.

In order to gain a maximum of light and ventilation use has been made of an elevation with a continuous window. This has been made possible by using a cantilever construction so that no columns are visible on the exterior. It is this type of construction which has given to the multi-storey factory a façade which lends itself to an expression suitable for an industrial building; by it great scope has been given to the architect in his endeavour to uplift its aesthetic qualities. The most satisfactory attempt in dealing with this problem has been to encase the whole elevation with a large architrave of flat bands sometimes enriched with coloured tiles or faïence work; this has the effect of giving stability to the strong horizontal lines of the continuous fenestration.

One-Storey Buildings.—Where one-storey buildings are necessary the practice in Europe is to use the north light type of factory, the usual pitch of the roof being 60 and 30 with the horizontal (*see* Plate, fig. 9). These roofs are designed so that no direct sunlight can enter the building and by this method a uniform intensity of light is distributed throughout the building. The height from floor to supporting beam is usually from 12 to 15 ft. but where a great deal of overhead shafting is used the height is increased to obtain an adequate drive for the belting. A modern tendency is to localize power units, and a growing tendency in favour of individual motors for each machine permits the height of the one-storey building to be reduced. This is an asset which, so long as the ventilation is adequate, makes construction and heating requirements less expensive.

For certain manufactures in America north light factory roofing is considered obsolete. This form of construction has given way to a variety of a new combination of trusses which give better lighting and ventilation and are sometimes known as the "butterfly" truss (*see* Plate, fig. 7). Apart from the improvement in the efficiency of a factory and its workpeople, this butterfly con-

struction possesses many qualities which will give the industrial architect opportunities for making the single storey factory building just as complete a piece of architecture as the multi-storey factory has now become. Hitherto the multi-storey building stood alone in having gained for itself a definite style of architecture.

The outstanding demand of the modern manufacturer is for clear floor space and this demand is fully met by this construction. Spans from 50 to 60 ft. are usually more necessary in the one-storey building than the multi-storey building and whilst these can be obtained by north light construction, butterfly construction solves the problem more efficiently for certain manufactures. North light with its awkward angles makes maintenance work expensive whereas in butterfly construction, flashings, ridges and surface water problems are considerably reduced. The interior appearance of a one-storey building designed with a butterfly truss is superior to the north light type and receives readily the numerous factory accessories such as sprinklers and heating pipes. In order that the direction from which the light enters the building may be always changing throughout the day, these roofs are faced east and west. Tests have been made and it has been proved that operatives suffer less fatigue when the object upon which they are working has varying intensities of light cast upon it. The direct beam of light is diffused by the use of prismatic or ribbed glass so that this variation may be kept within working limits. There are articles which will not withstand this alteration of light values, but the majority of manufactures are not affected by even a very strong light for short periods during their production. An excellent natural ventilation is brought about and is controlled by automatic opening gear, consisting in some factories of ranges of glass over 800 ft. which are operated by one push-button, the entire length of glass moving en masse. Whilst this is recommended in certain cases 100 ft. is most preferred. With this type of roof facilities for cleaning the glass are much more convenient than with the north light construction, as the cleaner can work freely from the flat portion of the roof.

Layouts.—Great strides have been made in the layout of works, and sequence of manufacture has become a special study in all countries. It is in this sequence of manufacture that mass production has been made possible. The elimination of handling and reduction of the travelling distance necessary for an article during its creation has been reduced to a minimum. Many large factories incorporate in their layout large service basements in which goods are conveyed from one part of the factory to another without covering any of the manufacturing area. These are also used as interim stores in which goods may be placed awaiting their despatch to another department. So important is this sequence of manufacture that it is among the first drawings prepared for a proposed new factory, and great care is taken to design the building in such a way that some or all departments may receive additional area without a dislocation of the normal sequence of manufacture. In America use is made of apartment factories in which several firms will rent floors in the same multi-storey building thereby greatly reducing the transport of goods when these manufacturers are inter-dependent.

The delivery and despatch of goods varies in the different countries; in the United States and on the continent of Europe much use is made of railway transport, even for the smaller factories; whereas in England considerable use is made of road transport and many important factories are found depending solely upon this method. Many factories are now independent units and it is possible in some instances for workpeople to obtain within their own works most of the necessities as well as some of the entertainments of life. It is not an unusual occurrence to find in America and in many European factories, large recreation grounds, ranges of shops, hospitals, restaurants at which the employees are supplied at cheap rates. The two main considerations in modern factory design are the possible maximum output and the health and welfare of the factory operatives, and there are architects and engineers who specialize in this branch of building. (*See* FACTORY DESIGN.)

See *Internationale Architektur* (ed. W. Grotius, Munich, 1925); W. Linder, *Bauten der Technik* (1927) and current architectural periodicals of London, New York, Paris and Berlin.

INDUSTRIAL BUILDINGS: INTERIORS

Interior Surfaces.—The interior surfaces of factory buildings are largely controlled by the manufacturer and there are many ways of treating wall surfaces, ceilings and floors. A granolithic concrete surface has been found satisfactory, and is used extensively in England. Maple and woods offering similar properties are also used, but the surface of floors has not come so near perfection as other materials in factory work.

All excrescences and ledges on wall surfaces are reduced to an absolute minimum. Generally the wall surfaces are painted in a light colour; in corridors and passages they should always receive a dado of a darker colour at least shoulder-height. The actual wall surface is best left in concrete and all edges protected with metal casings where liable to be in contact with trucking. The floors of lavatories should be laid to falls, and the walls tiled.

The divisioning of a factory should generally be reduced to a minimum. Where it is essential the division walls should take the form of metal-glazed removable screens so that in the event of any future alteration they may be taken down and re-used without interference either to themselves or floor and walls to which they were attached.

Ceilings of both one-storey and multi-storey buildings should act as reflecting surfaces and should be designed so that they may be easily cleaned and are not liable to condensation.

Miscellaneous Buildings.—There are many structures complementary to the purely industrial or manufacturing make-up of any large centre of commercial production; *e.g.*, warehouses, silos, gate houses, railway sidings, chimney stacks, power stations, reservoirs, markets, coal bunkers, fire stations, water towers, etc. These structures are necessary adjuncts to the factory proper, but they may form units by themselves.

When they are part of the factory group, the location of these smaller dependent units may form part of the sequence of manufacture. They should be placed so as to function with the factory and incidentally they themselves must be capable of further extension. It is in these structures that the industrial architect is given the opportunity to create a layout that not only allows the most efficient manufacturing process, but also gives relief and contrast in building shapes.

The warehouse, usually a large multi-storey building of low floor heights and small window area, is in direct contrast with the airy and light feeling of the manufacturing plant.

The chimney stack, always a dominating feature, need not be looked upon as something to be rid of, for if in itself it is well designed it can serve a useful purpose, to mark the main axis.

Many water towers have been designed in reinforced concrete and treated frankly as such. Others have been erected in structural steelwork and both of these types have their merits but the latter has to be studied very carefully in order to produce an effect which will be in sympathy with the rest of the group of buildings.

Independent Structures.—When these complementary buildings are independent structures they must be designed from another aspect and are usually on a much larger scale. The warehouse, and more especially the grain elevator and market, are buildings which sometimes dominate all surrounding architecture. There are many examples of silos, towering structures in concrete, whose mass effect is one of the finest achievements in modern architecture. Grain elevators, in which huge quantities of grain are stored, weighed and shipped need not be the ungainly structures which they are occasionally. An example of well designed silos is that at Capetown Harbour where a large grain elevator gives a scale and fits well into the background afforded by Table Mountain.

The enormous height of the grain elevator is mainly due to the fact that the thrust of the grain is constant and it is therefore economic design to carry these structures to a great height. In addition to these huge structures, small silos are found alongside the railroads in agricultural districts of the grain producing countries for ensiling the produce of the local centres.

Markets.—In recent times there have been a few new examples of that old institution, the market, which is now chiefly

ısed for the sale of perishable goods. The advent of the large tore buildings has been a determent to their extended use, and o it is only in a few cases where a large self contained market has ıeen a practical proposition. The huge factories which now deal ı perishable manufactures have also restricted the extension of he market system. But there are examples such as T. Garnier's ıarket at Lyons which is in itself an industrial group and has killfully combated the problem of dealing with a large floating opulation. (D. T. W.)

III. COMMERCIAL BUILDINGS

Under this heading are included all buildings designed for the urchase, sale, exchange or transport of goods or for the work ıvolved in the financing of businesses, etc. In former times ıe bulk of business was carried on between individuals and their ıore or less immediate neighbours; when the business concerns, ıen comparatively small, built at all it was for themselves; 40 ears ago a small building or one or two floors in a larger one ıfficed. The corporation, the trust and the super-trust have nce been organized. To-day nearly all business is national in ope, and much of it international; it requires great headquarters the principal cities, notably the larger ones, and sky-scrapers concentrated masses, grouped for centralized business as in ew York, co-ordinate and speed it up. Business has either to ıild for itself on a vast scale or else to rent space in the build-gs now being erected with a rapidity heretofore unequalled (*see* RCHITECTURE). Building space is produced where it is needed ıd where speculating builders think it will be; it is manufac-red, rented, sold; it differs from other merchantable commodities ıly in that it cannot be transported; but for this reason, and be-use considerable capital is necessary for any building and full turns on the investment may not come in for years, speculation this field is small.

The need for larger buildings and the introduction of skeleton nstruction, two factors that appeared almost simultaneously, ve resulted in the new American architecture whose buildings ve tremendous bases and multi-storeyed towers (*see* ARCHITEC-RE). To preserve adequate light and air for all, however, in ost American cities the form of the new buildings is restricted law, with a tower of unlimited height sometimes permitted on area equal to one-fourth of the lot (*see* ZONING). Aesthetı-lly, the most refined effect and greatest symmetry, and practi-lly, the best lighting and ventilation, are obtainable when this ver rises from the centre of the lot, a position in which it can also taller and structurally stronger than when placed elsewhere.

OFFICE PLANNING

Since the office building of the sky-scraper type is the most tinctive example of commercial architecture, let us consider in detail. The usual procedure in most plan studies is to start :h the ground floor and build up. But in planning office build-:s, and this applies to apartments and hotels as well (*see* SOCIAL CHITECTURE), the architect reverses this process and plans from : top down. That is to say, he develops a typical upper-floor n first, because the major income is derived from these typical ors, and if some sacrifice is to be made, it can better be made the ground floor than on the office floors. A typical office unit irst determined upon, a series of such units is arranged along h sides of a corridor, and then the line of vertical circulation 'ts or elevators) is fixed at a central point on this corridor so t no tenant is obliged to walk more than 100 ft. from his office or to an elevator. Utility spaces—toilets, cleaners' closets, vent fts, flues, etc.—are then added and the plan is completed. A e of plan which, with the ever-increasing concentration of iness and the development of larger and larger organizations, rapidly becoming popular, is that in which a building is de-ıed as a solid mass, as opposed to the more usual type in which ontains area-ways and courts. The typical upper-floor plan of h buildings shows a series of connecting offices on the outside, le the artificially lighted and ventilated core of the building is en over to elevators and rooms for storage, conferences, etc., onging in common to the occupants of the various offices. This e necessitates each floor being occupied by a complete organiza-tion, or at least members of the same profession, and in New York, for example, the installation of common services, notably for doctors, in whole buildings occupied by them, has been carried even further to include rooms for special examinations, appliances and even attendants.

Authorities differ as to what constitutes the ideal office unit; they agree that it is better to have less space (less capital investment) permanently rented at a high figure than much space partially rented at a low figure. Lighting is the important factor here. The depth, *i.e.*, distance from windows to corridor, of a well-lighted office is never more than twice the clear ceiling height. Twenty feet is better than twenty-five. The width of the unit varies with the distance between steel columns, which economical engineering consideration places at not less than 15 ft. nor more than 22 feet. In the best office units each internal division can be subdivided into smaller rooms in the single large office unit. Although a 4 ft. corridor might serve all practical purposes, the width should increase with the length for the sake of beauty of proportion. Corridors should also increase in size as they approach the elevators.

The building lot at the architect's disposal determines the arrangement of offices. It should be noted that "dark" spots, such as always occur where a wing joins the main building, are used, as far as possible, for the necessary utilities, such as elevators, stairways and smoke towers. Toilets can be artificially ventilated and lighted, but it seems better to place them on small back courts, which furnish inferior office space at best, thereby retaining some degree of natural light and full natural ventilation. The British building laws require outside toilets, always; *i.e.*, they must always have outside windows, no matter how much artificial ventilation may be provided.

Staircases and Elevators.—In American office buildings, stairways are little more than fire-escapes. As the law requires them to be entirely enclosed with fire-resisting walls and doors, they are never conspicuous and rarely visible. In London, where the height of buildings is limited to nine or at the most ten storeys, there is one conspicuous open stairway and there are one or two sets of enclosed stairs.

Elevators are often the key to the plan scheme and are usually grouped together for greater service efficiency. Even small buildings have at least two (because of possible breakdown), and if more are needed on account of greater floor area or greater number of storeys, they are so placed that a tenant waiting for a lift may be able to step easily to the first one that flashes a signal. A battery of six elevators, three facing three, is the ideal arrangement. Eight, four facing four, are possible. More than eight in one battery is not practical, because then the passenger might not reach the lift before it had passed. If more than one system is installed, the systems must be separated enough for each to serve effectively an entirely new area, and the plan problem simply repeats itself; *i.e.*, two buildings side by side, but with connecting corridors.

Just as 100 ft. each way from the elevator line is the convenient limit one may go horizontally, 15 storeys is about the limit of effective service for a single battery. As the building with ground area for one group of elevators increases in height, it may require a battery of more than eight, in which case the problem becomes two buildings, one placed on top of the other, with the vertical circulation of the upper structure running through the lower as an "express" service.

Lighting.—Window spacing and height is an important consideration. The usual bay between steel columns is from 15 to 20 feet. Experience seems to dictate the use of two windows in this bay. One window to a bay gives too much wall space and too little light; three windows give too little wall space and too much light. An even field of equally spaced windows is more elastic for interior division into offices. The amount of natural light is not as important as the quality of light. Windows located with regard to exterior architectural effect rather than to interior comfort and convenience sometimes extend nearly to the floor, while above is left a dark void of wall space and ceiling. Many windows of average size are preferable to a few large openings, just as several

well-distributed ceiling lights in a room give better illumination than one powerful centre light. In most northern countries, particularly North America, window openings have to be suitable for both tropical summers and severe winters; while large glass surfaces are attractive in warm weather, they cause financial loss in the heating of buildings and discomfort in cold.

Ground Floors and Basements.—No general principles can be formulated for the planning of ground floors, basements and sub-basements, because conditions vary widely according to the local problem. In the entrance hall, in addition to the elevators, telephone booths, news-stands, etc., specialty shops of all kinds and frequently a bank occupy the spaces opening on the streets. The entrance hall itself is often lavishly adorned; magnificent and imposing entrances are appreciated by the tenants and facilitate the renting of space. The ceilings are often treated in colour; the metal-work on the doors, elevators and mail chutes is sometimes masterfully conceived and executed; large lamps made up of vertical and horizontal planes of coloured glass hang from the ceiling; an effect of spaciousness is striven for. Straight lines and simplicity in the various designs introduce an air of modernism.

The number of floors below the street level depends on the height and, to some extent, on the location of the building. Some very high buildings have as many as five floors below the street level. In some, situated near subway stations, tunnels run from the building to the station; the first basement floor then becomes a second entrance hall; however, it is usually simply treated and such services as boot-black stands and extra telephones are installed. Caretakers' quarters, boilers and other mechanical equipment are located on various of these subterranean floors according to the needs of the problem.

Theory and Forecast.—A business city is essentially a manufacturing plant producing everything from architectural plans to legal briefs. It is created with a full service of streets and buildings but is used to full capacity hardly eight hours a day with Sundays off. The plant works at 30% efficiency. Cities have never been intelligently planned because they have never been planned co-operatively. Individual buildings have been well designed from the point of view of distinct units, but never from the point of view of the community as a whole. There is a tendency in building to utilize larger and larger lots. In New York city, for example, the Telephone building and the New York Life Insurance Company building both occupy small city squares. If the city square were made the lot unit for a building, it would be possible to design structures to serve better the various needs of modern city life, with each building a coherent part of the whole scheme. Buildings so planned could contain apartment dwellings in the top storeys and commercial spaces in the lower; a man leaving his office could then take an elevator to his home; the enormous waste entailed at present when practically whole city populations are transported to and from their places of business twice daily would be eliminated. The cores of such buildings would be given over to elevators, communal services and theatres, elements in which artificial light and ventilation suffice. By using an arcaded side-walk one storey up with bridges at the cross streets the present side-walks could be given over to vehicles and the capacity of the present streets increased. Farther up, at the first set-back, above which would be residences, would be a second side-walk, as a promenade. The other set-backs could be used for terraces and gardens. Business and residence would be united, economy effected and an abundance of light and air provided for the dwellings. On the ground floor, on a level with the vehicular traffic, could be supply services, motors, power and electricity, while underground would be parking spaces, and, further down, sewerage.

When a building occupies an entire city square, it requires four distinct lines of distributing elevators instead of one or two. It becomes four buildings instead of one; *i.e.*, four similar units with connecting corridors. It might be possible to provide means of transporting people through buildings in some way other than or additional to the present system of elevators. None has yet been tried. There has been no building large enough. A large city square, 200 ft. by 800 ft., generally faces two avenues of which one is more important. While in a building occupying such a square several entrances would be placed along the side streets and both avenues, a starting point for distribution might be determined at a point near the most important avenue. A moving stair or similar contrivance might be developed to carry passengers toward the rear and sides of the building while rising. This would probably serve only the first 10 or 12 storeys, as, owing to the narrow side streets, most building laws permit an average of only about 12 storeys, with a tower on an area equal to one-fourth of the base. Due to the size of the average city squares, buildings more than 200 ft. wide from the elevator centre are improbable.

The architectural treatment of a building for advertising purposes is receiving increasing consideration. The Telephone Company and Sears Roebuck and Company are but two examples in the United States that, each having their own architects, give their buildings throughout the country a distinctive appearance. In the American Radiator building, New York city, Raymond Hood has portrayed in the black shaft and the gold and red crest the glow and warmth of heating apparatus. Such advertising features, used as an inherent part of a building's composition, have aesthetic as well as commercial value. The time is coming when crude signs will be considered as offensive as foul smells; restrictions on noise, smells and ugliness will increase as the aesthetic sense of the public is educated.

The illumination of the exteriors of buildings at night will, probably, play an important part in the city architecture of the future. Already flood-lights are used on the upper set-backs to illuminate the topmost storeys. With the development of new materials and the ever-improving methods of lighting, it is possible that the giant buildings of future cities will be beacons that light both directly and by reflection the streets themselves.

BANK BUILDINGS

The planning of modern banks and financial institutions involves the many mechanical improvements that affect lighting, ventilation and control, and the new inter-communicating devices that facilitate the rapid transaction of business. Due largely to experiments made by the Federal Reserve System of the United States, established by act of Dec. 23, 1913, vault construction has made notable advances, certain types of vault being virtually impregnable to fire, burglar and even mob attack. Although these practical matters are part of the architect's work, they do not materially affect the aesthetic problem. One tendency that does concern the purely architectural aspect should be noted. The main banking room, where the major part of the public transacts business, is becoming more and more the architectural feature of the interior. Even the officers of the bank, from the president down, are quartered in this space, and the various partitions necessary to separate bank employees and public take the form of screens, counters, rails, etc., which thereby become a kind of furniture rather than an architectural separation. Some of these great banking rooms are among the most magnificent and richly treated spaces in modern architecture, comparable to the interiors of government buildings (*see* GOVERNMENTAL ARCHITECTURE), or those of the palaces of former times.

The period when it was considered necessary for banks to be designed like Greek temples has passed, and their most characteristic exterior feature to-day is an air of solidity and permanence. They frequently occupy part or all of the ground floor in office buildings, but where a whole building is constructed for one, the exterior (through few windows and wide expanses of smooth wall and imposing metal ornament) is designed to give an effect of impregnability and endurance. Iron, especially since the invention of non-rustable iron alloys, has been used increasingly in grilles, for it has inherent decorative qualities as well as the appearance of strength. The vault is usually placed in the basement, for it is more easily protected there, and, according to the psychology of safety, it is a better advertising feature for it to be situated underground than on the main floor where it is conspicuous to every passer-by. Among large banks it is becoming customary for the same architects to design all the branches, giving them a characteristic style; their common qualities, however,

e usually achieved through decoration, since the dissimilarity in t sizes and building shapes makes it difficult to get much similar- / in exterior design.

STORES

Following the trend of all commercial and industrial construc-)n, stores are being concentrated in larger units. The small shop : the street level continues to exist, and, the modern designers its façade, in both Europe and America, in their efforts to at- ıct the passer-by, have taken full advantage of new materials, mbinations of colours and tastes in composition (*see* SHOP :ONT DESIGN). The great department store is the principal mod- ı solution of the retailing problem. The building often covers an tire city block (occasionally even two), and is sometimes many)reys in height. By means of quantity purchase and elaborately veloped service and delivery systems, the department store sup- es the public with every kind of commodity, so competing with : specialty shops. In its design the architect must consider (1) : movement of people, and (2) the movement of merchandise. In Paris and Berlin the centrally lighted "well" type of store, th its surrounding galleries, is still the rule and gives an im- :ssive interior which is both airy and attractive. But in Lon- n and New York every inch of floor-space is utilized, and ificial illumination takes the place of the natural light pro- :ding from the sky-light over the central well. In fact, Ameri- ı building laws in most cities do not permit the open well form store because of fire hazard. In addition to the usual lifts, : movement of shoppers is facilitated by means of mechanical vices such as escalators and ramps. Intercommunicating belt ıveyors, etc., are usually installed to speed the movement of rchandise.

TRANSPORT

Although architecture relating to transport is here listed in the nmercial category, transport affects every branch of human leavour more or less directly and might well be discussed under / or all subdivisions of contemporary architecture.

Railway Terminals.—This is the most important problem architect has to deal with in this group. Mammoth stations becoming an impressive feature of the modern city and, since advent of electricity has largely eliminated the old-fashioned oke-filled shed that architects formerly tried to express, they :r fine opportunities for architectural genius. There are two sons: the tendency to combine the terminals of several rail- ys in a central or union depot, and the increasing realization t railway stations are the real gateways of the modern city. ıreover, business communities grow up around railway stations, perty values increase, and the terminal may then take the form ı sky-scraper with income producing offices in its upper storeys. tels adjacent to, and even connected with, the terminal are, course, frequent. First impressions are likely to be lasting ones, l no better point could be chosen at which to make an effective)lay. Even in small towns and villages, stations are being cted in keeping with the local environment and designed with eye to artistic fitness. Generally speaking, two classes of people ke use of a station; those travelling daily to adjacent suburbs,) know precisely where and how to go, and desire to reach their ns with the least possible inconvenience; and strangers who st make inquiries at every turn. The architect, therefore, has)rovide an entrance of generous proportions leading directly to entral hall where information booths, booking-offices, luggage- ms, parcel deposits, news-stands, etc., are convenient, and from ch gates to trains, conspicuously marked, are readily accessible. thermore, the movement of trains, luggage and freight in- /es engineering complications of no mean order. These exact- requirements have been met with notable success in several osing structures. The Pennsylvania station (McKim, Mead White, architects), and the Grand Central terminal (Warren Wetmore, architects), both in New York, the Union station Vashington, D.C. (D. H. Burnham and Company, architects), new Union station in Chicago (Graham, Anderson, Probst White, architects), and the station at Helsingfors, Finland iel Saarinen, architect), are some of the most impressive nples. (*See* RAILROAD PASSENGER TERMINALS.)

Airports.—The growing popularity of air transport has cast a new challenge to the architect. International air travel is an accepted fact on the continent of Europe to-day, and its air terminals require all the passenger facilities of railway stations plus the customs provisions of steamship docks. At the airport of the future passengers will doubtless be able to take different lines to different countries and transfer from one line to another. Future airports will be centres of international as well as domestic travel; the boundaries of a country will no longer mark its ports of foreign call. Since the first requisite of an airport is a good flying field, it is usually situated outside the city that it serves; consequently hotel and restaurant facilities must be provided for both passengers and pilots, and subway or bus terminals for the lines transporting people to and from the field.

The architectural development of the airport is in its infancy. For the most part flying fields have been equipped merely with mechanical requisites, and planned mainly from an engineering viewpoint. With the present rapid growth of the industry, however, the possibilities afforded for designing airports with imposing and striking effect, making use of the most recent methods of construction and lighting, and the need for these new entrances to nations and cities to be impressively planned is becoming appreciated.

Perhaps the most striking design at the present time is that planned by Maurice Chauchon for Pau, France, 50 m. from Bordeaux, which is considered a strategic site for airway travel. The international aerodrome, 370 ft. wide by 260 ft. long, will hold three giant commercial continental passenger planes, the wingspread of each being about 130 feet. The plan is conceived in such a way that the hangars can be made longer and more added when necessary. Parts of aeroplanes and all mechanical supplies required will be kept on hand in adjoining machine shops. The project calls for a restaurant, hotel, customs-house, information bureau, ticket office, money change booth with provisions for the exchange of foreign money, porters, radio and meteorological service. A roof of glass slabs set in reinforced concrete provides daylight illumination for the main hangar. At night, at either side of the aerodrome, two lateral beams can be deflected over the ground to indicate the best angles for landing; according to the direction of the wind; two vertical beams, each of 1,000,000 candle power, are especially adapted for foggy weather; a permanent light will always be displayed in the right-hand corner of the field; the name PAU, in illuminated letters 70 ft. long, will be so sunk in the ground that planes can taxi over it safely.

(H. W. C.)

INDUSTRIAL ARTICLES. The various aspects of industry, its development and ramifications are fully dealt with either in key articles or under separate headings. The main article INDUSTRY provides a historical introduction together with general indications of the manifold interests with which modern industry is linked up. A special article on WAR CONTROL OF TRADE AND INDUSTRY embodies the chief lessons learned by industrial students from the World War. In addition to the main article, branches of industrial activity have special headings, *e.g.*, INDUSTRIAL ACCIDENTS; INDUSTRIAL ACCIDENTS, PREVENTION OF; ASSOCIATIONS, INDUSTRIAL; INDUSTRIAL COUNCIL; INDUSTRIAL COURT; ELECTRIFICATION OF INDUSTRY; INDUSTRIAL FATIGUE RESEARCH BOARD; INDUSTRIAL INSURANCE; INDUSTRIAL RELATIONS; RESEARCH, INDUSTRIAL; INDUSTRIAL REVOLUTION; INDUSTRIAL TRANSFERENCE BOARD; INDUSTRIAL WELFARE AND MEDICINE; INDUSTRIAL WELFARE SOCIETY; and INDUSTRIAL WORKERS OF THE WORLD.

Labour's increasing activities in coming to grips with organized industry are well-covered in the various articles on LABOUR and its connotations. Labour colonies are found treated in the article FARM COLONY, and other leading articles of interest to students of labour and its problems are LABOUR DAY; EMPLOYMENT EXCHANGE; HOURS OF LABOUR; STRIKES AND LOCK-OUTS; TRADE UNIONS; TRADE UNION CONGRESS; TRADE, WORLD'S STATISTICS, and kindred articles such as TRUSTS and TRADE ORGANIZATION.

All the main articles are supplied with full cross-references to subsidiary articles where further and, in some cases, more detailed

information will be found.

INDUSTRIAL ASSOCIATIONS: *see* ASSOCIATIONS, INDUSTRIAL.

INDUSTRIAL CHEMISTRY may be broadly defined as applied chemistry, whether in testing laboratories or in chemical industry. Recent compilations by the National Research Council indicate more than 1,000 industrial research laboratories in America, and to these should be added laboratories which analyse materials against specifications, exercise control over some industrial processes, and examine finished products with reference to published guarantees or the purchasers' stated requirements. The recognition of adequate analysis and testing has spread to department store and individual laboratories as well as to corporation and Federal Government laboratories. The interpretation of analytical results is usually more important than the data themselves. Even the older industries such as baking, ceramics and textile manufacture now recognize the necessity of chemical control as a major step in plant efficiency, cost reduction, waste elimination and uniform properties of saleable products. Many industries not commonly regarded as chemical industries are successful only when under complete chemical control. The manufacture of sugar, tanning of the best leather, and the manufacture of steel are examples.

Remarkable strides have been made in the chemical industry since 1914, when the World War made necessary the rapid creation of such an industry to supply the shortage of many necessities, particularly in the field of organic chemistry. This situation confronted England, America, France, Italy, Japan and practically all civilized countries, since Germany had specialized in this type of manufacture and exercised a virtual world monopoly. As a result, many countries determined to become self-contained so far as the chemical industry was concerned, providing in particular chemical compounds such as synthetic pharmaceuticals, medicinals and dyes which, though comparatively small in tonnage, bear such relation to other industries as to give them the character of a "key" material. The end of the World War saw a world supply far in excess of the demand for many types of industrial chemicals. There followed a number of drastic readjustments. Many of the smaller manufacturers had to discontinue and sell out to their financially stronger associates, or unite themselves in groups. The laws and customs of the different countries have directed this readjustment to a great extent. In Europe cartels have been formed. The most important example is the *Interessengemeinschaft* or "I.G." of Germany, which has become a cartel of international importance, with connections reaching into not only all major lines of chemical industry but into allied fields, particularly those concerned with raw materials. Consolidations have taken place in Great Britain, giving rise to Imperial Chemical Industries, Ltd., an exceedingly strong group composed of the major chemical manufacturers of Great Britain. There have been international agreements on the European continent with respect to division of market, consolidation of sales and advertising, and similar functions. In the United States there have also been certain groupings or consolidations, but due to the German Anti-Trust law, there has been nothing approaching the I.G. in extent.

NEW INDUSTRIES

Chemistry has introduced many new notes into industry. The photographic industry is an example of one founded on a single chemical fact, namely, that halogen salts of silver turn dark in the light. Unpromising raw materials have been made the basis of many industries such as the manufacture of ethylene glycol and its derivatives from natural gas, and the preparation of amyl alcohol and compounds derived therefrom, from pentane separated from natural gas gasolene. Cellulose derived from wood, cotton and annual growing stocks, has been made the promising raw material of the immediate future, and already supplies a variety of lacquers, several kinds of artificial silk or rayon, artificial leather, sausage casings and films used for a variety of display and wrapping purposes. Synthetic resins, prepared in the laboratory, have provided a building material of great importance in these days of mass production, lending themselves particularly to moulding compounds, enabling metal inserts to be moulded in place, and intricate forms to be produced by a single operation. Acetic acid, once a by-product of wood distillation, is now produced by fermentation, and acetic anhydride is prepared by catalysis from acetylene gas. Methanol is prepared on a great scale from gases derived from coal. Aluminium since its introduction into industry has become a metal of many uses produced in great quantity. Metals such as tungsten, tantalum and molybdenum, once regarded as rare, are now important commercially. Another service has been the supply of materials prepared according to precise requirements. The range of alloys permits to-day a careful selection, depending upon the peculiar use, thus contributing directly to economic savings possible through longer life in service or resistance to rust and corrosion.

In the field of organic chemistry the work of arranging atoms and molecules to order has been of the greatest importance. The organic chemist begins by isolating and identifying the active principle of some natural medicinal product. When the characteristics of such a compound have become established, he then proceeds to synthesis. This work begins in the laboratory and when perfected there, goes through semi-works development and innumerable physiological tests before manufacture is attempted on a commercial basis. By this method it has at times been possible to eliminate groups of atoms found to be responsible for such deleterious properties as habit-forming, or perhaps other groups are added in the synthetic product to widen the use of the compound or make it more specific. Such work does not always start with natural products, for organic chemistry now produces in commercial quantities numbers of compounds quite different from anything known in nature and devised to meet a particular need.

Chemistry is valued by industry on many accounts. It serves to guard raw materials as to quality and supplements them by establishing new sources. It prevents waste by assisting in the selection of materials for particular uses, thereby avoiding the production of "seconds." It turns by-products into profits and often creates a new industry as a result. It speeds production by the improvement of processes and by imparting improved physical characteristics through changes in chemical composition. It protects the guarantee by determining in advance that the warranted material will meet specifications. It supplies reliable information as to products and processes as well as trends in industry; such information may save industry by avoiding surprise. It has assisted in breaking monopolies and in countless instances has reduced costs to a surprising degree. Since chemistry is a fundamental science dealing with the ways of materials, it naturally occupies a position in the front rank of the aids to modern industry. (H. E. H.)

INDUSTRIAL COUNCILS. In the principal British industries working conditions in the widest sense—including wages, hours of labour and terms of employment generally—are normally settled or adjusted by some form of direct negotiation between employers organised in associations and workpeople organised in trade unions. As between these organisations there has been built up, in many industries, more especially those engaged in the export trade, stable and definite machinery for discussion often comprising elaborate local and national arrangements for conciliation and for arbitration in the last resort. Thus the half century prior to the World War witnessed, side by side with the growth of representative associations formed for contest, the joint development by these organisations of conciliation or arbitration machinery for avoiding disputes or settling them if they arose. A Royal Commission appointed in 1891 drew attention to the existence and spread of these voluntary conciliation boards and urged their extension and encouragement. In 1911 an attempt was made by the State to strengthen the machinery of conciliation by the establishment of an Industrial Council of a national character, comprised of 13 representatives of employers and a corresponding number of workpeople and presided over by a nominated independent chairman, "for the purpose of considering and enquiring into matters referred to them affecting trade disputes, and especially of taking suitable action in regard to any dispute referred to them affecting the principal trades of the country as

likely to cause disagreement involving ancillary trades, if the parties before or after the breaking out of a dispute are themselves unable to settle." The Industrial Council of 1911 functioned for a time, but in the special circumstances created by the war it fell into abeyance. Since the war the extensive voluntary machinery for direct discussion between organised employers and workpeople has been supplemented by the creation of Joint Industrial Councils formed in accordance with the recommendations of the Whitley committee of 1917.

See also INDUSTRIAL RELATIONS, CONCILIATION AND ARBITRATION, WHITLEY COUNCILS, STRIKES AND LOCKOUTS. (J. H.)

INDUSTRIAL COURT. The Industrial Court is a permanent Court of Industrial Arbitration to which the British Minister of Labour can refer, with the consent of both parties, industrial disputes for settlement. The Court had its origin in the recommendations of the Whitley committee (report of 1918) which were in part to the effect that there should be established a standing arbitration council to which differences might be submitted in cases where the parties failed to reach an agreement and wished to refer to arbitration. Effect was given to these recommendations in the Industrial Courts Act, 1919. Under Part I. of this act a trade dispute may be reported to the minister of labour, whereupon the minister has to take the matter into consideration and to take such steps as seem to him expedient for the settlement thereof. This enables the minister, if the parties to the dispute consent, to endeavour to settle the dispute by conciliation. The fact that such action is taken only by the consent of the parties ensures that negotiations are carried on under favourable conditions; and it is by conciliation that the majority of disputes in which the minister is called upon to intervene are settled, in many cases by the ultimate agreement of the parties to refer their difference to arbitration. An important provision of the act (section 2 [4]) is designed to ensure that, before a difference can be referred to arbitration, any existing joint conciliation or arbitration machinery shall have been tried and found wanting. The arbitration procedure outlined in the act is that the minister of labour may, with the consent of the parties, refer differences to arbitration either by the Industrial Court, a single arbitrator, or a board of arbitration constituted of employers and workpeople with an independent chairman. During 1927 there were issued 82 decisions on cases referred to the Court for determination, making a total of 1,354 decisions since the establishment of the Court. In Part II. of the Industrial Courts Act the minister is given power to enquire into the causes and circumstances of a dispute, whether apprehended or existing, and if he thinks fit, to refer any matters appearing to him to be connected with or relevant to the dispute to a Court of Inquiry. This power is intended to be exercised by the Minister in cases in which, in his opinion, the interests of the public are involved and the object is to render the public familiar with the authentic facts of the dispute. A Court of Inquiry is not a form of arbitration, and there is no question of securing the consent of the disputants to its appointment. Courts of Inquiry have power to request persons to give evidence and, though no penalties are attached to failure to fulfil the request, in no case has it been refused. Up to the end of 1927 sixteen Courts of Inquiry had been appointed.

See Reports of the Ministry of Labour for years 1923 and 1924 (Cmd. 2,481) and for 1927 (Cmd. 3,090). (J. H.)

INDUSTRIAL ELECTRIFICATION: *see* ELECTRIFICATION OF INDUSTRY.

INDUSTRIAL FATIGUE RESEARCH BOARD, a body constituted in 1918 under the control of the Medical Research Council to study, on systematic and scientific lines, problems relating to the human factor in industry. It is responsible for a special series of published reports. (*See* FATIGUE, INDUSTRIAL; and INDUSTRIAL PSYCHOLOGY.)

INDUSTRIAL INSURANCE. The system of industrial insurance in its present form has been evolved from the endeavours on the part of small local burial societies to secure to persons in humble circumstances a sum sufficient to defray their funeral expenses. Many of these small societies are still in existence, but as it became apparent that there was a general demand for the services which they rendered, other organizations founded on a broader basis, and employing the medium of collectors, were established, and have developed to such a degree that the business now transacted by the larger collecting societies and industrial insurance companies has attained enormous proportions. The provision of funeral benefits remains the predominant function of the system. The advantages of life insurance as a means of making provision for dependents are, however, becoming more generally appreciated. The great majority of the contracts in force consist of whole-life policies, but the popularity of endowment assurance, which is so conspicuous a feature of ordinary life insurance business, appears to be extending in some measure to industrial insurance.

The principal characteristics of the system are well known, and all, or at least some of them, are present in a greater or less degree in every form of industrial insurance policy: the sums assured are small in amount, the premiums are collected by agents at the homes of the assured, and are generally payable weekly or at other short intervals, and the weekly premium is the basic unit of the tables, the sum assured being the variable depending upon the age of the policyholder and the form of policy. It is interesting to note that the statutory definitions of industrial insurance have varied in different countries, and even from time to time in the same country according as emphasis is laid on one or other of these characteristics.

In Great Britain industrial assurance business is defined by the Industrial Assurance Act, 1923, as that of effecting assurances upon human life, premiums in respect of which are received by means of collectors, and are payable at intervals of less than two months. In the same Act a collector is described as a person who makes house-to-house visits for the purpose of receiving life assurance premiums.

The British System.—An account of the British system may serve to indicate the essential principles governing the conduct of industrial insurance business wherever it may be transacted.

In Great Britain industrial assurance business is regulated mainly by the Industrial Assurance Act, 1923, 13 and 14 Geo. 5, c. 8. The institutions authorized to transact the business of industrial assurance are divided into two classes, registered friendly societies, referred to in the Act as collecting societies, and assurance companies, referred to in the Act as industrial assurance companies. The operations of registered friendly societies are governed by the Friendly Societies Acts, and those of assurance companies by the Assurance Companies Act, 1909, and the provisions of these Acts so far as they have not been superseded or repealed by the 1923 Act continue to apply to societies and companies transacting industrial assurance business. Under the Act the Chief Registrar of Friendly Societies is constituted the sole authority for the supervision of industrial assurance business, and in this capacity is to be known as, and styled, the Industrial Assurance Commissioner. The powers conferred upon the commissioner include not only those in relation to industrial assurance business hitherto vested in the Board of Trade and the Chief Registrar of Friendly Societies respectively, but also certain others of a far-reaching character. He may reject any account, return a balance sheet that does not comply with the requirements of the Act, and give such directions as he thinks necessary for the variation thereof. Disputes may be referred to him, and acting in a judicial capacity he may hear and determine such cases. He has power to investigate offences, and in cases where he has reasonable cause to believe that an offence has been committed or is likely to be committed, he is authorized to hold an inspection into the affairs of the society or company. His decisions in the more important cases are published in the annual report which he is required to make each year of his proceedings under the Act, and which is to be laid before Parliament. By the 1923 Act every company and society transacting industrial insurance business is required to deposit and to keep deposited with the Paymaster General in respect of such business the sum of £20,000.

Under the Life Assurance Act, 1774, a policy issued to one person on the life of another is invalid unless the person proposing the assurance has an insurable interest. By the 1923

Act and the Friendly Societies Act 1924, policies insuring money to be paid for the funeral expenses of a parent, child, grandparent, grandchild, brother or sister are not to be invalidated by the absence of insurable interest. The maximum sums payable on the death of a child are, however, fixed at £6 for children under three years of age, £10 for children up to six years of age, and £15 for children up to ten years of age.

The provisions of the Act relating to valuations are of great importance. The valuation must be made by an actuary, and the basis is to be such as to place a proper value on the liabilities, regard being had to the mortality experience, to the average rate of interest from investments and to the expenses of management including commission. There is in the Act no suggestion of anything in the nature of a standard basis of valuation or of a maximum scale of expenditure on management. A certificate is to be given by the same persons as sign the balance sheet that the assets are in the aggregate fully of the value stated therein. The commissioner has power to reject a valuation, and order it to be amended, and may direct further particulars and explanations to be furnished in order to satisfy himself whether the valuation complies with the provisions of the Act. If a valuation discloses a deficiency the commissioner may, if he is satisfied that the society or company should cease to carry on business, take the necessary steps to have it wound up.

Lapsed Policies.—The large number of lapsed policies has been a frequent subject of complaint in regard to industrial insurance business. The Act, however, contains stringent provisions for safeguarding the rights of owners of policies. Before the forfeiture of a policy can be incurred, a notice of the arrears owing must be served and 28 days allowed in which to pay. If the arrears are not paid, and the policy has been in force for a prescribed period, the owner of the policy is on making application to the insuring office within one year from the date of the notice, entitled to a free paid-up policy or in certain circumstances to a surrender value. Rules are prescribed for ascertaining the value of a policy and for determining the amount of the free paid-up policy. The provisions regarding forfeiture are to be printed in every premium receipt book.

The Industrial Assurance Act, 1923, was the direct outcome of the recommendations of a departmental committee appointed in 1919 by the Board of Trade to enquire into the business carried on by industrial assurance companies and collecting societies. The committee in the following year presented a unanimous report criticizing the methods of some of the offices, and proposing amending legislation.

COLLECTING

Costly Collections.—The great problem which all industrial insurance companies, no matter where they may be established, have to solve is the reduction of expenditure. The collection of premiums by agents is necessarily a costly process, and owing to the smallness of the sums involved, the expense ratio must inevitably be considerably higher than in the case of ordinary life assurance business. Most companies are able to conduct their ordinary business at a cost of about 12 to 15% of the premiums, but from the evidence furnished to the departmental committee it appeared that the average annual total expenditure of companies and societies on industrial business for the six years 1912–17 represented about 44% of the premium income. In 1926 the expense ratio for all companies had fallen to 34% and for all societies to 41%. The former of these two ratios is weighted heavily by the experience of the largest company whose rate of expenditure has shown a progressive decline to 26%, a figure which is much lower than that of any other company. The substitution of a salary basis of remuneration for that of commission is becoming more usual, and the introduction of the "Block system," under which a given area is exclusively allotted to a particular agent, promises to be productive of satisfactory results.

The tables issued by industrial assurance companies usually show for each age at entry the sum assured by weekly premiums of one penny or multiples thereof. The plan of taking the penny premium as the unit facilitates accounting as well as collection by agents. There is an increasing tendency, however, especially in the case of endowment assurances, to quote the sums assured by monthly premiums, and as in ordinary assurance business to show the premiums required to provide specified sums assured. The following are specimen rates taken from the prospectus of a large British office:—The sum assured at death by a premium of one penny per week is, for age next birthday at entry 10, £15:0:0; age 20, £10 18s.; age 30, £7 17s.; age 40, £5 7s.; age 50, £3 9s.; age 60, £2 3s. A premium of 5s. paid every four weeks will secure at the expiration of 15 years or at death, if previous, for age at entry 1, £45; age 10, £44 5s.; age 20, £43 5s.; age 30, £42 10s.; age 40, £40 15s.; and age 50, £37 10s.

In Great Britain, since 1919, almost all offices have issued revised tables giving more favourable terms than formerly. This has been made possible by the general decrease in the death-rate, and the increase in the rate of interest obtainable on investments. It may be anticipated that with the continuance of these influences, profits will enure, to a share of which policyholders will no doubt be admitted, even although industrial insurance policies usually do not carry the right of participation in profits. Several offices, both proprietary and mutual, have for some time had bonus schemes in operation, and surpluses have been distributed either in the form of additions to the sum assured or curtailment of the period for which premiums were originally payable. One large company for many years gave "mortuary" bonuses, that is, additions to the sum assured varying with the duration of the policies, in all cases becoming claims during the ensuing year or a further specified period, but to policies issued since Jan. 1, 1923, a vested bonus conditional only on the policy remaining in force for five years is allotted in respect of the premiums paid in each year. This is a reversionary bonus, payable at the same time as the original sum assured, thus introducing into industrial assurance business a system of distribution of surplus previously confined to ordinary business. In the last year for which information is available this company distributed to its industrial policyholders surplus amounting to not far short of £3 millions. Another large proprietary company has extended to existing policyholders the advantages of the new tables intended for future entrants, under which larger benefits are insured. These concessions to industrial policyholders are examples of the general disposition on the part of directors and proprietors to admit them to a share in the prosperity of the company. It must be pointed out, however, that the first task confronting a number of offices has been to strengthen their reserves to the standard required by the 1923 Act.

The publication of the first complete return of the results of valuations under the British 1923 Act affords an opportunity of surveying the position of British Industrial Assurance organizations. The date of valuation in the majority of the cases was Dec. 31, 1926. The following is a summary of the results:—

British Industrial Insurance Returns

	Industrial assurance companies	Collecting societies	Total
No. of companies or societies	18	170	188
No. of policies	56,097,000	15,529,000	71,626,000
Sums assured	£821,542,000	£202,951,000	£1,024,493,000
Assurance funds	£164,688,000	£32,634,000	£197,322,000
Surpluses	£6,589,000	£1,935,000	£8,524,000
Deficiencies	£53,000	£357,000	£410,000

From an analysis of the returns it can be affirmed that there has been a definite strengthening of the bases of valuation, that the proportion of expenses to the premium income is diminishing, and that a general improvement in the administration of the business in the interests of the policyholders is being effected. The proportion of the surpluses to the sums assured appears to be greater for the societies than for the companies, but this is attributable to the fact that the companies' surpluses are in most cases the results of annual valuations, whilst those of the societies have accumulated during the longer intervals which had in many instances elapsed since the previous valuations.

It will be observed that the number of policies brought under review was nearly 72 millions, about two policies per head of the total industrial population of the British Isles, assuring on the average about £14 each.

The total funds held by the companies and societies amounted to about £200 millions, a notable result of the accumulation of a multitude of small sums contributed by a large proportion of the total population, who are thus given a direct interest in the financial stability of the nation.

Statistics of Growth.—The stages in the remarkable development of industrial assurance business are indicated by the following statistics.

In Great Britain, for industrial assurance companies and collecting societies together, in 1877 the premium income amounted to about £2 millions, in 1897 it was about £9½ millions, in 1907 about £17 millions, in 1920 nearly £36 millions, in 1925 £45,182,000, and in 1926, the latest year for which figures are available, £45,435,000. At the end of these years the funds amounted to nearly £2 millions, £21½ millions, £48 millions, £108 millions, £184 millions and £201 millions respectively. In 1926, 8,116,000 policies were issued, a decrease of about a quarter of a million from the average of the previous five years which was attributable to the coal strike.

In Australia the number of policies in force at the end of 1925 was 1,311,000, or 220 policies per 1,000 of population, and the sums assured were not far short of £50 millions.

These are impressive figures and indicate that industrial assurance is performing a very valuable social service. It is claimed, and no doubt quite reasonably, by the advocates of the system, that such results could not be obtained without the personal contact of agent and policyholder.

It is clear, however, that the agents do not restrict their activities to industrial business but use the opportunities afforded by their acquaintance with the circumstances of policyholders to advocate the advantages of the extended benefits to be obtained through the medium of ordinary life assurance. That these efforts are attended by considerable success is evidenced by the fact that both in Great Britain and in America the largest industrial offices transact also the largest amount of ordinary business. The practice of using the organization of the industrial branch to extend the operations of the ordinary branch is no doubt profitable to the offices and their agents, but they are entitled to claim that it enables them to confer on their policyholders the benefits of assurance facilities at the relatively cheaper rates of the ordinary system. Amongst other examples of the pressure deliberately exerted by offices in popularizing the less expensive types of policy may be mentioned the recent development of industrial assurance by monthly premiums. (P. G. B.)

UNITED STATES AND CANADA

Industrial life insurance in the United States and Canada is, in general, similar to that transacted by the British insurance companies. The collecting societies, however, have no counterpart here. In the United States, supervision of industrial as well as other insurance is exercised not by the Federal Government, but by the several States. In Canada the business is regulated partly by the Dominion Government and partly by the provinces. There are few States that have specifically defined industrial insurance, although often references in the law indicate its nature. The following definition was adopted in New York State in 1927: "Industrial life insurance is hereby defined to be that form of life insurance, either (*a*) under which the premiums are payable weekly, or (*b*) under which the premiums are payable monthly or oftener, if the face amount of insurance provided in the policy is less than $1,000, and the words, 'industrial policy' are printed upon the policy as a part of the descriptive matter." In Canada, the Dominion Insurance Act, as amended in 1927, provides, "'industrial insurance' means life insurance the premiums for which are payable at shorter intervals than quarterly and are normally collected at the home of the insured."

Early History and Growth.—Prior to 1875 insurance for workingmen and their families was supplied largely by co-operative societies, which frequently failed after a comparatively short existence. There were also arrangements whereby social organizations collected premiums weekly and paid them over to insurance companies. During the year 1875, through the efforts of John F. Dryden, the Prudential Friendly Society was organized in Newark, N.J., and in 1877 the name was changed to the Prudential Insurance Company of America. This company adopted in large measure the methods of the Prudential of London, and may properly be called the first industrial company in America. In 1879, the Metropolitan Life and the John Hancock of Boston, both of which were already transacting ordinary insurance, commenced writing industrial insurance. These three companies now have in force over 85% of the industrial life insurance in the United States.

The business was introduced in Canada in 1881, and is now carried on there by three Canadian, two United States and an Australian company.

Industrial insurance has grown steadily and rapidly in volume and in public favour. Policy conditions have been greatly liberalized, and restrictive provisions in the earlier policies gradually eliminated. Expense rates and lapse rates have been notably reduced, and mortality rates, especially at the younger ages, have greatly improved. Hence the companies have been able to largely increase the amount of benefit for a given premium. As an illustration, in one company, under a policy issued in 1895 on a child aged two years next birthday, weekly premium ten cents, the maximum benefit, reached after 11 years, was $230, whereas under the present table, the benefit for the same weekly premium is $424, reached in nine years, and the premiums cease at age 75. The remarkable growth of this form of insurance will be seen from the following table (*Spectator Year Book*, 1927) showing the industrial insurance in force in United States companies:—

End of year	Policies in force	Insurance in force
1880	228,357	$ 19,590,780
1900	11,215,531	1,468,474,534
1920	49,178,887	7,121,380,255
1926	78,268,739	14,213,136,743

The foregoing table includes the business of United States companies in Canada, amounting in 1926 to 3,217,885 policies and $517,984,522 insurance. It also includes not only policies of pure life insurance, but policies of combined life, health and accident insurance. Some of the small companies are not included in the tabulation.

At the end of 1927, there were probably more than 100 companies transacting industrial life insurance in the United States, most of them issuing only life insurance policies, but some, especially in the South, issuing policies of combined life, health and accident insurance. It is estimated that these companies had in force in the United States at the end of 1927 about 76,000,000 policies of pure life insurance, representing perhaps 45 or 50 million lives, and $14,500,000,000 insurance, about 7% being on coloured persons. In addition, there were probably 3 or 4 million policies of combined life, health and accident insurance carrying 200 or 300 million dollars of life insurance, and weekly sickness benefit of many millions. In Canada, at the end of 1927, there were about 3,900,000 industrial life insurance policies in force, with insurance of $680,000,000.

Plans.—Most industrial life insurance is based upon the collection of a weekly premium of 5 cents or multiples thereof, with the amount of insurance varying according to the age at entry. Many companies also publish tables for even amounts, such as $100 and $250, with the weekly premium varying according to age. While premiums are usually payable weekly, the Metropolitan Life Insurance Company has also been issuing monthly premium industrial policies, at reduced premiums, since the beginning of 1927. The most popular industrial policies are whole life (frequently with premiums ceasing at the age of 70 or 75) and 20 year endowment. In most companies, insurance may be written at any time from birth up to age 60, 65 or 70 at entry. The average benefit per policy is about $200, but the average amount

per insured person is larger because many persons carry two or more policies. Policies are rarely written for more than $1,000 except by the principal Canadian company, which issues a special series of weekly premium industrial policies at reduced premium rates, for $1,000, $1,500 and $2,000. The benefits on policies issued on children usually start considerably below the maximum provided under the policy, and increase with duration until the maximum is reached. Several States, in fact, and the principal Canadian provinces, limit the insurance a parent may legally carry on the life of a child. From about 1895 to 1905, there was considerable agitation against the insurance of children, but this movement has gradually become of little importance.

Bases.—The mortality table in most common use for the calculation of reserves is the Standard Industrial Table, based on the experience of the Metropolitan Life on standard industrial risks during the period 1896–1905. It has been recognized as a permissive standard by laws of New York State and Canada. The more recent tables of premiums and benefits, however, have been based, directly or indirectly, on later and much improved mortality rates. Mortality under industrial policies is naturally much higher than under ordinary policies because of the lower economic status of the average industrial policy holder. The interest rate generally assumed for calculation of premiums and reserves is 3½%.

PRACTICAL WORKING

Collections.—A company usually divides its territory into "districts"—a district being a part or the whole of a city, perhaps with nearby cities and towns. It is in charge of a manager or superintendent, controlling a staff of agents, together with assistant managers or assistant superintendents averaging about one for every eight or nine agents. The agent is usually compensated partly by collection salary or commission, based on the size of his "debit" (*i.e.*, the business on which he collects), and partly by a commission for his "increase" in weekly premium, resulting from the excess of new business issued over business lapsed. Industrial agents, as a rule, write ordinary insurance as well, and are paid a commission thereon. There are not far from 70,000 industrial agents and probably 10,000 managers, superintendents and assistants. By far the greater part of industrial insurance is written without medical examination, being inspected by the writing agent.

Policy Provisions.—Industrial policies are usually incontestable after one or two years from the date of issue. There may or may not be a named beneficiary, but in either event, most policies contain a "facility of payment" clause permitting payment to any relative by blood or connection by marriage or other person incurring burial or other expenses on behalf of the insured. Restrictions as to travel or residence are rare, and in the large companies there is no limitation of benefits on account of suicide. There is usually a grace period of four weeks for payment of premiums—in monthly premium policies it is 31 days. Reinstatement of lapsed policies within one year, upon satisfactory evidence of insurability, is usually provided by the policy, and actual practice is still more liberal; in two of the large companies, revival is permitted within 13 and 20 weeks respectively, irrespective of the condition of health. If premiums cannot be paid in cash, many companies will reinstate lapsed policies by charging the arrears against the policy as an interest bearing lien. Non-forfeiture values in the form of extended insurance or reduced paid-up insurance are usually provided after payment of premiums for three (sometimes five) years. Cash surrender values are usually granted after ten years; in some companies five. There is seldom a provision for loan values. One large company provides that if premiums are paid for one year direct to the home office or a district office, thereby saving the expense of collection by an agent, a refund of 10% will be allowed the policy holder. The John Hancock Company has always been a mutual company, and the Metropolitan and Prudential companies were mutualized in 1915. Dividend distribution is annual, and the dividends to industrial policy holders declared by these three companies in 1927 amounted to approximately $79,000,000. Dividends are declared mainly in the form of credits on premiums, paid-up additions to the face of the policy, and mortuary and maturity dividends, which are additions to death claims and matured endowments. Most of the small companies are stock companies, and pay no dividends to policyholders. The London Life of Canada, although a stock company, allows mortuary and maturity dividends. Disability benefits and double indemnity in case of accidental death, such as are common in ordinary insurance, are rarely found in industrial policies. Some companies, however, including the largest three, do provide a disability benefit payable in event of total loss of sight, or the loss of both hands or both feet, or one hand and one foot; in a few companies, also for the loss of a single hand or foot.

Health and Welfare Work.—The weekly calls of the agents at policy holders' homes afford the companies a notable opportunity for health and welfare work. Among their activities are the dissemination of health literature, offers of free nursing service, participation by the companies in general public health work (in co-operation with public health authorities), including surveys of sickness and unemployment, studies of mortality and sickness, health exhibits, health demonstrations in various localities, the exhibition of films, support of health legislation and publication of magazine advertisements relating to various phases of health and welfare. The Metropolitan company, which has been a leader in health activities, has in 19 years distributed about 490,000,000 pamphlets relating to health and citizenship, and has provided 30,000,000 free nursing visits to policy holders. The marked reduction in the mortality rate of its industrial policy holders—an even greater reduction than among the general population—indicates that its efforts have been successful. (R. V. C.)

INDUSTRIAL MANAGEMENT: *see* SCIENTIFIC MANAGEMENT.

INDUSTRIAL PENSIONS: *see* PENSIONS IN THE UNITED STATES.

INDUSTRIAL PSYCHOLOGY. Industrial psychology may be defined as the study of the conduct of men and women in their capacity as wage earners. It aims at describing and explaining all those activities by means of which a person adjusts himself to his economic environment; hence it must take into account the fundamental elements of man's constitution, his innate tendencies and their expression in thought, feeling and action both on the conscious and unconscious level, as well as his acquired aptitudes. As yet, only a tentative beginning has been made, so that we are far from even an approximation to scientific generalisation.

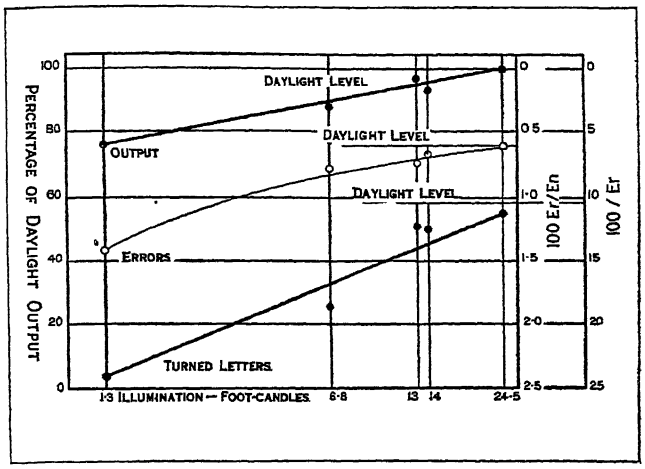
HISTORY OF THE SCIENCE

The development of industrial psychology has been largely determined by its history. Prior to 1914, psychologists concerned themselves but little with industrial problems. A few writers occasionally saw a possible industrial application of some psychological generalisation; and in 1913 Münsterberg made a more ambitious attempt (*Psychology and Industrial Efficiency*). Industrial development had been governed by the claims of machinery rather than of man. The enormous improvement in machinery during the 19th century, the studies made in the natural sciences, the growing knowledge of the mechanism of the body, all tended to focus general interest on man's likeness to a machine. The phrase "the human machine," which is rightly applied to part of his structure, became synonymous with man himself rather by implication than by design. The outbreak of the World War, with its urgent demands for increased production in all departments of activity, brought home to society the futility of considering the worker merely as a machine.

Industrial operations, as usually conducted, had been implicitly based on a crude mathematics. If 6 units of work could be done in one hour, then 6×8 would be done in 8 hours, 6×12 in 12 hours. The physiological necessity for sleep prevented the complete working out of this principle. Up to about 6 or 7 hours, according to the nature of the work, there seemed nothing obviously wrong with the calculation; when however, the problem was one of 12 hours, the discrepancy between the facts and the calculation challenged investigation. Though it was not then recognised, that stage marked an epoch in the history both of psychology and of industry. The focus of interest was changed from the machine to the worker of the machine, and the assistance

of psychology, hitherto looked upon as a somewhat recondite study, was invoked.

The Work Curve.—Previous work of a more or less theoretical character into problems of fatigue suggested the lines of investigation. Hence the earliest work in industrial psychology was concerned with fatigue. As the time was one of urgency, the problem had to be dealt with practically, and the only measure



FROM "INDUSTRIAL FATIGUE RESEARCH BOARD REPORTS"

GRAPH SHOWING INCREASE IN OUTPUT AND DIMINUTION OF ERRORS (BOTH TOTAL AND TURNED LETTERS) WITH INCREASE OF ILLUMINATION

to hand was the one that had prompted the inquiry, viz., the work curve, obtained by computing and graphing the hourly output records of numbers of workers. The reproach is sometimes made against industrial psychology that it is primarily interested in output. The truth is that output happens to be a convenient measure. Psychology's real interest lies in what is measured.

Hours of Work.—Thus the earliest systematic inquiries of industrial psychology concerned the problem of the 12-hour day in munition factories, and used as data the records of large numbers of people working over long periods. Comparisons were made between groups of people working a 12-hour day and other comparable groups working a 10-hour day. (*Health of Munition Workers' Committee,* [*a*] *Interim Report,* Cd., 8511 [1917]; [*b*] *Final Report,* Cd. 9065 [1918].) In many processes the results of the latter groups showed that an increase in hourly output more than counterbalanced the shorter time available for production, so that the total production was actually greater than when the hours of work were longer. Similarly lost time and sickness were found to diminish with the shorter working day. When hours are shortened, a long period elapses before adaptation to the new conditions is fully obtained; on the other hand, when hours are lengthened, there is sometimes an immediate reduction in hourly output.

Since the War, researches along these lines have been pursued in such different occupations as: charging of blast furnaces, silk weaving, shell making, metal-polishing, tinplate manufacture and in the processes of collar machining, folding and shirt ironing in the laundry trade. The curves of the output of the average worker, when graphed, usually assume the same general shape, viz., a rise at the beginning of the spell, a period of relative stability, and a fall at the end. The interpretation of these empirical facts cannot yet be given. Slight variations occur according to the arrangement of the hours of work, but the type remains characteristic of many industrial processes. Muscio, experimenting on women medical students doing mental tests, obtained similar curves.

Rest Pauses.—An important innovation stressed by the industrial psychologist has been the introduction of short rests, in the middle of a working period, of about 10 or 15 min. duration. These regular breaks are technically known as rest pauses. It is sometimes argued that frequent irregular rests are invariably taken by the workers, either voluntarily or because the supply of work fails, and that regular rest pauses are therefore not required. Where, however, direct experiment has been possible, it has shown that the organised rest pause is the better working arrangement.

The observations of H. M. Vernon for the Health of Munition Workers' Committee proved the advantage of breaking up working spells, and since then it has been verified in the boot industry, in metal-polishing, in celluloid-polishing, in shirt ironing, in sweet-packing, in handkerchief-folding and in stamping lids. The introduction of a rest about the middle of the spell of work improves the output as a rule by about 5%, and in some processes it affects advantageously the period preceding the rest. Not only is the work improved, but the regular rest is much appreciated by the worker. The probability is that the improvement is largely due to changes in feeling; most people can face with equanimity and possibly enthusiasm the prospect of two hours' work at the end of which will come a period of free time, but to face four or five hours of unbroken labour is depressing.

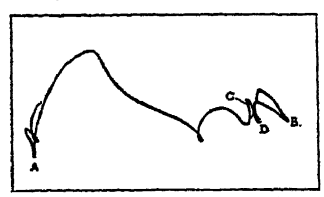
The subject of rest pauses has not yet been exhaustively studied, and particular cases need particular study; still the above statements seem to be valid in general. Exactly when a rest pause should occur must depend on the nature of the work, while the amount of actual increase in output will vary with the relation of the human factor to the machine factor in the particular process.

Physical Environment.—Among other influences that have been shown similarly to affect the worker and have been effectively measured by means of the output curve are improvements in lighting, heating, ventilation and seating. (*See* FACTORY AND WORKSHOPS LAW; OFFICE MANAGEMENT.)

MOTION AND TIME STUDY

At an early stage the young science of industrial psychology had to encounter the previous application of quasi-scientific methods to industry, initiated in America by Taylor and Gilbreth. Their general object was to study the nature and rate of the movements made by a worker, in order to eliminate the unnecessary ones. This is technically known as motion and time study. Unfortunately this study had resulted in imposing on all the so-called "one best way," obtained by analysing the movements of the quickest workers. So unnatural a procedure awakened much criticism and no little resentment. It is not irrelevant to note that the movement originated with engineers, not with psychologists.

Properly conducted, motion and time study are but special applications to industrial processes of the laws of habit formation. Young learners pick up, by watching proficients, many actions of industry; with practice they evolve a commendable copy but uncritically they may adopt some unnecessary movements which, while apparently not interfering with the work, may become fixed; the result is that the worker develops muscular habits harmful to himself, or fails to attain a speed commensurate with his real ability. Just as the skater, swimmer or golfer improves by expert teaching, itself the resultant of careful study, so does the industrial worker. In such varying trades as silk weaving, metal-polishing, chocolate covering, it has been found that by systematising movements and by training novices in the relevant motions, a saving of energy results, which is an advantage to all concerned. Faulty methods of learning are not only a hindrance during the learning period, but there is also an invariable tendency for the worker to regress to them under certain conditions, even when they are apparently overcome. (*The Medical Problems of Flying,* Medical Research Council Report No. 53 [1920] and *A Study of Telegraphists' Cramp,* Industrial Fatigue Research Board, Report No. 43.)



FROM "INDUSTRIAL FATIGUE RESEARCH BOARD REPORTS"

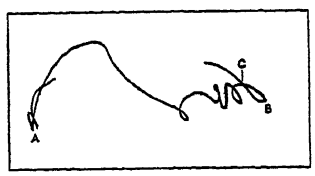
THE PATH TRAVELLED BY THE WORKER'S HAND IN ORIGINAL METHOD OF SWEET-DIPPING

The aim of Taylor and Gilbreth, in standardising the time and method taken to perform a task, was primarily to reduce the cost

of production, and they also had in mind the welfare of the worker and higher wages. From the worker's point of view however, the drawback of their system was that it produced a feeling of being always keyed-up. From the psycho-physiological point of view it was based on the fallacy that the shortest and speediest movements were necessarily the least tiring, and that the best style of movement could be obtained from combining a number of best movements adopted by different workers. If the study of industrial processes in relation to the worker is to be scientific, it must consider the whole of the conditions, not a part; it must regard the worker as a human being, not as the performer of a limited set of movements.

LEADERSHIP AND MONOTONY

Important though the material environment undoubtedly is, no workers can do their best unless the general mental environment is right. Not even the very best material conditions will result mechanically in good work, and sometimes even poor material conditions can be nullified by good mental conditions. By this is understood the conditions governing the group as a whole, dependent primarily on the efficiency or otherwise of its leadership. Industrial life is often criticised for failing to supply that effective stimulus of working or a common end, which is more obviously evident in the army. Factories where there is this sense of working for a common end as well as for individual wages are more common than those not familiar with the inside working of factories realise.



FROM "INDUSTRIAL FATIGUE RESEARCH BOARD REPORTS"

THE PATH TRAVELLED BY THE WORKER'S HAND IN NEW SWEET-DIPPING METHOD. AN OUTPUT INCREASE OF 20% FOLLOWED THE INTRODUCTION OF THIS METHOD

If, as McDougall asserts (*The Group Mind*, p. 135 [1920]), the personalities of its leaders more effectively than any other actor engender national unity and bring it to a high pitch," it is no less true that a factory owes its corporate unity to the personality of its leader and his deputies. The time may come when it will be possible to test for leadership as it now is for intelligence; at the moment the problem has only been formulated. The qualities of leadership are required by all those in charge of others, and there is no correlation between ability to do a job and ability to superintend others doing it. To the psychologist there standing as to justify their position, then they need as emotional interpreter someone of different temperament to neutralise their more harmful effects.

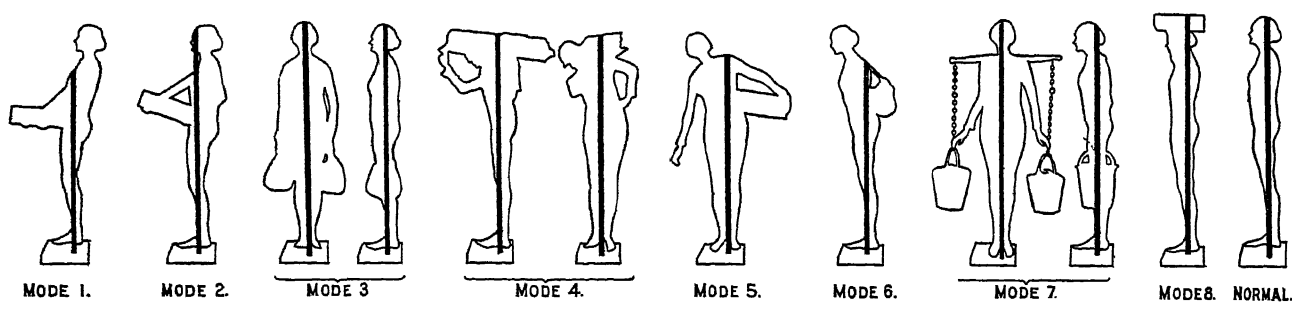
A good leader should possess vitality, sympathy, justice and humour, as well as knowledge of the work. The emotional, and as a corollary, the physical effect on subordinates of different types of leaders is patent throughout industry. Where the commands of one are cheerfully obeyed, those of another arouse truculent antagonism or sullen acquiescence. Can anyone doubt the effect on the health, happiness and efficiency of the workers? Many authorities are unwittingly the cause of the sick leave they deplore among their subordinates.

Monotony.—In addition to the effect of the leadership, one has to accept the fact that in modern industry, with its subdivision of labour, a large number of people are employed in repeating the same limited set of movements for hours, days, months and years. This "repetition of movement" is often erroneously called monotony. Literally "monotonous" means "of one tone"; it suggests absence of change and refers rightly to the general mental atmosphere and not to the movements of the worker. Repetitive movements must either be studied as such, in which case they belong to the psychology of habit formation, or else put in their complete setting, including, at least, the repetition work, the varying amount done as the hours go on, the opinions of fellow workers and authorities about that work, physiological changes, emotional changes, and the collective life of the factory. The total reaction at any given moment will be the reaction to a composite situation which constantly changes.

The worker on one process often stigmatises some other process as monotonous, when to the observer there is nothing to choose between them. There are compensations too in many processes if one studies the worker as a human being and not merely as the performer of a repetition process; *e.g.*, some workers experience a sense of power in operating a large or a delicate machine. It is not suggested that repetition work is good in itself; but merely to describe the repetition work as monotonous and to imply that such description embraces the whole psychological situation, is misleading.

VOCATIONAL GUIDANCE AND SELECTION

Observation of workers shows that in particular posts some are much more successful both subjectively and objectively than others. Hence arises the question of vocational guidance, which



ION "INDUSTRIAL FATIGUE RESEARCH BOARD REPORTS" (CONTROLLER OF H.M. STATIONERY OFFICE)

DIAGRAM ILLUSTRATING DIFFERENT METHODS OF CARRYING

Investigation showed that these modes can be arranged in order of efficiency, the displacement of the body necessary to bring the centre of gravity over the foot being an important factor. Modes 7 and 3, yoke and bundle carrying, are most economical

e certain types, almost neurotic, whose symptoms find expression chiefly in their relations with others. The person who reacts ways to the emotion aroused in himself by a situation and not the situation itself, the inevitable "nagger" who can never wern easily because he is always at war with himself, the "obssional" whose obsession can be readily touched up by the ork—these represent a few whose emotional development makes e much harder for some of their subordinates and unbearable r others. (*See* M. Culpin, *The Nervous Patient*, p. 92 [1924].) their other qualities, *e.g.*, their business acumen, are so out-

must be distinguished from vocational selection, a simpler problem. The latter problem sets out to select a worker to fit the job, the former to select for a given person (usually an adolescent) that job most suited to his capacities. This theoretically presupposes a knowledge of the person, a knowledge of all possible occupations, and a power of relating one to the other. Those who have done most work in this field are convinced that the most useful measure of a person is his general intelligence.

Mental Ratio.—By suitable tests it is possible to gauge with a high degree of accuracy the intelligence of any child, and to ex-

press it in a quantitative form, known as the mental ratio. This remains fairly uniform throughout the years of growth, and inborn intelligence does not develop to an appreciable extent beyond the age of puberty. It is the amount and kind of knowledge and interests that separate the adult from the child, not the intelligence with which he deals with that knowledge and those interests. To put a child of a high level of intelligence to a job requiring little, is wasteful, while the reverse process is futile; moreover, the one provokes discontent, the other worry.

Temperament and Character.—In other directions, viz., the measurement of temperamental and character qualities, less advance has been made. In this field, observation and interpretation are still the only methods available. There are some occupations where people of a particular temperament are more likely to become inefficient and break down than in others. This temperament is characterised by a disproportionate development of fear in some form. Whether this is due to its innate strength or to some environmental influence, or both, cannot be adjudged yet. The sufferer shows over-anxiety concerning things he cannot alter, is unduly sensitive to the opinions of authorities, etc. Sometimes the symptoms appear in a more objective form, masking their actual subjectivity, so that the focus of anxiety appears outside the sufferer, who, with more than normal frequency complains of machine trouble, noise, unsuitable keys (in telegraphy), etc.

Such people, in the interests of themselves, their fellow-workers and the work, ought to be diverted from occupations where their mental make-up cannot fail to be expressed in the work. If they enter such occupations as telegraphy or dispensing or even coal-mining they will almost certainly break down: the breakdown will be attributed to overwork, although actually the overwork may have subjective rather than objective reality. If there is an occupational disease recognised as such, the problem is still further complicated. (*Reports of the Miners' Nystagmus Committee* [Medical Research Council Reports Nos. 65 and 80]; "Psycho-neurotic Aspects of Miners' Nystagmus" [*Brit. J. Med. Psy.* vol. iii. 1923].)

When the qualities of the applicant for a job have been assessed and the requirements of various trades are known, it is possible to advise a child as to what he may most advantageously take up.

Organization.—A vast field is, however, still untouched. Most of the studies made so far relate to those aspects of industry which are primarily a means to an end, not ends in themselves, and even in this limited sphere there is much to be done. Little is known as yet, for example, about the organiser and his organisation. It is obvious that the organisation of a big business is no mere rule-of-thumb working out of principles gained by even a scientific analysis of other places; it has some of the qualities of a work of art, and the attitude of mind of an original organiser is akin to that of the artist. No real appreciation of the field of industry is possible without a recognition of this.

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INDUSTRIAL RELATIONS. This term is used to denote the relations of all those engaged in the production and distribution of goods and the rendering of services. It involves the methods by which the proceeds of these activities are divided between employers and workers or different classes of workers, and the settlement of the conditions under which work shall be carried on. The adjustment of the position of individuals in relation to those with whom they are associated in work is part of a wider adjustment in relation to the general community, and there is a close connection between political and industrial movements. In Great Britain the rapid development of the factory system during the Industrial Revolution and the concentration of the industrial population in towns, largely destroyed the personal bond between master and man who had worked together in the scattered and rural hand industry units. The rapidity of the change and the domination of employers caused an embitterment of relations which has greatly influenced the labour movement.

Joint stock enterprise, which developed after the Limited Liability Act 1858, created a more complex situation than in the case of individual employers using their own capital, the employing section being divided into (a) investors of capital, (b) users of capital or management. The latter alone have relations with the wage-earners. The repeal of the Combination Laws 1824–25 gave workers the right to combine and to withhold labour by concerted action. Organization, hitherto confined to craftsmen, extended among other classes after a docks strike (1889). From 1910 the growth of trade union organization was shown by national and other strikes, one object of which was to secure the recognition by employers of the right of the unions to make agreements for their members in the industries concerned. During the War compulsory arbitration and State control of profits were instituted by the Munitions of War Acts. Results of the War were (1) increased trade union membership and political power; (2) the improvement of the earnings of unskilled and semi-skilled workers owing to (a) uniform cost-of-living advances without changes in base rates, (b) increased organization, (c) employment on machine production; (3) increased employment of women. Varying economic conditions in different industries since the War have further disturbed the pre-War wage position, when the rates of skilled and unskilled workers showed no great variation by industry. Such irregularity is a disturbing factor. Existing wages-rates were maintained for a short period after the War by the Wages (Temporary Regulation) Act. Unrest caused the Government to call two national conferences of employers' and workers' organizations which led to extended Trade Board action and further legislation relating to unemployment. Arising from a dispute a royal commission on coal mining was appointed and hours, which under an act of 1908 had been fixed at eight and one winding turn, were reduced to seven, being restored to eight by an act of 1926. In 1919 and 1920 hours in industry generally were reduced to 48 or less, by agreement, without reduction of wages. Depression in industry from 1921 onwards caused considerable unrest owing to reductions in wages, and there was a substantial loss of trade union membership. Recurrent coal-mining disputes led, in 1925, to the appointment of a royal commission, the report of which was accepted by neither side.

A further stoppage in 1926 culminated in a general strike called by the trade union congress general council which, since the War, had steadily increased its authority as the central trade union co-ordinating body. This strike lasted ten days, the essential services being carried on by the Government. There has since been a movement for co-operation between employers and the unions in the solution of industrial difficulties, and few stoppages of work have occurred. Economic difficulties created by the War caused similar disturbances in other countries. While in Great Britain industrial conditions continue still to be settled by voluntary agreements between employers and workers, Governments have taken greater powers of intervention in other countries, *e.g.*, in Russia, Italy, Spain and Germany.

Working conditions may be regulated by employers and workers themselves, by individual or collective bargaining. Whitley or joint industrial councils are a form of standing joint machinery for collective discussion within individual industries. There are also, as part of the voluntary arrangements within industry, conciliation, arbitration or wages boards. The constant problem for the State is the harmonizing of the interests of employers and workers in industry with those of the community, and the conditions under which industry may be carried on have been subject to intervention, in the interests of the workers as citizens, by legislation upon such matters as the establishment of minimum wages, the regulation of hours, insurance against unemployment and sickness, the protection of health and safety and the general welfare of workers while engaged in their work. (*See* TRADE BOARDS; HEALTH INSURANCE.) The adverse effect on the com-

munity of stoppages of work owing to differences between employers and workers has caused States to take action for the avoidance and settlement of disputes.

NATIONAL AGREEMENTS

Collective Bargaining.—Individual bargaining and collective bargaining are terms used to describe the discussion that precedes the making of an agreement concerning working conditions. The former is the discussion between an employer and a single wage-earner and the latter is the discussion between an employer or group of employers and a group of workers with a view to a collective agreement as to working conditions covering all those represented in the discussion. Organization ensures stability to the agreements reached. Unless satisfactory conditions are settled, employers may refuse to give employment or may "lock-out" employees and workers may withhold their services or "strike." Organization gives the workers the bargaining power which is lacking in an individual. It provides also a means of discussion of their desires and for the expert presentation of demands by officials skilled in negotiation and freed from the fear of reprisal which is often present in the minds of employees. Further, the workers in a particular establishment have the support of their fellows in other establishments and a union has resources for obtaining information outside the particular establishment or locality concerned. Collective agreements have effect beyond the membership of organizations both in establishments in which union members are employed and in others. In some cases, however, only union members may be employed, these being called 'closed shops" as distinguished from "open shops" in which there s no such restriction. Action to compel non-members to become nembers often causes serious disputes. The agreed conditions ire usually the "recognized" or "standard" conditions in any)ccupation in a district and under the "Fair Wages Resolution")f the House of Commons, Government contractors must observe hese conditions.

There are often national agreements relating to procedure and eneral matters such as the length of the working hours, relation f piece-rates to time-rates, overtime and night-shift rates of pay-ient, rules for the working of tools, general fluctuations of wages nd sliding scales, holidays, apprentice questions, training and mployment of workers. Detailed conditions as to wages are ometimes settled nationally but it is more usual for basic conitions to be settled locally, the national organizations confining hemselves to the settlement of general changes and to acting as he co-ordinating and appeal authority. Thus the conditions in idustries which are carried on in many parts of the country, are djusted both to local circumstances and to the required degree f uniformity. Wages-rates fixed by national bodies are often raded according to area. The existence of different types of nions with conflicting interests adds to the complexity of collecve bargaining. The craft unions, for example, seek to obtain, as ir as possible, similar conditions in each industry in which their iembers are employed. Where there are several unions having iembers in an industry there are sometimes federations of unions hich act as a unit for negotiating purposes.

In some industries, *e.g.*, iron and steel, collective agreements rovide for sliding scales of wages based on the selling price of ie product or, as in the tinplate industry, on the cost of the raw aterial, steel bars. In coal-mining, wages vary according to the :oceeds of production, after costs have been deducted, de-rmined by accountants appointed by the two sides, the proceeds ing divided between wages and management on an agreed basis. he Coal Mines (Minimum Wage) Act 1912 provides for the ing of district minimum subsistence-wages (by the decision, if :cessary, of the independent chairman) by district boards. Other dustries have sliding scales by which wages are regulated accordg to a cost-of-living index figure. The number of these is now eatly reduced and the principle of payment according to the timated capacity of the industry has been re-adopted.

The enormous number of questions which constantly arise is own by the complexity and length of collective agreements. The nstant association, however, of representative persons of experience, responsibility and negotiating ability on both sides increases the chance of reaching amicable settlement of the most difficult new problems, and this, together with the adaptability and freedom from rigidity of the system, causes it to be recognized as the main means by which constructive progress towards a merging of the interests of all parties in industry can be made. A new development in this direction is the appointment of joint committees of both sides to examine all the costs and circumstances of an industry with a view to greater efficiency.

Collective bargaining demands for its efficient operation the possession by representatives of adequate authority to bind their members. While some trade union executives have considerable authority, it is usually necessary to take the opinion of the members either by a ballot or through a delegate conference, before agreements are made. It is difficult on some occasions, when discussions have been long and intricate, to convey all the reasons for a particular policy to thousands of workers who have not had the advantage of being present at those discussions. At the same time, the effectiveness of a voluntary agreement depends upon its terms being in general accord with the views of those who are bound by it, and experience has shown that statutory and compulsory measures are practically unenforceable unless this condition is satisfied. In practice the recommendations of leaders carry very great weight.

Collective agreements have a stabilizing effect as, when there is a settled procedure for dealing with questions which may arise, and when the basic conditions are clearly defined and the settlement is for a definite period or subject to termination only after due notice, employers are enabled to enter into contracts with confidence. Where organization is not strong and unions are not able to compel unorganized employers to observe agreed conditions, there is a demand for the statutory extension of agreements, a policy which involves serious practical difficulties.

Collective agreements usually provide for a settled procedure for dealing with disputes in order to obviate stoppages of work. A common form of procedure is for the matter to be discussed first within the establishment. Failing settlement it may then be discussed between the local employers' association and representatives of the union, and then by the national executives, work continuing in the meantime. In the shipbuilding industry in Great Britain provision is made for the appointment of an independent chairman, without the power to give a decision, when there is an irreconcilable difference of opinion on matters other than general wages fluctuations. The fact that a stoppage of work may be the result of failure to settle provides an incentive to agreement. When action is taken in breach of an agreement, the organization whose members are at fault is expected to restore the *status quo ante* pending discussion of the matter in dispute. Stoppages without the sanction of an organization are called "unofficial."

Conciliation, Arbitration and Wages Boards.—Conciliation boards are a form of standing or *ad hoc* joint machinery in organized industries for the purpose of enabling agreement to be reached on matters which ordinary negotiations have failed to settle. They generally consist of an equal number of representatives of employers' associations and of trade unions who are parties to the agreement establishing the board. The rules of some of the boards provide that, in the event of failure to secure agreement, an umpire, arbitrator or conciliator shall be appointed. Some boards limit themselves to wages questions, but conditions settled by general collective agreements are not within the power of boards to alter. The rules of boards usually require that there shall be no stoppage of work pending the consideration of the difference referred to them.

In the iron and steel trade differences not settled in a works are referred to a neutral committee chosen from employers and workers from other works. If this fails there is reference to a board of arbitration consisting of representatives of the two sides with a neutral chairman. In addition there are several standing district wages boards, composed of representatives of the two sides, with, in some cases, a neutral president who may give a binding decision.

In the coal-mining industry there are district conciliation boards composed of equal numbers of both sides. In some districts, if there is no settlement, the matter is referred to an independent chairman. Disputes under the Minimum Wage Act 1912 are referred to statutory joint district minimum wage boards having an independent chairman, who has the power to give a decision.

In the boot and shoe manufacturing industry under the agreement of 1895 there are local boards of conciliation and arbitration. In case of failure to reach agreement an independent chairman is appointed with power to give a decision. There is also a national standing committee of three of each side to deal with all questions arising out of the national agreements. In national negotiations there is a standing independent chairman who acts only as a conciliator.

In the bleaching, dyeing and finishing industry there are standing reference boards, constituted of four representatives of each side to which any dispute on other than a general question must be referred. If the board fails to settle, each side appoints an arbitrator who appoint an umpire. The decisions of the tribunal are final.

The railway services have a form of wages board on which the users of railways are represented. In default of agreement by negotiation, questions are referred to a central wages board constituted of eight representatives of each side. Appeal may be made to a national wages board which is constituted of six representatives of the companies, two representatives from each union and four representatives of users of railways (nominated by the trade union congress, co-operative union, federation of British industries and associated British chambers of commerce, respectively) and an independent chairman. The board must report within 28 days from the date of reference of a matter to it, and it is agreed that there shall be no stoppage of work within that period. This agreement, which is terminable by 12 months' notice on either side, received statutory effect in Part IV. of the Railways Act 1921, but there are no penalties for its non-observance.

The electricity supply, tramways and wool textile joint industrial councils, not desiring arbitration, have adopted interesting *ad hoc* procedure of a combined court of inquiry and conciliation board character, and have referred important matters to boards consisting, in the first two cases, of representatives of the parties, employers' and workers' representatives from other industries and an independent chairman for investigation and recommendations. In the third case the parties themselves were not represented on the tribunal. The councils were free to accept or reject the recommendations but, in fact, they were accepted.

This procedure associated the parties in friendly circumstances in a thorough investigation of facts. Trade boards and agricultural wages committees in Great Britain, wages boards in Victoria and Tasmania, labour disputes committees in New Zealand and the minimum wage boards for home workers in Germany, France, Austria, Czechoslovakia and Norway are of a compulsory character, but they have the characteristic feature of being constituted mainly of representatives of the industries concerned.

Whitley or Joint Industrial Councils.—These are standing bodies which meet regularly for the purpose of discussing not only matters upon which there are differences but also all questions affecting their industry. A committee of employers' and workers' representatives, with the Right Hon. J. H. Whitley, M.P., as chairman, was appointed in 1916 to consider the means of securing a permanent improvement in industrial relations, and to recommend means for securing that those relations should be systematically reviewed by those concerned. The committee stated their opinion that an essential condition of securing a permanent improvement in the relations between employers and employed is that there should be adequate organization on the part of both, that a permanent improvement must be founded upon something other than a cash basis, and that workpeople should have a greater opportunity of participating in the discussion about, and adjusting of, those parts of industry by which they were most affected. They proposed, therefore, a tripartite organization of standing joint bodies, a national joint council for the whole industry, district joint councils to provide the means of discussion in the districts, and works committees. The constitution of district councils and works committees was to be defined by the national councils, and, throughout, the membership was to be determined by organizations. In the circumstances created by the War, in which centralization of the settlement of conditions became the rule, and the preoccupation of the leaders of organizations with national matters caused them to become somewhat detached from the rank and file in the shops, a shop stewards' movement commenced which threatened to disintegrate the whole system of collective bargaining. The committee's plan was intended to maintain a constant and live connection between the individual members in the individual establishments, and the machinery by which their conditions were settled, and to provide means by which both the interests of individuals and those of the whole industry would receive full consideration. This report gave a new impetus to the creation of constitutional machinery, and, assisted by the Ministry of Labour, joint industrial councils were established in many important industries and services including municipal and Government services. In addition, in industries in which organization was not sufficiently strong for the requirements of a Whitley council, interim industrial reconstruction committees were established. On the railways, station, depot and sectional councils were established to deal with the local application of national agreements, suggestions as to operating and working, and co-operation in obtaining increased business and efficiency. These received statutory recognition in the Railways Act 1921.

The councils are constituted of employers' and workers' representatives alone, except in the case of the pottery council on which there are three independent members in an advisory capacity. The number on each side is not always equal but each side votes as an entity. Usually, unless there is agreement, no action is taken on the proposal under consideration.

The chairman is appointed from among the members and is often, alternately, an employers' and workers' representative or there may be joint chairmen acting in turn. Each council has a written constitution and practically all councils have appointed executive or general purposes committees, the number of council members often being large. Special committees may be appointed such as, in the case of the pottery council, which was the first to be established, the research, inventions and designs committee, wages and conditions committee, organization committee, statistical and enquiries committee, apprenticeship committee. An important rule is that meetings shall be held regularly, usually not less than once a quarter.

Another important advantage of the Whitley council procedure is that all the organizations in an industry meet on one body and there is provided an opportunity of reconciling conflicting interests, and of emphasizing the community of interest of all concerned. There is no settled practice as regards supervisory workers who are generally not represented. In the electricity supply industry, however, there is a separate joint body for the technical and supervisory staff. The national maritime board has panels for (1) masters, (2) navigating officers, (3) engineers, (4) sailors and firemen, (5) catering department. These sit separately to negotiate conditions, the board meeting as a whole when general questions arise. There are district panels which may be divided into sections. Craft unions receive *ad hoc* representation when questions affecting their members are under discussion.

In consequence of the difficult economic conditions since the establishment of Whitley councils, the main subject of consideration, contrary to the intentions of the Whitley committee, has been wages and working conditions, and this subject has been responsible for their breakdown in many cases before they had been in existence long enough to stand the strain. A contributory cause has been insufficient organization on both sides for the effective operation of council decisions. Further, councils sometimes attempted too much regulation by national decisions without adequate regard to local circumstances. Of the councils which survive (about 50) many have found it necessary to delegate considerable freedom to district councils and to confine their action to co-ordination and to the settlement of differences.

Important work has been done by certain councils in research id in the collection of information and statistics. Other im-ortant matters considered have been unemployment, education, aining and apprenticeship, safety, health, welfare and com-ercial problems. The docks joint council has carried out portant work for the decasualization of dock labour.

It is usual to require differences to be considered by councils fore a stoppage of work occurs. Certain councils, *e.g.*, pottery, oe and shoe, printing, do not exercise the function of wage ttlement, this being left to agreements between the various or-nizations, but they act as the conciliating authority in the case differences involving the possibility of a stoppage of work.

In other countries, there is no general application of the hitley scheme except in Belgium where organization has grown ce the War, and where there are national joint commissions h district and shop councils in many industries.

POSITION OF SHOP STEWARDS

Works Committees and Councils in Great Britain.—rks committees may be of two main kinds (a) committees of rkpeople or their representatives or (b) joint committees of the nagement and the workpeople. As the works became organized trade unions, official shop representatives, known as shop wards or delegates, were appointed either by the workpeople by the union for various purposes, such as the collection of s, and representing the workers in the discussion of griev-es with the management. During the War the application of tion and the introduction of payment by results raised many stions of detail, and works machinery gained a new importance. mmittees of shop stewards became common and, although in e cases shop stewards of unions of skilled and unskilled kers were in conflict on matters such as the manning of chines, committees were usually representative of all trades he establishments. The stress of the War conditions in the ps also made it necessary to promote the physical welfare of kers and many welfare committees were formed which were wn as works committees. Further impetus was given to the nation of joint works committees by the report of the Whitley mittee on works committees. The committee regarded "the blishment of works committees representative of the manage-nt and the workpeople, and appointed from within the works, n essential part of the scheme of organization suggested to re improved relations between employers and employed," and ed that "in every industry there are certain questions, such as s of wages and hours of work, which should be settled by rict or national agreement and with any matter so settled no ks committee should be allowed to interfere; but there are many questions closely affecting daily life and comfort in, and success of, the business, and affecting in no small degree iency of working, which are peculiar to the individual work-p or factory." They urged strongly that such committees uld be set up with the co-operation of employers' organiza-s and trade unions. There had arisen early in the War a strong p stewards' movement by association between works organiza-s in different undertakings which was of a somewhat extreme tical character, and which acted independently of trade unions. Germany, Italy and Russia, and other countries also, such ements occurred with revolutionary results. Trade unions suspicious of works committees with which they are not di-ly concerned, in view of the menace to their organization h arises from isolated arrangements. On the other hand, kpeople are apt to lose interest in works committees when the litions of employment in which they are mainly interested, es and hours, are settled by other machinery or are otherwise rally satisfactory.

n addition to the creation of works committees following the tley reports, the position of shop stewards was regularized in e industries, *e.g.*, engineering, in order to enable works discus-s to be conducted in a constitutional manner and with due rd to existing agreements in the industry.

'orks committees are sometimes composed entirely of indi-al workers elected by ballot, secret or otherwise, by occupa-tions or by departments. Some are composed entirely of members of trade unions so elected. In some cases officials of unions may attend meetings regularly or in special circumstances. In large undertakings there is often a general committee comprised of dele-gates from departmental committees. It is usual for meetings to be allowed during working hours and for wages to be paid for time so lost. Among subjects which are dealt with by works committees are welfare, benevolent, holiday and loan funds, pen-sions schemes, sports and recreation, accident prevention, share-purchase schemes, piece-price fixing and education. In some cases dismissals of individuals, or, in case of slackness of business, of numbers of individuals, are subject to review by works com-mittees. This is greatly valued as it gives individuals greater security of employment and protection against victimization. At a time of depression prior consultation enables plans for the shar-ing of work or regularization of employment to be discussed. Methods of production, regularity of output and prevention of waste are other matters dealt with by committees. They are in some cases informed regularly of the state of business.

Works Committees in Other Countries.—The works com-mittee movement was stimulated in other countries, as in Great Britain, by the War circumstances. In Europe, it was influenced also by the revolutionary movements between 1918 and 1920 based on workers' and soldiers' councils. Between 1919 and 1922 Germany, Austria, Czechoslovakia, Norway and Luxembourg passed laws on the subject. In Japan, works councils of varied types have continued to be established in many undertakings, always as purely advisory bodies. Both labour organizations and works committees have established themselves but the interests of the two forms of organization are not yet reconciled. In Russia industrial establishments are generally controlled by workers' com-mittees in association with trade unions, the latter being strongly represented on the governing authorities of the country. In other countries provision has sometimes been made for particular industries such as railways and mining.

In Germany the Weimar Constitution provided for the estab-lishment of workers' councils, regional workers' councils and re-gional economic councils, a federal workers' council and a federal economic council, all in organic connection. A provisional federal economic council was established, which has now been reconsti-tuted, but regional councils have not been set up. The Works Councils Act of 1920 was not in accord with this workers' control movement which was antagonistic to trade unions. This act pro-vided that "workers' representative bodies" should be established in all industrial and commercial undertakings, including agriculture but excluding shipping, employing not less than 20 persons. Within the council there are sections for wage-earners and for salaried employees. In smaller undertakings employing more than five persons, shop stewards were to be appointed. Appointments, which are for a year and can be terminated only by a labour court, are confined to workers aged 24 years and upwards with not less than three years' continuous service and are made by ballot of workers over 18 years old. In certain circumstances a repre-sentative body set up by collective agreement ("tarifliche Betriebs-vertretung") may be substituted for a works council. In a com-posite undertaking a joint works council ("Gesambetriebsrat") may be formed, the councils for the constituent works continuing to function. In exceptional cases a "common works council" ("gemeinsamer Betriebsrat") may be formed, the individual works councils being eliminated. Representatives receive their wages for the time spent in their work in that capacity within working hours. By an act of 1922 one or two members of works councils are appointed to the control board (this is not a board of directors) of a joint stock company, a limited partnership with share capital ("Kommanditgesellschaft auf Aktien"), a registered co-operative society, a mutual insurance association, a company established under the mining laws, or, optionally, the control board of a lim-ited liability company. Agreements between works councils and employers must always be subordinate to any collective agree-ments in force. Subject to this, the councils deal with such mat-ters as wages and other working conditions, methods of produc-tion, staffing, discipline and dismissals, and employers must keep

the councils informed of all action taken which affects these matters, of the trading position of the undertaking, and of the anticipated demand for labour. In large undertakings a profit and loss account and a balance sheet must be presented and explained. In case of disagreement with the employers appeals may be made to the State conciliation boards and the labour courts. These appeals resolve deadlocks and are substantial aids to the maintenance of peace. The power given to the council in respect of the review of dismissals is highly valued.

Since the years of depression 1923–25 the councils have largely disappeared from commercial establishments. In spite of the statutory provisions, the working of the councils has been to a considerable degree dependent upon the extent to which the workers have been organized in trade unions. There is, however, a tendency among some employers to favour works agreements in place of general collective agreements. The trade unions have tended to become industrial unions covering whole industries, and have formed organizations of works councils corresponding with the main groups of the trade union movement, with works councils headquarters in various localities, divided into groups for each branch of industry. There is a trade union central works committee for the whole country and all the councils are linked up in industrial groups. A movement of some importance has been the linking up of the councils in undertakings which form vertical trusts, *i.e.*, covering the whole process of production from the raw material to the finished products. These are voluntary associations known as trust works councils ("Konzarnbetriebsrat"). The effect on the trade unions has been to cause them to concentrate more attention on the production problems of industry and to produce a type of leader who is more closely associated with the work and the workmen in the undertakings.

In Austria the act of March 15, 1919, is similar to the German act. Agriculture is excluded and there are special arrangements for railways, Government departments and postal services. Disputes with regard to the working or establishment of councils are referred to a conciliation board which usually works through committees constituted of one representative nominated by the employers and workers, respectively, and an impartial chairman, usually a judge, all appointed by the Ministry of Social Administration. Failing settlement by agreement the board gives a final decision against which there is no appeal, but the administrative court, which is not in terms debarred from action, has allowed appeals to be made to it. In Austria the expenses of the councils other than wages are a charge upon the workers.

EXTENT OF STATE INTERVENTION

Conciliation and Arbitration.—Conciliation and arbitration form an important part of State intervention in every country. In Great Britain conciliation or arbitration action can be taken only with the consent of the parties. In Germany, Denmark, Sweden, Finland, Norway, Austria, Holland, Australia, New Zealand, South Africa (public utilities) and in some South American countries, conciliation procedure can be enforced on the parties. In Belgium, unless conciliation procedure is utilized, the parties are penalized in respect of payments from the unemployment insurance fund. In Australia the presidents of arbitration boards or conciliation committees have power to intervene on their own initiative before the compulsory arbitration procedure, which follows failure to settle, is put into operation. In Italy there are "co-ordinating bodies" which have a statutory right to intervene and stoppages of work are prohibited. In Germany the proposals of conciliation tribunals, if not accepted, can be made binding on the parties, although the use of this power is strictly confined to disputes seriously affecting the public interest. In Austria the conciliator may proceed to arbitration. In Norway a stoppage of work can be prohibited by the conciliator pending conciliation proceedings and a settlement by arbitration may be ordered in disputes endangering the public interests. In Denmark, Sweden, Finland and New Zealand the conciliation authority may make proposals and publish them with the facts. In Italy the "co-ordinating bodies" may determine the conditions to be put into operation. In Holland the facts as elicited by conciliation proceedings may be published or, in serious disputes, a committee of investigation may be ordered. In Canada, besides conciliation under similar conditions to those in Great Britain, there is, in respect of five provinces, power to compel submission of a dispute in mining, transport and public utility industries to a board of conciliation and arbitration, stoppage of work in the meantime being prohibited.

There is usually provision for arbitration in which a decision is made on the matters in dispute by a third party, either a single arbitrator, a board of arbitration or a labour court. Arbitration may be voluntary and the awards open to voluntary acceptance, or compulsory in both cases.

The great difficulty in compulsory measures is the enforcement of penalties when large numbers of workers are involved. Moreover, the fact that either party can force the other to arbitration tends to make conciliation procedure ineffective. Conciliation and arbitration machinery is constantly being modified in the various countries. National circumstances and psychology, the size and distribution of the population, the nature of the industries, and the economic conditions prevailing must all be taken into account in estimating the suitability of the machinery in any country.

Great Britain.—Although there had been much legislation relating to the settlement of disputes and the regulation of wages, the only effective action until 1896 was the operation of agreed conciliation arrangements within various industries, based on the inherent desire of those engaged in industry to settle their own affairs, against which compulsory systems have never been more than partially successful in this or any country. Other reasons for the failure of legislation were dislike of appearance before justices of the peace, unwillingness to trust untried arbitrators and the severe penalties for non-observance of decisions. The Conciliation Act 1896 removed all elements of compulsion and gave the Board of Trade power to promote the settlement of disputes by conciliation or arbitration by consent of both parties, and to establish standing conciliation boards. In 1908, standing panels of independent chairmen, employers' and workers' representatives were appointed with a view to assisting parties in making their nominations for arbitration proceedings. Increasing unrest caused the appointment in 1911 of an industrial council of 13 representatives of employers and workers respectively, with Sir George (now Lord) Askwith as chairman. The council proved to be too large to be effective for either conciliation or arbitration and ceased to function. In 1912, for the settlement of a coal-mining dispute, the Coal Mines (Minimum Wages) Act, which provided for the fixing of minimum conditions by 22 district joint committees with independent chairmen, was passed. During the War it was of vital importance to prevent stoppage of production and, under the Munitions of War Acts, compulsory arbitration, with the prohibition of strikes and lock-outs, came into operation. The effect was that the slower procedure of negotiation or conciliation was largely abandoned. As so much work was for Government purposes and increased wages were reimbursed by the consumer, employers had not the same financial interest as under normal conditions. Even in War circumstances, however, the legal prohibition of strikes was only a qualified success and, as in Australia, was ineffective when large numbers were concerned. The Whitley committee made a recommendation against compulsory arbitration but in favour of a standing arbitration tribunal as a part of the voluntary machinery, and the Industrial Courts Act 1919, which superseded the Conciliation Act, complied with these recommendations. Part I. provided for a standing industrial court consisting of a president and panels of representatives of employers and workers, including women members, and independent persons, the expenses being borne by the Government. A court is constituted by the president and usually consists of three persons. There is power also to utilize technical assessors. Cases are referred to the court, by consent of the parties, by the Ministry of Labour, the terms of reference, as in all arbitration cases, being agreed upon by the parties. Terms of reference define the issues upon which a decision is required. Requests for interpretations of the court's awards may be referred direct to the court by either of the parties. The awards are not of compulsory application. For civil service cases, which, under an agreement,

e referred to the industrial court for settlement, there are ecial panels nominated by the chancellor of the Exchequer and e staff organizations, respectively. Part I. of the act also pro-des that any trade dispute may be reported to the Minister r either party to a dispute and the Minister may take expedient eps to promote a settlement. If both parties consent, he may fer the dispute to the industrial court or to one or more persons pointed by him or to a board of arbitration of one or more rsons nominated by each side, and an independent chairman pointed by him. Boards are sometimes constituted of an inde-ndent person, by whom the decision is given, with assessors, the ject of the latter being to provide the former with the assistance experienced persons from either side for the elucidation of :ts, and to give the parties the assurance that the points in their ie are made clear when the award is made. The policy is based the acceptance of the principle of the general regulation of in-strial conditions by collective agreements and, to minimize vernment intervention, the act precludes the Minister from erring a dispute to arbitration unless existing agreed arrange-nts in the trade for the settlement of disputes have been iausted.

Although arbitration awards are not compulsorily binding, eement to refer a dispute to arbitration is regarded as a settle-nt of a dispute, work being resumed in the case of a stoppage on conditions operating when the stoppage occurred. Arbitration ceedings under voluntary conditions are informal and are free m restrictions such as apply to proceedings in courts of justice. e parties are encouraged to state their case freely and without tility.

For the purposes of its conciliation work the Ministry of bour has six district conciliation officers who keep in touch h industrial movements in their areas. Discussion with an im-tial and experienced person at an early stage often directs otiations into a course which leads to an amicable settlement. cumstances arise in which one party cannot approach another nake proposals for settlement without the appearance of giving , and in such cases a mediator renders useful service. There o general prohibition of strikes and lock-outs but strikes in ach of contract are illegal, under penalty, in gas, water, elec-ity supply and local authorities' services (Conspiracy and Pro-ion of Property Act 1875, Electricity Act 1919, Trade Union 1927).

British Colonies.—In Australia there is a Commonwealth rt of conciliation and arbitration, with a justice of the High irt as president, which deals with disputes extending beyond boundaries of any one State, and each State has a wage-ig authority which also deals with industrial disputes. In New th Wales there is a court of arbitration with district courts an appeal court of three judges. Subject to the court of arbi-ion's control, industrial boards for any industry or section of istry, or combination of industries may be established to deal matters referred to them by the court. There are also con-tion committees and officers with power to call conferences. pages of work are illegal in public utilities, in industries ered by awards or agreements (unless, by secret ballot of two-ds of the members, an award is no longer binding, and when lays' notice of strike has been given). The Government can r a secret ballot. A minimum living wage is settled by the e Board of Trade. In Queensland there is a court of arbitra-of not more than three judges, which may regulate conditions, or without application, remit disputes to industrial boards, inquiries and fix a minimum living wage. Strikes and lock-by organized workers and employees are prohibited unless orized by secret ballot or, in others, unless authorized by the t after a secret ballot. In South Australia there are an indus-court and industrial boards with an appeal from the latter to former. Strikes and lock-outs are prohibited and a minimum e is settled by a board of industry. In Western Australia e is a court of arbitration and strikes and lock-outs are pro-ed. Awards and agreements filed with the courts are binding ughout industries or districts in all cases. In Victoria and nania there are wages boards in each industry which fix minimum conditions, the determination being referable in Victoria to a court of industrial appeals for confirmation or revision. The Federal court, unlike the State courts, has not power to determine industrial conditions otherwise than in the settlement of a dispute, but State courts cannot fix conditions inconsistent with those fixed by the Federal court. The Federal court fixes a basic living wage independently of those fixed by the States. The president of the Federal court can call compulsory conciliation conferences and the court may refer disputes to a conciliation committee or local board. Under the Industrial Peace Act 1920, a Commonwealth council of employers' and workers' representatives with an independent chairman was appointed to inquire into disputes and provision was made for special tribunals and local boards with power to make compulsory awards which may modify those of the court. The legislation generally is operative in the towns and difficulty arises owing to overlapping of Federal and State decisions.

In New Zealand the system of compulsory arbitration applies to registered unions. Disputes are referred to the court of arbitration if they have not been settled by a district conciliation officer sitting with assessors as conciliation councils. These have compulsory powers. A strike or lock-out is prohibited while a dispute is under consideration or during the currency of an award. For other workers there is compulsory reference of disputes to a conciliation commissioner and later to a labour dispute committee composed of representatives of the parties and an independent chairman. Failing a settlement within 14 days of the publication of a committee's findings, a secret ballot may be taken. Strikes and lock-outs are prohibited if an award or agreement is in force or a period of three weeks has not been allowed for investigation and a ballot. The provision as to awards and agreements is similar to that in Australia. A minimum wage is in operation.

In South Africa strikes in public utility undertakings are prohibited and compulsory arbitration applies to these cases. The main provision for the settlement of disputes is by the creation of joint industrial councils in organized trades and boards of conciliation in others. The Minister of Labour can appoint arbitrators on application and if a majority of employers and workers agree to be bound by the award a stoppage becomes unlawful before the award is issued. Agreements may be made binding in any district.

Other Countries.—In Germany there are Federal and district conciliators and district conciliation committees. Failing success, an "adjustment board" consisting of a conciliator with assessors may be appointed. Failing agreement, an award may be made which may be declared binding. This, however, is put into operation only when the dispute menaces the well-being of the community as a whole. Either party can apply to have a decision made binding, and the party that refuses to accept it is legally liable for loss, damage or other consequences. Unless there is adequate evidence to the Minister of Labour that it is financially impossible to carry out a compulsory award, an establishment may be compelled to carry on under Government supervision. An act of 1926 provided for the establishment in 1927 of local, State and Federal labour courts with jurisdiction, to the exclusion of civil courts, in civil disputes affecting collective agreements, or arising out of employment or apprenticeship, or concerning a contract of employment, or arising out of the Works Council Act but not disputes on claims for new conditions of employment. The local and State courts are divided into chambers for manual and non-manual workers, and special chambers for crafts or disputes in particular occupations, constituted of a judge and assessors. The Federal labour court is a branch of the Federal court of justice.

In Italy, under the act of April 1926, strikes and lock-outs are prohibited. Provision is made for the recognition of one association only for employers and workers, respectively, for each occupation in a district, the associations being federated. There are six employers' confederations covering large sections such as industry, agriculture, commerce and one confederation for trade unions, which have authority over the constituent associations, approve collective agreements and give permission for action to

be taken before the labour magistracy. There are also national federations under the confederations. Agreements between associations are binding under penalty on all employers and workers in the category and district covered. All organizations are controlled by the Minister of Corporations. Co-ordinating bodies or corporations of employers' and workers' associations may deal with collective labour questions and disputes. For the purpose of settling disputes arising out of collective agreements or demands for new conditions of employment there is a labour magistracy constituted, as special sections of the 16 courts of appeal, of the president and two experts on production and labour, with an appeal to the court of cassation. A charter of labour defines the position of the Fascist State in relation to problems of labour and production.

In Norway, following serious disputes in 1927, compulsory arbitration was re-introduced by the Labour Disputes Act. If conciliation (which may be compulsory) fails to settle a dispute and it is likely to injure public interests the Government, on the report of the national conciliator, may order settlement by arbitration and prohibit a stoppage of work. Ballots on proposals made by conciliators may also be required and a report made giving the numbers voting for and against the proposal. In any case stoppage of work must not commence within four days of notice being given to a conciliator.

In France there are, as in Belgium, conseils de prud'hommes which conciliate in disputes affecting individuals. These consist of a justice and representatives of employers and workers. There is also conciliation by Government officials by consent of the parties.

In Belgium there is a system of conciliation boards, constituted by industries themselves or by the Government. Employment exchange committees also have power to intervene in disputes.

In Austria there are central and district conciliation boards, the chairman acting alone in the first place. The boards may act as arbitration tribunals. Factory inspectors also act as conciliators.

Enquiry and Investigation.—In various countries special action is taken by Governments with a view to informing the public of the facts concerning disputes. In Great Britain under Part II. of the Industrial Courts Act, the Minister of Labour may appoint a court of enquiry to enquire into matters connected with an existing or apprehended dispute. Sixteen courts have been appointed, two of which were in respect of coal mining and three in respect of docks. The appointment of courts is entirely within the discretion of the minister and does not depend upon the application or consent of parties to a dispute. Courts have been constituted of an independent chairman and representatives of employers and workers, usually one of each chosen from industries outside those involved in the dispute. All are nominated by the Minister. A court may require any person to give evidence before it but no penalties are attached for refusal to do so. Evidence may be required on oath but this power has not been used.

The above provisions were based on the Industrial Disputes Investigation Act 1907, of Canada, which, however, is of a more compulsory character, and is confined to mines and public utilities. During the War its scope was extended temporarily and boards may be appointed in other industries by joint consent of parties. A board of conciliation and investigation may be appointed by the Minister of Labour on his own initiative or on the application of a party to a dispute. In practice boards have never been appointed except on such application which must be accompanied by a declaration that a stoppage is imminent. When a board has been applied for or appointed, a strike or lock-out is prohibited under penalty pending the report of the board. Thirty days' notice of changes in working conditions is required. A board consists of one member nominated by each party and an independent chairman agreed upon by the members or nominated by the Minister, the latter being the usual procedure. There are penalties for failure to attend or supply evidence but these do not appear to be enforced. Of the 642 cases up to 1926 in which action was taken either by conciliation or by the appointment of a board, a stoppage was averted or ended in all but 37 cases. In all these cases one or both parties had indicated by making application, a desire to avoid a stoppage. Where illegal stoppages have taken place no action has been taken by the Government, enforcement being left to the parties. In the report of the Nova Scotia coal commission in 1926 it was indicated that the commission had come to the conclusion that the power of a party to secure the appointment of a board of investigation, if and when it so desired, had the effect in some cases of making prior negotiations unreal and of operating against the settlement of disputes by the parties themselves. It has also been suggested that the existence of this power has caused claims to be made and to be pressed to the point of a dispute which would not otherwise have been allowed to reach that stage. The administration of the act, like that of the Industrial Courts Act, has been on a voluntary basis.

In 1925 the act was declared by the judicial committee of the privy council *ultra vires* of the Dominion parliament under the constitution. The act has since been amended to render it possible for each province to make itself subject to the provisions. British Columbia, Saskatchewan, Manitoba, New Brunswick and Nova Scotia have passed laws for this purpose.

In the Netherlands there is similar power to appoint a committee of enquiry in a dispute which may seriously affect the interests of the community and in which at least 300 workpeople are involved, if all other means of settlement have failed.

Under the Australian Industrial Peace Act, the Commonwealth council of employers and employees may appoint committees of enquiry and may itself conduct enquiries, and in many countries conciliation officers and conciliation tribunals have power to publish facts and recommendations. In New Zealand this action is taken for the purpose of allowing the proposals to be balloted upon.

In special circumstances, royal commissions are appointed in Great Britain. These are established by act of parliament and have power to compel persons to attend and to supply evidence. This procedure permits a longer and more thorough investigation than is possible to a court of enquiry which has to act in the difficult circumstances created by a threatened or existing stoppage of work.

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(F. W. L.)

THE UNITED STATES

Industrial Relations in the United States have been coloured at every turn by the individualistic traditions of the country and by the absence of caste distinctions. These two strains in American life should be kept in mind in attempting to understand the various aspects of labour relations, such as trade unionism, social

legislation, arbitration and conciliation, and the latter-day emphasis on securing co-operation within the individual plant. The relations between employers and employees can be divided into a controversial phase and a constructive phase, though these aspects overlap. The historical developments are largely concerned with the controversial phase.

Trade Unionism.—American trade unionism has quite a different complexion from the European. In Europe unionism has fulfilled not only economic functions but also political and social; its purpose has been not only to raise the economic status of the worker, but also to compensate him for his inferior social status by giving him vicarious prestige through the power of the unions. In America, on the other hand, labour organization has largely taken the form of "business unionism" for purely practical bargaining purposes. Unionism in the United States is a much more recent phenomenon than in other countries. The industrial revolution, which was in full swing in England around 1800, did not produce its full effects in the United States until about the middle of the century. Thus American unionism did not gain any momentum until after 1850, and no existing union traces its history beyond that time. In colonial days, the newness of the environment, the predominance of agriculture, the local industrial development retarded through the fixed policy of the English Government, kept difficulties between organized workers and employers from being a national problem. The earliest known workers' association is that of the Philadelphia shoemakers of 1792, which was followed by a few other sporadic societies. It was not until the end of the first third of the century that labour organizations became numerous enough to be conspicuous.

Even to-day union organization has not reached foreign proportions. As late as 1900 the American Federation of Labour (*q.v.*) embraced less than 600,000 members. At present the total membership of all unions combined is less than 4,500,000. The late development of trade unionism is perhaps one reason for this; another is the persistent opposition of employers. Various court decisions have made organization more difficult, since unions do not have the legal position they achieved in England. In some of the recent decisions of the supreme court it has been made illegal for a union to attempt to organize workers into unions if these workers have signed a so-called individual ("yellow dog") contract with the employer agreeing not to do so. Union leaders have also complained that the process of injunction has seriously hampered their activities.

Unionism is embodied largely in the American Federation of Labour, a loosely federated group of national unions, each to some degree with its own economic aims. But there are certain characteristics common to all groups. American labour for the most part has for over 40 years renounced the struggle for independent political power and is the most determined enemy of communism and, to a large degree, of socialism. There has been much bitterness against individual and group employers, but the philosophy of class conflict as such is not much in evidence. American workers are not inclined to regard their status as immutable. It is true that unions, though started with economic purposes, soon took on a considerable political complexion. But though at first they attempted to use legislation to improve the conditions of the worker, latterly they have shown little interest in labour legislation and indeed at times union leaders have opposed certain measures intended particularly for the benefit of the worker.

Equality of citizenship for the wage earner was a much nearer goal for early American unions than it was for those in other countries. A political democracy had already been established in principle. A few States still lagged behind with property qualifications attached to the franchise, and these and other injustices gave occasion for a good deal of political activity. But with the advent of practically universal suffrage it was easy to remedy certain other abuses. The unions took a prominent place everywhere in intensive campaigns to abolish imprisonment for debt, to establish laws providing for a mechanics' lien, to reform the regulations concerning compulsory militia service, to develop a system of public education having no taint of charity, and to exclude Mongolians from immigrating to compete with American workmen.

With success in the more purely political programmes, unions turned to legislation for economic reforms. The limitation of hours of labour formed the earliest of the major issues upon which labour organizations co-operated. They were successful, in 1840, in securing, by an executive order of President Van Buren, a limitation to ten hours a day for certain Government employees, and in 1868 in securing, through the action of Congress, a general eight hour day for these employees.

When, however, labour unions tried to secure the limitation of hours and the improvement of wages and other economic conditions in private industry through Government action, they encountered such obstacles that in time their faith in this approach was much weakened. Among the difficulties which they met was the hostile attitude of the agrarians on the one hand, who were not much in sympathy with legislation pampering the city workers, and of the employers and the commercial group on the other. Furthermore, progress had to be achieved in 48 States. Not only had public opinion to be roused, but legislation had to run the gauntlet of the courts and be watched at every point to keep it from being nullified by ineffective enforcement. The courts proved the greatest obstacle, for they were none too favourable to legislation suggesting an abandonment of freedom of contract. Latterly, therefore, unions have evinced comparatively little interest in labour legislation and have to a large extent left the field to outside groups. (*See* further TRADE UNIONS.)

STATE AND WORKER

Labour Legislation.—In recent years, labour legislation has been largely promoted by public groups composed neither exclusively of employers or of unions. Progress, however, has been hampered by the individualist traditions of the country. Then again, though there were many examples of unsatisfactory conditions in factories, it is probable that they existed to no such extent as they did in the early English factories, or in Continental factories. The result was no such intense reaction as in England to bring about a public outcry for labour legislation. Besides, labour legislation had to meet the usual criticism that it was based upon "foreign socialistic ideas." There was little sympathy with German bureaucratic ideas and as such legislation found its most scientific exposition in Germany, the cry that it was un-American and collectivist was easily raised against it.

As a result, there is no health insurance law, old-age pension provisions or unemployment insurance law in any State in the Union or in the Federal Government. Many of the larger companies have made elaborate provision for pensions, health insurance and even group life insurance, but of course this has left the employees of smaller companies without protection of this character. The various attempts to regulate child labour federally have been upset and the constitutional amendment was defeated by an overwhelming vote of the people, so that this regulation of child labour must depend upon the various types of legislation passed in each State in accordance with its own particular standards. Minimum wage legislation for women and children which has been on the statute books in 14 of the States, was recently interpreted so unfavourably by the United States Supreme Court as largely to nullify it.

But in factory codes, sanitary regulation and safety provisions State regulation has decidedly advanced. This has been accompanied by a wide-spread safety movement on the part of employers, resulting in part from the recently awakened interest in systematic management, and in part from an admirable system of workmen's compensation in approximately 40 States. This legislation, once bitterly opposed by the employers, now includes industrialists as its strongest supporters.

Mediation and Arbitration.—In accordance with the conflict theory of labour relations, a technique of mediation and conciliation was developed both in the Federal and State administrations, and within industries in private contract between groups of employers and the unions. But compulsory arbitration of the type developed in Australia has made no headway. For the most part Governmental intervention has avoided compulsion and relied

on the friendly offices of governmental agencies in investigating dispute and bringing the parties together. The only element of npulsion is the power to summon witnesses, hold hearings and nmand evidence. The distinction has been made that there is re cause for the State exercising compulsion on essential indus- s than on so called non-essential ones. Nevertheless, neither Federal or State legislation has compulsion obtained any perma- nt foothold. In only two important instances—the Colorado of 1915 and the Kansas "Court of Industrial Relations" of o—has an element of compulsion been included. In the latter ance, the law met with determined opposition on all sides and s declared unconstitutional by the United States Supreme Court far as it applied compulsory arbitration to other than transport public utilities, and was superseded by a new law which abol- ed the court.

Federal legislation applicable to disputes on transportation cor- rations engaged in interstate commerce began with the act of 8, and gave the president power of voluntary arbitration, and making an inquiry into the facts that would make it easier to le such disputes. The principle of voluntary arbitration was ntained in the Erdman Act of 1898 and the Newlands Act of 3, the successive laws which superseded the act of 1888. The nsportation Act of 1920 gave certain powers to render awards he National railway board. Though the awards of that board e not legally binding there was dissatisfaction with the element compulsion which inhered in its powers to invoke public opin- without the submission of both parties. Largely as a conse- nce of this dissatisfaction the latest law, the Railway Labor of 1926, abolished the provision for such a board. Voluntary liation and arbitration are outstanding features.

The prejudice against compulsory arbitration has had a definite s in the fear that under a system of compulsory arbitration rds would finally be made even in matters of minute detail.

Thus both nationally and locally judicial process has been fined to conciliation and voluntary arbitration. A department onciliation was included in the scope of powers of the Federal partment of Labor by an Act passed in 1913, and its commis- ers intercede whenever a situation suggests that they may be to prevent a break. National commissions have also been pointed to take testimony on important strikes and to recom- d the principles upon which the issue should be settled and e have also been of a voluntary character. One of the out- ding ones was President Roosevelt's anthracite coal commis- of 1902, whose report was long a basis of agreement.

Within the field of private agreement there have been many eriments in setting up judicial machinery, such as the protocols he New York garment trades, in which a complicated extra- l industrial Government was established. Since the back- nd for such experiments have been grievances, the subject handled largely from a juridical point of view, rather than n the point of view of co-operation and production, as is the in the more recent clothing agreements.

hese processes of mediation and conciliation, and judicial esses as a means of solving the labour problem, have been n a disproportionate popular interest. For a while there were cations that they were regarded by many as panaceas, but ntly the attitude has changed.

CONSTRUCTIVE PHASE OF INDUSTRIAL RELATIONS

nce about 1910 a movement has developed to introduce into agement scientific and professional principles. One of the points was the importance of a highly co-operative em- ee morale. It is true that many aspects of personnel man- ent may have been introduced as a defence against unionism to this extent may be involved in the controversial phase of strial relations; but its main impulse has been constructive.

new conception of labour relations as part of manage- t has introduced a constructive attitude towards the labour lem and prevented it being regarded inherently as a matter ly of unionism, legalism, conciliation and arbitration or legis- n. The way has thus been made clear for the adoption of a der perspective, in which the items mentioned above are given a place, but in which other aspects, previously neglected, are accorded their due prominence. These aspects are those dealing with the proper organization of work relations in each plant.

Differences in morale and in satisfaction with their daily job between the employees in two organizations may have no relation to the wages paid. There are examples of factories existing side by side in the same vicinity paying the same wages in one of which there is a contented working force and in the other a dissatisfied, restless group. Sometimes, where there is a disparity in wages, the concern paying the higher wage has the dissatisfied workers. The difference is one in technique,—the degree to which *system* and practical common sense have been applied to the every-day problems of living and working together.

Present day interpretation of the labour problem adds to the old-time conception of "the economic man," invented by the economists, and described as one struggling for his share of what is provided, the conception of "the administrative man," who has his place in industry as a unit in a complicated organization. In other words, we now recognize that in any private business plant there is, in addition to the economic side of industrial relations, a purely administrative problem of organization and functions. This problem in an industrial concern is not very different from that which arises in a Red Cross or consumers' co-operative organization, in the post office, and in other agencies which also are trying to provide services, and in which no question of capital or labour is involved. There are laws of sound administration as well as "economic laws."

Realistic analysis has, furthermore, taken out some of the misplaced conflict allocated to the factory. It has been recognized that the determination of real wages takes place chiefly not within but without the factory walls in the competition between industries and in taxation, and that often the contest for the economic surplus is not solely, or even for the most part, between capital and labour but between various other groups. Agricultural workers are pitched against industrial workers, employers and employees in one industry against those in another. Sometimes the inequalities between groups are due to the vagaries of credit and monetary systems. Though the economic struggle has been dramatized as taking place in the factory, only a very small part of that struggle in fact takes place there.

Thus, the modern United States emphasis in the treatment of the difficulties of industrial relations is upon the improvement of the more routine problems in the individual factory.

Attention to the administrative aspects has developed a "technique of good will," with an extensive literature going under the general title of personnel administration. The problem has been to satisfy the desires of workmen within the limits of the requirements of productive efficiency and to see how productive efficiency could be furthered by this satisfaction of workmen's aspirations.

Modern behaviouristic psychology has been invoked to satisfy these desires. They may perhaps be roughly classified as the desire for justice, the desire for status and the desire for opportunity. The first, "justice," is the elemental desire for fair play; "status" is the desire of the workman for some recognition of his dignity as a participant in the industrial activities, and "opportunity" is the desire of a certain proportion of the employees to forge ahead. As a step in the effort to satisfy the desire for justice might be included the pension systems and provision for health and group life insurance which have been set up particularly by the larger companies. At times these are established on a basis under which the employees contribute to the fund and at times on a non-contributory basis. To satisfy the desire for status the technique that has been developed has been that of works councils and employee representation, employee stock ownership and similar plans.

Employee representation is probably one of the most interesting aspects of the new personnel movement. Feeling the need of providing some form of group expression to the workers, executives have introduced employee representation having no connection with trade unionism as such but in a way as a substitute for unionism. Over 1,500,000 individuals are employed in concerns operating such plans.

In some plans the function of the employees' representatives is purely advisory. No vote may be taken and the advice is not necessarily followed, but the employees realize that at least their viewpoint has not been entirely ignored. On the other hand, there are types in which preliminary legislative power is given to employees' committees on matters of employee interest; this may be subject to the veto of the management or may provide for outside arbitration of issues.

The method of satisfying the desire of the workman for "opportunity" is to recognize that what the more energetic workman particularly desires is a successful career. In order to satisfy this desire, elaborate systems for detecting, training and promoting workers have been established in many plants. Much effort has been made to evolve systems of training and methods of making promotion available to able employees. These are particularly necessary in America because of the decline of the apprentice system. It has been estimated that only a minority of employees are really ambitious for advancement, but it is recognized that it is important to train and advance this group, however large it may happen to be.

In connection with this desire of the workman for opportunity can be included the large question of security of employment, as an essential aspect of making the worker's job a career. The individual employer cannot do much to prevent the effects of cyclical unemployment, but he can temper its effect. Much attention has been given to seasonal unemployment, particularly by some large corporations. Here the subject of industrial relations becomes involved in the larger problems of management, for to do away with seasonal unemployment the production manager must plan skilfully and the financial and sales executives of the company must co-operate in stabilizing operations.

In the dispensation of justice and in the more general problem of carrying out a personnel programme it has been recognized that specialized machinery is necessary. As a result progressive companies have established "employment" or "personnel" departments. This is particularly important because new groups of employees are constantly being marshalled into new industries. Formerly the theory in certain plants was that any worker could see the general manager or the employer. Now it is recognized that it is impossible for the able manager to give time to these matters, and that injustice was often done to the workman because of inadequate provision for the specialization of this function. Hence the necessity of such departments has been accepted as particularly important in large companies.

Among other things the purpose of such a personnel department is to make certain that the employees are treated fairly and grievances adjusted at the source. Complaints are handled in such departments with a works council acting mainly as a court of appeal. In some cases the right of "firing," as well as the right of hiring, has been taken away from the foreman, and though there were misgivings at first, this system has worked fairly successfully. The trend is not to have these matters settled in a juridical fashion but as matters of adjustment.

Personnel administration and the larger movement for thorough and systematic management have become fused, and tend towards the fading of class distinctions, the existence of which has been known to interfere considerably with efficient organization.

This new attitude of employers to their labour problems as a part of good management has served as a challenge to trade unionism. This has been particularly true of the employee representation movement where there have been some interesting attempts on the part of the union to join with management in "union-management co-operation." The most notable example is on the Baltimore and Ohio railroad in which the shop crafts and the railroad company have been working out methods of furthering their mutual responsibility for successful production. Another example of unionism in a constructive relation may be found in the men's clothing industry. In this industry the trade union has assumed a very real responsibility for securing production, and an elaborate plan of unemployment insurance and production standards has been worked out. There have been other examples of what may be called industry-wide co-operation between unions and employers. It must be confessed, however, that the greatest progress in industrial relations has been made in the better adjustment that has been worked out as a part of good management in the individual plant in abolishing any difference in the treatment of the rank and file of workers and other members of the organization.

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ARBITRATION IN THE UNITED STATES

In general, any business controversy may be submitted to arbitration. Experience has proved, however, that arbitration is more particularly adapted to the following general categories of controversies: differences concerning the interpretation of the terms of a commercial contract; questions involving the interpretation of commercial custom and the application of trade rules in determining such questions; matters involving professional skill or opinion as, for instance, in architectural and engineering undertakings; trade disputes where questions concerning quantity, price, quality or other question of classification arises; controversies arising out of contracts relating to public undertakings; matters of dispute between partners; disputes under leases or transactions in real property except, perhaps, where some questions of title are involved. The United States Arbitration Act also facilitates arbitration in the general field of maritime transactions and in foreign and interstate commerce.

Systems of commercial arbitration may be classified into two general types: (1) where, in the absence of or without regard to any statutory provision, the parties submit the matter in controversy to the decision of other persons and where performance of the terms of the agreement must depend solely upon the good faith of the parties; (2) where, by statute, enforceability is given to the agreement of the parties to submit a controversy to arbitration. Some statutes make enforceable only the arbitrators' awards while others make enforceable also the agreement to arbitrate. The agreement to arbitrate may be supplemented by rules, by-laws or other regulations of trade and commercial associations which require their members to arbitrate their differences, and for failure to do so such members may be fined, suspended, or disciplined by action of the organization. An agreement to arbitrate a future as well as an existing dispute is irrevocable and enforceable only under the United States Arbitration Act and under the recent laws of New York, New Jersey, Territory of Hawaii, Massachusetts, Pennsylvania, California, Oregon and Louisiana.

The common law rule of the right of a party to revoke the authority of the arbitrator prevails in the States of Alabama, Delaware, Maryland, Mississippi, New Mexico, Oklahoma, South Dakota and Vermont. In these States the only remedy the aggrieved party has is to sue for damages for breach of contract when the second party refuses to perform under an arbitration agreement. A party to a submission to arbitration of an existing

dispute may not revoke such an agreement in the following States: Illinois, Iowa, Maine, Michigan, Minnesota, Nebraska, Nevada, New Hampshire, North Carolina, Utah, Wisconsin and Wyoming, and also in Georgia after the submission has been delivered to the arbitrator, and in Missouri and North Dakota if hearings have been started. An agreement to submit to arbitration an existing dispute is irrevocable if the submission is made a rule of court prior to the rendering of an award in the following States: Arkansas, Connecticut, Florida, Idaho, Indiana, Kansas, Montana, Ohio, Rhode Island, Tennessee, Virginia and West Virginia, and in Kentucky when the submission states the issue and names the arbitrators. In Colorado and Washington the courts have held that an agreement to submit to arbitration a future dispute must be performed before an action at law may be commenced on the subject.

In January 1926, the United States Arbitration Act came into effect. Under this act a dispute arising out of a contract relating to interstate commerce in which more than $3,000 is involved, or arising out of a maritime transaction, is arbitrable, and an agreement to arbitrate either an existing or a future dispute is valid, irrevocable and enforceable.

Practically all statutes in the United States make majority awards valid. While the practice still prevails of each party appointing an arbitrator, both to select an additional arbitrator, such additional arbitrator cannot alone render a valid award unless he is specifically authorized to do so by the parties. Under these statutes, except in the States of Massachusetts, Illinois, Nevada, Utah, Wyoming, North Carolina and to a more limited extent, Pennsylvania, questions of law can be referred to the court only upon the request or consent of both parties if any reference is allowed. Differences in the State statutes lead to different practices in different States and for this reason efforts are being made by business men and commercial and professional organizations to obtain a uniform State law applicable to all business controversies alike throughout the country.

The principles and practice embodied in the United States Arbitration Act and in the State statutes of New York, Massachusetts, New Jersey, Hawaii, Pennsylvania, California and Oregon, may be said to represent the commercial policy of the United States. Under these laws there are five outstanding principles: (1) A written arbitration agreement is valid and irrevocable save as any other contract is revocable, and specifically enforceable if made in accordance with the statute. (2) The agreement may be for either an existing or a future dispute. (3) The court, upon application of either party, is authorized to enforce the agreement, if necessary appointing an arbitrator. (4) The court will stay an action brought by a party to an arbitration agreement, pending its settlement by arbitration. (5) The award when confirmed by a court may have judgment entered upon it and is then enforceable in the same manner as any other judgment.

Tribunals.—As a result of these laws and the business use of arbitration thereunder in the United States, arbitration has become highly organized, requiring competent administration. New York city alone has more than 80 trade and commercial tribunals administered by various trades or commercial organizations. The American Arbitration Association, which is representative of the business, legal and professional arbitration interests of the country, maintains a national panel of arbitrators consisting of several thousand carefully selected persons distributed in different localities, so that throughout the country it is possible to arbitrate a dispute under standard rules compiled from the extended experience of the American Arbitration Association by men who are informed in arbitration principle and procedure.

At the beginning of 1928 the following branches of industry and commerce had adopted arbitration in some degree or form, to be administered through trade associations: the automobile industry, boot and shoe industry, bottlers' trade, clothing and dry goods trades, confectioners, construction industry, cotton and by-products, financial institutions, food industries, fuel, heat, light and power, furs, grain, hay and seeds, hardware, imports and exports, leather, hides and skins, lumber and allied industries, jewellers' trades, motion picture industry, paint, oil and varnish industry, printing and engraving trades, real estate, rubber trade, silk industry, toy manufacturers, transportation, warehousing, wool and the theatrical industry. The aeronautical, electrical manufacturing, music, paper and pulp, chemical and zinc industries, furniture and florists' trades and the great retail organizations have the matter under consideration.

Approximately 75% of all commercial arbitrations in the United States are disposed of through trade associations, of which 332 have adopted rules and maintain facilities for their members. In addition, 162 trade associations provide occasional facilities and arrange for an informal procedure. The distinguishing features are that they deal with a given commodity, that they recognize trade customs in their consideration of the question and that the proceedings can be held locally and conducted uniformly by branches of associations in different parts of the country. Mixed cases are disposed of through local commercial bodies, such as chambers of commerce or boards of trade. In such instances, there is usually a supervisory committee, a panel of arbitrators and rules of procedure. Certain definite tendencies in policies are apparent: (1) toward uniform State arbitration laws which will make valid, irrevocable and enforceable either an existing or future definite agreement to arbitrate; (2) toward the use of arbitration clauses in contracts, safeguarding the parties against the unknown risks and costs of litigation; (3) toward the responsible administration of arbitration under rules of procedure; (4) toward the finding of awards in accordance with business customs and practice; (5) toward the submission of questions of law to the courts only when requested by both parties; (6) toward limiting arbitration to matters wherein the basis exists for making a business judgment; (7) toward the elimination of the umpire and the substitution of neutral arbitrators for the appointment of a partisan by each of the parties.

The increase in the practice and scope of arbitration in the United States is due to a number of causes, the most important being: (1) The increase in business makes it impossible for the courts to keep pace in the settlement of disputes. The fact that a legal decision is often long delayed has compelled business to adopt a more expeditious, cheaper and simpler method than litigation. (2) The changing provisions of the State laws, their liberal interpretation by the courts and the use of arbitration by attorneys on behalf of their clients greatly advance the practice of arbitration. (3) The desire of business to order its own affairs, to keep out of the courts and to avoid unnecessary publicity leads business men to settle their differences in private. (4) The educational work being carried on by such organizations as the American Bar Association, the Chamber of Commerce of the United States and local chambers, universities and trade associations, all working toward a common policy and practice, in co-operation with the American Arbitration Association—a central co-ordinating body—account for the direction now being given to arbitral policy and its development throughout the country. But most important is the realization that arbitration stabilizes an industry with respect to the relationships of its members, eradicates trade abuses, promotes ethical standards and increases trade through the elimination of friction and ill-will. These values, added to that of economy, are responsible for the extension of arbitration in the United States. (M. H. G.)

INDUSTRIAL RESEARCH: *see* RESEARCH, INDUSTRIAL.

INDUSTRIAL REVOLUTION, THE. When we say of a society that it has passed through the industrial revolution we have in mind a definite picture of its life and power. We are thinking of a society that makes great use of machinery, conducts its operations in industry and commerce on a large scale, and supplies the needs of its simplest members by an elaborate series of world-wide exchanges. The creation of any such society must be in some respects a gradual development. Certain features of our modern economic life can be traced back to the days when Columbus and the great sailors of his time put Europe in touch with the New World and the Far East; others to the history of the Crusades, when a brisk trade was conducted by the chief Italian cities in the rich textiles of Syria; others to the earlier history of Europe when classical Greece, the successors of Alex-

ander the Great, and the Roman empire in turn exploited the wealth of the Mediterranean basin. There was large capital invested in industry as well as in commerce before the 18th century, and even so modern a phenomenon as mass-production was not altogether unknown before the industrial revolution. No people and no age could pass directly from a primitive and simple economy to a life so complicated as that of modern Britain or modern Germany. Some critics, surveying these earlier tendencies, doubt whether the term "industrial revolution" is appropriate, arguing that revolution implies sudden and catastrophic change. But a closer examination shows that the great inventions which distinguished the 18th and 19th centuries played so decisive a part in creating the new kind of society that the term industrial revolution, invented by a Frenchman and made familiar by Arnold Toynbee, is not too violent a description of the changes they produced. It is now an established phrase, like the Renaissance, or the middle ages, with a well-understood meaning and content.

England the Pioneer.—We mean, then, by the industrial revolution the change that transforms a people with peasant occupations and local markets into an industrial society with world-wide connections. This change has come to different peoples at different times. There are parts of the world, like China, where it did not begin till the 20th century began. It came first in England because the English people had favourable political institutions, internal free trade, advantages of climate and geographical position, considerable experience of foreign trading, special connections with the New World and abundance of coal. In the first phases of the revolution coal mattered much less than it did afterwards, for the first great mechanical inventions in the textile industries were worked by water-power, and rapid industrial development was possible at this stage without coal. This explains why France made such rapid progress as an industrial nation before the French Revolution. France had great inventors like Jacquard and Vaucanson, and she had a richer foreign trade than Great Britain. But when a series of inventions had made coal the chief source of economic power, France was at a great disadvantage. As late as 1847 she produced only 5,000,000 tons of coal, whereas the English production so early as 1800 was 10,000,000 tons, and from 1845 it was over 34,000,000. If France had kept the frontiers established by the Treaty of Amiens, her history would have been very different, for that treaty left her with the Belgian coal-fields.

The Revolution in Iron.—The inventions which gave this predominant importance to coal began with the discoveries by the two Abraham Darbys and by Henry Cort of methods of using coal instead of charcoal in blast furnaces and forges. Before these discoveries iron manufacture depended on charcoal. It was therefore carried on mainly in counties like Sussex with extensive woodlands. But by the early 18th century the industry was in great difficulties, for the supplies of fuel were giving out. When the Darbys, Cort, John Wilkinson and James Watt had revolutionized the industry the difficulties vanished, coal took the place of charcoal, and the iron manufacturer could set up his plant in the neighbourhood of coal-fields. So the industrial revolution created the black country, and enabled England to turn to account the good fortune which had given her abundance of coal, and coal conveniently placed near her ports. Between 1720 and 1788 the production of pig-iron in England grew from 25,000 to 68,000 tons; between 1788 and 1839 it grew from 68,000 to 1,347,000 tons.

The Textile Revolution.—The revolution in the manufacture of iron which created the black country was accompanied by a revolution in the textile industries which transformed Lancashire and the West Riding. This revolution was started by a series of inventions in the 18th century. The flying shuttle was invented by John Kay in 1733; the spinning jenny was patented by James Hargreaves in 1770; a roller spinning frame, worked by water-power was patented by Richard Arkwright in 1769 and 1775; the mule which enabled English mills to match the delicate muslins produced by Indian fingers was invented by Samuel Crompton in 1779. The cotton industry established by these discoveries was conducted at first by water-power, but before the end of the century its progress and its power received a great stimulus from the most important of all the discoveries of the industrial revolution.

Steam Power.—Profiting by the earlier pioneer work of Thomas Savery and Thomas Newcomen, Watt learnt how to make steam the servant of man's will. By his invention of the separate condenser, patented in 1769, he produced a new type of engine. In his early engines steam was used to force a piston up and down, and they were mainly used for pumping water in mines, but Watt went on to devise a method by which steam could be applied to rotary movements as well, and this was in some respects the most important of his discoveries. From that time there was scarcely any limit to the range of the invention, which revolutionized one industry after another. In the textiles the new power was first applied to spinning; later it was used for weaving, as the result of a series of inventions, beginning with the imperfect power-loom patented by the Rev. Edmund Cartwright in 1785. The effect was to give new freedom to the industry, which was now independent of water-power, just as the iron industry was independent of woodland. The growth of the cotton industry was the most sensational event of the early revolution. In 1764 England imported 4,000,000 lb. of cotton wool, in 1833 she imported 300,000,000 pounds. A table drawn up by the Chamber of Commerce at Mulhouse in 1835 shows that in that year England produced over 60% of the cotton goods consumed in the world; France 16%; the United States 7%; Switzerland, Saxony, Prussia and Belgium between them a little less.

This expansion of the industry involved, of course, a great increase in the demand for raw cotton. When first the industry began to grow England and France competed for a deficient supply. At that time the West Indian islands provided more cotton than the continent of America. The United States had a great deal of short stapled cotton, which could not be exported profitably, because the cotton adhered so closely to the seeds that it was difficult and costly to prepare it for export. But in 1793 Eli Whitney invented a saw-gin which enabled this cotton to be cleansed, and from that time the United States became the chief source of supply. This invention led incidentally to a great extension of slavery in the southern States, for slaves were especially suitable for growing cotton in the river beds.

The woollen and worsted industries were older than the cotton industry, and in their case these technical improvements were introduced more gradually. They led to the concentration of both industries in the West Riding, the worsted industry declining in the eastern counties, and the woollen in the south-west.

Canals.—It is important to notice that the cotton industry was established on a large scale while England was still depending on canals and roads for transport. There had been a great development of road making and canal making in the 18th century, in consequence, partly, of the agrarian revolution. This revolution, which increased rapidly the system of large tenant farming, with landlords applying their capital to improvement, made farming much more productive. It was effected partly by Enclosure Acts which were passed through parliament, setting up commissioners to enclose the common fields and the common wastes. Under the old system individual freedom was limited by the rights of the commoners. By this change enterprising landlords could apply the lessons taught by Jethro Tull and other agricultural pioneers, who had discovered how to improve crops and stock. But the roads were in a very bad state, much worse than in contemporary France, and it was necessary to construct new roads and reconstruct old ones, in order to enable corn and other agricultural products to be taken to the towns. So the governing class threw itself into road development, and turnpike trusts were set up all over the country for that purpose. Similar motives led to canal building. The most famous of the inventors in this field was James Brindley, who was commissioned by the duke of Bridgewater to make a canal to connect his coal-field with Manchester. His success gave a stimulus to the movement, and the industrial districts of the north and the midlands were rapidly connected with each other and with the ports by a network of waterways.

Railways.—But man's new servant, steam, was soon brought

into use for the purpose of transport. The first steam locomotive was tried at the Merthyr Tydfyl iron works in the early days of the 19th century. The founder of the British railway system was George Stephenson, the engineer of the Stockton and Darlington railway, opened in 1825, and the designer of the engine which won the prize in the competition held at Rainhill in 1829. The success of the Liverpool and Manchester railway opened in 1830 led to an age of feverish activity in railway building, and by 1848 nearly 5,000m. of railway line had been laid in Great Britain. This in its turn had a powerful influence on the metal industries. Sea transport changed more slowly; the first steamship crossed the Atlantic in 1819, and, by 1847, 60 or 70 steamships were turned out every year.

Engineering.—In some respects the most important of the results of Watt's discoveries was the use of machines for making machines. Mechanical engineering begins to be important in English history about 1820 (the first textile machinery was made of wood), and with the rapidly growing demand for machinery from all parts of the world its importance grew at a rapid rate. The scope and power of the industry were increased by a series of inventions such as James Nasmyth's steam hammer in 1838, and by discoveries associated with the names of Henry Bessemer (1856), the brothers Siemens (1866) and Snelus (1879), which created the modern steel manufacture. All the metal industries were helped further by the chemical discoveries of which Michael Faraday had made a beginning in 1826, discoveries that created in their turn the successful chemical industries of Lancashire and Cheshire.

The effect of all this energy in scientific pursuits and industrial enterprises was to make England the leading representative of the new civilization: the workshop of the world. Her early progress was all important. For, as we have seen, England had an industrial revolution before the railway era. In the two countries where industrial expansion was most rapid in the latter half of the 19th century, Germany and the United States, the industrial revolution began with the introduction of the railway. In earlier ages the chief obstacle to industrial development was the difficulty of land transport. In Germany and America this difficulty was resolved by the railways. In England, on the other hand, where the sea was nowhere very far distant, an industrial revolution was possible without the railways, because canals and roads could give access to the ports. It was mechanical engineering that received the greatest stimulus from the railways. Therefore, when the world wanted railways and docks, England was ready with the plant, the experience, the capital and the skill. Hence it was to English capital and English labour that the world turned for this task. But there was this difference between the early days of the revolution, when England sold piece goods all over the world, and the later, when she sold railways; for the railways she sold were turning peasant into industrial societies, and it was certain that when this change had taken place, England's preponderant share in the trade of the world would decline. When the 20th century opened England had powerful industrial rivals both in and out of Europe.

Electricity.—The 19th century was the century of steam. Before its close man had discovered in electricity an even more valuable servant. A new industrial revolution was thus set in train, a revolution of which we cannot yet forecast the consequences. One effect is seen in the growth of motor industries in the home counties. The great industrial revolution concentrated industry in certain districts; Lancashire is the home of cotton, the West Riding of wool, Staffordshire of pottery, the great metal industries are found near the coal-fields. Electricity gives industry again a wider choice, and the factory inspectors' reports for 1926 drew attention to the development of industries in the south of England. Transport is easier, and power can be made available in the country districts.

Social Results.—The conversion of a peasant to an industrial society brings with it great changes in a nation's habits and manner of life. Of the changes that followed the first development of the new system, those that made the greatest impression on the thinkers and observers of the time were the great improvement in production, and the opportunities this new world offered to individual talent and character. The great cheapening of commodities was illustrated in one of the publications of the Society for the Diffusion of Useful Knowledge, by the case of stockings. This little book, *The Results of Machinery*, put it thus: "Two centuries ago, not one person in a thousand wore stockings; one century ago, not one person in five hundred wore them; now, not one person in a thousand is without them." Life was in this sense easier, and the first impression made by this improvement led to a belief that the secret of progress was to allow every enterprising person to make what profit he could by any means that he chose. There was another way in which the early results of the revolution made enlightened persons suspicious of any attempt to interfere with industry, or to control and direct the social life of the times. The revolution gave great opportunities to the workman who could save a little money and was shrewd and daring in investing it. Most of the early cotton spinners were men who had made their way. It might have been expected that the new industrial capitalists would come from the class of merchant capitalists who financed the woollen industry, but in fact they came from men of small beginnings. Robert Owen, for example, one of the most successful of them, owed his success to a loan of £100. The exhilarating atmosphere of a world in which men could make their own careers helps to explain the optimism of the time, and the disregard of evils which called for action.

Evils of the New Town Life.—For the industrial revolution had produced mischief of which the consequences still pursued the British people in the 20th century. That revolution found Great Britain without any effective system of local government. The country districts were in the hands of the country gentlemen, acting as magistrates, and the towns were unorganized for any of the more important purposes of administration. Manchester, which had a population of a quarter of a million, was at the time of the Reform bill administratively a collection of villages governed by a court leet. It is not surprising, therefore, that the towns which sprang up so rapidly, as the textile and metal industries expanded, were quite unable to handle the new problems, and that their uncontrolled growth made the new town life hideous and squalid. In the 'forties, when parliament had been reformed, and a spirit of enquiry was active the state of the towns was examined by committees and commissions, such as the Health of Towns Commission, and their appalling condition was revealed. A first effort to reform those conditions was made by the Public Health Act of 1848, but the problem proved too difficult, and the several attempts that were made in the 19th century showed how fatal was the mischief done in the early days when there was no legislation to cope with the new conditions.

The Regulation of Factories.—The revolution had made this problem of town life acute and pressing. It created also new industrial relationships which soon caused strife and discontent. Before the textile industries passed into the factory, spinning and weaving were done either in the workers' homes or in the house of a small master. Spinning was woman's work and weaving man's work. In the mill, spinning was mainly men's work and weaving women's work, but both weavers and spinners depended on the help of children. The early mills had difficulty in getting labour, for they were built on streams in districts where there was little population. The difficulty was got over by the supply of children from the workhouses. The hardships of these children led to an agitation and it was made illegal to apprentice children 40m. from home. But by this time the use of steam-power had made it possible to put up factories in or near towns, and the apprentice children were no longer needed. The campaign against the long hours of children became a campaign against the long hours of the factory, for it proved in practice impossible to shorten the hours of children without restricting the hours of the factory, and this campaign was brought to success in 1847, when parliament passed the Ten Hours Act, for which Shaftesbury (then Lord Ashley) had fought since 1833. Factory legislation and factory inspection were gradually extended to other industries in the course of the century. In this department of government England has led the way.

Trade Unions.—Large-scale industry in engineering and mining as well as in the factory created a different relationship between employer and employed than the sort of relationship which existed in the days of the craftsman. The place of the guild was taken by combinations of employers and employed. Strikes and combinations were not unknown before the industrial revolution, but the revolution gave a new importance and a new scope to trade unions. Their rights and their liabilities became one of the acute questions of politics. A fierce act against trade unions, called the Combination Act, was passed in 1799, modified in 1800, and repealed in 1824. Next year a new act defined the powers of the trade unions in such a way as to make effective combination very difficult. Trade unions did not obtain full recognition until after the workmen had been enfranchised in 1867. After the World War they were given a new place in public life by the institution of Whitley councils and similar bodies, composed of representatives of organizations of employers and workpeople.

Unemployment.—Another result of the industrial revolution was periodic mass-unemployment, a consequence of mass-production. The revolution made industries interdependent, and by bringing the whole world into close economic relationships it made the industries of one country dependent on the conditions in remote places. A coal strike hits the textile industries; a deadlock in engineering holds up shipbuilding. The poverty or the quarrels of the Continent affect all British export industries; a political or commercial crisis in America may throw the cotton industry of Lancashire or the engineering industries of Newcastle into distress. Unemployment was not a new thing at the industrial revolution, but it is evident that a nation which is involved in this world economy is subject to vicissitudes that do not affect a more primitive community. It is sometimes said that the industrial revolution has substituted unemployment for famine as the nightmare of mankind.

Problems of Industrial Civilization.—The industrial revolution has not had exactly the same consequences in all countries. For those consequences depended partly on the conditions preceding the revolution and those conditions varied. English experience has been peculiar in one important respect. In England peasant farming disappeared with the agrarian revolution that began in the 16th century and ended in the 19th century. In other countries the peasant survived. France, for example, possesses important industries, but her people are mainly rural. Germany, much more industrial than France, has still a large peasant population. In England the old peasant type of life, in which agriculture and village crafts were combined, has vanished, whereas something of it remains in other countries that have passed through the industrial revolution.

But the industrial revolution has produced certain results that are common to industrial civilization. Thus one country after another has been obliged to copy the example of England and to legislate for the control of factories. Asia has followed Europe. Provision against unemployment by State or municipal insurance was first made in certain Continental countries, notably Germany and Belgium. Just before the war England established a scheme for a few industries, and after the war this scheme was extended to cover almost every industry except agriculture. In almost every industrial country this problem has received attention. If we want to realize how much the industrial revolution has done to create common problems and to suggest common remedies we have only to glance at the publications of the International Labour Office of the League of Nations, or to consider what reforms it pursues by conference and convention. In every country the same problems and the same remedies are under discussion: unemployment insurance, factory acts, hours of work, minimum rates of wages, the rights of trade unions, family endowment. One effect of the all-embracing system which the revolution has established has been to standardize the occupations, the cares and even the amusements of man. The cinema is as much the mark of the modern world as the factory; the railway as the football or baseball field; the wireless talk as the trade union. It is by these institutions that the modern traveller is reminded, as the mediaeval traveller was reminded by cathedrals and monasteries, that he can leave his own country without passing into a wholly strange and separate world.

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INDUSTRIAL SCHOOL (in Great Britain) a school for the education and vocational training of neglected or delinquent children, under 14 and generally under 12 years of age when they are sent there by a court. A child may be committed to an industrial school for such period as the court thinks proper, but not beyond the age of 16. The word was formerly used in the United States in the same sense, but has died out of late. *See* also REFORMATORY SCHOOLS.

INDUSTRIAL TRANSFERENCE. In the normal course of industrial development the decline of particular industries (or, as has more frequently happened, of particular crafts) occurs gradually, and the adjustment of the personnel of the trade or craft to its reduced demand for labour accomplishes itself, without mass distress, through such natural processes as the retirement or death of its ageing workers, the reluctance of youths to enter a declining trade where working conditions are bad and prospects worse, and the continuous voluntary exodus from the industry of persons of all ages attracted by the better conditions prevailing and prospects offered in other industries in the neighbourhood or, maybe, in another part of the country, or of the world. This organic readjustment has not always taken place in such rapid and thorough fashion as to provide against any and all cases of individuals or communities being left stranded by the receding of their craft, but for at least a century and a half prior to the close of the World War the development of trade, commerce and industry was such as to create an absorptive power which in good time drew sufficient surplus labour from the declining industries or areas to reduce the position there to locally manageable proportions. After the armistice, however, British industry found itself in a position in which the decline of certain industries from their pre-war or swollen post-war dimensions was so rapid, and the expansion of other industries needing increased numbers of workpeople so halting, that large numbers of individuals skilled in particular crafts, and large blocks of the industrial population located in depressed areas, were left for several years in a chronic state of under-employment for which the internal readjustment of the industrial organism provided no escape. It was the coal, iron and steel, engineering, shipbuilding, and, later, the cotton and woollen and some other staple industries which were found, as the post-war wave of prosperity subsided, to have workers in excess of their capacity for employment.

On the other hand certain industries and certain areas of Great Britain were enjoying an expansion and activity comparable with that of any good pre-war year. The south-eastern half of the kingdom was much more prosperous than the north-western half. There were industries—such as those in the chemical group, some branches of the textile trade, the clothing trade, the printing trades, etc., whose rate for unemployment was round about 5 per cent. and in some cases as low as 3 per cent. There were whole counties in which the rate of unemployment was less than 3 per cent. Experience over the previous few years had shown that surplus workers in the depressed areas and industries could, given favourable opportunity, find work in the more thriving areas and it seemed probable that with encouragement, guidance and assistance the rate of this movement could be increased. But the employment exchange system was not cut out to move large groups of workpeople with their families from one part of the kingdom to another. One of the difficulties in the way of the transference of long-unemployed workers was the petty debt to tradesmen, and perhaps to the local authorities, incurred by the family whose head was unemployed; another was the scarcity of houses, especially in the parts where employment was brisk. In these circumstances the Government announced on Jan. 6, 1928 the estab-

lishment of an Industrial Transference Board "for the purpose of facilitating the transfer of workers, and in particular of miners, for whom opportunities of employment in their own district or occupation are no longer available."

See House of Commons Official Report Dec. 7, 1927. (J. H.)

INDUSTRIAL WELFARE AND MEDICINE, a term used in Great Britain to embrace not only the activities of industrial medical services but the control of environment and working conditions, the study of the effects of poisons and other occupational health hazards and the investigation of the mortality and morbidity experience of occupational groups. In the United States the work is called industrial hygiene. The subject is treated here in two sections: A. *Great Britain* and B. *The United States.*

GREAT BRITAIN

Industrial Welfare.—The movement, which was only embryonic before the World War, received great impetus in Great Britain from the recommendations of the Health of Munition Workers' Committee. The work includes needs within and outside the factory. Within the factory it covers the selection of workers for engagement; supervision of general behaviour; of progress and apprenticeship; of transfer and disposal of workers; of general cleanliness, ventilation and temperature; of canteens; of ambulances, rest-rooms and first-aid; of cloak-rooms, sanitary conveniences and of overalls. Outside the factory it covers housing accommodation, transit facilities, sick visiting, recreation and education. The keeping and studying of personal records of earnings, sickness and accidents is required. Welfare committees composed of workers are found invaluable to the activities of welfare superintendents.

The Home Office obtained powers under the Police, Factories, etc. Act 1916, enabling the Secretary of State by order to require occupiers of factories to make reasonable provisions relating to "arrangements for preparing or heating and taking meals; the supply of drinking water; the supply of protective clothing; ambulance and first-aid arrangements; the supply and use of seats in workrooms; facilities for washing; accommodation for clothing; arrangements for supervision of workers." Under these powers more than 14 orders had been made by the beginning of 1928 concerned with the special needs of different industries. At the same time a series of valuable pamphlets have been issued to set forth how the requirements of the orders can be complied with. Action on these lines continues; but already some matters have become of general application, thus drinking water must now be supplied in all factories, while the provision of first-aid has become generally compulsory under the Workmen's Compensation Act 1923.

Other activities which may be called "voluntary" welfare include housing efforts, recreation grounds, institutes, educational schemes, nurses and sick visiting, canteens and dental clinics at factories; all provide examples of extension of factory welfare without legal compulsion.

In 1872 the Metalliferous Mines Regulation Act called for accommodation for persons employed in metalliferous mines to dry conveniently and change their clothes. In 1910 the Mines Accidents (Rescue and Aid) Act gave power to make orders relating to: (*a*) The supply and maintenance of appliances for use in rescue work, and the formation and training of rescue brigades; (*b*) The supply and maintenance of ambulance appliances and the training of men in ambulance work.

The Coal Mines Act of 1911 contained, too, an important clause providing for accommodation and facilities for taking baths and drying clothes where the majority of workmen employed in a mine desire such. Unfortunately this clause was a dead letter except at some half-dozen collieries. But under the Mining Industry Act 1920, welfare work for miners received a great impetus. This Act provides a fund, derived from a levy of 1d. a ton on the output of each mine every year, to be applied for purposes connected with social well-being, recreation and conditions of living of workers, and with mining education and research.

The fund amounts to about £1,000,000 a year; its allocation is directed by an independent central committee on which both miners and colliery owners are represented. Four-fifths of the contributions coming from each coal-field must be spent within that field: the remaining one-fifth of the fund is devoted to welfare matters of mutual interest to the whole industry, such as the promotion of research into safety and health, and the provision of higher education for miners and their families. Expenditure from the fund is now year by year keeping pace with contributions. The Act of 1920 was due to expire in 1925, but the success achieved by the activities thus instigated led to prolongation of the life of the levy to the fund for a further period of five years. The total credits of the fund on Dec. 31, 1928, amounted to £7,883,105.

The provision of pithead baths has been insured by part III. of the Mining Industry Act 1926, which placed a levy on royalties, "the royalties welfare levy." The sum so raised is made over to the central Welfare committee to be devoted to the provision of pithead baths.

The central committee consults with district committees concerning the amount and purposes of grants in each district. The activities of the fund (with the one exception of allocations for pithead baths) deal with needs *outside* working hours; while progress in factory welfare made under statutory orders is extending with regard to needs *within* working hours. The contrast is sharp.

In the case of factories voluntary effort is forwarding outside welfare schemes; but in the mines no similar efforts are taking place with regard to such needed inside welfare as the provision of drinking water, improved lighting, or pithead kitchens.

The procedure followed in these two lines of advance is also in contrast. Factory welfare proceeds through statutory orders, compliance with which can be enforced; while mining welfare consists of activities, originated and pursued by the mining community, but financed through a statutory levy.

Industrial Fatigue.—The maintenance of health, especially that of women and young persons, has always been a driving force in the code of legislation controlling factories and mines, but its close study is practically a new science, known technically as the study of industrial fatigue. In Great Britain the study is pursued on general principles by the Industrial Fatigue Research board, an integral part of the Medical Research council. This board came into existence in 1918, owing to appreciation of a national need for intensive investigation to which attention was directed during the War by the activities of the Health of Munition Workers' Committee. Problems of interest to particular establishments are tackled by the National Institute of Industrial Psychology (*see* INDUSTRIAL PSYCHOLOGY). Much practical knowledge as to human activity, embodied in some 50 reports issued by the board, and in the Journal of the Institute, has been placed on a scientific basis.

Certain points may be succinctly stated: work is necessary to health, and health is needed for efficient work; even, steady work is better than spasmodic efforts; an optimum temperature, which should vary about a mean, exists for each process and is associated with best output, least sickness and fewest accidents; ventilation is to be read in the stimulating effect of air movement, rather than in change of air; rest periods during long spells of work, particularly if posture is changed, may increase output and lessen monotony; monotony in repetitive work, in temperature, in ventilation, in long spells of activity without pauses, and even in food supply, is disadvantageous; good factory canteens improve health and output; change of personnel; *i.e.*, labour turnover, reduces production and increases lost time due to sickness and accident; suitable overalls create pride in work and in person; vocational training adds joy to work; vocational selection on engagement increases output and reduces labour turnover; certain workers exhibit a predisposition to sustain accidents and should be employed where accident-risk is at a minimum; the tendency to sustain accidents is associated with a tendency to fall sick.

Industrial Medicine.—This deals with the prevention of sickness and the restoration to health of the disabled. Modern research has enabled important protective measures to be adopted, and established the tremendous importance of personal, as contrasted with mechanical, factors; they account for 80% of industrial acci-

dents. Further, just as in the case of sickness, the newly employed and those who are not quite well are disposed to sustain accidents. Action should, therefore, aim at interesting workers in accident prevention through the safety-first movement (*see* SAFETY FIRST), at reducing labour turnover, at maintaining health, and at eliminating the susceptible. Under the heading of accidents are here included sudden gassings; *e.g.*, from carbon monoxide, nitrous fumes and arseniuretted hydrogen, as well as caisson disease.

Information as to the occurrence of certain occupational diseases: *e.g.*, anthrax, toxic jaundice, chrome and epitheliomatous ulcerations, and poisoning from lead, mercury and arsenic, is obtained from notification sent by practitioners to the chief inspector of factories.

Compensation claims for diseases named in the schedule to the Workmen's Compensation Act 1906 give information concerning the occurrence of other diseases, of which certain troubles which particularly concern coal-miners are the most important; *i.e.*, nystagmus, and miners' beat knee, beat hand and beat elbow. Here recent investigation into causation is ahead of prevention; thus, the distressing trouble, nystagmus is associated with work for long periods in imperfectly lighted galleries of coal-mines. Owing, however, to the danger of explosions from mine-gases, the problem of improving the lighting underground is not a simple one (*see* COAL; MINING).

In contrast stands another compensatible eye trouble, cataract, which occurs among glass blowers and furnacemen exposed to glowing heat. Here means for prevention are known; they consist in wearing spectacles, the glass of which has been specially devised for cutting off heat rays, but difficulty arises in getting the workers to use them.

Further knowledge is drawn from occupational mortality records. They reveal any undue prevalence among a group or groups of workers of some particular cause of death; phthisis is the most notable example (*see* TUBERCULOSIS). Recent statistical investigation has shown that when this cause of death (*a*) is the only one in excess, its undue prevalence is due to the spread of infection among persons whose daily work brings them close together; *e.g.*, in tailoring, printing, and making boots and shoes; (*b*) is associated with excessive death-rates from other lung diseases, and occurs later in life than usual, as happens among sandstone masons, gold-miners, tin-miners, grinders of metal, some pottery workers and others, its excessive prevalence is due to inhaling fine dust of silica, which sets up a condition in the lungs known as silicosis, a condition which takes some years to develop and predisposes its victims to tuberculous infection; and (*c*) is associated with excessive death-rates from all other causes of death, and occurs rather earlier in life than usual, as happens among publicans and inn-servants, its undue prevalence is caused by excessive indulgence in alcohol.

Knowledge of causation in each case points the way to prevention: (*a*) Commodious, well ventilated and lighted premises, associated with medical examination to eliminate the tuberculous, will rid tailoring, printing and shoe-making from the scourge of phthisis. (*b*) Reduction to a minimum of risk from breathing silica dust must abolish silicosis; the problem now belongs to the technical engineer and is being solved in certain industries. The financial burden of compensation is promoting active attention to dust prevention and control. (*c*) Limitation of alcohol consumption, such as has been taking place in this country in recent years, and could be extended, has already reacted not only upon the occurrence of phthisis in industry, but also of ill health from other causes, including accidents.

Another disease to which mortality records have directed attention is occupational cancer (*see* CANCER). Workers who handle pitch, a distillation product of gas-tar, and others who mix pitch with coal-dust in the manufacture of briquettes, suffer from warts which appear on the exposed parts of the skin, and also on the scrotum. These warts show a special tendency to become epitheliomatous with the formation of "pitch" cancer. Shale-oil workers coming in contact with crude paraffin, a product obtained by distillation, similarly suffer from warts and "paraffin" cancer; but workers manipulating refined paraffin do not suffer. Chimney-sweeps have long been noted for their high death-rate from scrotal cancer which originates from exposure to soot, a distillation product of coal. Quite recently an equally high mortality from scrotal cancer has been revealed among mule-spinners in the cotton trade due to contact with lubricating oils, possibly obtained from shale. Cancer of the lips and buccal cavity is nearly confined to males who by smoking expose these parts to the distillation products of tobacco. The evidence here summarized suggests that certain products obtained by distilling vegetable substances can sensitize the skin to cancer.

Evidence from the dye industry suggests that the products in question may possibly be benzene compounds. Workers in this industry exposed to certain amino-benzene compounds, particularly benzidine and naphthylamine (compounds which, when they gain access to the body, are excreted by the kidneys), have been found to develop malignant tumours of the bladder.

Treatment during the early stages of illness and injuries sustained in occupation is not peculiar to industrial medicine, even though recent advances in orthopaedic surgery have been of great benefit to those manually employed. But in a few cases treatment is special to the disease; *e.g.*, the onset of caisson disease can be met by immediately resubmitting the victim to the high pressure atmosphere from which he has just too rapidly emerged; or, again, persons overcome by carbon monoxide gas can be best brought round by the new method of administering a mixture of oxygen and carbon dioxide through artificial respiration; while burns caused by acids or alkalis, which must be specially neutralized before ordinary treatment is applied, may be added to the list.

The convalescent stage on the contrary may be profoundly expedited by occupation, particularly where recovery is slow and tedious. The industrial convalescent tends either to return to work too soon before he is ready for full employment, when he may quickly break down again, or, by saving himself, develop bad habits; or to delay—particularly if he is receiving compensation—until he has lost skill, developed some permanent stiffness, or become neurasthenic. He needs, at an early stage, amusement to divert his thoughts; next, occupational therapy, in which work is performed for wages during limited hours, in order to occupy his mind and assist in restoring lost or weakened function; *e.g.*, a hand stiff after a wound; or lastly, vocational training for new work when he cannot return to his previous occupation.

At each stage industry can play its part, but with regard to occupational therapy and training it is the only available agency. "After-care" in workshops, and special settlements for those discharged from tuberculosis sanatoria is pointing the way, which is equally valuable for orthopaedic, mental and other cases. Occupational therapy and vocational training are rapidly coming to the front both in Great Britain and America.

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THE UNITED STATES

Though the specific occupational diseases are numerous, a relatively small part of the sickness of working persons is due to such ailments. Apart from such disabilities as those due to faulty posture and inadequate or defective illumination, most of the

possible ill effects of work and working environment obviously must be exerted upon the body or through entrance to the body by way of the skin, nose or mouth.

Dust, Fumes and Gases.—With little doubt, the most important single occupational health hazard is atmospheric pollution by toxic or irritant dusts, fumes and gases. Most of the industrial poisons are air borne and through inhalation reach the lungs, while certain ones are in part swallowed and thus exert their effects through the gastro-intestinal tract. Most ducts are made up of units of a wide range of sizes, from fragments readily discernible by the unaided eye, to microscopic particles measured in fractions of a micron. Probably one-half of the dust inhaled is exhaled; a large portion of the remainder is caught by the moist mucous membranes of the upper respiratory tract, the nose and throat. Some is trapped on the walls of the larger tubes leading to the lungs and much of this is driven back toward the throat and is eliminated with mucose secretion. Only the very small dust particles, those approximately 10 microns or less in diameter, can penetrate far into the lungs. Dusts made up of fine particles may not be readily visible. They can be present even in a damp atmosphere.

Not all dust is notably harmful, nor all harmful dusts equally dangerous. Certain dusts are injurious because they are definitely poisonous. Others cause a disease of the lungs known as pneumoconiosis. Generally speaking, inorganic dusts, as those of metals or minerals, do more damage than organic dusts, as vegetable or animal matter. Not infrequently, dusts are of mixed character, inorganic dust being mingled with organic, as for example, the dust of jute or flax mills where earth or sand (inorganic) may be present in considerable quantities mixed with vegetable (organic) particles.

By far the most important of the injurious dusts is silica (an oxide of silicon) which is the major constituent of sand, quartz and granite. It produces a form of pneumoconiosis known as silicosis, characterized by a growth of fibrous tissue in the lungs accompanied by gradual loss of normal lung function and usually, ultimately, is associated with the development of pulmonary tuberculosis. (*See* MINERS' PHTHISIS.)

Poisons cause perhaps the most clearly defined group of occupational diseases. The rapid progress of industrial chemistry has led to the introduction of many substances known to be toxic, while new processes are constantly being developed bringing, not infrequently, new hazards in the exposure of workmen to poisonous substances.

Lead is used in most paints, in floor coverings, in many sorts of glass, commonly in brass and in solder; in plumbing installations, in the storage batteries which furnish power or light for motor cars, railroads and aeroplanes, in the rubber of tires and in much of that used for other purposes, in modern high compression gasolene, in the type and plates from which books and newspapers are printed and in scores of other articles of common use. Inevitably, the men and women who produce, use or market many of the articles containing lead may be affected by this very toxic substance. Reports of deaths attributed to lead have declined relatively in recent years, but such reports do not accurately reflect the actual influence of lead poisoning. There is abundant evidence that lead reaching the lungs is more readily toxic than that ingested. Some individuals are extraordinarily susceptible to poisoning and when exposed for even a few days to considerable quantities of lead may be seriously affected. True acute poisoning is very rare. Most of the cases of chronic type recognized have been exposed to lead over a period of months or years. Death may be due directly to severe poisoning, but in most cases is in part attributable to other causes, with lead as a secondary factor. The disease admits of prevention and control.

It is quite impracticable to list all of the recognized industrial poisons, which number several hundred. The most important are lead and its derivatives, benzol and many of its derivatives and carbon monoxide. There are others scarcely less important, such as mercury, arsenic and hydrogen sulphide (*q.v.*).

Skin Affections form a very large and important group of occupational diseases involving a multitude of industries and processes. A list of skin irritants would be almost as long as that of the industrial poisons. Prominent, however, among the industrial dermatoses are the superficial cancers produced by coal tar, soot and a number of petroleum products (*see* DANGEROUS TRADES), chrome sores, a great variety of burns by powerful acids and alkalies, the dermatitis of candy workers and chocolate dippers, that of masons and plasterers and the folliculitis or infection of the hair follicles of the arms common among machinists. The causes of the many industrial skin diseases are so diverse, the conditions differ so greatly and so many simulate dermatoses of non-industrial origin that most cases call for the investigation and care of a dermatologist.

Ventilation.—Wholly apart from risks of atmospheric poisons, of increased or diminished atmospheric pressure and of extremes of temperature and humidity, good working conditions entail proper ventilation. The criteria of good ventilation are that air should be (1) pure rather than polluted by dust or other foreign matter, (2) cool rather than warm, (3) moist rather than dry and (4) moving rather than still.

In the United States work rooms tend to be too warm. A temperature of approximately 68° F is sufficiently high for persons engaged in sedentary or very light work and too high for those engaged in more active exertion. At 68° F the relative humidity for sedentary work should be about 45%.

Light.—A great part of the work men and women perform under modern conditions must be done in buildings dependent for light upon sources other than the sun. The aspects of industrial lighting which warrant particular consideration are its character, its adequacy and the location of the source in relation to the eyes of the worker.

Apart from the question of general or focal illumination of work, a discussion of light involves consideration of the hazard of such light rays as the ultra-violet rays and of the kindred rays known as Roentgen rays or X-rays and those emanating from radium. Ultra-violet rays given off in arc welding, in arc flashes on electric switchboards and from various other sources, may produce a very distressing dermatitis or ophthalmia, the latter a congestive reaction of the conjunctivae or lining membranes about the eye. Workers with X-rays and radium or with certain other radio-active substances may develop a severe dermatitis or even cancer of the skin. In recent years numbers of workers with radio-active earths have suffered injury or even death due to the destructive action of the gamma rays of radium upon the blood-forming organs and upon other tissues.

Industrial Medical Service.—The mutual interest of employer and employed in the maintenance of the health of workers has led to the establishment in the United States of hundreds, perhaps thousands, of industrial and mercantile health services, varying greatly in purpose, in degree of elaboration and in standards of professional service, but all contributing in some measure toward the furthering of the physical well being of the working men and women who utilize them. Many of the industrial medical activities found their origin in an effort to meet the need for furnishing the prompt and adequate medical care demanded of employers by the operation of workmen's compensation acts which most of the several State legislatures passed between 1912 and 1920. Many of the industrial clinics, dispensaries or plant hospitals continue to limit their activities largely to emergency surgery. There is, however, rapidly spreading a realization of the fact that sickness is more important as a cause of working incapacity than are accidents, that from five to ten days are lost from work on account of illness for one lost from injuries, and that economic self-interest, if not humanity, calls for intelligent consideration of the ill health of workers and of means for its prevention or remedy.

The most simple effort to meet the medical needs of industrial workers lies in the provision of the "first-aid kits" found in most industrial establishments throughout the country. From this elemental installation, plant medical services range far in complexity of organization. In many industrial dispensaries a trained, registered nurse is on duty the full working day, who usually works under the direction of a part-time or full-time physician.

Few full-time physicians are engaged in plants employing less than a thousand, but many such plants employ part-time physicians. In larger establishments a reasonable ratio for adequate health protection is one physician to every 2,000 employees and one nurse to every 1,000.

Where plant medical departments serve a large organization the variety of activities may include certain or all of the following: Physical examination of labour applicants and the subsequent periodic examination of employees; re-examination of individuals transferred from one department to another; emergency treatment of minor injuries and illnesses; diagnostic aid in involved and obscure clinical conditions with guidance in the seeking of further medical counsel and care and a well-trained and competent visiting nurse service.

In addition, there may be an eye clinic for the treatment of eye injuries and diseases as well as for refraction; dental clinics for the examination of the teeth of labour applicants and for the supervision of the dental hygiene of employees; psychiatric clinics for the study and guidance of cases of mental abnormality; physiotherapy units with facilities for the care of such cases as old fractures, burns, bruises, sprains and arthritis, by baking, massage or diathermy; posture clinics for the correction of gross postural defects; and nutrition clinics offering supplementary diet for cases of malnutrition or underweight.

A few establishments maintain sanatorium facilities for tuberculous employees, either through a private institution or through the support of beds or cottages in semi-public sanatoria. Others conduct rest houses or camps for the use of debilitated employees. A few railroads or isolated groups operate excellent private hospitals. More frequently, industrial organizations maintain in local hospitals beds or wards, for the care of injured employees. In most instances these various services are conducted at the cost of management; in others, the cost is shared by employees, perhaps through a mutual benefit association.

The prime purpose of these varied industrial medical activities is not to replace or supplant the personal physicians of employees, but rather to meet emergency needs without loss of working time, production and wages; to stimulate an intelligent interest in the maintenance of health and to offer guidance in the efforts of sick or defective individuals seeking competent medical care at prices they can afford to pay. Through the study of the clinical records of the all too small portion of plant medical departments which keep trustworthy and accurate records, there is coming to light knowledge of the nature and extent of sickness among the great portion of the population engaged in industries. Industrial morbidity data are of such great value as to justify almost alone the cost of plant medical service.

The Governmental Control of industrial and mercantile working conditions is not uniform throughout the States. In most of the larger industrial States, departments of labour or industrial commissions maintain inspection forces and issue regulations for the suppression of unhealthful conditions and the encouragement of safe practices in operation. Subsidiary or separate boards administer the workmen's compensation acts. But few State or territorial compensation laws assure compensation for any important number of cases of occupational disease. There is observable a very definite trend toward the inclusion of such diseases, and in a number of States, there are being developed better resources for guidance of industry in connection with the control of hazardous processes. A number of the larger municipal health departments have nominal organizations in the field of industrial hygiene. Generally speaking, their contribution is negligible beyond the realm of examination of food handlers. The U. S. Public Health Service, through its office of industrial hygiene, has for years made many notable contributions to the subject.

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INDUSTRIAL WORKERS OF THE WORLD, THE, commonly known as the I.W.W., a revolutionary labour union organization which played in the early 20th century a considerable part in American and world labour history. It was founded in July 1905 at Chicago, Ill., as a result of a conference of Socialists and trade union leaders, of whom the most outstanding were E. V. Debs (*q.v.*), William D. Haywood, Daniel DeLeon, W. E. Trautmann, Vincent St. John and the Rev. T. J. Hagerty, who provided the first organizational plan of the union (known by Samuel Gompers' derisive nickname of "Father Hagerty's wheel of fortune"). All workers of every trade were to be accepted by the union which was, and is, subdivided into industrial sections (29 in number in 1928), craft unions not being allowed. The basis of the organization was explained in its well-known preamble. "The working class and the employing class have nothing in common. . . . Between these two classes a struggle must go on until the workers of the world organize as a class, take possession of the earth and the machinery of production and abolish the wage system." (This phrasing was adopted in 1908, a previous reference to political action being deleted, as a result of a struggle in which the syndicalist element thrust out the followers of DeLeon.) The organization was bitterly opposed to the American Federation of Labor (*q.v.*) on the ground of its alleged supineness in defending its members, its toleration of inter-union craft quarrels, and the anti-revolutionary attitude of its president, Samuel Gompers (*q.v.*).

Its chief strength, originally, lay in the Western Federation of Miners, which withdrew in 1907 on the unseating by the I.W.W. of President Sherman, its nominee. Since that time its strength has varied very greatly; the figures of paid-up membership in 1906 were 60,000 and in 1919 35,000, but these figures give no reliable indication of its strength. Since the defection of the miners, the I.W.W. membership has become more and more predominant among the nomadic workers (partly foreign born) such as lumber-men, long-shoremen and "hoboes," for whom the American Federation of Labor made no provision. This class of worker rarely pays dues, except on the occasion of first taking out an I.W.W. ticket. Of the innumerable strikes directed by the I.W.W. the Lawrence, Mass., strike of 1912 was the most famous and first brought the organization into prominence. Some 30,000 textile operatives were involved and for the first time large bodies of non-English-speaking workers were led together to ultimate victory; their spirits being kept up partly by the use of the I.W.W. "red book" songs, of a coarse but vigorous character, which have since travelled across the world. In addition, many "free speech fights" were undertaken, *e.g.,* in 1909 at Missoula, Mont., Spokane, Wash., Newcastle, Pa., and later more important struggles at Paterson, N.J., Aberdeen, S.D., Old Forge, Pa., San Pedro, Calif., etc. These were mostly cases in which the municipalities objected to I.W.W. propaganda and arrested the "wobbly" (the slang name for I.W.W.) speakers, the I.W.W. replying by providing a continuous stream of speakers "until the jails burst." Over 5,000 "wobblies" have been in prison. Elsewhere, especially in the western States, the history of the I.W.W. has been violent and sanguinary. The facts which led, for example, to the shooting of the organizer and poet, Joe Hill, in Utah, are greatly disputed; the murder of organizer Frank Little in Butte, Mont., has been dealt with in a Federal enquiry. (*See* the *Sixth Annual Report* of the Secretary of Labor.) In some of the States attempts were made to drive the I.W.W. out of existence.

After the World War, the general attack on "red" organizations, together with a quarrel with the Communist International (*q.v.*) gravely weakened the I.W.W. A large number of States have passed "criminal syndicalism" laws, mostly held constitutional on appeal to the Supreme Court, with the object of suppressing the I.W.W. altogether. A mass trial of over 100 prominent I.W.W. members at Chicago in Aug. 1918 resulted in a number of heavy sentences. The less important position of the I.W.W. since the War may be due to the cutting off by the immigration laws of the influx of unskilled labour which formed its most hopeful field. But it should be added that the I.W.W. claims to have had its highest recorded membership in 1923.

Australia.—I.W.W. locals exist, or have existed in nearly every industrial country, especially in the ports. In Great Britain they have appeared in London, Liverpool and Glasgow. But they have only achieved importance, outside America, in Australia between 1911, when the first local (Adelaide) was chartered from Chicago, and 1917–18, when the organization faded away.

See P. F. Brissenden, *History of the I.W.W.*, Columbia university Studies lxxxiii. (1920) with bibl.; V. G. Childe, *How Labour Governs in Australia*, ch. x.–xi. (1923). *See* also SYNDICALISM, SABOTAGE and DIRECT ACTION.

INDUSTRY, the quality of steady application to work, diligence; hence employment in some particular form of productive work, especially of manufacture; or a particular class of productive work itself, a trade or manufacture.

INDUSTRY AND TRADE, WAR CONTROL OF. Government control of industry has appeared sporadically in every important war of modern times, under the form of commandeering of supplies and means of transportation and production. It has also occasionally assumed the form of price-fixing. But, except in the rare cases of cities under siege, governmental control never assumed the form of a general system, dominating the whole economical life of a belligerent nation, before the World War of 1914–18. In that war the general control of industry was inaugurated promptly by Germany, after a considerable delay by France and England, and, after many half-way measures that proved ineffective, by the United States in the last year of the war. In the case of every belligerent nation the extension of control was a gradual process, which had by no means reached its logical limits when hostilities came to an end.

The conditions that forced control of industry upon the several warring nations were:—

1. Universal conscription, with its tendency to disorganize all industries, essential and unessential alike, by the withdrawal of the most energetic labourers and "key-men" in the technical and administrative staffs;
2. The vast consumption of material and equipment under the technical conditions of modern warfare;
3. The insatiate demand for financial resources for maintaining and supplying the huge armies in the field and the services incidental to them;
4. The maintenance of the health and spirit of the working civil population through the provision of the necessities of life at practicable prices.

While the conversion of national industry to the uses of war was nowhere complete, it is a conservative estimate that in all the chief belligerent states from three-fourths to four-fifths of all industry was by the time of the armistice converted to the meeting of war requirements, direct or indirect.

I. GREAT BRITAIN

The system of state control of trade and industry in Great Britain, which played so vital a part in the successful issue of the war, was not planned as a comprehensive whole by anything in the nature of an economic general staff, but was built up gradually in a number of different departments as a series of partial adjustments to particular needs and emergencies. In many ways it was characteristic of British temperament. Modern Germany had shown a capacity for large-scale organization of trade and industry which was foreign to the British tradition. Great Britain was, and still is, the home of an obstinate individualism and independence of character which resisted bureaucratic regulation and made even co-operation in trade and industry difficult. France too had a traditional way of thinking based on first principles and clear-cut definition of rights and duties which was equally alien to British psychology. The Englishman distrusted logic and definitions, and prided himself on being able to "muddle through." His system of government was based on an unwritten constitution, a genius for compromise and a profound distrust of State interference.

With such a background State control of trade and industry on the scale it eventually reached would have been unthinkable before the war and certainly formed no part of the Government's plan of operations in the event of a European war. The only measure of State intervention which had been carefully worked out before the war was the taking over of the railways. This was carried out in August, 1914, and throughout the war the railways of the country were run by a Railway Executive on behalf of and for the account of the State. The British "War Book" contained no other plans for State intervention in trade and industry.

Throughout the war there were two slogans which must have been repeated many hundreds of times, in scores of different contexts—"Every private interest must be subordinated to the successful prosecution of the war" and "There must be as little interference as possible with the normal channels of trade." The real problem was to determine the exact degree of interference with normal trade channels which was necessary for the successful prosecution of the war. On this question opinions varied widely at different times and among different persons. In the abstract there was an almost universal bias against State interference. Manufacturers and traders naturally believed in freedom of trade, the rights of property, and the merits of *laisser-faire;* they had a deep-rooted dislike for the restrictions on individual liberty and private enterprise which State Socialism implied. By a process rationalisation this instinctive antipathy gave rise to the axiom that State management was necessarily inefficient and that Government interference would therefore only make matters worse. If this were true, it followed that to substitute an inefficient for an efficient system of industrial organisation just when the nation was fighting for its existence, would be suicidal folly. Nor was the attitude of ministers and departmental officials very different. They distrusted the power of the Government to intervene successfully in matters on which there was no past experience to serve as a guide.

During the early stages of the war "business as usual" was the accepted doctrine. During the first few months the main problem was to combat unemployment and get the wheels of industry restarted in the normal channels, or, if that was impossible owing to the blockade of Central Europe, to open new markets in other parts of the world. In the absence of any plan of industrial mobilization for war, this was the only possible policy to pursue. A prosperous state of trade, regular employment at good wages and high profits for the revenue to tax and the Treasury to borrow, were regarded with good reason as essential conditions for the successful prosecution of the war.

First Steps in State Control.—Three large measures of State intervention, however, were introduced in the first month of the war, the first of which—the taking over of the railways—has already been mentioned. The second was in the sphere of finance. The Government suspended the Bank Act, introduced a State paper currency and placed the credit of the nation behind approved commercial bills payable by enemy and other debtors, who were unable to meet their liabilities. These two measures saved the money market from an acute crisis; but at the same time opened the door for that expansion of currency and bank credit under Government auspices, which more than anything else was responsible for the rise of prices throughout the war. So far as State control was designed to combat high prices, it was an indirect consequence of the system of inflation by which the war was to a considerable extent financed. As Lord Rhondda said in Nov. 1917 (Parl. Debates, House of Lords, vol. XXVI., cd. 1077, 1917):—"The real controller of prices is not the Food Controller but the Treasury. The principal factor in the rise of prices is the expansion of currency arising from inflation of credit and the issue of large amounts of paper money." Lastly the Government set up the Royal Commission on Sugar Supply to monopolise the purchase and import of sugar on Government account. The outbreak of war cut off all supplies from Central Europe, which in 1913 sent over 75% of the sugar imported into Great Britain. Large purchases were made by the Government in other markets within the first three weeks of the war, and from that time onwards the import and distribution of sugar was carried on under direct State control. (*See* FOOD, MINISTRY OF.)

The next steps in control arose as a result of the difficulties experienced in obtaining military supplies for the British and Allied armies. In July 1914 the Army Contracts Department of the War Office consisted of 56 officials and clerks. A staff of not more

than 20 was sufficient to handle the business of purchasing munitions and explosives under the system of competitive tendering then in vogue. (In Nov. 1918, the staff employed by the Ministry of Munitions for the administration of complete control numbered 65,142.) By Oct. 1914, the centralised buying machinery of the War Office, which had functioned smoothly and efficiently before the war, as a result of reforms introduced after the Crimean and South African wars, was becoming paralysed. In Nov. 1914, the new director of army contracts, U. F. Wintour C.B., C.M.G., presented a report to the army council which contained the following sentences, the truth of which was not generally realised for many months: "The war is a war of organisation, in which the raising of men is one very important item. It is equally important that they should be equipped, clothed, fed and provided with guns, arms and ammunition. For the provision of these necessaries, industry, and industry alone, has to be relied upon, and the rapidity and effectiveness with which industry can be organised to meet the emergency cannot but have an enormous influence upon the issue of the struggle." A proposal was made in Oct. 1914, that the Government should take over the big armament firms as they had already taken over the railways, but the authorities at that time shrank from assuming such a responsibility and preferred to rely on private enterprise and the law of supply and demand to produce an adequate flow of munitions. In June 1915, with the establishment of the Ministry of Munitions, the theory that industry could be left to adapt itself of its own accord to war needs was abandoned. National organisation and detailed control of supplies, prices and methods of production were introduced. National factories were built; raw materials of all kinds required for making munitions were imported on Government account and distributed at fixed prices; and manufacturers, instead of being left to produce munitions or not as they thought fit at prices determined by their own sense of propriety, were now compelled to produce them at prices based on cost and if necessary were instructed how to do it. (*See* MUNITIONS, MINISTRY OF.)

The Path to General Control.—By requisitioning practically the whole output of the engineering industry and making use of nearly all the iron and steel obtainable for making munitions, the Ministry of Munitions virtually suppressed private trade and ignored civilian needs. The Army Contracts Department of the War Office on the other hand, which continued to purchase food, textiles, leather goods and other miscellaneous articles for the Army, only needed a proportion, though a growing proportion, of the national supplies. Civilian requirements had to be met, and this introduced a competing demand which had somehow to be reconciled with military necessities. It was this that led eventually to the extension of State control to cover the supply and distribution of many of the necessaries of life for the whole population.

During the first period, which may roughly be defined as the first twelve months of the war, the problem was primarily that of obtaining supplies for the forces regardless of price. This in itself was by no means a simple problem. It soon became evident that supplies were lacking, first, because only those familiar with Army requirements were invited to tender, or if invited were able or willing to do so; secondly, because manufacturers were either full up with private orders, or, with large private orders on their books, were unable to offer their whole output; and thirdly, because in certain items the requirements outran the productive capacity of the industry to meet them. In nearly every case delays inherent in the purchasing machinery of the War Office aggravated the difficulties; and the confusion and dislocation caused by speculation, by competitive buying on the part of local commands and Allied delegates and by uncertainties about supplies of raw material, the need of the Army for men and the probable requirements of the War Office, rendered some more systematic form of organisation essential, if the Government was to count on being able to obtain what it wanted. This stage was marked by negotiations with representative associations or committees able to speak on behalf of a whole industry, and the substitution of collective agreements covering a long period and a wide area of production for the previous system of piece-meal demands, individual tenders, and frenzied speculation.

The next stage in the problem was marked by the growing importance attached to the question of price. Hitherto with minor exceptions the prices paid by the Government had been those that any large buyer would have had to pay; they were determined by market forces and on the whole were neither more nor less than private individuals had to pay for similar goods. As a result, however, of Parliamentary criticism of Government extravagance, but without any express sanction from Parliament (which at that time was even more opposed to measures of State interference than the Government itself), attempts were made by voluntary agreement to base prices on cost of production and a reasonable profit. Later this principle, known as the "costings system," was embodied in regulations 7 and 2b of the Defence of the Realm Regulations, and it became the accepted doctrine that Government Departments had not merely the right, but the duty, to purchase supplies at prices bearing no necessary relation to market prices. The culminating point came when the right to fix maximum prices was laid down first by an administrative extension of the right to licence dealings, and finally by explicit mention in regulations 2b and 2f. Thus the price problem was solved in theory and in law (at least for the duration of the war) by giving the Government the power to fix its own prices. Before the end of the second year of the war this right had been successfully established, having been applied by the Ministry of Munitions to certain metals as early as Sept. 1915 and by the War Office to the whole of the domestic wool clip in June 1916.

During the second year the twin problem of supplies and prices began to develop more general implications and to cover an ever-widening range of commodities and processes. The corollary of limited State interference with market forces was more State interference; control and centralized purchase had to be extended from the finished article to the raw material. This introduced further problems. The Government had to devise the best methods, varying greatly in different trades, for buying raw materials in foreign markets or for controlling their purchase by traders. The control of purchase, import and shipment of raw materials was adopted by the War Office in March 1916, for Russian flax, in May 1916 for kips, and in August 1916 for jute. In the meantime the decision to requisition the domestic wool clip in June 1916 raised a new set of problems relating to the treatment of the farmer and the purchase of agricultural produce at fixed prices from hundreds of thousands of individual growers. The State had now to become wholesale collecting merchant as well as wholesale distributing merchant.

Control of Materials, Industry and Man-power, 1917.—In the third year of the war a change of Government occurred, which reflected and emphasized the growing changes that were taking place in the economic situation. The shortage first of finance, and then of tonnage, became increasingly stringent towards the end of 1916 and the beginning of 1917, and signs of actual shortage were becoming pronounced in certain essential raw materials. All three reasons added weight to the general considerations which by that time were beginning to favour control of raw materials. The War Office accordingly carried through negotiations for the purchase of the whole of the Australian and New Zealand wool clips. The vast scale of the Government's operations in the woollen and worsted industry now brought to the fore two problems which had not hitherto needed any special attention: the maintenance of the export trade and the provision of necessary supplies for the civilian population. The first was of importance owing to the difficulties of the financial situation and the need of obtaining foreign currency to pay for essential imports. But after the United States had joined the Allies foreign exchange difficulties ceased to be so pressing a problem, and the shortage of tonnage and the need for conserving raw materials for military and essential civilian needs, rendered the maintenance of the export trade of secondary importance in the system of war economy. The provision of supplies for the civilian population, however, rapidly became from Jan., 1917, onwards one of the most difficult and complex problems of the whole war organization, and it was in the establishment of the Ministry of Food and the introduction of standard clothing and

TABLE I. *National Organization of War Control*
War Cabinet, War Priorities Committee

1. Ministry of Munitions	2. Ministry of Food	3. Ministry of Shipping	4. War Office	5. Board of Trade
Iron & Steel Industry Non-ferrous Metals Machinery Explosives & Chemicals, Fertilisers Mechanical Transport Glass Manufactures Mineral Oil	Wheat Commission (cereals, pulse, etc.) Sugar Commission Meat & Animal Fats Dairy Produce Oils & Fats Industry (margarine, soap, feeding stuffs, etc. Fruit & Vegetables Tea & Coffee	Shipping Industry Shipbuilding	Woollen & Worsted Industry Flax, Jute & Hemp Industries Leather Industry Boots & Shoes	Coal Industry Timber Supply Cotton Industry Tobacco & Matches Paper & Pulp Supplies Petroleum Executive

6. Railway Executive
7. Port and Transit Executive
8. Canal Control Committee
9. Liquor Traffic Control Board
10. War Trade Department (Import & Export Regulations)
11. Food Production Department
12. Director General of National Service

boot schemes, with the object of supplying the necessaries of life for civilians and ensuring their fair distribution at controlled prices, that Government control during the war approached nearest to the programme of State Socialism. (*See* FOOD, MINISTRY OF.) The year 1917 also marked the most critical point in the man-power problem. A director-general of national service was appointed to facilitate the release of men for the Army, to restrict employment in non-essential trades and industries, and to secure the transfer of labour where it was most required. Finally, towards the end of 1917, the necessity of rendering greater assistance to the Allies both in tonnage and supplies led to the imposition of further restrictions on civilian consumption, to the establishment of a common programme of imports for all the Allies, and to the gradual recognition of the principle of equality of sacrifice and the pooling of resources. (*See* ALLIED MARITIME TRANSPORT COUNCIL.)

Control by 1918.—By the middle of 1918 the national organization of war control had reached approximately its final stage. There was virtually no trade or industry which was not subject to control in some form or other. The Ministry of Munitions and the Ministry of Food between them controlled 70 per cent. of the country's imported supplies and followed up control of import by control of price, distribution and manufacture. The Ministry of Munitions covered the iron and steel industry, the non-ferrous metals industry, explosives and chemicals, machinery, mineral oils, glass manufacture and mechanical transport. The Ministry of Food through the Wheat commission, the Sugar commission and its supply departments was responsible for importing and distributing cereals, sugar, meat, dairy produce, vegetable oils, fish, fruit, tea and coffee and controlled the price and distribution of most home-produced foodstuffs. The Raw Materials department of the War Office controlled the woollen and worsted industry, the leather industry, boot and shoe manufacture, and the flax, hemp and jute industries. Under the Board of Trade were ranged the Coal Controller, the Railway Executive, the Port and Transit Executive Committee, the Canal Control Committee, the Cotton Control Board and the import of paper and pulp. The Ministry of Shipping controlled shipbuilding, the shipping industry and the allocation of tonnage, and through its programme committees and the Allied Maritime Transport Council acted as a co-ordinating body for all importing departments. The War Trade Department issued import and export licenses on the advice of the appropriate Departments for such foreign trade as still remained in private hands. The Liquor Traffic Control Board, the Food Production Department and the Director General of National Service dealt with the remaining field of home production—the last-named by restricting employment in non-essential industries. Even such industries as piano-making came under war control and found themselves precluded from obtaining the labour and material they required. One of the last conferences on control held at the Board of Trade in Oct. 1918, was to decide whether the responsibility for controlling the manufacture, price and distribution of candles should be entrusted to the Tobacco and Matches Control Board or to the Oils and Fats Department of the Ministry of Food, which was already controlling soap.

A glance at the accompanying chart illustrates the immense field over which control was exercised and the large number of departments concerned in its administration. The principle of piecemeal growth rather than logical planning favoured initiative and elasticity, but raised problems of overlapping and lack of co-ordination which had to be met by inter-departmental conferences and in the last resort by the intervention of the Cabinet. To deal with questions of priority in supply of labour and materials the Cabinet appointed in 1917 a War Priorities Committee, which in 1918 had as many as seventeen sub-committees.

The system of national organization thus built up rested in the last resort on the quite simple consideration that to the extent to which labour and capital were not engaged in essential war services, the nation's war effort was being weakened. In other words the political economy of war consists in the economical direction of the nation's resources towards the greatest possible efficiency in war. This involves (1) economy of man-power, to release men for the army and supply labour for essential services; (2) economy of finance, to prevent wasteful private expenditure and enable the nation to purchase supplies from abroad; (3) economy of transport, or the avoidance of all unessential movement of goods and the reduction of land and sea transport to the minimum necessary; (4) economy of production, or the centralized planning of productive activity in the right order of priority to meet essential requirements and with the minimum of waste and duplication of effort; and (5) economy of consumption, or the rationing and limitation of current consumption of food and necessaries, with the prohibition of the manufacture and sale of luxury articles.

The above principles were never of course completely realized in practice, but they all nevertheless influenced the policy in some sphere or other in varying degrees and with varying success. Their literal application on a universal scale would have been politically and psychologically impossible. War control appears to violate human instincts and human traditions even more than the institution of war itself; and the military effort of a nation at war is seen to depend not merely on the strength of its armed forces but on the extent to which the civilian population will submit to irksome restrictions and interference in the normal routine of everyday life. (E. M. H. L.)

The Future of Control.—The essence of war control of trade and industry is the replacement of private enterprise by collective organization. Control is clearly necessary in war time; but inasmuch as the conditions of war are wholly unlike those of peace, it is said that the experience of State control during the war gives us no guidance on the vexed question of the degree of State intervention which may be desirable in peace. This statement has a large measure of truth, but the question merits some further examination.

In the first place it is evident that if the League of Nations

breaks down and the Great Powers were to engage in another world war, State control on a drastic and comprehensive scale would be introduced in each country. The organization would probably start about where it left off in the last war; and if the world's economic resources proved able to stand the strain of a prolonged struggle, the final stage would be a sort of military communism compared with which the existing system in Russia would appear a very paradise of liberty. Private property would cease to exist; freedom of speech, freedom of thought and freedom of movement would be abolished; the whole population would be conscripted and not only their food but their incomes would be rationed down to the minimum necessary to support life. The public and private resources of the community would be wholly devoted to the prosecution of the war and the privileges and amenities now enjoyed by the few would be wiped out in the interests of social harmony. Personal freedom and private property are condemned by the exigencies of modern war. This is an aspect of the matter which has received too little attention and provides, perhaps, an additional reason for taking risks, and even making sacrifices, in the cause of peace, disarmament and the abolition of war.

But setting aside the possibility of another war, the experience of war control is held by some to have other lessons that may be applied in peace. Short of rationing, it is said, and the more extreme forms of arbitrary interference with personal freedom and private enterprise, there are still left many features of war organization which the State might well adopt in times of peace. Among these, for instance, might be the principle of State importation of primary foodstuffs and raw materials; the control of power and transport on national lines; the guarantee of fixed prices for certain staple agricultural products; and the compulsory amalgamation of competing firms into publicly supervised Cartels or Trusts. Such proposals would be included in the programme of some Socialist thinkers. At the other end of the scale would be the view of extreme individualists, who would not only oppose any extension of State control in peace but would maintain that the experience of State control during the war had demonstrated once more that State organization is necessarily inefficient and wasteful and in all circumstances inferior to private enterprise.

To those who preserve an open mind in this controversy and regard the question of the precise degree of State intervention or collective organization which is desirable in economic affairs as among the most important and difficult problems for the future to solve, two conclusions may suggest themselves: 1. that administration by public or semi-public bodies is not always and necessarily inefficient and inferior to private enterprise; 2. that collective organization of trade and industry is at its best where consumption or demand is fairly regular or can be foreseen with considerable accuracy. The field over which accurate measurement of future demand could be made during the war was enormously widened owing to the formulation of precise requirements by the military authorities and the limitations of tonnage. Nothing comparable to this stabilization of demand is conceivable in peace, except in a comparatively narrow field. In war "production for use" was possible because the "use" for which each product was required could be laid down with some confidence and the relative order of priority of different "uses" could be to some extent gauged. In peace, short of rationing or communism, production must be for a market, the essence of which is that it provides an automatic measure of the "usefulness" of products.

Even in the absence, however, of effective control over demand, it is still possible to regulate supply and thus indirectly influence consumption and prices. It is in this direction that post-war developments show a parallel to war control. Control of supply at source was the key which enabled the State in the interests of consumers to prevent prices rising. A similar technique can be applied to stabilize prices in the general interests of producers. In both cases the underlying principle is that within limits the play of economic forces can be modified and controlled by collective action. "Rationalization" of industry, "orderly" marketing, and "management" of credit can be regarded as lineal descendents of ideas which had their origin or at any rate received a large stimulus from war control.

The underlying issue on which the study of war control may throw light, is not so much the question whether the State, conceived of as public Departments, should actually conduct this or that trade or industry; but how far the State, conceived of as the guardian and trustee of the general welfare, should permit or encourage, or itself initiate the sort of large-scale co-operation and collective planning which is now being tried out as an alternative to the unrestricted play of economic forces. *Laissez faire* and unregulated competition may be even more wasteful of wealth and welfare than the operation of trusts and monopolies. It is perhaps the task of State control to minimise the evils and preserve what is best in both systems.

II. GERMANY

The first systematic action toward industrial control was taken by Germany. Upon the declaration of war by England it became at once evident that overseas supplies of raw materials, on which German industry had become largely dependent, would be cut off. The conservation of supplies on hand and their appropriation to essential uses was imperative. Within a fortnight, at the instance of Walter Rathenau, the Government, in co-operation with the cartels, had completed a rapid survey of the material resources of the nation and had worked out a policy, based partly on the requisition of materials and plant, but mainly on voluntary agreements, which offered a reasonable assurance of the continuous supply of military necessities on the scale then contemplated as adequate—erroneously, as the development of the war proved. Through the Reichsbank and the system of financial institutions dependent on it the necessary credit was supplied without stint to all industrial enterprises regarded as essential for war. The mobilization plans provided from the outset for the exemption of "key-men," technical and administrative, and the suppression of unessential industries provided labourers to take the place of those who had been called to the colours. On Dec. 2, 1916, the control of industrial resources was strengthened by a law instituting an industrial conscription of labour, applying to all males between 16 and 60. Auxiliary measures stiffened Government control over industrial enterprises. But to the end of the war the essential basis of industrial control was the quasi-voluntary agreement between the Government and the independent business man or group of business men, with a reserve power of compulsion in the Government's hands resting on the control of materials, credit and labour. This power of compulsion served to secure supplies, but did not restrict prices so strictly as to preclude large war profits, with attendant manifestations of popular discontent that grew more serious as the war dragged on.

III. FRANCE

In France the outbreak of the war was followed by a mobilization of men for military service which took the experts and "key-men" out of industry along with those who could be easily replaced. In consequence economic life was seriously dislocated. Unemployment reached extraordinary proportions. After the mobilization in Aug. 1914, the principal industries employed on the average only 60% of their normal personnel, and as late as Jan. 1915, 20% of the industrial working population was unemployed.

French industry, being highly individualistic in spirit, was far slower than that of Germany to adjust itself to war needs and war control. Gradually, however, a machinery of control was set up, of which the most effective part was the disposition of manpower. Committees of economic action composed of business men and engineers were organised in the several departments, to co-operate with the military and administrative authorities in supplying labour to agriculture and the essential industries.

Price control, so far as the munitions and supplies for the army were concerned, was effected through contracts, with sufficient reserve power over labour, raw materials, transportation and credit on the side of the Government to ensure reasonable terms. The prices of products for the use of the civil population were

subject to an informal and inadequate control through the departmental committee of laymen co-operating with the administrative authorities. In neither case was the control rigid enough to check a rise in prices, which produced much discontent among the workers, whose wages did not rise in equal proportion.

IV. UNITED STATES

The situation in America, upon that country's entry into the War, was in many respects peculiar. The Allies had already attained to a practical maximum of their industrial war effort, and the demands of war were still rapidly expanding. In this effort American industry had already come to play a conspicuous part. Allied war industry was drawing heavily on America for steel, copper, cotton and a large class of wholly or partly finished war materials. A powerful chain of war industries had been built up in America; labour and materials were rapidly advancing in price, and profits rose on a huge scale.

The American Government had to meet the problem of supplying the American armies with the materials of war without cutting off the supplies needed by the Allies. Control was essential not only to national but to international ends. Whereas in the early part of the War each belligerent had aimed primarily at effecting the most practicable distributions of resources between its own military and essential civil uses, the United States from the outset was confronted with the problem of making the best practicable distribution among the military, Allied and essential civil uses. American control was bound to envisage the entire system of needs of the Allied and Associated Powers.

The difficulties to be overcome in instituting control were, however, all but insurmountable. No close relation between government and industry had been developed, as in Germany; neither was the American administrative system adapted to prompt co-ordination. At the outbreak of the War the army and navy, each enjoying the power of commandeering, were in a position to enter the market for supplies, in competition with the Allied purchasing agencies, and there was no authority anywhere competent to allocate limited supplies in the order of importance of needs or to keep prices within bounds. A council of national defence, consisting of the secretaries of War, the Navy, the Interior, Agriculture, Commerce and Labour, with an advisory council and a widely ramifying organisation of committees, of executives and experts, had been created prior to the declaration of war. Out of this grew a multiplicity of organs of control, a War Industries Board, a railway control, a control of ocean tonnage, a food administration, a fuel administration and a War Trade Board. But there was no central co-ordinating principle except the war powers of the President, which in the nature of the case could be exercised only sporadically.

Co-ordinated control of industry came into existence on March 4, 1918, when the President, by a letter, reorganised the War Industries Board and specified its duties, constituting it in effect the administrative organ with power to apply the President's war powers over industry. Mr. Bernard M. Baruch was named by the President chairman of the board, with direct responsibility for its functioning, the other members of the board to act in an advisory capacity.

As finally reorganised the board controlled the exercise of the power of requisitioning. The army and navy, the railroad administration, the food and the fuel administrations, the War Trade Board, the Shipping Board, the War Finance Corporation, the Allied Purchasing Commission and other agencies dealing with industry, were required under the President's orders to co-operate with the War Industries Board. Thus it became possible to secure effective co-ordination in the whole field of industry. The board was in a position to control exports and imports, the movement of traffic over the railways and coastwise shipping; it was able to ration out materials, fuel, power, credit facilities to every business establishment in the country, to place a check upon every construction enterprise, public or private, except on proof of absolute necessity, to standardise production in the interest of economy, and in short to do everything necessary to ensure that the resources of the nation at war should be applied most effectively to the national needs, both of the people as a whole and of the military forces.

In America direct authority to fix prices was never granted by law nor established by executive order. The War Industries Board had, however, sufficient power to control prices in effect, and in case of need it actually controlled them. No specific theory of fair prices lay behind the board's control, but a conception of efficient economic organisation for war.

V. LABOUR AND PERMANENT ECONOMIC RESULTS

War control of industry in its highest phase of development amounted in effect to nationalisation of economic resources, labour, capital, material things. Men could not work at what they liked best or put their capital to the most lucrative uses or sell their materials and goods to the highest bidder. They were called on to subordinate their private interests to the national needs. The conception of public service became generalised, as it were, and although with the end of hostilities private motives were again given free play, the conception of service retained a large measure of its vitality, exerting a considerable influence upon action.

Labour, conceived of as "man-power," won recognition early in the history of war control as the most vital of the national resources. The proper provisioning of labour, care for the health of the labourer and his family, maintenance of proper housing standards and the like, assumed the rank of military necessities. Here too the influences set in motion in war carried over into times of peace.

One of the most striking results of war-time control was the revelation of the extent of economic waste in the conventional scheme of production. By co-ordination, by concentration of effort upon essentials and by curbing of excessive variety in forms through standardisation, it became possible for the United States, while maintaining 4,000,000 men under arms, to supply the civil needs of its population with no appreciable lowering of peace-time standards. While recognising that such extreme application to practical needs would in the long run be deadening to industry, most leaders of industry came out of the War convinced of the necessity of eliminating much waste that had gone unnoticed in the pre-War period.

War control of industry promptly fixed in the minds of those who participated in its decisions a conception of international economic interdependence. Control of the resources within a nation led straight to the necessity of controlling exports and imports, and this in turn led to an understanding of the need of permanent economic relations under which all nations might have equal access to the raw materials of the world. This remains a problem, the solution of which will tend to lessen war.

Another result of the war-time control was the more systematic survey of the potential resources, and their development where at all practicable. As a consequence, many resources are being developed in peace that formerly had been neglected. War control, with its compulsion to the use of substitutes, gave a greater freedom and elasticity to production, making a higher degree of efficiency possible in peace time. Incidentally to the control of industry, financial institutions, money and credit were everywhere subjected to control, with the result that new and more efficient methods of handling specie reserves and managing the flow of credit were devised and added to the peace times equipment.

Some countries, finding themselves cut off because of the War from their usual sources of manufactured articles, soon learned to make these things for themselves, with the result that when peace returned the old manufacturing countries found that a part of their former markets for manufactured articles had been permanently lost. And so with raw materials; new sources of supply and substitutes were found.

For the most part the achievements of war control were made possible only by the solidarity of feeling and concentration upon national purposes engendered by extreme national necessity. No conclusions as to national control in peace time can be deduced from them. But we have learned that government can co-operate with business to the advantage of both. What may be deduced

from the experience of the World War is that war under modern conditions demands drastic control of industry. War cannot now be conducted incidentally with business as usual. (B. M. B.)

(*See* also SHIPPING, MINISTRY OF; FOOD, MINISTRY OF; MUNITIONS, MINISTRY OF; ALLIED MARITIME TRANSPORT COUNCIL; SHIPPING CONTROL COMMITTEE; TONNAGE PRIORITY COMMITTEE; WHEAT COMMISSION, etc.)

BIBLIOGRAPHY.—There is no book adequately covering the whole field of War Control of Trade and Industry. Brief contemporary surveys are contained in the Reports of the War Cabinet for 1917 and 1918 (Cd. 9,005 and Cmd. 325). Different aspects of war control are dealt with in the volumes contained in the Economic and Social History of the World War (British Series), *e.g.*, J. A. Salter, *Allied Shipping Control;* E. M. H. Lloyd, *Experiments in State Control;* H. D. Henderson, *Cotton Control Board.* The unpublished and official *History of the Ministry of Munitions* may be consulted at the London School of Economics and some other libraries. The following contain accounts of control based on first-hand information:—Sir Leo Chiozza Money, *The Triumph of Nationalisation;* Rt. Hon. C. Addison, *Politics from Within, 1911–1918* and *Practical Socialism,* vol. I.; F. H. Coller, *A State Trading Adventure;* and F. H. Hatch, *The Iron and Steel Industry, 1914–1918;* J. L. Garvin, *Economic Foundations of Peace* and A. C. Pigou, *Political Economy of War. See* also Bernard M. Baruch, *American Industry in the War* (Report of War Industries Board, 1921); Paul Willard Garrett, *Government Control over Prices,* 1920; Grosvenor B. Clarkson, *Industrial Am. in the World War,* 1924.

INE, West Saxon king, of the line of Ceawlin, succeeded Ceadwalla in 688. In the earlier part of his reign he was at war with Kent, but peace was made in 694, when the men of Kent gave compensation for the death of Mul, brother of Ceadwalla, whom they had burned in 687. In 710 Ine fought in alliance with his kinsman Nun against Gerent of West Wales and was victorious, and in 715 he repulsed an attempted invasion by Ceolred, king of Mercia. In 721 Ine slew the rebel Cynewulf, and in 722 his queen Aethelburg destroyed Taunton, which was held by Eadbriht, another rebel. In 725 Ine fought with the South Saxons, who had previously been subject to him, and slew their leader Aldbryht. In 726 he resigned the crown and went to Rome where he died shortly afterwards, being succeeded by Aethelheard in Wessex. Ine is said to have built the minster at Glastonbury. He issued a written code of laws for Wessex, which is still preserved.

See B. Thorpe, *Antient Laws,* i., 2–25 (1840); R. Schmid, *Gesetze der Angelsachsen* (1832, 2nd ed. 1858); *Anglo-Saxon Chronicle,* ed. J. Earle (1865); C. Plummer (1865); Bede, *Hist. Eccl.* ed. C. Plummer, iv., 15, v. 7 (1896); F. Liebermann, *Gesetze der Angelsachsen* (1898).

INEBOLI, a town on the north coast of Asia Minor, 70 m. W. of Sinub (Sinope). Ineboli represents the ancient *Abonouteichos,* famous as the birthplace of the false prophet Alexander, who established there (2nd century A.D.) an oracle of the snake-God Glycon-Asclepius. Alexander obtained leave from the emperor Marcus Aurelius to change the name of the town to *Ionopolis,* whence the modern name is derived. (*See* ALEXANDER THE PAPHLAGONIAN.) It is the first place of importance touched at by vessels going eastwards from Constantinople. The roadstead is exposed and landing difficult. The exports are chiefly wool and mohair. The population (1927) was 47,538.

INEBRIETY, LAW OF. The legal relations to which inebriety gives rise are partly civil and partly criminal.

I. **Civil Capacity.**—The law of England as to the civil capacity of the drunkard is practically identified with and has passed through substantially the same stages of development as the law in regard to the civil capacity of a person suffering from mental disease (*see* INSANITY). Unless (*see* III. *inf.*) a modification is effected in his condition by the fact that he has been brought under some form of legal control, a man may, in spite of intoxication, enter into a valid marriage or make a valid will, or bind himself by a contract, if he is sober enough to know what he is doing, and no improper advantage of his condition is taken (*cf. Matthews* v. *Baxter,* 1873, L.R. 8 Ex. 132; *Imperial Loan Co.* v. *Stone,* 1892, 1 Q.B. 599). The law is the same in Scotland and in Ireland; and the Sale of Goods Act, 1893 (which applies to whole of Great Britain), provides that where necessaries are sold and delivered to a person who by reason of drunkenness is incompetent to contract, he must pay a reasonable price for them.

Under the Roman law, and under the Roman Dutch law as applied in South Africa, drunkenness, like insanity, appears to vitiate absolutely a contract made by a person under its influence (*Molyneux* v. *Natal Land and Colonization Co.,* 1905, A.C. 555).

In the United States, as in England, intoxication does not vitiate contractual capacity unless it is of such a degree as to prevent the person labouring under it from understanding the nature of the transaction pending (see *infra*). The same rule is by implication adopted in the Indian Contract Act (Act ix. of 1872, s. 12). In some legal systems, however, habitual drunkenness is a ground for divorce or judicial separation (Sweden, Law of April 27, 1810; France, Code Civil, art. 231, *Hirt* v. *Hirt,* Dalloz, 1898, pt. ii., p. 4, and n. 4).

II. **Criminal Responsibility.**—Under the law of England, until early in the 19th century, voluntary drunkenness was never an excuse for criminal misconduct. Sir Matthew Hale (P.C. 32) took a fairly moderate view, viz., that a person under the influence of this voluntarily contracted madness "shall have the same judgment as if he were in his right senses." But the law on the subject was ultimately defined by the House of Lords in 1920, in the case of *Director of Public Prosecutions* v. *Beard* (1920, A.C. 479), in which all the earlier decisions were reviewed in the following terms: (1) Insanity, whether produced by drunkenness or otherwise, is a defence to the crime charged; (2) evidence of drunkenness which renders the accused incapable of forming the specific intent essential to constitute the crime should be taken into consideration with the other facts proved in order to determine whether or not he had this intent; (3) evidence of drunkenness falling short of a proved incapacity in the accused to form the intent necessary to constitute the crime, and merely establishing that his mind was affected by drink so that he more readily gave way to such violent passion, does not rebut the presumption that a man intends the natural consequences of his acts; (4) the test of criminal responsibility is not the same in the case of drunkenness as in the case of insanity, and upon a plea of drunkenness where insanity is not pleaded, the jury should not be asked to consider whether, if the accused knew what he was doing, he also knew that he was doing wrong.

The law of Scotland accepts, if it does not go beyond, later developments of that of England in regard to criminal responsibility in drunkenness. Indian law on the point is similar to English (Indian Penal Code, Act. xlv. of 1860, ss. 85, 86; Mayne, *Crim. Law of India*). *See* also the Criminal Code of Queensland (No. 9 of 1899), art. 28; the Penal Code of Ceylon (No. 2 of 1883), art. 79; the Criminal Code of Grenada (No. 2 of 1897), art. 51; and the Criminal Code of St. Lucia (1920, s. 22): Under the French Penal Code (art. 64), *il n'y a ni crime, ni délit, lorsque le prévenu était en état de démence au temps de l'action.* According to the balance of authority (Dalloz, *Rép.* tit., Peine, ss. 402 *et seq.*) intoxication is not assimilated to insanity within the meaning of this article, but it may be and is taken account of by juries as an extenuating circumstance (Ortolan, *Droit Pénal* i. s. 323: Chauveau et Hélie i. s. 360). Nor is it assimilated to insanity in Germany (Clunet, 1883, p. 311); but in Germany, as in France, intoxication may apparently be an extenuating circumstance. Under the Italian Penal Code (arts. 46–49) intoxication—unless voluntarily induced so as to afford an excuse for crime—may exclude or modify responsibility. In the United States the prevalent legal doctrine is similar to the English legal view.

There remains the question how far drunkenness itself is a crime. Mere private intoxication is not, in England, indictable as an offence at common law; but in all civilized countries public drunkenness is punishable when it amounts to a breach of the peace (*see* LIQUOR LAWS) or contravention of public order; and modern legislation in many countries provides for deprivation of personal liberty for long periods in case of a frequent repetition of the offence. Reference may be made in this connection to the Inebriates Acts, 1898, 1899 and 1900 (*see* III. *inf.*), and also to similar legislation in the British colonies and in foreign legal systems (*e.g.,* Cape of Good Hope, No. 32 of 1896; Ceylon, Licensing Ordinance, 1891, ss. 23, 24, 29; New South Wales, Vagrants Punishment Act, 1866; Massachusetts, Acts of 1891, c. 427, 1893, cc. 414, 44: France, Law of Jan. 23, 1873, art. 6).

III. **State Action in Regard to Inebriety.**—This assumes a variety of forms. (*a*) Measures regulating the punishment of occasional or habitual drunkenness by fines or short terms of imprisonment. (*b*) Control in penal establishments for lengthened periods. (*c*) Laws prohibiting the sale of liquor to persons who are known inebriates: *e.g.*, in England (Licensing Act, 1902); Ontario (Rev. Stats., 1897, c. 245, ss. 124, 125); New South Wales (Liquor Act, 1898, ss. 52, 53); Cape of Good Hope (No. 28 of 1883, s. 89). (*d*) Laws regulating the appointment of some person or persons to act as guardian or guardians, or who may be endowed with legal powers over the person and estate of an inebriate. Thus in France (Code Civil, arts. 489 *et seq.*) and Germany (Civil Code, art. 6 [3]), an inebriate may be judicially interdicted if he is squandering his property and thereby exposing his family to future destitution. (*e*) Control for the purpose of reformation. Legislation of this character provides reformatory treatment: (1) for the inebriate who makes a voluntary application for admission; (2) by compulsory seclusion for the inebriate who refuses consent to treatment and yet manages to keep out of the reach of the law; (3) for the inebriate who is a police court recidivist or who has committed crime caused or contributed to by drink. The legislation of Great Britain (Inebriates Acts, 1879–1900) deals both with voluntary application and with the committal of criminal inebriates or of police court recidivists. A brief sketch of the English system must suffice.

The Inebriates Acts of 1879–1900 deal in the first place with non-criminal, and in the second place with criminal, habitual drunkards.

For the purposes of the acts the term "habitual drunkard" means "a person who, not being amenable to any jurisdiction in lunacy, is notwithstanding, by reason of habitual intemperate drinking of intoxicating liquor, at times dangerous to himself or herself, or incapable of managing himself or herself and his or her affairs," although when sober no such danger or incapacity exists (*Eaton* v. *Best*, 1909, 1, K.B. 632). A person would become amenable to the lunacy jurisdiction not only when habitual drunkenness made him a "lunatic" in the legal sense of the term, but where it created such a state of disease and consequential "mental infirmity" as to bring his case within s. 116 of the Lunacy Act, 1890, the effect of which is explained in the article INSANITY. Any "habitual drunkard" within the above definition may obtain admission to a "licensed retreat" on a written application to the licensee, stating the time (the maximum period is two years) that he undertakes to remain in the retreat. When an habitual drunkard has once been committed to a retreat, he must remain in the retreat for the time that he has fixed in his application, subject to certain statutory provisions similar to those prescribed as to leave of absence and discharge from mental homes; and he may be retaken and brought back to the retreat under a justice's warrant. The term of detention may be extended on its expiry, or an inebriate may be re-admitted on a fresh application, without any statutory declaration, and without the attesting justice being required to satisfy himself that the applicant is an habitual drunkard. Licensed retreats are subject to inspection by an inspector of retreats appointed by the home secretary, to whom he makes an annual report. There are also statutory provisions as to offences—(1) by licensees failing to comply with the requirements of the acts; (2) by persons ill-treating patients, or helping them to escape or unlawfully supplying them with intoxicating liquor; (3) by patients refusing to comply with the rules. The home secretary may (1) authorize the establishment of "State inebriate reformatories," to be paid for out of moneys provided by parliament; and (2) sanction "certified inebriates' reformatories" on the application of any borough or county council, or any person whatever, if satisfied concerning the reformatory and the persons proposing to maintain it.

Miscellaneous.—Any person convicted on indictment of an offence punishable with imprisonment or penal servitude (*i.e.*, of any non-capital felony and of most misdemeanours), if the court is satisfied from the evidence that the offence was committed under the influence of drink, or that drink was a contributing cause of the offence, may, if he admits that he is, or is found by the jury to be, an habitual drunkard, in addition to or in substitution for any other sentence, be ordered to be detained in a State or certified inebriate reformatory, the managers of which are willing to receive him. Again, any habitual drunkard who is found drunk in any public place, or who commits any other of a series of similar offences under various statutes, after having within 12 months been convicted at least three times of a similar offence, may, on conviction on indictment, or, if he consent, on summary conviction, be sent for detention in any certified inebriate reformatory. Habitual drunkenness has been held to be a ground for the refusal of restitution of conjugal rights (*Fisk* v. *Fisk*, 122 L.T. 803). Where the husband of a woman is an habitual drunkard, she may obtain a protection order; where the wife is an habitual drunkard, the husband may obtain an order equivalent to a decree for judicial separation (Licensing Act, 1902, s. 5). A convicted inebriate of 60 years or upwards may be disqualified for an old age pension (Old Age Pensions Act, 1908, s. 3). A parent who is convicted of an offence under the Children Act, 1908, may be sentenced to detention in a certified inebriate reformatory (s. 26).

BIBLIOGRAPHY.—As to the history of legislation on the subject *see* Parl. Paper No. 242 of 1872; 1893 C. 7008. *See* also Wyatt Paine, *Inebriate Reformatories and Retreats* (1899); Blackwell, *Inebriates Acts, 1879–1898* (1899); Wood Renton, *Lunacy* (1896). An excellent account of the systems in force in other countries for the treatment of inebriates will be found in Parl. Pap. (1902), cd. 1474.

(A. W. R.)

United States.—In the United States, by the decided weight of authority, the contract of a completely intoxicated person is voidable. It is capable of repudiation or ratification when the party becomes sober, and the ratification may be express or implied, the burden being upon him to take action within a reasonable period after he becomes sober to disaffirm it; otherwise ratification is presumed from his silence. The rule is the same in the United States as in England that a man may, in spite of intoxication, bind himself by contract, if he knows what he is doing and comprehends the consequences of his acts. If his intoxication utterly and entirely deprives him of his reason and understanding he may set his contract aside on the ground of drunkenness.

Voluntary intoxication carries with it the assumption by the drunkard of all criminal responsibility, while if the criminal act was committed when the intoxication was involuntary this is a complete defence to a criminal charge based on the act. However, the condition known as delirium tremens, when it has progressed to a degree establishing permanent insanity, which renders the person incapable of distinguishing between right and wrong, relieves him from criminal responsibility for his acts, even though the condition was voluntary in its inception. The theory and reason for the rule is that the man is insane, and his insanity is a defence even though it was produced by the voluntary excessive use of intoxicating liquors. (*People* v. *Rogers*, 18 N.Y. 9; *Flanigan* v. *The People*, 86 N.Y. 554; *State* v. *Haab*, 195 La. 230.) Intoxication, even though voluntary, may be adduced in evidence in those acts which become crimes when done *knowingly or with a specific intent or purpose*, and the courts have held that in such cases the fact of intoxication is admissible to negative the existence of such knowledge or intent, which is a necessary element of the crime.

The manufacture and sale of intoxicating liquors for beverage purposes in the United States is controlled by the 18th amendment to the Constitution, commonly known as the Volstead Act. This grew out of the so-called Prohibition Act of Nov. 21, 1918, upheld by the U.S. Supreme Court (*Hamilton* v. *Kentucky Distilleries, etc., Co.*, 251 U.S. 146; *United States* v. *Standard Brewery*, 251 U.S. 210; *Ruppert* v. *Caffey*, 251 U.S. 264), on the ground that the act was a proper exercise of the war powers granted to the United States by the Constitution. The National Prohibition Act (Oct. 28, 1919, chap. 83, Acts 66th Congress, 41 Stat. at L. 305) prohibits the manufacture, sale and transportation of intoxicating liquors for beverage purposes and the U.S. Supreme Court (*Ruppert* v. *Caffey, supra*) held that the provisions of the act extending such prohibition to malt liquors, whether intoxicating or not, with alcoholic content of ½ of 1% of alcohol by volume, was a proper

exercise of the powers of Congress; thus the validity of the 18th amendment was upheld. The act itself made certain exceptions, under a permit system (chap. ii., ss. 12 and 13, and chap. iii., ss. 78 and 80), stating lawful uses of liquor; *i.e.*, for scientific, sacramental, medicinal and mechanical purposes. (*See* NATIONAL PROHIBITION ACT.) (J. P. EA.)

INFALLIBILITY, the fact or quality of not being liable to err or fail (Med. Lat. *infallibilitas, infallibilis,* formed from *fallor,* to make a mistake). At the present time the idea of infallibility in religious matters is most commonly associated with the claim of the Roman Catholic Church, and more especially of the pope personally as head of that Church, to possess the privilege of infallibility, and it is with the meaning and limits of this claim that the present article deals.[1] The substance of the claim to infallibility made by the Roman Catholic Church is that the Church and the pope cannot err when solemnly enunciating, as binding on all the faithful, a decision on a question of faith or morals. The infallibility of the Church, thus limited, is a natural outcome of the fundamental conception of the Catholic Church and its mission. Every society of men must have a supreme authority, whether individual or collective, empowered to give a final decision in the controversies which concern it. A community whose mission it is to teach religious truth, which involves on the part of its members the obligation of belief in this truth, must, if it is not to fail of its object, possess an authority capable of maintaining the faith in its purity, and consequently capable of keeping it free from and condemning errors. To perform this function without fear of error, this authority must be infallible in its own sphere. The Catholic Church has expressly claimed this infallibility for its formal dogmatic teaching.

The infallibility of the pope (*q.v.*) was first defined in 1870 at the Vatican Council. The exact formula for the papal infallibility is given by the Council in the following terms (Constit. *Pastor aeternus,* cap. iv.); "we teach and define as a divinely revealed dogma, that the Roman Pontiff, when he speaks *ex cathedra—i.e.,* when, in his character as Pastor and Doctor of all Christians, and in virtue of his supreme apostolic authority, he lays down that a certain doctrine concerning faith or morals is binding upon the universal Church—possesses, by the Divine assistance which was promised to him in the person of the blessed Saint Peter, that same infallibility with which the Divine Redeemer thought fit to endow His Church, to define its doctrine with regard to faith and morals; and, consequently, that these definitions of the Roman Pontiff are irreformable in themselves, and not in consequence of the consent of the Church." A few notes will suffice to elucidate this pronouncement.

(*a*) As the Council expressly says, the infallibility of the pope is not other than that of the Church; this is a point which is too often forgotten or misunderstood. The pope enjoys it in person, but solely *qua* head of the Church, and as the authorized organ of the ecclesiastical body united with him.

(*b*) The late date at which the dogma was defined is explained by the fact that the mode of exercising authority on the part of the Church has varied since the time of Christ; but it is affirmed that the dogma was already contained in that of the papal primacy established by Christ himself in the person of St. Peter. A certain dogmatic development is not denied, nor an evolution in the direction of a centralization in the hands of the pope of the exercise of his powers as primate; it is merely required that this evolution should be well understood and considered as legitimate.

(*c*) Infallibility is the guarantee against error, not in all matters, but only in the matter of dogma and morality; everything else is beyond its power, not only truths of another order, but even discipline and the ecclesiastical laws, government and administration, etc.

(*d*) Again, not all dogmatic teachings of the pope are under the guarantee of infallibility; neither his opinions as private instructor, nor his official allocutions, however authoritative they may be, are infallible; it is only his *ex cathedra* instruction which is guaranteed; this is admitted by everybody.

(*e*) The last phrase of the definition is aimed at Gallicanism and kindred doctrines, political rather than theological, which placed the authority of the Church above that of its head.

But when does the pope speak *ex cathedra,* and how is it to be distinguished when he is exercising his infallibility? As to this point there are two tendencies among Catholics. (*i.*) Some extend the privilege of infallibility to all official exercise of the supreme *magisterium,* and declare infallible, *e.g.,* the papal encyclicals. In this sense it was understood by Döllinger, who pointed out that the definition of the dogma would commit the Church to all past official utterances of the popes, *e.g.,* the Syllabus of 1864, and therefore to a war *à outrance* against modern civilization. This view was embodied in the circular note to the Powers, drawn up by Döllinger and issued by the Bavarian prime minister Prince Hohenlohe-Schillingsfürst on April 9, 1869. It was also the view universally taken by the German governments which supported the *Kulturkampf* in a greater or lesser degree. (*ii.*) Others, while recognizing the supreme authority of the papal *magisterium* in matters of doctrine, confine the infallibility to those cases alone in which the pope declares positively that he is imposing on all the faithful the obligation of belief in a certain definite proposition, under pain of heresy and exclusion from the Church (*cf.* J. Fessler, *Die wahre und die falsche Unfehlbarkeit der Päpste;* French trans. 1873). Those who hold this second view contend that it has never been officially condemned; and they are able, while admitting the supreme authority of the encyclicals, to assert that no infallible definition has been formulated by the popes since 1870.

The controversies occasioned by this question had started from the beginning of the Council, and were carried on with bitterness on both sides. The minority, among whom were prominent Cardinals Rauscher and Schwarzenberg, Hefele, bishop of Rotterdam (the historian of the councils), Cardinal Mathieu, Mgr. Dupanloup and Mgr. Maret, did not pretend to deny the papal infallibility; they pleaded the inopportuneness of the definition and brought forward difficulties mainly of an historical order. The majority, in which Cardinal Manning played a very active part, took their stand on theological reasons of the strictest kind; they invoked the *tu es Petrus* and the *pasce agnos* of Christ; they showed the popes, in the course of the ages, acting as the guardians and judges of the faith, arousing or welcoming dogmatic controversies and authoritatively settling them, exercising the supreme direction in the councils and sanctioning their decisions; they argued that the few historical difficulties did not involve any dogmatic defect in the teaching of the popes; they insisted upon the necessity of a supreme tribunal giving judgment in the name of the whole of the scattered Church; and finally, they considered that the definition had become opportune for the very reason that under the pretext of its inopportuneness the doctrine itself was being attacked.

The definition once proclaimed, controversies rapidly ceased; the bishops who were among the minority one after the other formulated their loyal adhesion to the Catholic dogma. The last to do so in Germany was Hefele, who published the decrees of April 10, 1871, thus breaking a long friendship with Döllinger. In France, though no bishops abandoned it, a few priests, such as Father Hyacinthe Loyson, refused their adhesion. The most distinguished among the German dissentients was Döllinger, who resisted all the advances of the archbishop of Munich, was excommunicated on April 17, 1871, and died unreconciled, though without joining any separate group. After him must be mentioned Friedrich of Munich, several professors of Bonn, and Reinkens of Breslau, who was the first bishop of the "Old Catholics" (*q.v.*).

See L. Billot, S.J., *De Ecclesia Christi* (3 vols., Rome, 1898–1900); Acton, "History of the Vatican Council" in the *North British Review,* I. iii. (Oct. 1870–Jan. 1871); P. J. Toner, art. "Infallibility" in the *Catholic Encyclopaedia;* and C. Mirbt, art. "Vatikanisches Konzil" in Herzog-Hauck, *Realencyklopädie* (full bibliography); "Infallibility" in Hastings' *Encyclopaedia of Religion and Ethics* (Protestant); H. E. Manning (cardinal), *Petri Privilegium,* 1871, and *The Vatican Decrees in their Bearing on Civil Allegiance,* 1875; J. H. Newman (cardinal), *Letter to the Duke of Norfolk,* 1875.

[1] On the idea of infallibility in reference to a written revelation, *see* INSPIRATION.

INFAMY, public disgrace or loss of character. Infamy occupied a prominent place in Roman law, and took the form of a censure on individuals pronounced by a competent authority in the State. Such a censure involved disqualification for certain rights both in public and in private law. In English law infamy as a cause of incompetency was abolished by 6 & 7 Vict. c. 85. The same has occurred in most of the codes which followed the Roman law in this relation, *e.g.*, the Spanish penal code of 1848.

The word "infamous" is used in a particular sense in the English Medical Act of 1858, which provides that if any registered medical practitioner is judged by the General Medical Council, after due enquiry, to have been guilty of infamous conduct in any professional respect, his name may be erased from the medical register. The General Medical Council are the sole judges of whether a practitioner has been guilty of conduct infamous in a professional respect, and they act in a judicial capacity, but an accused person is allowed to appear by counsel.

See *Pratt* v. *British Medical Association,* 1919, 1. K.B. p. 270 and cited cases. As to dentists, *see* the Dentists Act, 1921, establishing a dental board.

INFANCY, in medical practice, the first year of life. On being born the normal infant cries lustily, drawing air into its lungs. As soon as the umbilical cord which unites the child to the mother has ceased to beat, it is tied about 2in. from the child's navel and is divided above the ligature. The cord is wrapped in a sterilized gauze pad and the dressing is not removed until the seventh to the tenth day, when the umbilicus is healed.

The first event in a baby's life is its first bath. The room should be at a temperature of 70° F, and the bath water at 100° F. The child should be well supported in the bath by the left hand of the nurse, and care taken to avoid wetting the gauze pad covering the cord. In some cases infants are covered with a white substance termed "vernix caseosa," which may be carefully removed by a little olive oil. Sponges tend to harbour bacteria, so absorbent cotton wool should take their place. After the first ten days 94° F is the most suitable temperature for a bath. Night and morning, from the first, the mouth and nostrils should be cleansed with wet pledgets of cotton wool. When the baby has been well dried the skin may be dusted with pure starch powder to which a small quantity of boric acid has been added. The most important part of the toilet of a new-born infant is care of the eyes, which should be carefully cleansed with cotton wool dipped in warm water, and one drop of a 2% solution of nitrate of silver dropped into each eye. The clothes should consist exclusively of woollen undergarments, a soft flannel binder, which should be tied on, being placed next the skin, with a long-sleeved wool vest, and over this a loose garment of flannel coming below the feet and long enough to tuck up. Diapers should be made of soft absorbent material about 2ft. square and folded in a three-cornered shape. An infant should always sleep in a bed or cot by itself. More than half the deaths from violence of children under one month are due to suffocation in bed with adults. A healthy infant should spend most of its time asleep, and should be laid into its cot immediately after feeding.

Physically, the first year is the most important one of the entire life cycle. Increase in height and weight and development of the organs of the body are greater than at any future similar period. The degree of health during the first year will determine, to a great extent, the health of the individual during later life. The main factor of proper infant care is nourishment, dependent upon the amount, character and regularity of feeding. Secondary factors of proper infant care are those which are concerned with the environmental conditions of life including fresh air, sunshine, sleep, cleanliness, bathing, exercise and the other measures of physical hygiene. The most definite evidence of health in infancy is an even continuous gain in weight in relation to height.

The normal infant at birth weighs about 7 lb. During the two or three days following birth a slight decrease in weight occurs, usually 5 to 6 oz. When nursing begins the child increases in weight up to the seventh day, when it will have regained its weight at birth. From the second to the fourth week after birth (according to Camerer) an infant should gain 1 oz. daily or 1½ to 2 lb. monthly, from the fourth to the sixth month half to two-thirds of an ounce daily or 1 lb. monthly, from the sixth to the twelfth month ½ oz. daily or less than 1 lb. monthly. At the sixth month it should be twice the weight at birth. The average weight at the twelfth month is 20 to 21 lb. The increase of weight in artificially fed is less regular than in breast-fed babies.

Gain in weight is less in warm weather. Teething is apt to delay a regular gain in weight and from the seventh to the tenth month the weight may remain almost stationary or increase very little. The baby should be weighed once each week during the first six months and once every two weeks during the second six months. Weighing should take place at the same hour on the same day each week and with the same amount of clothing.

The average height at birth is about 19 in. If the weight of the baby is over or below seven lb., the height should be correspondingly greater or less. The important points in determining health are: first, the relation between height and weight and, second, the rate of increase in height and weight. From birth to three months, the increase in height will be about three in.; the same rate of increase should take place during the second three months and again during the following six months.

At birth, the circumference of the abdomen and of the chest should be the same; in the average baby, about 13½ in. The circumference of the head should be about 14 in. The chest and abdomen increase in size at the same rate and the head at a slightly less rate during the first year. At one year of age, the circumference of the head, chest and abdomen should be the same; about 18 in. for the average baby. Any disproportion to these measurements is evidence of malnutrition or some definite disease.

Food.—The ideal food for an infant is its mother's milk. Artificially-fed children are more liable to epidemic diseases. The child should be applied to the breast the first day to induce the flow of milk. The modern tendency is to feed it at 6 A.M., 10 A.M., 2 P.M., 6 P.M. and 10 P.M., thus the mother gets a night's rest. Frequently, however, these intervals have to be shortened.

Artificial Feeding.—The simplest artificial food is cow's milk, diluted with boiled water and with the addition of a little cream and milk sugar. At first two parts of water should be added to one of milk and week by week the water should be diminished until at three months equal parts of milk and water and at six months three times as much milk as water are used. A teaspoonful of cream and a quarter of a teaspoonful of sugar of milk in each feed are appropriate amounts. Unless the source is unimpeachable the milk should be either sterilized by boiling or pasteurized, *i.e.*, subjected to a form of heating which, while destroying pathogenic bacteria, does not alter the taste. The milk in a suitable apparatus is subjected to a temperature of 65° C (149° F) for half an hour and is then rapidly cooled to 20° C (68° F).

Various patent foods are on the market, some of which are satisfactory, but great care must be exercised in their selection as many are injurious. All infants artificially fed should be given fresh orange juice daily, beginning with a teaspoonful at the end of the first month, gradually increasing the amount to two tablespoonfuls at the end of the fourth month and thereafter. Twice the amount of the juice of canned tomatoes (uncooked) and diluted with an equal amount of water may be used in place of the orange juice. These juices supply the needed vitamins which may be lacking in the pasteurized or boiled milk. (*See* VITAMINS; DIET.) As an additional aid to nutrition and to supply the vitamins that may be lacking in other foods, codliver oil may be given to babies more than one month old. The average dose is one-half teaspoonful at one month, one teaspoonful at two months, one and one-half teaspoonfuls at three months and two teaspoonfuls thereafter during the first year. This dose is given twice daily.

Additional foods may be given daily as follows: At four months, two tablespoonfuls of strained vegetable soup. At five months, three tablespoonfuls of the soup and one teaspoonful of vegetable pulp. At six months, one tablespoonful of strained cereal gruel, two ounces of vegetable soup and two teaspoonfuls vegetable pulp. At seven months, double the amount of cereal gruel and vegetable pulp, increase amount of vegetable soup by one ounce, add one-third slice dried bread. At eight months, give above amount cereal

gruel twice daily. At nine months, increase vegetable soup to four ounces and pulp to one tablespoonful, add one tablespoonful mixed coddled egg. At 10 months, increase vegetable pulp to two tablespoonfuls, coddled egg to two teaspoonfuls, dried bread to one-half slice, cook beef bone in soup stock. At 11 months, increase amounts of all foods, add one teaspoonful mealy part of baked potato and same amount strained applesauce.

Method of Modifying Milk.—Wash all utensils in hot soap suds and rinse in boiling water. Boil bottles, nipples and corks for three minutes. Measure sugar and dissolve in small amount of water; pour into pitcher and add full amount of water; stir milk in bottle and add amount for day's formula. Stir mixture and pour right amount in each feeding bottle. Cork the bottles and place them on ice. Keep at a temperature at or slightly below 50 degrees, Fahrenheit, until used. At feeding time replace cork with nipple, hold bottle in pan of hot water until contents are warm. Test warmth of milk by dropping a small amount on arm just above wrist; the milk should feel warm but not hot.

Rules for Feeding

1. Establish regular feeding habits and keep to them.
2. Feed by weight rather than age.
3. Wash bottles and nipples after each use; keep nipples in covered jar full of sterile water.
4. Give the baby water to drink from a bottle, cup or spoon between feedings.
5. Give the milk first at each feeding; then the additional foods.
6. Increase the additional foods gradually and in small amounts.
7. Decrease the amount of the milk formula at each feeding by the amount of other liquid given.
8. Give only one additional food at any one feeding.
9. Cook all cereals longer than the directions given on the package.
10. Strong and healthy babies can take solid food at an earlier age than weak and delicate babies can.
11. Vegetables used in making soup are: carrots, turnips, spinach, chard, celery, asparagus, lettuce, beet greens, onions, string beans, cabbage and cauliflower (not more than three at any one time); all vegetables should be fresh.
12. The formulae and other directions given for feeding apply to the average normal baby. If the baby is not gaining in weight or if any digestive disturbance develops, medical advice about the diet should be secured.

Normal Infant's Development.—A healthy infant should live out of doors during the daytime as much as possible, warmly clad, with a hot water bottle if necessary, protected from wind and rain and excessive sunlight. On the second day the eyes are sensitive to light, in the second month the infant notices colours, at the sixth month it knows its parents, and should be able to hold its head up. During the sixth month the baby usually begins to cut its temporary teeth. Attempts to stand are made about the tenth month, and walking begins about the fourteenth month. By this time the intelligence should be developed, memory is observed, and the child should be able to articulate a few small words. With the advent of walking and speech the period of infancy may be said to end.

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PHYSICAL HYGIENE

One of the most important questions in the physical hygiene of children is that of habit formation. Babies are born without habits. They acquire them and the type of habits formed depends upon the kind and regularity of infant care and the environment, or surroundings, of the baby and young child during these early, formative years of life. "Habit" may be defined as the repetition of an act until it becomes automatic and a more or less unconscious action.

The kind of habits we acquire affect health, development, mentality, character and adjustment to life. The majority of habits have their inception during the first five years of life and habit formation begins at birth. A common example of this occurs in earliest infancy. If a baby is taken up when he cries, he learns immediately that a cry will accomplish this desired result. If his cry does not bring this attention, he learns that it is useless to cry for this purpose and this type of crying habit is prevented. Habits of regularity in feeding, sleeping, bathing and the other functions of the body vitally affect health and the proper ones should be established as soon as the baby is born and persisted in without interruption.

While the best habit formation consists in the cultivation of good habits and the avoidance of bad habits, there are instances where the bad habits have already been formed and correction is necessary. For the prevention of bad habits which are concerned with the routine of daily life, it is essential to establish regular and fixed hours for feeding, sleep, bathing, exercise or play and bowel movements. For information regarding all except the last mentioned, *see* NURSERY EQUIPMENT. The more common bad habits which are to be prevented or corrected are: nail biting, sucking, the use of a pacifier, dirt eating, bed wetting and masturbation.

Training for Regular Bowel Movements.—This may be started during the second month. Set a small chamber between the nurse's knees, place the baby on this with his body supported firmly and his back braced against the nurse's chest. At first it may be necessary to insert into the opening of the rectum, the end of a rolled cone of oiled paper or the end of a piece of white soap whittled into the shape and size of a lead pencil. As it is normal for the baby to have one or two bowel movements a day, this practice should be carried out twice daily; immediately after the first morning and the late afternoon feedings. It is probable that for the first week or two the effort will be unsuccessful but after that time the use of the cone or soap may be omitted, the baby will begin to learn what is expected and the habit of regular bowel movements at these times should be established. Persistence and absolute regularity are essential for success.

Sucking and Nail Biting.—The habit of sucking a piece of the clothing, a corner of the blanket, the thumb or the fingers begins early in infancy. This may be a sign of hunger and attention should be paid to the amount and the quality of the feeding. If uncorrected, this habit may persist until the child is five or six years old. The results of this practice may be serious and lead to misshapen lips, irregular teeth, malocclusion of the jaws, deformed palate and excessive adenoid growths. The flow of saliva is stimulated and digestive disturbances may result. The use of a pacifier is equally harmful and will produce the same symptoms and deformities. In addition it may cause an infection of the mouth or a general infectious disease as it is practically impossible to keep a pacifier clean. Nail biting commonly begins later in life—at about three years—and is most common in nervous children and those who are undernourished. The prevention and treatment of these conditions consists of attention to the diet and general health of the child, avoidance of the use of the pacifier and, the emotional development of the child permitting, some form of mechanical restraint.

Bed Wetting.—Children should be able to control the bladder at two years of age. If lack of control persists beyond this time, either during the day or night, some physical cause for this condition may be looked for. This may be excessive nervousness, anemia, malnutrition, local irritation in the genital region or a rectal irritation due to worms. Such causes should be sought for and removed by competent medical care. Early training in good habits of bladder control may be commenced by the end of the first year and consist in placing the child on the chamber at regular intervals during the daytime, the last thing before bedtime and once during the night. If the bed wetting persists, the child should sleep without a pillow and the foot of the bed may

be raised slightly. All fluids in the diet should be eliminated after four o'clock in the afternoon. At the same time a definite effort should be made to interest the child in overcoming the habit. An appeal to his self-respect, pointing out the way in which he differs from other children in this practice and the promise of recognition of his self-helping efforts by simple rewards have been found helpful.

Masturbation.—As this habit is more often an emotional than a physical one, proper attention to the mental hygiene of early childhood insures the best results. It must be remembered however that irritation of the genital region may produce efforts at masturbation and a physical examination and medical advice are essential in such instances. In the majority of instances the action is reflex and mainly subconscious with no moral significance.

Intelligent guidance and simple rewards yield the best results in correcting all types of bad habits. Punishment will invariably bring harmful consequences. (S. J. B.)

INFANT, in non-legal use, a very young child, a baby, or one of an age suitable to be taught in an "infant school"; in law, a person under full age, and therefore subject to disabilities not affecting persons who have attained full age.

This article deals with "infants" in the last sense; for the more general sense *see* INFANCY and CHILD. The period of full age varies widely in different systems, as do also the disabilities attaching to nonage (non-age). In Roman law, the age of puberty, fixed at 14 for males and 12 for females, was recognized as a dividing line. Under that age a child was under the guardianship of a tutor, but several degrees of infancy were recognized. The first was absolute infancy; after that, until the age of seven, a child was *infantiae proximus,* and from the eighth year to puberty he was *pubertati proximus.*

By the law of England full age is 21, and all minors alike are subject to incapacities. The period of 21 years is regarded as complete at the beginning of the day before the birthday; for example, an infant born on the first day of January attains his majority at the first moment of the 31st of December. The incapacity of an infant is designed for his own protection, and its general effect is to prevent him from binding himself absolutely by obligations. Of the contracts of an infant which are binding *ab initio,* the most important are those relating to "necessaries." By the Sale of Goods Act, 1893, an infant liable on a contract for necessaries can be sued only for a reasonable price, not necessarily the price he agreed to pay. The same statute declares "necessaries" to mean "goods suitable to the condition in life of the infant, and to his actual requirements at the time of the sale and delivery." In the case of goods having a market price, the market price is reasonable. In all other cases the question is one of fact for the jury. The protection of infants extends sometimes to transactions completed after full age; the relief of heirs who have been induced to barter away their expectations is an example. "Catching bargains," as they are called, throw on the persons claiming the benefit of them the burden of proving their substantial righteousness.

At common law a bargain made by an infant might be ratified by him after full age, and would then become binding. Lord Tenterden's act required the ratification to be in writing. But now, by the Infants' Relief Act, 1874, "all contracts entered into by infants for the repayment of money lent or to be lent, or for goods supplied or to be supplied (other than contracts for necessaries), and all accounts stated, shall be absolutely void," and "no action shall be brought whereby to charge any person upon any promise made after full age to pay any debt contracted during infancy, or upon any ratification made after full age of any promise or contract made during infancy, whether there shall or shall not be any new consideration for such promise or ratification after full age." For some years after the passage of this statute highly conflicting views were held as to the meaning of the part of sec. 2 whereby it was enacted that "no action shall be brought, whereby to charge any person . . . upon any ratification made after full age of any promise or contract made during infancy." Some authorities were of opinion that the section only applied to the three classes of contract made void by the previous section, viz., for goods supplied, money lent and on account stated. Others thought the effect to be that no contract, except for necessaries, made during infancy could be enforced after the infant came to full age. After several conflicting decisions it has been settled that both these views were wrong. Of the infant's contracts voidable at common law there were two kinds. The first kind became void at full age, unless expressly ratified. The second kind were valid, unless repudiated within a reasonable time after full age was attained by the infant. The Infants' Relief Act (sec. 2) strikes only at the first class and leaves the second untouched. Thus a promise of marriage made during infancy cannot be ratified so as to become actionable; but an infant's marriage settlement, being of the second class, is valid, unless it is repudiated within a reasonable time after the infant attains full age. What is a reasonable time depends on all the circumstances of the case. In a case decided in 1893 a settlement made by a female infant was allowed to be repudiated 30 years after she attained full age, but the circumstances were exceptional. A contract of marriage may be lawfully made by persons under age. Marriageable age is 14 in males and 12 in females. So, generally, an infant may bind himself by contract of apprenticeship or service. Since the passing of the Wills Act, an infant, except he be a soldier in actual military service or a seaman at sea, is unable to make a will. Infancy is in general a disqualification for public offices and professions, *e.g.,* to be a member of parliament or an elector, a mayor or burgess, a priest or deacon, a barrister or solicitor, etc.

Before 1886 the custody of an infant belonged in the first place, and against all other persons, to the father, who was said to be "the guardian of his children by nature and nurture"; and the father might by deed or will dispose of the custody or tuition of his children until the age of 21.

The Guardianship of Infants Acts.—The Guardianship of Infants Act, 1886, placed the mother almost on the same footing as the father as to guardianship of infants. On the death of the father the mother becomes guardian under the statute, either alone when no guardian has been appointed by the father, or jointly with any guardian appointed by him under 12 Chas. II. c. 24. A change of the law even more important is that whereby the mother may by deed or will appoint a guardian or guardians of her infant children to act after her death. If the father survives the mother, the mother's guardian can only act if it be shown to the satisfaction of the court that the father is unfitted to be the sole guardian. On the death of the father, the guardian so appointed by the mother acts jointly with any guardian appointed by the father. The act of 1886 also gives power to the high court and to county courts to make orders, upon the application of the mother, regarding the custody of an infant, and the right of access thereto of either parent. The court must take into consideration "the welfare of the infant, and . . . the conduct of the parents, and . . . the wishes as well of the mother as of the father." The same statute also empowers the high court of justice, "on being satisfied that it is for the welfare of the infant," to "remove from his office any testamentary guardian or any guardian appointed or acting by virtue of this act," and also to appoint another in place of the guardian so removed. Power is given to a court sitting in divorce practically to take away from a parent guilty of a matrimonial offence all rights of guardianship.

The passing of the Guardianship of Infants Act, 1925, has brought about a further very important change in the law on this subject and this act is to be "construed as one with" the act of 1886. The welfare of the infant is declared to be "the first and paramount consideration" in the making of a custody order, but the principle of equality between the sexes is "now to obtain with respect to the guardianship of infants," so that "the mother shall have the like powers to apply to the court" as are possessed by the father. It is, however, in the extension of jurisdiction to courts of summary jurisdiction that the act is most remarkable, since it confers upon these courts powers differing very widely from those which formed the original basis of their jurisdiction.

This extension is of immense benefit to the very poor, amongst whom quarrels as to the custody of children are not less common than amongst those able to afford more expensive litigation. The incorporation of the act of 1886 with the act of 1925 has given rise to a curious difficulty. The former act gave the mother the right to apply, but did not mention the father; but since the right of application to a court of summary jurisdiction is purely statutory, it would appear that the father had no right to apply to such a court. Sec. 16 of the Administration of Justice Act (1928), however, has removed the father's disability in this respect.

Another radical change has been made in the rights of parents as to guardianship of their children. In consequence of several cases where, after children had been rescued by philanthropic persons from squalid homes and improper surroundings, the courts had felt bound by law to redeliver them to their parents, the Custody of Children Act, 1891, was passed. A parent who has abandoned or deserted his child, is, *prima facie*, unfit to have the custody of the child. And before the court can make an order giving him the custody, the onus lies on him to prove that he is fit. The same rule applies where the child has been allowed by the parent, "to be brought up by another person at that person's expense, or by the guardians of the poor-law union, for such a length of time and under such circumstances as to satisfy the court that the parent was unmindful of his parental duties." Many cases of this kind can now be dealt with most satisfactorily under the Adoption of Children Act, 1926, which has decreased to a large extent the importance of the earlier legislation. (*See* ADOPTION.)

In the same direction as the Custody of Children Act, 1891, and the Guardianship of Infants Act, 1925, is the Children Act, 1908, whereby considerable powers have been conferred on courts of summary jurisdiction. (*See* CHILDREN, PROTECTIVE LAWS.)

There is not at common law any corresponding obligation on the part of either parent to maintain or educate the children. The legal duties of parents in this respect are those created by the poor laws, the Education Acts and the Children Act, 1908.

An infant is liable to a civil action for torts and wrongful acts committed by him. But, as it is possible so to shape the pleadings as to make what is in substance a right arising out of contract take the form of a right arising from civil injury, care is taken that an infant in such a case shall not be held liable. With respect to crime, mere infancy is not a defence, but a child under seven years of age is presumed to be incapable of committing a crime, and between seven and 14 his capacity requires to be affirmatively proved. After 14 an infant is *doli capax*.

Scotland.—The law of Scotland follows the leading principles of the Roman law. The period of minority (which ends at 21) is divided into two stages, that of absolute incapacity (until the age of 14 in males, and 12 in females), during which the minor is in pupilarity, and that of partial incapacity (between 14 and 21), during which he is under curators. The guardians (or tutors), of the pupil are either tutors-nominate (appointed by the father in his will); tutors-at-law (being the next male agnate of 25 years of age), in default of tutors-nominate; or tutors-dative, appointed by royal warrant in default of the other two. No act done by the pupil, or action raised in his name, has any effect without the interposition of a guardian. After 14, all acts done by a minor having curators are void without their concurrence. Every deed in nonage, whether during pupilarity or minority, and whether authorized or not by tutors or curators, is liable to reduction on proof of "lesion," *i.e.*, of material injury, due to the fact of nonage, either through the weakness of the minor himself or the imprudence or negligence of his curators. Damage in fact arising on a contract in itself just and reasonable would not be lesion entitling to restitution. Deeds in nonage, other than those which are absolutely null *ab initio*, must be challenged within the *quadriennium utile*, or four years after majority.

The Guardianship of Infants Act, 1886, the Custody of Children Act, 1891, the Children Act, 1908, and the Guardianship of Infants Act, 1925, mentioned above, all apply to Scotland.

United States.—In the United States the principles of the English common law as to infancy prevail, generally the most conspicuous variations being those affecting the age at which women attain majority. In many States this is fixed at 18. There is some diversity of practice as to the age at which a person can make a will of real or personal estate.

INFANTE, a title of the sons of the sovereigns of Spain and Portugal, the corresponding *infanta* being given to the daughters. (From Lat. *infans*, young child.) The title is not borne by the eldest son of the king of Spain, who is prince of Asturias, *Il principe de Asturias*. While a son or a daughter of the sovereign of Spain is by right infante or infanta of Spain, the title, alone, is granted to other members of the blood royal by the sovereign.

INFANTICIDE. In sharp contrast to the modern anxiety to lessen child mortality, a feature due to the ethical advance of civilization, is the extent, as vouched for by sound historical evidence and by the direct observation of cultures in modern times, of the practice of infanticide or of putting new-born infants to death or of allowing them to die.

Thus it is recorded of the Nandi that "children are buried alive in cow-dung if they cry in their mother's womb or if at birth they present their legs first, or are born with teeth, as these events are considered unlucky. Children who are blind or badly deformed, and illegitimate children, *i.e.*, the offspring of unmarried girls, are likewise made away with at birth." From every quarter of the world, from simple nomadic peoples to settled agriculturalists comes evidence of similar practices, supported by similar reasons. The horror of the abnormal explains many of the cases. Breaches of the rules regulating sexual intercourse (an element present of necessity in all marriage systems whereby the status of the issue of the sexual union of the parents is established) may, as with the Nandi, lead to the immediate death of the offspring of an irregular union because, as is definitely certain in some instances, the ancestral spirits seeking reincarnation can only achieve their desire by regular marriage. They are ready therefore to punish matrimonial offences; and to avoid the dreadful consequences of rearing illegitimate children, in the community which the ancestors built up, the community is purged at once of their presence. In some cases a distinction is drawn between children born to parents who have neglected the formalities of marriage but are otherwise free to marry, and the offspring of those whose unions are forbidden by the law of exogamy (*q.v.*) or by some fundamental social ordinance. Illegitimate children of the first category are perhaps allowed to live, even to obtain membership of the community, to be legitimized by the subsequent formal marriage of their parents, while illegitimate children of the second category are put to death sometimes in a horrible manner, as if, it may be because, they are regarded as evil spirits. The birth of twins, as an abnormal occurrence, may be viewed as either an indication of future prosperity or of impending misfortune and social attitudes conform with the view taken in the community of the incident. Some welcome twins as proof of divine favour, others deem them akin to animals and therefore to be destroyed, while special treatment is often found to be applied to the cases where the twins are of opposite sex and therefore deemed to have had intercourse in violation of the law of exogamy.

Infanticide is sometimes practised for economic reasons as when an Australian mother thinks she is unable to rear the new-born babe owing to there being a young child whom she is still feeding. A child of a few years of age is sometimes killed, to pass its strength on to a weakly elder child. Cases are known where a child has been killed in order that its soul may pass to a woman desirous of offspring. In India female infanticide was attributed to the custom of hypergamy (*q.v.*). To some superstition related to the social order is also attributed the rule of the Wataveta requiring the destruction of every child born to a woman after her daughter's marriage. The system of age-grades which forms an essential part of the structure of that tribe is perhaps the factor in this connection.

Children, especially the first-born, were killed to cure barrenness, to ensure health, good fortune and general fertility. Reincarnation beliefs play a part since if the son is the reincarnation

of his father, the son is put to death and the father lives. Again special sanctity, special virtue attached to the first-born and therefore the sacrifice of the first-born had special efficacy. In certain conditions the legitimacy of the first-born is dubious and his destruction may then be regarded as a special case of illegitimacy. There are many proofs of infanticide in religions possessing ethical potentialities such as Druidism and Semitism as well as in advanced communities such as Egypt, Greece and Rome.

It has been suggested that there is a social norm, a belief that "a particular number of children is the right number of children" (Carr-Saunders, *see* bibl.) and families in excess of the number approved by this convention may well have been kept to the norm by infanticide. How far among primitive peoples there is at times some deliberation as to whether a child shall be allowed to live, is not clear, but the evidence is thought to point to some semi-conscious adjustment of numbers.

That the destruction of weak, deformed and unsightly children at birth would have favourably affected the quality of the community is highly probable. Eugenic motives, however, were not present and the destruction of such children was conditioned by the superstitions attached to them.

Misinterpretation of imperfect data led McLennan in his pioneer work on *Human Marriage* (1865) to attribute an importance to infanticide as a factor in producing exogamy and thus shaping the social structure, which is now regarded as without warrant. The case of infanticide which he cited from Assam as due to the constant capture of girls taken by stronger villages as wives proved to be a case of "a superstition which condemned to death such as were born in a particular position" analogous to those cited above.

BIBLIOGRAPHY.—A. C. Hollis, *The Nandi* (1909); Sir B. Spencer and F. J. Gillen, *The Arunta* (1927); A. M. Carr-Saunders, *The Population Problem* (1922), in which, with a copious bibliography, there is a full discussion of the evidence for infanticide among hunting and fishing races, agricultural and historical races. *See* also E. Westermarck, *History of Human Marriage*, 6th ed. 3 vols. (1925); and *The Origin and Development of Moral Ideals* (1905); *Reports of the Census of India 1901 and 1911.* (X.)

Law.—Infanticide is murder or manslaughter according to the presence or absence of deliberation. The infant must be a human being in the legal sense; and "a child becomes a human being when it has completely proceeded in a living state from the body of its mother, whether it has breathed or not, and whether it has an independent circulation or not, and whether the navel-string is severed or not; and the killing of such a child is homicide when it dies after birth in consequence of injuries received before, during or after birth." A child in the womb or in the act of birth, though it may have breathed, is therefore not a human being, the killing of which amounts to homicide.

In 1922 by the Infanticide Act of that year it was provided that where a woman by any wilful act or omission causes the death of her newly born child, but at the time of the act or omission had not fully recovered from the effect of giving birth to such child, and by reason thereof the balance of her mind was then disturbed, she is, notwithstanding that the circumstances were such that the offence would have amounted to murder, to be found guilty of infanticide and may for such offence be dealt with and punished as if she had been guilty of the manslaughter of the child. What constitutes a "newly born child" was considered by the court of criminal appeal in *Rex* v. *O'Donoghue* (138 L.T. Rep. 240). The court declined to define the expression, but where a woman was charged with the murder of her child who was just above a calendar month old at the date of its death, the judge at the trial held that there was no evidence that the child was "newly born" within the meaning of the act, and the court held that his ruling was correct in law.

(W. DE B. H.)

INFANTRY, the collective name of soldiers who fight on foot. The word is derived ultimately from Lat. *infans,* infant, but it is not clear how the word came to be used to mean soldiers. The suggestion that it comes from a guard or regiment of a Spanish infanta about the end of the 15th century cannot be maintained in view of the fact that Spanish foot-soldiers of the time were called *soldados* and contrasted with French *fantassins* and Italian *fanteria.* The *Oxford English Dictionary* suggests that a foot-soldier, being in feudal and early modern times the varlet or follower of a mounted noble, was called a boy (cf. *Knabe, garçon,* footman, etc., and *see* VALET).

I. HISTORICAL

Although it may be confidently asserted that the original fighting man was a foot-soldier, infantry was differentiated as an "arm" considerably later than cavalry; for when a new instrument of fighting (a chariot or a horse) was discovered, it was assimilated by relatively picked men, who *ipso facto* separated themselves from the mass or reservoir of men. How this mass itself ceased to be a mere residue and developed special characteristics; how, instead of the cavalry being recruited from the best infantry, cavalry and infantry came to form two distinct services; and how the arm thus constituted organized itself, technically and tactically, for its own work—these are the main questions that constitute the historical side of the subject. It is obvious that the "residue" was far the greatest part of the army; the history of the foot-soldier is practically identical with the history of soldiering.

The natural evolution of primitive fighting was towards the differentiation of the champion, the proved excellent fighting man, and to providing this man, on whom everything depended, with all assistance that better arms, armour, horse or chariot could give him. But suppose our champion slain, how are we to make head against the opposing champion? For long ages, we may suppose, the latter, as in the *Iliad,* slaughtered the sheep who had lost their shepherd, but in the end the "residue" began to organize itself, and to evolve a method of fighting which enabled it, or at least the better part of it, to oppose a firm and united front to the enemy's champions—in which term we include all selected men, whether horsemen, charioteers or merely specially powerful axemen and swordsmen. But once the individual had lost his commanding position, the problem presented itself in a new form—how to ensure that every member of the group did his duty by the others—and the solution of this problem for the condition of the ancient hand-to-hand struggle marks the historical beginning of infantry tactics.

The Phalanx and the Legion.—Gallic warriors bound themselves together with chains. The Greeks organized the city state, which gave each small army solidarity and the sense of duty to an ideal, and the phalanx in which the file-leaders were in a sense champions yet were made so chiefly by the unity of the mass. But the Romans went further. Besides developing solidarity and a sense of duty, they improved on this conception of the battle to such a degree that as a nation they may be called the best tacticians who ever existed. They split the mass of combatants into three bodies, of which the first, formed of the youngest and most impressionable men, was engaged at the outset, the rest, more experienced men, being kept out of the turmoil. This is the very opposite of the "champion" system. Those who would have fled after the fall of the champions are engaged and "fought out" before the champions enter the area of the contest, while the champions, who possess in themselves the greatest power of resisting and mastering the instinct of self-preservation, are kept back for the moment when ordinary men would lose heart.

It might be said with perfect justice that without infantry there would never have been discipline, for cavalry began and continued as a crowd of champions. Discipline, which created and maintained the intrinsic superiority of the Roman legion, depended first on the ideal of patriotism. This was ingrained into every man from his earliest years and expressed in a system of rewards and punishments which took effect from the same ideal, in that rewards were in the main honorary in character (mural crowns, etc.), while no physical punishment was too severe for the man who betrayed, by default or selfishness, the cause of Rome. Secondly, though every man knew his duty, not every man was equal to doing it, and in recognition of this fact the Romans evolved the system of three-line tactics in which the strong parts of the machine neutralized the weak. So closely knit were the parts of the system that not only did the decadence of patriotism

sap the legionary organization, but also the unsuitability of that organization to new conditions of warfare reacted unfavourably, even disastrously, on the *moral* of the nation. Between them, the Roman infantry fell from its proud place, and whereas in the Republic it was familiarly called the "strength" (*robur*), by the 4th century A.D. it had become merely the background for a variety of other arms and corps. As the Roman *imperium* extended the burden of foreign service became too heavy for the ordinary citizen, the citizen-army ceased to exist, and the mere necessity for garrisoning distant lands threw the burden of service upon the professional soldier.

The Roman Imperial Army.—The natural consequence of this last was the uniform training of every man. There were no longer any primary differences between one cohort and another, and though the value of the three-line system in itself ensured its continuance, any cohort, however constituted, might find itself serving in any one of the three lines, *i.e.*, the *moral* of the last line was no better than that of the first. In brief, the old Roman organization was based on patriotism and experience, and when patriotism gave place to "egoism," and the experience of the citizen who spent every other summer in the field of war gave place to the formal training of the paid recruit, it died, unregretted either by the citizen or by the military chieftain. The latter knew how to make the army his devoted servant, while the former disliked military service and failed to prepare himself for the day when the military chief and the mercenary overrode his rights and set up a tyranny, and ultimately the inner provinces of the empire came to be called *inermes*—unarmed, defenceless—in contrast to the borderland where the all-powerful professional legions lay in garrison.

In these same frontier provinces the tactical disintegration of the legion slowly accomplished itself. Originally designed for the exigencies of the normal pitched battle on firm open fields, and even after its professionalization retaining its character as a large battle unit, it was soon fragmented through the exigencies of border warfare into numerous detachments of greater or less size, and when the military frontier of the empire was established, the legion became an almost sedentary corps, finding the garrisons for the blockhouses on its own section of the line of defence. Further, the old heavy arms and armour which had given it the advantage in wars of conquest—in which the barbarians, gathering to defend their homes, offered a target for the blow of an army—were a great disadvantage when it became necessary to police the conquered territory, to pounce upon swiftly moving bodies of raiders before they could do any great harm. Thus gradually cavalry became more numerous, and light infantry of all sorts more useful, than the old-fashioned linesman. To these corps went the best recruits and the smartest officers, the opportunities for good service and the rewards for it. The legion became once more the "residue."

The battle of Adrianople (*q.v.*), the "last fight of the legion," illustrates this. The frontal battle was engaged in the ordinary way, and the first line of the imperial army was fighting man to man with the front ranks of the Gothic infantry, when suddenly the armoured heavy cavalry of the Goths burst upon their flank and rear. There were no longer *Principes* and *Triarii* of the old Republican calibre, but only average troops, in the second and third lines, and they were broken at once. The first line felt the battle in rear as well as in front and gave way. Thereafter the victors, horse and foot, slaughtered unresisting herds of men, and on this day the infantry arm, as an arm, ceased to exist.

The Dark Ages.—Regular infantry was still maintained for siege, mountain and forest warfare. But the *robur*, the kernel of the line of battle, was gone, and though a few of the peoples that fought their way into the area of civilization in the dark ages brought with them the natural and primitive method of fighting on foot, these infantry nations, without any infantry system comparable to that of the Greeks and Romans, succumbed in turn to the crowd of mounted warriors—not for want of good military qualities, but for want of an organization which would have distributed their fighting powers to the best advantage. One has only to study the battle of Hastings to realize how completely the infantry masses of the English slipped from the control of their leaders directly the front ranks became seriously engaged. For many generations after Hastings there was no attempt to use infantry as the kernel of armies, still less to organize it as such beforehand. Indeed, except in the Crusades, where men of high and of low degree alike fought for their common faith, and in sieges, where cavalry was powerless and the services of archers and labourers were at a premium, it became unusual for infantry to appear on the field at all.

In those days in truth the infantry was no more the army than to-day the shareholders of a limited company are the board of directors. They were deeply, sometimes vitally, interested in the result, but they contributed little or nothing to bringing it about, except when the opposing cavalries were in a state of moral equilibrium, and in these cases anything suffices—the appearance of camp followers on a "Gillies Hill," as at Bannockburn, or the sound of half-a-dozen trumpets—to turn the scale. Once it turned, the infantry of the beaten side was cut down unresistingly, while the more valuable prisoners were admitted to ransom.

Revival of Infantry.—But even this infantry contained within itself two half-smothered sparks of regeneration, the idea of *archery* and the idea of *communal militia*. Archery, in whatever form practised, was the one special form of military activity with which the heavy *gendarme* (whether he fought on horseback or dismounted) had no concern, in sharp contrast to the Byzantine army in its heyday and to the Mongols who inflicted such sharp lessons on European chivalry in the 13th century. Here therefore infantry had a special function, and so far ceased to be "residue." The communal militia was an early and inadequate expression of the town-spirit that was soon to produce the solid burgher militia of Flanders and Germany and after that the trained bands of the English cities and towns. It was under the influence of these two ideas or forces that infantry as an arm began once again, though slowly and painfully, to differentiate itself from the worthless "residue."

Courtrai.—The first true infantry battle since Hastings was fought at Courtrai in 1302, between the burghers of Bruges and a feudal army under Count Robert of Artois. The citizens, arrayed in heavy masses, and still armed with miscellaneous weapons, were careful to place themselves on ground difficult of access—dikes, pools and marshes—and to fasten themselves together, like the Gauls of old. Their van was driven back by the French cross-bowmen, whereupon Robert of Artois, true feudal leader as he was, ordered his infantry to clear the way for the cavalry and without even giving them time to do so pushed through their ranks with a formless mass of gendarmerie. This, in attempting to close with the enemy, became immovably fastened in the mud. The citizens swarmed all round it and with spear, cleaver and flail destroyed it.

Crécy (*q.v.*) was fought forty-four years after Courtrai. Here the knights had open ground to fight on, and many boasted that they would revenge themselves. But they encountered not merely infantry, but infantry tactics, and were for the second, and not the last, time destroyed. The English yeomen had reached a level of self-discipline and self-respect which few even of the great continental cities had attained. They had, further, made the powerful long-bow (*see* ARCHERY) their own, and Edward I. had combined the shock of the heavy cavalry with the slow searching preparatory rain of arrows (*see* FALKIRK). That is, infantry tactics and cavalry tactics were co-ordinated by a general, and the special point of this is that instead of being, as in France, the unstable base of the so-called "feudal pyramid," infantry had become an *arm*, capable of offence and defence and having its own special organization, function in the line of battle and tactical method. This last, indeed, like every other tactical method, rested ultimately on the *moral* of the men who had to put it into execution. Archer tactics did not serve against the disciplined rush of Joan of Arc's gendarmerie, for the solidarity of the archer companies that tried to stop it had long been undermined.

The English Archer.—Yet we cannot overrate the importance of the archer in this period of military history. In the city militias solidarity had been obtained through the close personal relation-

ship of the trade gilds and by the elimination of the champion. Therefore, as every offensive in war rests upon boldness, these militias were essentially defensive, for they could only hope to ward off the feudal champion, not to outfight him (*see* LEGNANO). England, however, had evolved a weapon which no armour could resist, and a race of men as fully trained to use it as the gendarme was to use the lance. Crossbows indeed were powerful, and also handled by professional soldiers (*e.g.*, the Genoese at Crécy), but they were slow in action, six times as slow as the long bow, and the impatient gendarmerie generally became tired of the delay and crowded out or rode over the crossbowmen. The long bow gave them the power of killing without being killed, which the citizens' spears and maces and *voulges* did not. But like all missiles, arrows were a poor stand-by in the last resort if determined cavalry crossed the "beaten zone" and closed in, and besides pavises and pointed stakes the English archers were given the support of the knights, nobles and sergeants—the armoured champions—whose steady lances guaranteed their safety. Here was the real forward stride in infantry tactics. Archery had existed from time immemorial, and a mere technical improvement in its weapon could hardly account for its suddenly becoming the queen of the battlefield. The defensive power of the "dark impenetrable wood" of spears had been demonstrated again and again, but when the cavalry had few or no preliminary difficulties to face, the chances of the infantry mass resisting long-continued pressure was small. It was the combination of the two elements that made possible a Crécy and a Poitiers, and this combination was the result of the English social system which produced the *camaraderie* of knight and yeoman, champion and plain soldier. Fortified by the knight's unshakable steadiness, the yeoman handled his bow and arrows with cool certainty and rapidity, and shot down every rush of the opposing champions. This was *camaraderie de combat* indeed, and in such conditions the strategic offensive was possible and even easy. The English conquered whole countries while the Flemish and German spearmen and *vougiers* merely held their own.

The Hundred Years' War.—But the war of conquest embodied in these decisive victories dwindled in its later stages to a war of raids. The feudal lord, like the feudal vassal, returned home and gave place to the professional man-at-arms and the professional captain. Ransom became again the chief object, and except where a great leader, such as Bertrand Du Guesclin, compelled the mercenaries to follow him to death or victory, a battle usually became a mêlée of irregular duels between men-at-arms. The war went on and on, the gendarmes thickened their armour, and the archers found more difficulty in penetrating it. Moreover, in raids for devastation and booty, the slow-moving infantryman was often a source of danger to his comrades. In this *guerrilla* the archer, though he kept his place, soon ceased to be the mainstay of battle. It had become customary since Crécy (where the English knights and sergeants were dismounted to protect the archers) for all mounted men to send away their horses before engaging. Here and there cavalry masses were used by such energetic leaders as the Black Prince and Du Guesclin, and more often a few men remained mounted for work requiring exceptional speed and courage—as for instance when thirty men-at-arms "cut out" the Captal de Buch from the midst of his army at Cocherel—but as a general rule the man-at-arms was practically a mounted infantryman, and when he dismounted he stood still.

Cavalry therefore became, in a loose sense of the word, infantry. But we are tracing the history not of all troops that stood on their feet to fight, but of infantry and the special tactics of infantry, and the period before and after 1370, when the moral foundations of the new English tactics had disappeared, and the personality of Du Guesclin gave even the bandits of the "free companies" an intrinsic, if slight, superiority over the invaders, is a period of deadlock. Solidarity, such as it was, had gone over to the side of the heavy cavalry. But the latter had deliberately forfeited their power of forcing the decision by fighting on foot, and the English archer, the cadre of the English tactical system, though diminished in numbers, prestige and importance, held to existence and survived the deadlock. Infantry of that type indeed could never return to the "residue" state, and it only needed a fresh moral impetus, a Henry V., to set the old machinery to work again for a third great triumph. But again, after Agincourt, the long war lapsed into the hands of the soldiers of fortune, the basis of Edward's and Henry's tactics crumbled, and, under Joan of Arc, the French cavalry rode down the stationary masses of the English, lances and bowmen alike.

The net result of the Hundred Years' War therefore was to re-establish the two arms, cavalry and infantry, side by side, the one acting by shock, and the other by fire. The lesson of Crécy was "prepare your charge before delivering it," and for that purpose great bodies of infantry armed with bows, arblasts and handguns were brought into existence in France. When the French king in 1448 put into force the "lessons of the war" and organized a permanent army, it consisted in the main of heavy cavalry (knights and squires in the *ordonnance* companies, soldiers of fortune in the paid companies) and archers and arblasters (*francs-archers* recruited nationally, arblasters as a rule mercenaries, though largely recruited in Gascony). To these *armes de jet* were added, in ever-increasing numbers, hand firearms. Thus the "fire" principle of attack was established, and the defensive principle of "mass" relegated to the background. In such circumstances cavalry was of course the decisive arm, and the reputation of the French gendarmerie was such as to justify this bold elimination of the means of passive defence. This tendency of the French military temperament reappears at almost every stage in the history of armies.

Burgher Militias.—The foot-soldier of Germany and the Low Countries had followed a different line of development. Here the rich commercial cities scarcely concerned themselves with the quarrels or revolts of neighbouring nobles, but they resolutely defended their own rights against feudal interference, and enforced them by an organized militia, opposing the strict solidarity of their own institutions to the prowess of the champion who threatened them. The struggle was between "you shall" on the part of the baron and "we will not" on the part of the citizens, the offensive *versus* the defensive in the simplest and plainest form. The latter was a policy of unbreakable squares, and wherever possible, strong positions as well. Sometimes the citizens, sometimes the nobles gained the day, but the general result was that steady infantry in proper formation could not be ridden down, and as yeomen-archers of the English type to "prepare" the charge were not obtainable from amongst the serf populations of the countryside, the problem of the attack was, for Central Europe, insoluble.

The Wagenburg.—The unbreakable square took two forms, the *wagenburg* with artillery, and the infantry mass with pikes. The first was no more, in the beginning, than an expedient for the safe and rapid crossing of wider stretches of open country than would have been possible for dismounted men, whom the cavalry headed off as soon as they ventured far enough from the shelter of walls. The men rode not on horses but on carriages, and the carriages moved over the plains in laager formation, the infantrymen standing ready with halbert and *voulge* or short stabbing spear, and the gunners crouching around the long barrelled two-pounders and the *ribaudequins*—the early machine guns—which were mounted on the wagons. These *wagenburgen* combined in themselves the due proportions of mobility and passive defence, and in the skilled hands of Ziska they were capable of the boldest offensive. But such a tactical system depended first of all on drill, for the armoured cavalry would have crowded through the least gap in the wagon line, and the necessary degree of drill in those days could only be attained by an army which had both a permanent existence and some bond of solidarity more powerful than the incentive to plunder—that is, in practice, it was only attained in full by the Hussite insurgents. The cavalry too, learned its lesson, and pitted mobile three-pounders against the foot-soldiers' one- and two-pounders, and the *wagenburg* became no more than a helpless target. Thus when, not many years after the end of the Hussite wars, the Wars of the Roses eliminated the English model and the English tactics from the military world of Europe, the French system of fire tactics, masses of archers, arblasters and handgun-men, with some spearmen and halberdiers to stiffen them,

was left face to face with that of the Swiss and Landsknechts, the system of the "long pike."

The Swiss.—A series of victories ranging from Morgarten (1315) to Nancy (1477) had made the Swiss the most renowned infantry in Europe. Originally their struggles with would-be oppressors had taken the form, often seen elsewhere, of arraying solid masses of men, united in purpose and fidelity to one another rather than by any material or tactical cohesion. Like the men of Bruges at Courtrai, the Swiss had the advantage of broken ground and the still greater advantage of being opposed by reckless feudal cavalry. Their armament at this stage was not peculiar —voulges, gisarmes, halberts and spears—though they were specially adept in the use of the two-handed sword. But as time went on the long pike (said to have originated in Savoy or the Milanese about 1330) became more and more popular until at last on the verge of their brief ascendancy (about 1475–1515) the Swiss armed as much as one quarter of their troops with it. The use of firearms made little or no progress amongst them. But in a very few years after the Swiss nation had become soldiers of fortune *en masse*, the more open lands of Swabia entered into serious and bitter competition with them. From these lands came the Landsknechts, whose order was as strong as, and far less unwieldy than, that of the Swiss, whose armament included a far greater proportion of firearms, and who established a regimental system that left a permanent mark on army organization. The Landsknecht was the prototype of the infantryman of the 16th and 17th centuries, but his right to indicate the line of evolution had to be wrung from many rivals.

The Long Pike.—The year 1480 was a turning point in military history. Within the three years preceding it the battles of Nancy and Guinegate had destroyed both the old feudalism of Charles the Bold and the new cavalry tactics of the French gendarmerie. The former was an anachronism, while the latter, when the great wars came to an end and there was no longer either a national impulse or a national leader, had lapsed into the old vices of ransom and plunder. With these, on the same fields, the *franc-archer* system of infantry tactics perished ignominiously. It rested, as we know, on the principle that the fire of the infantry was to be combined with and completed by the shock of the gendarmerie, and when the latter were found wanting as at Guinegate, the masses of archers and arblasters were swept away by the charge of some heavy battalions of Swabian and Flemish pikes. Guinegate was the début of the Landsknecht infantry as Nancy was that of the Swiss, and the lesson could not be misread. Louis XI. indeed hanged some of his *franc-archers* and dismissed the rest, and in their place raised "bands" of regular infantry, one of which bore for the first time the historic name of *Picardie*. But these "bands" were not self-contained. Armed for the most part with *armes de jet* they centred on the 6,000 Swiss pikemen whom Louis XI., in 1480, took into his service, and for nearly fifty years thereafter the French foot armies are always composed of two elements, the huge battalions of Swiss or Landsknechts, armed with the long pike, and for their support and assistance, French and mercenary "bands." The term *Landsknecht* was not confined to the right bank of the Rhine. The French *lansquenets* came largely from Alsace, according to General Hardy de Perini. In the Italian wars Francis I. had in his service a famous corps called the "black bands" which was recruited in the lower Rhine countries.

The Italian Wars, 1494–1525.—The Italian wars of 1494 to 1544, in which the use of "fire" and shock was readjusted to meet the conditions created by firearms, were the nursery of modern infantry. The combinations of Swiss, Landsknechts, Spanish *tercios* and French "bands" that figured on the battlefields of the early 16th century were infinitely various. But it is not difficult to find a thread that runs through the whole.

The essence of the Swiss system was solidity. They arrayed themselves in huge oblongs of 5,000 men and more, at the corners of which, like the tower bastions of a 16th-century fortress, stood small groups of arquebusiers. The Landsknechts and the Romagnols of Italy, imitated and rivalled them, though as a rule developing more front and less depth. At this stage solidity was everything and fire-power nothing. At Fornuovo (1495) the mass of arquebusiers and arblasters in the French army did little or nothing; it was the Swiss who were *l'ésperance de l'ost*. At Agnadello or Vaila in 1509 the ground and the "encounter-battle" character of the engagement gave special chances of effective employment to the arquebusiers on either side. Along the front the Venetian marksmen, secure behind a bank, picked off the leaders of the enemy as they came near. On the outer flank of the battle the bands of Gascon arquebusiers, which would otherwise have been relegated to an unimportant place in the general line of battle, lapped round the enemy's flank in broken ground and produced decisive effect. But this was only an afterthought of the king of France and Bayard. In the rest of the battle the huge masses of Swiss pikes were thrown upon the enemy much as the old feudal cavalry had been, regardless of ditches, orchards, and vineyards.

Then for a moment the problem was solved, or partially solved, by the artillery. Thus by degrees a very numerous and exceedingly handy light artillery—"carts with gonnes," as they were called in England—came into play on the Italian battlefields, and took over from the dying *franc-archer* system the work of preparing the assault by fire. At Ravenna (*q.v.*) (1512), the fire action of the new artillery was extraordinarily murderous, ploughing lanes in the immobile masses of infantry. At Marignan (*q.v.*) the French gendarmerie and artillery, closely and skilfully combined, practically destroyed the huge masses of the Swiss, and so completely had "infantry" and "fire" become separate ideas that on the third day of this tremendous battle we find even the "bands of Piedmont" cutting their way into the Swiss masses.

The Spanish Infantry and the Arquebus.—But from this point the lead fell into the hands of the Spaniards. These were originally swift and handy light infantry, capable, like the Scottish Highlanders at Prestonpans and Falkirk long afterwards, of sliding under the forest of pikes and breaking into the close-locked ranks with buckler and stabbing sword. For troops of this sort the arquebus was an ideal weapon, and the problem of self-contained infantry was solved by Gonsalvo de Cordoba, Pescara and the great Spanish captains of the day by intercalating small closed bodies of arquebusiers with rather larger, but not inordinately large, bodies of pikes. These arquebusiers formed separate, fully organized sections of the infantry regiment. In close defence they fought on the front and flanks of the pikes, but more usually they were pushed well to the front independently, their speed and excellent fire discipline enabling them to do what was wholly beyond the power of the older type of firing infantry—to take advantage of ground, to run out and re-open fire during a momentary pause in the battle of lance and pike, and to run back to the shelter of their own closed masses when threatened by an oncoming charge. When this system of tactics was consecrated by the glorious success of Pavia (1525), the "cart with gonnes" vanished and the system of fighting everywhere and always "at push of pike" fell into the background.

By 1550 infantry had ceased to be an auxiliary arm. It contained within itself, and (what is more important) within its regimental units, the power of fighting effectively and decisively both at close quarters and at a distance. It had, further, developed a permanent regimental existence, both in Spain and in France, and in the former country it had progressed so far from the "residue" state that young nobles preferred to trail a pike in the ranks of the foot to service in the gendarmerie or light horse. The service battalions were kept up to war strength by the establishment of depôts and the preliminary training there of recruits.

The wars in which this system was evolved were wars for prestige and aggrandizement. But the wars of religion raised questions of life and death for the Frenchmen of either faith, and thus endowed operations with a new decisive spirit. Hence the relatively immobile "battalion" of pikes diminishes in importance and the arquebusiers and musketeers grow more and more efficient. Armies, too, became smaller, and marched more rapidly. Encounter battles became more frequent than "pitched" battles, and in these the musketeer was at a great advantage. Thus by 1600 the proportions between pikes and musketeers in the French army had come to be 6 pikes to 4 muskets or arquebuses, and the

bataillon de combat or brigade was normally no more than 1,200 strong. In the Netherlands, however, the war of consciences was fought out between the best regular army in the world and burgher militias. Even the French *fantassins* were second in importance to the Spanish *soldados*. The latter continued to hold the pre-eminent position they had gained at Pavia. They improved the arquebus into the musket, a heavier and much more powerful weapon (fired from a rest) which could disable a horse at 500 paces.

Alva.—At this moment the professional soldier was at the high-water mark of his supremacy. The musket was too complicated to be rapidly and efficiently used by any but a highly trained man; the pike, probably because it had now to protect two or three ranks of "shot" in front of the leading rank of pikemen, as well as the pikemen themselves, had grown longer (up to 18 ft.); and drill and manoeuvre had become more important than ever, for in the meantime cavalry had mostly abandoned the massive armour and the long lance in favour of half-armour and the pistol, and their new tactics made them both swifter to charge groups of musketeers and more deadly to the solid masses of pikemen. This superiority of the regular over the irregular was most conspicuously shown in Alva's war against the Netherlands patriots. Desperately as the latter fought, Spanish captains did not hesitate to attack patriot armies ten times their own strength. If once or twice this contempt led them to disaster, the normal battle was of the Jemmingen type—seven *soldados* dead and seven thousand rebels.

Such results as these naturally confirmed the "Spanish system" of tactics. The Dutch themselves, when they evolved reliable field armies, copied it with few modifications, and by degrees it was spread over Europe by the professional soldiers on both sides. The French, however, with their smaller battalions and more rapid movements were inclined to disparage both the cuirass and the pike, and only unwillingly hampered themselves with the long heavy Spanish musket, which had to be fired from a rest. In 1600, nearly fifty years after the introduction of the musket, this most progressive army still deliberately preferred the old light arquebus, and only armed a few selected men with the larger weapons. On the other hand, the Spaniards, though supreme in the open, had for the most part to deal with desperate men behind fortifications. Fighting, therefore, chiefly at close quarters with a fierce enemy, and not disposing either of the space or of the opportunity for "manoeuvre-battles," they sacrificed all their former lightness and speed, and clung to armour, the long pike and the heavy 2½ oz. bullet. But during the 17th century solidity, and the powers of passive resistance were, little by little, replaced by a more offensive armament and faculty, until at last the long pike disappeared altogether and the firearm, provided with a bayonet, was the uniform weapon of the foot-soldier. As far as France was concerned, it was a natural evolution. But the acceptance of the principle by the rest of the military world, imposed by the genius of Gustavus Adolphus, was rather revolution than evolution.

Gustavus Adolphus.—In the army which Louis XIII. led against his revolted barons of Anjou in 1620, the old regiments seem to have marched in an open chequer-wise formation of companies which is interesting not only as a deliberate imitation of the Roman legion (all soldiers of that time, in the prevailing confusion of tactical ideas, sought guidance in the works of Xenophon, Aelian and Vegetius), but as showing that flexibility and handiness was not the monopoly of the Swedish system that was soon to captivate military Europe. But the generals of the Thirty Years' War who were trained in the Spanish school formed their infantry into large battalions (generally a single line of masses). Experience certainly gave the troops that used these unwieldy formations a relatively high manoeuvring capacity, for Tilly's army at Breitenfeld (*q.v.*) "changed front half-left" in the course of the battle itself. But the manoeuvring power of the Swedes was higher still. Each party represented one side of the classical revival, the Swedes the Roman three-line manipular tactics, the Imperialists and Leaguers those of the Greek line of phalanxes. The former, depending as it did on high *moral* in the individual foot-soldier, was hardly suitable to such a congeries of mercenaries as those that Wallenstein commanded, and in the later stages of the Thirty Years' War, when the old native Swedish and Scottish brigades had been annihilated, the Swedish infantry was little if at all better than the rest.

But its tactical system, sanctified by victory, was eagerly caught up by military Europe. The musket, though it had finally driven out the arquebus, had been lightened by Gustavus Adolphus so far that it could be fired without a rest. Rapidity in loading had so far improved that a company could safely be formed six deep instead of ten, as in the Spanish and Dutch systems. Its fire power was further augmented by the addition of two very light field-guns to each battalion; these could inflict loss at twice the effective range of the shortened musket. Above all, Gustavus introduced into the military systems of Europe a new discipline based on the idea of exact performance of duty, which made itself felt in every part of the service, and was a welcome substitute for the former easy-going methods of regimental existence. The adoption of Swedish methods indeed was facilitated by the disrepute into which the older systems had fallen. Courage the mercenary certainly possessed, but his individual sense of honour, code of soldierly morals, and sometimes devotion to a particular leader did not compensate for the absence of a strong motive for victory and for his general refractoriness in matters of detail, such as march-discipline and punctuality, which had become essential since the great Swedish king had reintroduced order, method and definiteness of purpose into the conduct of military operations.

The Great Rebellion.—The problem of combining the maximum of fire power with the maximum of control over the individual firer was not fully solved until 1740, but the necessity of attempting the problem was realized from the first. In the Swedish army, before it was corrupted by the atmosphere of the Thirty Years' War, duty to God and to country were the springs of the punctual discipline, in small things and in great, which made it the most formidable army, unit for unit, in the world. In the English Civil War (in which the adherents of the "Swedish system" from the first ousted those of the "Dutch") the difficulty was more acute, for although the mainsprings of action were similar, the technical side of the soldier's business—the regimental organization, drill and handling of arms—had all to be improvised. Now in the beginning the Royalist cavalry was recruited from "gentlemen that have honour and courage and resolution"; later, Cromwell raised a cavalry force that was even more thoroughly imbued with the spirit of duty, "men who made some conscience of what they did," and throughout the Civil War, consequently, the mounted arm was the queen of the battlefield.

The Parliamentary foot too "made some conscience of what it did," more especially in the first years of the war. But its best elements—the drilled townsmen—were rather of a defensive than of an offensive character; towards the close of the struggle, when the foot on both sides came to be formed of professional soldiers, the defensive element decreased, as it had decreased in France and elsewhere. The war was like Gustavus's German campaign, one of rapid and far-ranging marches, and the armoured pikeman had either to shorten his pike and to cast off his armour or to be left at home with the heavy artillery (*see* Firth's *Cromwell's Army*, ch. iv.). Fights at "push of pike" were rare enough to be specially mentioned in reports of battles.

Disuse of the Pike.—A small proportion of pikes was still held to be necessary by experienced soldiers, for as yet the socket bayonet had not been invented, and while there was still cavalry in Europe that could be trusted to ride home, the development of fire power was everywhere hindered by the necessity of self-defence. On the other hand the hitherto accepted defensive means militated against efficiency in many ways, and about 1670, when Louis XIV. and Louvois were fashioning the new standing army that was for fifty years the model for Europe, the problem was how to improve the drill and efficiency of the musketeers so far that the pikes could be reduced to a minimum. In 1680 the fire-lock was issued instead of the matchlock to all grenadiers and to the four best shots in each French Company. The bayonet—in its primitive form merely a dagger that was fixed into the muzzle of

the musket—was also introduced, and the pike was shortened. The proportion of pikes to muskets in Henry IV.'s day, 2 to 1 or 3 to 2, and in Gustavus's 2 to 3, had now fallen to 1 to 3.

The day of great causes that could inspire the average man with the resolution to conquer or die was, however, past, and the "shallow order" (*l'ordre mince*), with all its demands on the individual's sense of duty, had become an integral part of the military system. How then was the sense of duty to be created? Louis and Louvois and their contemporaries sought to create it by taking raw recruits in batches, giving them a consistent training, quartering them in barracks and uniforming them. Henceforward the soldier was not a unit, self-taught and free to enter the service of any master. He had no existence as a soldier apart from his regiment and within it he was taught that the regiment was everything and the individual nothing. Thus by degrees the idea of implicit obedience to orders and of *ésprit de corps* was absorbed. But the self-respecting Englishman or the quick ardent Frenchman was not the best raw material for quasi-automatic regiments, and it was not until an infinitely more rigorous system of discipline was applied to an unimaginative army that the full possibilities of this enforced sense of duty were realized.

Methods of Fire Before 1740.—The method of delivering fire originally used by the Spaniards, in which each man in succession fired and fell back to the rear of the file to reload, required for its continued and exact performance a degree of coolness and individual smartness which was probably rarely attained in practice. This was not of serious moment when the "shot" were simple auxiliaries, but when under Gustavus the offensive idea came to the front, and the bullets of the infantry were expected to do something more than merely annoy the hostile pikemen, a more effective method had to be devised. First, the handiness of the musket was so far improved that one man could reload while five, instead of as formerly ten, fired. Then, as the enhanced rate of fire made the file-firing still more disorderly than before, two ranks and three were set to fire "volews" or "salvees" together, and before 1640 it had become the general custom for the musketeers to fire one or two volleys and then, along with the pikemen, to "fall on."

The Bayonet.—With the decay of cavalry methods and *moral* the adoption of the flintlock musket and the invention of the socket bayonet (the fixing of which did not prevent fire being delivered), all reason for retaining the pike vanished, and from about 1700 the invariable armament of infantry became the musket and bayonet. The manner of employing the weapons, however, changed but slowly. But the idea of "push of pike" remained, the bayonet (as at Marsaglia) taking the place of the pike, and musketry methods were still and throughout the War of the Spanish Succession somewhat half-hearted and tentative.

Linear Tactics.—Meanwhile the tactics of armies had been steadily crystallizing into the so-called "linear" form, which, as far as concerns the infantry, was simply two long lines of battalions (three, four or five deep) and gave the utmost possible development to fire-power. The object of the "line" was to break or beat down the opposing line in the shortest possible time, whether by fire action or shock action, but fire action was only decisive at so short a range that the principal volley could be followed immediately by a charge over a few score paces at most and the crossing of bayonets. Fire was, however, effective at ranges outside charging distance, especially from the battalion guns, and however the decision was achieved in the end, it was necessary to cross the zone between about 300 yd. and 50 yd. range as quickly as possible. It was therefore the business of the regimental officer to force his men across this zone before fire was opened. If, as Catinat recommended, decisive range was reached with every musket loaded and the troops well in hand, their fire when finally it was delivered might well be decisive. But in practice this rarely happened, and though here and there such expedients as a skirmishing line were employed to assist the advance by disturbing the enemy's fire the most that was hoped by the average colonel or captain was that in the advance fire should be opened as late as possible and that the officers should strive to keep in their hands the power of breaking off the fire-fight and pushing the troops forward again. The linear system rested on the principle that the maximum weight of controlled fire at short range was decisive, and the practical problem of infantry tactics was how to obtain this. The question of fire *versus* shock had been answered in favour of the former, and henceforward for many years the question of fire *versus* movement held the first place. The purpose was settled, and it remained to discover the means.

This means was Prussian fire-discipline, which was elaborated by Leopold of Dessau and Frederick William I., and practically applied by Frederick the Great. It consisted first in the combination, instead of the alternation, of fire and movement, and secondly in the thorough efficiency of the fire in itself. But both these demanded a more stringent and technically more perfect drill than had ever before been imagined, or, for that matter, has ever since been attained.

Prussian Fire Discipline, 1740.—On approaching the enemy the marching columns of the Prussians, which were generally open columns of companies 4 deep, wheeled in succession to the right or left (almost always to the right) and thus passed along the front of the enemy at a distance of 800–1,200 yd. until the rear company had wheeled. Then the whole together (or in the case of a deployment to the left, in succession) wheeled into line facing the enemy. These movements, if intervals and distances were preserved with proper precision, brought the infantry into two long well-closed lines, and parade-ground precision was actually attained, thanks to remorseless drilling and to the reintroduction of the march in step to music. Of course such movements were best executed on a firm plain, and as far as possible the attack and defence of woods and villages was left to light infantry and grenadiers. But even in marshes and scrub, the line managed to manoeuvre with some approach to the precision of the barrack square[1]. This precision allowed Frederick to take risks that no former commander would have dared to take culminating in the oblique order attack of Leuthen (*q.v.*). With it was bound up a fire discipline that was more extraordinary than any perfection of manoeuvre. Before Hohenfriedberg the king gave orders that *pelotonfeuer* was to be opened at 200 paces from the enemy and continued up to 30 paces, when the line was to fall on with the bayonet. The possibility of this combination of fire and movement was the work of Leopold, who gave the Prussian infantry iron ramrods, and by sheer drill made the soldier a machine capable of delivering (with the flintlock muzzle-loading muskets, be it observed) five volleys a minute. This *pelotonfeuer* or company volleys replaced the old fire by ranks practised in other armies. Fire began from the flanks of the battalion, which consisted of eight companies (for firing, 3 deep). When the right company commander gave "fire," the commander of No. 2 gave "ready," followed in turn by other companies up to the centre. The same process having been gone through on the left flank, by the time the two centre companies had fired the two flank companies were ready to recommence, and thus a continuous series of rolling volleys was delivered, at one or two seconds' interval only between companies. In attack this fire was combined with movement, each company in turn advancing a few paces after "making ready." In the advance of the deployed line the special Prussian fire-discipline gave Frederick an advantage of five shots to two against all opponents. The bayonet-attack, if the rolling volleys had done their work, was merely "presenting the cheque for payment" as a modern German writer puts it. The cheque had been drawn, the decision given, in the fire-fight.

Leuthen.—For some years this method of infantry training gave the Prussians a decisive superiority in whatever order they fought. But their enemies improved and also grew in numbers, while the Prussian army's resources were strictly limited. Thus in the Seven Years' War, after the two costly battles of Prague and Kolin (1757) especially, it became necessary to manoeuvre with the object of bringing the Prussian infantry into

[1]About this time there was introduced, for resisting cavalry, the well-known hollow battalion square, which, replacing the former masses of pikes, represented up to the most modern times the defensive as the line or column represented the offensive formation of infantry.

contact with an equal or if possible smaller portion of the enemy's line. If this could be achieved, victory was as certain as ever, but the difficulties of bringing about a successful manoeuvre were such that the classical "oblique order" attack was only once completely executed. This was at Leuthen (Dec. 5, 1757), perhaps the greatest day in the history of the Prussian army. Frederick's object was to destroy the left of the Austrian army (which far outnumbered his own) before the rest of their deployed line of battle could change front to intervene. His method was to place his own line, by a concealed flank march, opposite the point where he desired to strike, and then to advance, not in two long lines but in échelon of battalions from the right (*see* LEUTHEN). The échelon was not so deep but that each battalion was properly supported by the following one on its left (100 paces distance), and each, as it came within 200 yd. of the Austrian battalion facing it, opened its "rolling volleys" while continuing to advance; thus long before the left and most backward battalions were committed to the fight, the right battalions were crumbling the Austrian infantry units one by one from left to right.

One lesson of Leuthen that contemporary soldiers took to heart was that even a two-to-one superiority in numbers could not remedy want of manoeuvring capacity. It might be hoped that with training and drill an Austrian battalion could be made equal to a Prussian one in the front-to-front fight, and in fact, as losses told more and more heavily on Frederick's army as years went on, the specific superiority of his infantry disappeared. The last campaigns were indeed a war of positions, because Frederick had no longer the men available for forcing the Austrians out of them, and on many occasions he was so weak that the most passive defensive and the most elaborate entrenchments barely sufficed to save him. But whenever opportunity offered itself, the king sought a decisive success by bringing the whole of his infantry against part of the enemy's—the principle of Leuthen put in practice over a wider area with more elastic manoeuvre methods. In a battle each battalion or brigade fought as a unit in line, using company volleys and seeking the decision by fire.

Controversies and Developments, 1700–1790.—In this, and even in the most minute details of drill and uniform, military Europe slavishly copied Prussia for twenty years after the Seven Years' War. And withal, the period 1763–1792 is full of tactical and strategical controversies. The principal of these, as regards infantry, was that between "fire" and "shock" revived about 1710 by Folard, and about 1780 the American War of Independence complicated it by introducing a fresh controversy between *skirmishing* and *close order*. As to the first, in Folard's day as in Frederick's, fire action at close range was the deciding factor in battle, but in Frederick's later campaigns, wherein he no longer disposed of the old Prussian infantry and its swift mechanical fire-discipline, there sprang up a tendency to trust to the bayonet for the decision. If the (so-called) Prussian infantry of 1762 could in any way be brought to close with the enemy, it had a fair chance of victory owing to its leaders' previous dispositions, and then the advocates of "shock," who had temporarily been silenced by Mollwitz and Hohenfriedberg, again took courage. The ordinary line was primarily a formation for fire, and only secondarily or by the accident of circumstances for shock, and, chiefly perhaps under Saxe's influence, the French army had for many years been accustomed to differentiate between "linear" formations for fire and "columnar" for attack—thus reverting to 16th-century practice. While, therefore, the theoreticians pleaded for battalion columns and the bayonet or for line and the bullet, the practical soldier used both. Many forms of combined line and column were tried, but in France, where the question was most assiduously studied, no agreement had been arrived at when the advent of the skirmisher further complicated the issues.

In the early Silesian wars, when armies fought in open country in linear order, the outpost service was performed by irregular light troops, recruited from wild characters of all nations, who were also charged with the preliminary skirmishing necessary to clear up the situation before the deployment of the battle-army, but once the line opened fire their work was done and they cleared away to the flanks (generally in search of plunder). Later, light infantry became more in demand and wider in scope. Yet there was no suggestion that light troops or skirmishers were capable of bringing about the decision in an armed conflict.

Light Infantry.—In the American War of Independence the line was pitted against light infantry in difficult country, and the British and French officers who served in it returned to Europe full of enthusiasm for the latter. Nevertheless, their light infantry was, unlike Frederick's, selected line infantry. The light infantry duties—skirmishing, reconnaissance, outposts—were grafted on to a disciplined training. At first these duties fell to the grenadiers and light companies of each battalion, but during the struggle in the colonies, the light companies of a brigade were so frequently massed in one battalion that in the end whole regiments were converted into light infantry. This combination of "line" steadiness and "skirmisher" freedom was the keynote of Sir John Moore's training system fifteen years later, and Moore's regiments, above all the 52nd, 43rd (now combined as the Oxfordshire Light Infantry) and 95th Rifles (Rifle Brigade), were the backbone of the British Army throughout the Peninsular War. Meantime the infantry organization and tactics of the old régime, elsewhere than in England, had been disintegrated by the flames of the French Revolution, and from their ashes a new system had arisen.

The French Revolution.—The controversialists of Louis XVI.'s time, foremost of whom were Guibert, Joly de Maizeroy and Menil Durand (*see* Max Jahns, *Gesch. d. Kriegswissenschaften*, vol. iii.), were agreed that shock action should be the work of troops formed in column, but as to the results to be expected from shock action, the extent to which it should be facilitated by a previous fire preparation, and the formations in which fire should be delivered (line, line with skirmishers or "swarms") discussion was so warm that it sometimes led to wrangles in ladies' drawing-rooms and meetings in the duelling field. The drill-book for the French infantry issued shortly before the Revolution was a compromise, which in the main adhered to the Frederician system as modified by Guibert, but gave an important place in infantry tactics to the battalion "columns of attack," that had hitherto appeared only spasmodically on the battlefields of the French army and never elsewhere. This, however, and the quick march (100 paces to the minute instead of the Frederician 75) were the only prescriptions in the drill-book that survived the test of a "national" war, to which within a few years it was subjected (*see* FRENCH REVOLUTIONARY WARS). The rest, like the "linear system" of organization and manoeuvre to which it belonged (*see* ARMY; CONSCRIPTION, etc.) was ignored, and circumstances and the practical troop-leaders evolved by circumstances fashioned the combination of close-order columns and loose-order skirmishers which constituted essentially the new tactics of the Revolutionary and Napoleonic infantry.

Tactical Evolution in France 1792–1807.—The process of evolution cannot be stated in exact terms but certain tendencies are easily discernible. The first tendency was towards the dissolution of all tactical links. The earlier battles were fought partly in line for fire action, partly in columns for the bayonet attack. Now the linear tactics depended on exact preservation of dressing, intervals and distances, and what required in the case of the Prussians years of steady drill at 75 paces to the minute was hardly attainable with the newly levied ardent Frenchmen marching at 100 to 120. Once, therefore, the line moved, it broke up into an irregular swarm of excited firers, and experience soon proved that only the troops kept out of the turmoil were susceptible of manoeuvre and united action. Thus from about 1795 onwards the forms of the old régime gave way to new ones in which the skirmishers are fewer and the closed troops more numerous, and the decision rests no longer with the fire of the leading units (which of course could not compare in effectiveness with the rolling volleys of the drilled line) but with the bayonets of the second and third lines—the latter being sometimes in line but more often, owing to the want of preliminary drill, in columns. The skirmishers tended again to become pure light infantry, whose rôle was to prepare, not to give, the decision, and who fought in a thin line, taking every advantage of cover and marks-

manship.

In sum, then, from 1792 to 1795 the fighting methods of the French infantry were, as they have been aptly called, "horde tactics." From 1796 onwards to the first campaigns of the Empire, on the other hand, there was an ever-growing tendency to combine skirmishers, properly so called, with controlled and well-closed bodies in rear, the first to prepare the attack to the best of their ability by individual courage and skill at arms, the second to deliver it at the right moment (thanks to their retention of manoeuvre formations), and with all possible energy (thanks to the cohesion, moral and material, which carried forward even the laggards). Even when in the long wars of the Empire the quality of the troops progressively deteriorated, infantry tactics within the regiment or brigade underwent no radical alteration. The actual formations were most varied, but they always contained two of the three elements, column, line and skirmishers. Column (generally two lines of battalions in columns of double-companies) was for shock or attack, line for fire-effect, and skirmishers to screen the advance, to scout the ground and to disturb the enemy's aim. Of these, except on the defensive (which was rare in a Napoleonic battle), the "column" of attack was by far the most important. The line formations for fire, with which it was often combined, rarely accounted for more than one-quarter of the brigade or division, while the skirmishers were still less numerous. Withal, these formations in themselves were merely fresh shapes for old ideas. The armament of Napoleon's troops was almost identical with that of Frederick's or Saxe's. Line, column and combinations of the two were as old as Fontenoy and were, moreover, destined to live for many years after Napoleon had fallen. "Horde tactics" did not survive the earlier Revolutionary campaigns. Wherein then lies the change which makes 1792 rather than 1740 the starting point of modern tactics?

Napoleon's Infantry and Artillery Tactics, 1807–1815.—The answer, in so far as so comprehensive a question can be answered from a purely infantry standpoint, is that whereas Frederick, disposing of a small and highly finished instrument, used its manoeuvre power and regimental efficiency to destroy one part of his enemy so swiftly that the other had no time to intervene. Napoleon, who had numbers rather than training on his side[1], only delivered his decisive blow after he had "fixed" all bodies of the enemy which would interfere with his preparations —*i.e.*, had set up a physical barrier against the threatened intervention. This new idea manifested itself in various forms, strategic as well as tactical. As regards infantry the effect of it was revolutionary. Regiments and brigades were launched to the attack to compel the enemy to defend himself, and fought until completely dissolved to force him to use up his reserves. *"On s'engage partout et puis l'on voit"* is Napoleon's own description of his holding attack, which in no way resembled the "feints" of previous generations. The self-sacrifice of the men thus engaged enabled their commander to "see," and to mass his reserves opposite a selected point, while little by little the enemy was hypnotized by the fighting. Lastly, when "the battle was ripe" a hundred and more guns galloped into close range and practically annihilated a part of the defender's line. They were followed up by masses of reserve infantry, often more solidly formed at the outset than the old Swiss masses of the 16th century. If the moment was rightly chosen these masses, dissolved though they soon were into dense formless crowds, penetrated the gap made by the guns (with their arms at the slope) and were quickly followed by cavalry divisions to complete the enemy's defeat. Here, too, it is to be observed there is no true shock. The infantry masses merely "present the cheque for payment," and apart from surprises, ambushes and fights in woods and villages there are few recorded cases of bayonets being crossed in these wars. Napoleon himself said *"Le feu est tout, le reste peu de chose,"* and though a mere plan of his dispositions suggests that he was the disciple of Folard and Menil Durand, in reality he simply applied "fire-power" in the new and grander form which his own genius imagined.

The problem, then, was not what it had been one hundred and fifty years before. The business of the attack was not to break down the passive resistance of the defence, but to destroy or to evade its fire-power. No attack with the bayonet could succeed if this remained effective and unbroken, and no resistance (in the open field at least) availed when it had been mastered or evaded. In Napoleon's army, the circumstance that the infantry was (after 1807) incapable of carrying out its own fire-preparation forced the task into the hands of the field artillery. In other armies the 18th-century system had been discredited by repeated disasters, and the infantry, as it became "nationalized," was passing slowly through the successive phases of irregular lines, "swarms," skirmishers and line-and-column formations that the French Revolutionary armies had traversed before them—none of them methods that in themselves had given decisive results.

The British Peninsular Infantry.—In all Europe the only infantry that represented the Frederician tradition and prepared its own charge by its own fire was the British. Eye-witnesses who served in the ranks of the French have described the sensation of powerlessness that they felt as their attacking column approached the line and watched it load and come to the present. The column stopped short, a few men cheered, others opened a ragged individual fire, and then came the volleys and the counter-attack that swept away the column. Sometimes this counter-stroke was made, as in the famous case of Busaco, from an apparently unoccupied ridge, for the British line, under Moore's guidance, had shaken off the Prussian stiffness, fought 2 deep instead of 3 and was able to take advantage of cover. The "blankness of the battlefield" that distinguished the South African and Manchurian Wars was characteristic of Wellington's battles from Vimeiro to Waterloo, in spite of close order and red uniforms. But these battles were of the offensive-defensive type in the main, and for various reasons this type could not be accepted as normal by the rest of Europe. Nonchalance was not characteristic of the eager national levies of 1813 and 1814, and the Wellington method of infantry tactics, though it had brought about the failure of Napoleon's last effort, was still generally regarded as an illustration of the already recognized fact that on the defensive the fire-power of the line, unless partly or wholly evaded by rapidity in the advance and manoeuvring power or mastered and extinguished by the fire-power of the attack, made the front of the defence impregnable. There was indeed nothing in the English tactics at Waterloo that, standing out from the incidents of the battle, offered a new principle of winning battles.

Infantry Methods, 1815–1870.—Thus the later Napoleonic battle became the model for military Europe, and infantry tactics retained, in Germany, Austria and Russia, the characteristic Napoleonic formations, lines of battalion or regimental columns, sometimes combined with linear formation for fire, and always covered by skirmishers. The moral power of the offensive "will to conquer" and the rapidity of the attack itself were relied upon to evade and disconcert the fire-power of the defence. If the attack failed to do so, the ranges at which infantry fire was really destructive were so small that it was easy for the columns to deploy or disperse and open a fire fight to prepare the way for the next line of columns. And after a careful study of the battle of the Alma, in which the British line won its last great victory in the open field, Moltke himself only proposed such modifications in the accepted tactical system as would admit of the troops being deployed for defence instead of meeting attack, as the Russians met it, in solid and almost stationary columns. Fire in the attack, in fact, had come to be considered as chiefly the work of artillery, and as artillery, being an expensive arm, had been reduced during the period of military stagnation following Waterloo, and was no longer capable of Napoleonic

[1]Perhaps a still more significant cause was that Napoleon as a tactician reveals himself as more scientist than artist. His victories owed more to superiority of method and scientific calculation than to superiority of art—expressed in stratagem and surprise. Unlike Hannibal, Scipio, Cromwell, Wellington and other great tactical artists throughout the greater part of his career he had, or his strategy gave him, the advantage of numbers. Thus he tended, and was able to expend this fund of man-power more freely in battle than others among the Great Captains, who used surprise and ground as a means both to economise, and to obtain the highest dividend from, their limited capital.—*Military Editor.*

feats, the attack was generally a bayonet attack pure and simple. Waterloo and the Alma were credited, not to fire-power, but to English solidity, and as Ardant du Picq observes, "All the peoples of Europe say 'no one can resist our bayonet attack if it is made resolutely'—and *all are right.* . . . Bayonet fixed or in the scabbard, it is all the same." But the means (moral and material) at the disposal of the defence for the purpose of mastering this resolution were, within a few years of the Crimean War, revolutionized by the general adoption of the rifle, the introduction of the breech-loader and the revival of the "nation in arms."

Thirty years before the Crimean War the flint-lock had given way to the percussion lock (*see* GUN), which was more certain in its action and could be used in all weathers. But fitting a copper cap on the nipple was not so simple a matter for nervous fingers as priming with a pinch of powder, and the usual rate of fire had fallen from the five rounds a minute of Frederick's day to two or three at the most. "Fire power" therefore was at a low level until the general introduction[1] of the rifled barrel, which while further diminishing the rate of fire, at any rate greatly increased the range at which volleys were effective. Artillery, the fire-weapon of the attack, made no corresponding progress, and even as early as the Alma and Inkerman (where the British troops used the Minié rifle) the dense columns had suffered heavily without being able to retaliate by "crossing bayonets." Fire power, therefore, though still the special prerogative of the defence, began to reassert its influence, and for a brief period the defensive was regarded as the best form of tactics. But the low rate of fire was still a serious objection. Many incidents in the American Civil War showed this, notably Fredericksburg, where the key of the Confederate position was held—against a simple frontal attack unsupported by effective artillery fire—by three brigades in line one behind the other, *i.e.*, by a six-deep firing line. No less force could guarantee the "inviolability of the front," and even when, in this unnatural and uneconomical fashion, the rate of fire was augmented as well as the effective range, a properly massed and well-led attack in column (or in a rapid succession of deployed lines) generally reached the defender's position, though often in such disorder that a resolute counterstroke drove it back again. The Americans fought over more difficult country and with less previous drill-training than the armies of the Old World. The fire power of the defence, therefore, that even in America did not always prevail over the resolution of the attack, entirely failed in the Italian war of 1859 to stop the swiftly moving well-drilled columns of the French professional army—and the Austrians were thus induced to abandon their new "defensive" doctrine and restore "bayonet tactics." But a revolution was at hand.

The Breech-loading Rifle.—In 1861 Moltke, discussing the war in Italy, wrote, "General Niel attributes his victory (at Solferino) to the bayonet. But that does not imply that the attack was often followed by a hand-to-hand fight. In principle, when one makes a bayonet charge, it is because one supposes that the enemy will not await it. . . . *To approach the enemy closely, pouring an efficacious fire into him*—as Frederick the Great's infantry did—*is also a method of the offensive.*" This method was applicable at that time for the Prussians alone, for they alone possessed a breech-loading firearm. The needle-gun was a rudimentary weapon in many respects, but it allowed of maintaining more than twice the rate of fire that the muzzle-loader could give, and, moreover, it permitted the full use of cover, because the firer could lie down to fire without having to rise between every round to load. Further, he could load while actually running forward, whereas with the old arms loading not only required complete exposure but also checked movement. The advantages of the Prussian weapon were further enhanced, in the war against Austria, by the revulsion of feeling in the Imperial army in favour of the pure bayonet charge in masses that had followed upon Magenta and Solferino.

With the stiffly drilled professional soldier of England, Austria and Russia the handiness of the new weapon could hardly have been exploited, for (in Russia at any rate) even skirmishers had to march in step. The Prussians were drilled nominally in accordance with regulations dating from 1812, and therefore suitable, if not to the new weapon, at least to the "swarm" fighting of an enthusiastic national army, but upon these regulations a mass of peace-time amendments had been superimposed, and in theory their drill was as stiff as that of the Russians. But, as in France in 1793–1796, the citizen composition of their army saved them from their regulations. Dietrich von Bülow's predictions of the future battle of "skirmishers" (meaning thereby a dense but irregular firing line) had captivated the younger school of officers, while King William and the veterans of Napoleon's wars were careful to maintain small columns (sometimes company columns of 240 rifles, but quite as often half-battalion and battalion columns) as a solid background to the firing line. Thus in 1866 (*see* SEVEN WEEKS' WAR), as Moltke had foreseen, the attacking infantry fought its way to close quarters by means of its own fire, and the bayonet charge again became, in his own words, "not the first, but the last, phase of the combat," immediately succeeding a last burst of rapid fire at short range and carried out by the company and battalion reserves in close order.

Infantry in the War of 1870.—Immediately after the Austrian overthrow at Königgrätz the French army was served out with a breech-loading rifle greatly superior in every respect to the needle gun, and after four years' tension France pitted breech-loader against breech-loader. In the first battles (*see* WORTH and METZ: *Battles*) the decision-seeking spirit of the "armed nation," the inferior range of the needle-gun as compared with that of the chassepot, and the recollections of easy triumphs in 1864 and 1866, all combined to drive the German infantry forward to within easy range before they began to make use of their weapons. Their powerful artillery would have sufficed of itself to enable them to do this (*see* SEDAN), had they but waited for its fire to take effect. But they did not, and they suffered accordingly. In these circumstances their formations broke up, and the whole attacking force dissolved into long irregular swarms. These swarms were practically composed only of the brave men, while the rest huddled together in woods and valleys. When, therefore, at last the firing line came within 400 or 500 yd. of the French, it was both severely tried and numerically weak, but, fortunately for it, the French counterstrokes were subjected to the fire of the German guns and were never more than locally and momentarily effective. More and more German infantry was pushed forward to support the firing line, and, like its predecessors, each reinforcement, losing most of its unwilling men as it advanced over the shot-swept ground, consisted on arrival of really determined men, and closing on the firing line pushed it forward, sometimes 20 yd., sometimes 100, until at last rapid fire at the closest ranges dislodged the stubborn defenders. Bayonets (as usual) were never actually used, save in sudden encounters in woods and villages. The decisive factors were, first the superiority of the Prussian guns, secondly, heavy and effective fire delivered at short range, and above all the high *moral* of a proportion of resolute soldiers who, after being subjected for hours to the most demoralizing influences, had still courage left for the final dash.

II. INFANTRY IN MODERN WAR

The net result of the Franco-German war on infantry tactics, so far as it can be summed up in a single phrase, was to transfer the fire-fight to the line of skirmishers. Henceforward the old and correct sense of the word "skirmishers" is lost, and their duties of feeling the way for the battle-formations came to be taken over by a lesser number of "scouts." But although the fire-fight on this line of scouts built up into a firing line, was established as the centre of gravity of the modern battle, a hot controversy sprang up over its form. This, in the early stages, became a contest between "drill" and "individualism." To many German officers the most indelible impression of the battlefield was what

[1] Rifles had, of course, been used by corps of light troops (both infantry and mounted) for many years. The British Rifle Brigade was formed in 1800, but even in the Seven Years' War there were rifle-corps or companies in the armies of Prussia and Austria. These older rifles could not compare in rapidity or volume of fire with the ordinary firelock.

they called *Massen-Drückebergertum* or "wholesale skulking." The rest, who had perhaps in most cases led the brave remnant of their companies in the final assaults, believed that battles were won by the individual soldier and his rifle. The difference between the two may be said to lie in this, that the first sought a remedy, the second a method. The remedy was *drill,* the method *extended order.*

The extreme statement of the case in favour of drill pure and simple is to be found in the famous anonymous pamphlet *A Summer Night's Dream,* in which a return to the "old Prussian fire-discipline" of Frederick's days was offered as the solution of the problem, how to give "fire" its maximum efficacy. The other school, although closer akin to the reality of the fire-swept modern battlefield, under-rated the importance of control and instilled the idea that to teach the recruit to shoot and to work with other individuals in the squad or company, was as far as training could, or need, go. Disorder and crowding in the firing line was accepted, not as an unavoidable evil, but as a condition in which individuality had full play—a view that held much truth, but not the whole truth.

Between these extremes, official opinion, with the emperor William at its head, spent a few years in groping for close-order formations which admitted of control without vulnerability—a vain ideal even at that stage of the development of small arms, and ultimately formulated a compromise, combining the "drill" and teaching ideas in the German infantry regulations of 1888, which at last abolished those of 1812 with their multitudinous amendments. The necessity for "teaching" arose partly out of the new conditions of service and the relative rarity of wars. But it was still more the new conditions of fighting that demanded careful individual training. Of old, the professional soldier (other than the man belonging to light troops or the ground scout) was either situated out of danger, or so deep in battle that he became the unconscious agent of his inborn or acquired instincts. But the increased range of modern arms prolonged the time of danger, which was further prolonged by the increasing duration of battles.

Psychological Problems.—The psychological strain and problem created by this increased exposure to danger was further complicated by the enforced and inevitable dispersion of the troops while in the danger zone. Thus they stepped out of the control of their regimental leaders, and the higher commander lost the power to direct the fight according to a purposeful plan. In battle he could no longer proportion his effort to his ends, but only his means. Instead of being the driver of the battle-machine, with his hand on the throttle able to regulate the pressure, he was reduced to the rôle of stoker shovelling in more or less human fuel as he judged advisable. Military thought reconciled itself to this new conception in a remarkable spirit of resignation, and with a still more remarkable lack of research for fresh ways of reviving the craft of generalship. In default of this the only practicable alternative was to raise soldiership to a craft. If generals in the true sense could no longer be trained, the fighting man could at least be imbued in some degree with the faculties of generalship, so that he could control and direct himself when higher control and direction was released. Unfortunately, the tradition of "moulding" soldiers was too strong for the new training to have effective scope. This was merely soldered on to the old pattern frame. Man's natural instinct in a fight is "to kill without being killed," while the tendency of traditional military training has always been by stifling this natural instinct, to produce a man ready to let himself be killed—at the word of command. Such discipline of the instinct is undoubtedly a valuable quality. In situations of great danger the ordinary man is the slave of the unconscious, and his actions are determined mainly by his strongest natural instinct.

The very nature of late 19th-century armies tended to emphasize the importance of disciplining the instincts. For under conscription armies were no longer composed of the naturally adventurous, but of the more normal lovers of safety. By constant drill, however, they might be converted into danger-disregarding *automata.* There was, however, a weak point, and one accentuated by another modern condition—the increasing deadliness and range of fire-weapons. However useful it may be to get men to advance automatically in face of danger, their usefulness ceases the moment they are dead. And as weapons developed, automatic men offered an easy target. Was it then a choice between two evils, or could a third course be found? The experience of many wars suggests that such an alternative existed. For at the end of any long war it has been found that men become cunning and skilful individual fighters, and although more wary do not lose unless of indifferent material their willingness to sacrifice themselves at the call of need. This is "reason" as against inborn or implanted instinct.

Tactical Training.—There is one form of training in peace which is aimed at the cultivation of reason—tactical training. It may be robbed of most of its utility by meaningless application, but fundamentally it is an appeal to the reason, just as drill in the opposite way is a development of the instinct. But when tactical training has been applied to men whose natural instinct of self-preservation has been drilled out of them, and replaced by a purely automatic instinct of self-sacrifice, it cannot hope to provide self-directed soldiers as an effective substitute for generals who have lost the power to direct their men.

After 1870 there was a great opportunity to take this new middle road. The war on both sides had furnished ample proof that drill-disciplined troops, once their acquired instinct had been uprooted by heavy initial losses, suffered a worse reaction into confusion, and even panic, than could possibly have occurred with soldiers whose reason had been educated. But military doctrine, spurred on by the conscriptive system, chose to continue on the old road which led them in 1914 to a still deeper pit. Drill was therefore maintained as the basis of all European military training. To maintain it was right; the error lay in maintaining it in this place and form. No organization, military or industrial, can dispense with drill, for it is, fundamentally, but the method of executing a movement repeatedly, so that it may develop into a habit, thereby enabling it to be carried out with the minimum expenditure of energy and the maximum of efficiency.

Battle Drill.—Executive skill of any kind owes much to habit. Thus the changed conditions of warfare made drill more necessary than ever—but in a new form. For drill is a fine cement, but a bad foundation. The enforced dispersion, due to fire, required a "battle drill" as a means of developing the swift self-controlled movements of widely extended units and of synchronizing the co-operative action of the scattered groups of skirmishers. Unfortunately for the solution of infantry problems "drill" and "close order" were commonly confused—as they still are 50 years later, owing largely to the fact that in the 1870 battles the dissolution of close order formations practically meant the end of control as control was then understood. Thus, dispersion was only tolerated as an unavoidable evil and European soldiers sought to mitigate its consequences by postponing the moment of dispersion as long as possible—instead of seeking a permanent cure by adapting drill to the needs of dispersion. As the years passed and the memories of the battlefield faded, there was a natural tendency to make the wish father to the thought and to believe—in face of the evidence of technical progress in fire-arms—that closer rather than looser formations could be used on the next battlefield. The German infantry regulations of 1906 aptly illustrated this spirit—"It must never be forgotten that the obligation of abandoning close order is an evil which can often be avoided. . . ."

As the memories of 1870 faded, the absence of bullets on the mimic battlefields of peace training lent impetus to the inevitable reaction which follows every step of progress. It is difficult to visualize bullets but easy to see men. Hence, those who direct and umpire field exercises in peace tend to base their verdict on a count by heads, and thus if a commander wishes to gain a favourable verdict he is almost driven to put in sufficient numbers of men to impress the observer that his attack has adequate "weight." Even if he is adjudged to suffer casualties, they are customarily calculated in proportion to his strength, whereas the more discriminating verdict of bullets penalises dense numbers out of all proportion to the original strength. The inevitable out-

come was that each successive training regulation issued between 1875 and 1914 tended to encourage greater density of numbers, while all the time in the armament factories fresh weapons were being produced to take an even greater toll of thickened targets.

Influence of Boer Tactics.—In the course of this unreal reaction there was however one interruption. In the South African War of 1899–1902 the soldiers of Europe were astonished to find the ill-organized and undrilled Boers more than holding their own against superior numbers of regular troops, by the deadliness of their shooting combined with the evasive mobility of their movements. Instances were known when 18 Boer marksmen were sufficient to repulse several British battalions. So deadly was the Boer fire that in self-preservation the British infantry were forced to make an abnormally early deployment into many successive lines of widely extended men.

For a year or two some of the European armies were inclined to flirt with "Boer tactics," but its "individualism" was repugnant to their traditions, made too shadowy a spectacle, and was difficult to apply to short-service conscript troops. Besides it had outwardly ended in defeat, however uneconomic to the nominal victors, and critics were quick to point out that its pure individualism had hampered co-operative effort so that its exponents had been unable to push home their opening success. From this, it was an easy conclusion that individualism itself was at fault. Hence European armies soon reverted to their old doctrines, and so far as any permanent change occurred it was derived from the modifications introduced by the British, and "extended order" became the rule for infantry in battle. The British practice in and immediately after the South African war was to deploy the whole body before the attack began into a deep series of lines, with intervals of ten to 20 paces between men. The rear lines were merely used to feed the first, or "firing" line. These long continuous lines however had shown themselves unable to produce any decisive effect and were essentially unmanageable. Opposing positions were nearly always taken by wide outflanking movements, and even so were found empty, as the rigidly extended frontal advance rarely succeeded in pinning down the defenders. This defect was plain to European tacticians, and they soon adopted the obvious remedy—that of reducing the intervals and holding the reserves in concentrated formations, instead of dispersing them into lines.

The real lesson—the surprising fire effect exerted by scattered Boers sitting on distant *kopjes*—was soon forgotten, most easily by those armies that had not experienced it personally. The British army suffered less than others from the reaction towards denser formations, because of its experience and because its constant preoccupation with colonial expeditions gave less chance for the effects of fire to fade from its memory. Its national bane was that of "lines" themselves, rather than dense ones in particular. Lines required long pauses to restore their alignment unless they were to dissolve in disorder; the units forming them were trained to wait for their neighbours and to avoid an exposed flank as a deadly danger; consequently, the pace of the line became the pace of its slowest unit—with a correspondingly prolonged exposure of the target. For a line of men, even an "extended" line, is one of the most visible of targets—a swathe of human corn calling the attention of the reaper. Its very symmetry makes it a cemetery.

Revival of the Napoleonic Attack.—On the continent the natural swing of the peace-time pendulum received an artificial impulse from the rehabilitation of the "Napoleonic attack" in the decade before 1914. In France, particularly, an influential school of military thought had for long devoted itself to a minute study of Napoleon's campaigns and correspondence with the idea of discovering the secret of his victories. Thereby they hoped to formulate a remedy by which the debilitated military body of France could recover from its 1870 collapse and gain new strength. Valuable results were attained, but mistakenly they sought to apply them to the technical sphere of tactics, instead of adapting the spirit of his principles to the conditions imposed by the introduction of accurate firearms. The progress made in timed shrapnel suggested the use of concentrations of shrapnel fire to revive the deadly Napoleonic artillery preparation, and the infantry were to fulfil the rôle of the massed reserves which had poured through the breach thus made. Naturally, this conduced to greater density and was in turn accentuated by the propaganda of a new metaphysical school of military thought which was so obsessed with its discovery that the "will to conquer" is the soul of victory that it tended to forget that the human will, to be effective, must retain its habitation in the human body, and that human bodies are vulnerable to bullets.

The influence of this school grew when its leader and prophet, Colonel de Grandmaison, became chief of the Operations branch of the General Staff. The "security" aspect of the Napoleonic method was entirely overshadowed by the "audacity" form. De Grandmaison's text was that instead of waiting for the enemy to disclose his hand, "it is the quickness with which we engage the enemy that guarantees us against surprise, and the power of the attack which secures us against the enemy's manoeuvres." He summed up his theory by saying, "We must not recoil before this principle, of which only the form seems paradoxical: in the offensive, imprudence is the best of safeguards." The conclusion was that, whatever the rôle of a force or unit, there was only one mode of action—attack, which meant a headlong assault. The very simplicity of this theory combined with its appeal to the Frenchman's temperament—and its implicit tribute to the irresistibility of his spirit—to capture the imagination of the Army. Those who opposed it were derided and superseded, as "lacking in nerve." And the official doctrine was re-cast on the foundation that "the French Army, returning to its traditions, no longer knows any other law than the offensive. . . . All attacks are to be pushed to the extreme with the firm resolution to charge the enemy with the bayonet, in order to destroy him. . . . This result can only be obtained by bloody sacrifice. Any other conception ought to be rejected as contrary to the very nature of war."

Accordingly, the training of the infantry was directed to a discipline of the muscles, not of the intelligence, sacrificing initiative in order, by an incessant repetition, "to develop in the soldier the reflexes of obedience." The successive French tactical regulations issued during the 40 odd years of peace which separated the wars of 1870 and 1914, shed a curious light on the way the memory of pain fades—and still more the memory of its cause. Thus it came about that the first regulations of 1875 came nearest to the reality of 1914, whereas the last of the series was framed for a battlefield on which there were no bullets.

Emphasis on Fire Superiority.—If the German doctrine took hardly more account of the opposing fire, or of the progress in firearms, and was equally addicted towards density of formations, it laid more emphasis on the need of fire to help the assailants forward. This attitude is well exemplified in the German regulations of 1906 which defined the offensive as "transporting fire towards the enemy, if necessary to his immediate proximity"; the bayonet assault "confirms" it. As for the process of attack, the prescriptions may be summarized as follows—every attack was to begin with deployment into extended order, and the leading line was to advance as close to the enemy as possible before opening fire. In ground offering cover, the firing line should have practically its maximum density at the outset. In open ground, however, units were advanced one after the other till all were *in position*. It was on this position, called the "first fire position" and usually about 1,000 yd. from the enemy, that the full force of the attack was to be deployed, and from this position, as simultaneously as possible, it was to open the fight for fire-superiority. Then, each unit covering the advance of its neighbours, the whole line should fight its way by open force to within charging distance. If at any point a decision was not desired, it was deliberately made impossible by employing there such small forces as possessed no offensive power. Where the attack was intended to be pushed home, the infantry units employed were to act as far as possible simultaneously, resolutely and in great force. The process, and its underlying conceptions, was very similar in the British Army. It was directed to a "gradual building up of the firing line within close range of the position, followed by a final blow with the reserves in the greatest possible strength." In the

French it underwent natural modifications. It was considered (*see* de Grandmaison, *Dressage de l'infanterie*) that a premature and excessive deployment enervated the attack, that cover by ground should be used as long as possible to march *"en troupe"* and that a firing line should only be formed when it was impossible to progress without acting upon the enemy's means of resistance. Thereafter each unit, in such order as its chief could keep, should fight its way forward to the assault. "From the moment when a fighting unit is 'uncoupled,' its action must be ruled by two conditions, and by those only: the one material, an object to be reached; the other moral, the will to reach the object."

Problems of Defence.—To the problems of defence no army gave much attention. "The *defence,* as it used to be understood, needs no description. To-day in all armies the defence is looked upon not as a means of winning a battle, but as a means of temporizing and avoiding a decision until . . . the defending party is enabled . . . to take the offensive." "A firing line, covered and steadied by entrenchments, and restless local reserves ever on the look-out for opportunities of partial counter-strokes, are the instruments of this policy."

As regards entrenchments, in the light of what followed, and what had been foreshadowed in the Russo-Japanese War of 1904–5 (*q.v.*), there is a certain ironical interest in noting this phrase from the German infantry regulations: "The construction of trenches must never paralyse the desire for the irresistible advance, *and above all must not kill the spirit of the offensive*"—a sentiment echoed in the regulations of all the countries. Yet within a few weeks of the opening of the World War (*q.v.*) in 1914, the "irresistible advance" was completely paralysed—not by trenches but by the defensive power of modern firearms, especially the machine-gun. The digging of trenches, and their elaboration, was but the sequel and the supplement to this paralysing power. And the spirit of the offensive was drained with the life-blood of the warring infantries, in their futile obstinacy to recognize this transcendent fact.

Dominance of the Defensive.—In 1914, indeed, this dominance of the defensive was established in spite of the relative scarcity of machine-guns. As far back as the Egyptian campaign of 1884, Colonel Knollys, a military writer of the time, deploring that "machine-guns seem to be undervalued by the military authorities" could foresee that they were "concentrated essence of infantry." Twenty years later, in the Russo-Japanese War, the power of Hiram Maxim's invention, then a generation old, threw its ominous shadow over the battlefields of Manchuria—and movement grew stagnant. Yet in 1914 no army averaged more than two machine-guns to the infantry battalion. The legend, eagerly accepted by the French and British in excuse, of masses of German machine-guns, had no foundation in fact. The only difference was that the German machine-guns were "regimented," and this grouping contributed to their more effective handling, few as they were. The Germans believed similar legends about the British, and here the cause was largely due to the fact that the remarkably high standard of rifle-shooting, and especially of rapid fire, which had been developed with the idea of helping the attack forward, came into play most usefully as an impregnable resistance to the German attacks.

For a few weeks of war, movement was kept alive by searching for an open flank when frontal attacks proved futile. Where the frontal attacks broke down, the two sides dug in, powerless to come to grips effectively across the bullet-banned "No Man's Land." With the supplementary assistance of trenches and wire entanglements, a modicum of fire-weapons was adequate to hold such fronts, and the surplus was hurried off to the one still open flank—towards the sea.

Thus the experience of Manchurian battlefields was repeated, with emphasis. And this time, numbers were greater, distances less. The sea was soon reached, the front became static, and, with the collapse of the violent attempts to break this flankless line before it had crystallized, deadlock set in. The history of the next four years is of ceaseless renewals of the frontal onslaughts on entrenched lines held in reality by machine-guns, if nominally by men.

New Rôle of Artillery.—Although up to the start of war, cavalry had been trained for shock action, the cavalry charge, except for one or two isolated skirmishes, became a dead letter directly the first shot was fired. Thus, infantry was compelled to assume the rôle of the decisive arm, a rôle for which its relative immobility even under bulletless conditions had never fitted it. The hollowness of this assumption was soon proved, if not openly admitted, and the decisive rôle was tacitly passed over to the artillery. The issue of any attack came to depend almost entirely on the artillery preparation, later extended by the barrage, and the infantry masses became merely the satellites of the artillery to "confirm" its success by walking forward behind the wall of bursting shells in order to occupy the shell-flattened trenches of the enemy. Thus they became once more a "residue." From mediaeval camp-followers to modern barrage-followers—the wheel had come full circle. In this rôle of occupying and clearing up—"mopping up" as it was termed—the ground conquered by the artillery, the rifle was at a discount, the man-handled machine-gun too immobile to be effective in attack, and infantry, reviving the historic grenade (*q.v.*), came to use such short-range missiles as their main weapon. The bayonet, as always in modern history, was merely a symbol in attack, although used extensively for "pig-sticking" the helpless defenders once they were overpowered. Unhappily, the military authorities still continued—as for another 12 years—to call infantry the decisive arm. Hence they continued for long to cherish the delusion of "weight of numbers" and to use infantry in masses—merely adding thereby to the weight of corpses and of the post-war pensions bill.

Failure of Mass Assault.—The lowest level of infantry tactics was probably reached in 1916, where in the Somme offensive (*see* SOMME, BATTLES OF THE) the method was for battalions to advance in four or eight waves, not more, and often less than 100 yards apart, the men in each almost shoulder to shoulder, in a symmetrical well-dressed alignment, and taught to advance steadily upright at a slow walking pace with their rifles held aslant in front of them, bayonets upwards—so as to catch the eye of the observant enemy, an excellent imitation of Frederick's infantry *automata,* with the difference that they were no longer advancing against muskets of effective range of barely 100 yards. It was hardly remarkable that when darkness fell on the battlefield on July 1, many battalions were barely 100 strong. Later in the war the term "storm troops" came into vogue; in 1916 the term "target-troops" would have been apt. A few extracts from the pamphlet which regulated the training of the troops for the Somme offensive are worth quoting to illustrate the ideas then current. "The leading lines . . . should carry right through to the farthest limits of the objective. The assaulting troops should push forward at a steady pace in successive lines, each line adding fresh impetus to the preceding line. . . . The men in each line should be extended at two or three paces interval."

It was not inapt that the only paragraph in this pamphlet thought worthy of the emphasis of italics was that *"Finally, it must be remembered that all criticism by subordinates of their superiors, and of orders received from superior authority, will in the end recoil on the heads of the critics and undermine their authority with those below them."*

In these long-drawn out battles, the "farthest limits of the objective" were rarely attained, though even these limits became more and more modest as the method of the "limited objective"—conquest by a progressive series of short bites which enabled the enemy to fortify fresh lines before the attack could reach open country—was substituted for the attempt at a rapid "break-through." That progress, if costly, and if made at all, was due primarily to the weight of shells poured on the defences, but also in some degree to the revolt of the soldier's natural instincts from the artificial restraints imposed by official doctrine. For when the enemy machine-guns opened, the thick and stiff waves of the "assaulting" infantry were quickly thinned, till but a remnant remained on their feet. The rest littered the ground—dead or militarily dormant. Then, human nature and primitive cunning reasserting themselves over the formalism of authorized tactics,

the more enterprising and still uncowed survivors, formed into little groups, usually under some natural leader, and worked their way, by short dashes and crawling, from shell-hole to shell-hole, "stalking" the opposing machine guns, overcoming them, and often progressing to a considerable depth with little further loss. In view of the predominant part played by the artillery, it would seem a reasonable deduction that if this limited number of infantry, trained to "stalking" instead of dressing, had been sent forward originally, they would have gained equal ground, while saving the initial 400 or 500 casualties per battalion which were uselessly sacrificed to such shibboleths as the "weight of the attack" or "the bayonet assault."

Tactics of Infiltration.—The experience of 1916 reinforcing those of 1914 and 1915 confronted military science with two alternative remedies. One was to make men bullet-proof while still capable of movement by putting them in armoured vehicles (*see* TANKS). The other, necessarily more restricted in scope because of the wide effectiveness of fire on the battlefield, was to teach men to evade bullets by "stalking"—the skilful use of cover combined with the accurate use of rifles.

While a few individual tacticians in the British Army sought to apply the "human reaction" of 1916 and fit it into an improved tactical method, the Germans were the first to incorporate it officially and practise widely these new tactics of infiltration. Based on the group instead of the line, the idea was that a widely dispersed chain of little groups should, under cover of the bombardment, probe the enemy's front to discover its weak points and thus penetrate between the posts and machine-gun nests of the defence. While the leading groups pushed onwards through the enemy's position, the "islets" of the resistance cut off from help could be outflanked and reduced by fresh troops from the reserves. Sound economy of force was embodied in the basic principle of these infiltration tactics, that reserves should be used to exploit success instead of to redeem failure—to follow and back up the leading groups wherever a penetration had been made, instead of to reinforce those parts of the front where the attackers had been held up.

In Sept. 1917 the German command employed infiltration as part of the new tactics which they tested in the "experimental" attack at Riga, on the Russian front. In November it was tried with fresh success in their counterstroke at Cambrai (*q.v.*), and in consequence became the basis of the training of their infantry for the great 1918 offensive (*see* ST. QUENTIN, BATTLE OF). Here, greatly aided by surprise, gas and fog, it achieved astonishing success, and the German troops penetrated to a depth and at a speed which eclipsed all former estimates.

By the British also the "group" idea had been accepted in the autumn of 1917, and when somewhat belatedly the training direction of the British Expeditionary Force was centralized—under an Inspector General of Training[1]—after the early disasters of 1918, the training of the infantry was radically re-cast on more flexible lines with "soft-spot" tactics as the pivot. When the British, in conjunction with their French and American allies, retook the initiative and the offensive in the late summer, these new tactics were a contributory factor in purchasing the final victory at an economical price. In the Australians particularly, less trammelled by instinct and training than European troops, they found most able exponents. If the tanks, the lavish use of gas and smoke-shells, the flood of American reinforcements, and the decay of the German morale under the strain of its immense physical casualties, were the outstanding factors in this dramatic turning of the tide, it is unquestionable that the "soft spot" tactics saved thousands of lives in the last phase, and enabled the infantry to make better progress with lighter loss than under any previous system. Not least of its assets was that its life-saving possibilities did much to restore the moral of infantry whose confidence had been steadily undermined by years of unintelligent misuse. Its handicap was, however, that it had to be applied to and by a vast "residue" who had to absorb it under stress and without qualification, whereas it was essentially the method for a highly trained and carefully picked élite—if its inherent advantages were to be exploited to the full.

Post-World-War Reactions.—After the war, the customary reaction took place, with even greater rapidity than after 1870. Instead of developing the lessons of 1918 and remodelling military organization in the light of this experience, all the armies of Europe reverted to 1914. Tanks, artillery and aircraft were cut down, and gas the only hope of humane warfare was forsworn; and the post-war armies were patched up again on the sand foundation of masses of infantry. So strictly did military authority adhere to 1914 that it rechristened infantry "the decisive arm," and began to train afresh for a war of mobility. No authority deemed it necessary to explain how an infantry that had so quickly become paralysed in 1914, could nevertheless become mobile when it faced machine-guns four to six times as numerous as formerly. And for each machine-gun there were added four light machine-guns, to multiply the power of fire-defence.

The sole condition which enabled infantry in the World War to make a general advance—even for a limited distance—was that hostile machine-guns be overwhelmed by artillery or tanks. With artillery the issue turned on whether the concentration was sufficiently intense so to plaster the defences with shells that their machine-guns were overwhelmed by a profusion of explosives rather than by deliberate aim. For the machine-gun was so small a target and so easily concealed, that guns rarely succeeded in hitting it except by the "plastering" method. In attacks which attained a limited success, experience showed that a concentration of one gun to every ten yards of front was the minimum necessary, while one gun to five yards became the normal standard in the sectors where a definite result was sought (*see* ARTILLERY). But with the post-war reduction of artillery, the most that the divisional artillery could provide was a very thin barrage—one gun to every 30 yards of front—on barely one-tenth of the normal frontage of a division. Even so, on the remaining nine-tenths the infantry would have to advance without support. And as the reserve of medium and heavy artillery under the control of higher formations is now of still more slender proportions, it will be obvious that infantry cannot rely on artillery to help them forward, and may have to sit passively in trenches for the first year or two of a future war, while the industries of the nation concerned are being converted to war production and the output of munitions is raised to the level of 1917. Even so, such a type of warfare is ruinous. The mere preliminary bombardment before the battle of Ypres, 1917 (*q.v.*), namely 4,283,550 shells, cost £22,000,000.

Restriction of Tank Strength.—If tanks are a cheaper and more effective means of helping infantry to advance, the possibility of this solution was practically nullified by the reduction of tank strengths which occurred in all armies after the war. For the British army retained only four tank battalions to meet the needs of 136 infantry battalions, although the former were gradually equipped with new and improved machines. The French army, more logical, retained 44 tank battalions, while reducing the infantry by 1928 to 225 battalions, but the machines were of an obsolescent wartime pattern. But apart from the questionable economy of tying modern tanks, which have become several times faster and more widely mobile than their World-War prototypes, to the service of a crawling infantry which in itself contributes little to the essential task of overcoming hostile machine-guns, there is a profounder aspect of this policy. For a survey of military history reveals that in a well-balanced army the cavalry, because of the mobility which enabled it to strike at the enemy's rear, has been the decisive arm. Its vulnerability in face of modern fire-arms brought about the decay of its former functions, and one of the outstanding lessons of the World War was the need to revive these by the substitution of an armoured mechanical cavalry. In the last few years military opinion has been gradually converted to the view that the true functions of tanks are best fulfilled by employing them as an independent arm, and constituting mobile armoured divisions to replace the cavalry divisions of former days. Progress in thought, although slow, has nevertheless outstripped progress in new equipment, and meantime armies

[1]Lieut.-General Sir Ivor Maxse was the officer appointed to this post. —Editor.

remain constituted mainly of infantry. In continental countries where conscription is still maintained, this decadent condition is almost inevitable, because all are poor, machines are dear and man-power is cheap in peace-time—if the most expensive instrument under the test of war. As regards Germany, the victorious allies were still sufficiently under the impression of war experience to impose a ban on her equipment with tanks—just as Rome, after Zama, forbade conquered Carthage to retain war-elephants.

But for wealthy industrial countries like Great Britain and the United States which have reverted to small professional armies of relatively high cost, it is not easy to understand or justify the continuance of armies which, despite their smallness, are based on a disproportionately large infantry. For the military justification of professional over conscript armies is that the former, by their high training and superior quality can gain quick results, and like Alexander's Macedonians offset opposing quantity by the swiftness and decisiveness with which they strike. History however shows that warfare has become static wherever the means of defence have acquired a material preponderance over the means of offence. It shows also that even under the most favourable conditions infantry have only a limited power of forcing a decision—because their capacity to transport weapons and to move is limited by the narrow bounds of a man's muscular strength and endurance. Infantry have been most effective when they have been a complementary arm, composed of picked and highly skilled specialists, capable of forming a pivot of combined stability and destructive power for the action of more mobile arms. Modern infantry are certainly stable, but little else. They have great defensive power, through their machine-guns, but hardly any offensive power. Always limited in strategic mobility, because of the limitations of the human legs, they have to-day lost their tactical mobility, because of the limitations of the human skin as a protection on a bullet-swept battlefield.

INFANTRY ORGANIZATION BEFORE, DURING AND SINCE THE WORLD WAR

Up to 1913 the British infantry was organized on a radically different plan from that of other armies, the battalion consisting of eight companies. Then, however, a school of reform[1] carried the day in spite of much opposition. The old "Eight Company" organisation was exchanged for that of battalions of four companies, each 200 strong. The battalion had also a machine-gun section of two guns. A company consisted of its headquarters and four platoons; a platoon of four sections. A section was commanded by a non-commissioned officer and was a normal fire unit. Four battalions, from various regiments, were grouped into a brigade. In the British Army the regiment is a unit of sentiment and the spring from which *esprit de corps* arises. It is based on a fixed regimental dépôt which is the common link of battalions scattered over the British Empire. The four-company battalion marked a stepping-stone in the history of the British infantry, because the platoon became the "tactical" unit instead of the company. As a logical consequence the first unit (section) decreased in size and became the command of a junior N.C.O.—a corporal or lance-corporal.

Other Armies, 1914.—In the German, French and U.S. armies the regiment consisted of three battalions, and was a tactical as well as an administrative unit. In Germany it was commanded by a colonel with a lieutenant-colonel as his second-in-command. The battalion commanded by a major was divided into four companies, each commanded by a captain. The company was divided into three sections (*Züge*), each under a subaltern. Every infantry regiment and Jäger battalion was provided with a machine-gun company of six guns, plus one spare.

The French company was organized into four sections, commanded in war by three subalterns and one adjutant (superior company sergeant-major). The sections were grouped in pairs to constitute *pelotons* (platoons) under the senior of the two section leaders. Machine-gun sections were allotted to battalions as in the British Army. In the United States the company was composed of three officers and 150 rifles, divided into two sections, each of three squads. In the World War, however, the U.S. infantry regiment was remodelled on the continental model, having also a regimental machine-gun company, a headquarters company and a supply company.

Thus before the war the infantry battalion consisted in almost every country of about 1,000 men and was divided into four companies each commanded by a mounted officer. But the British battalion was the weakest in fighting strength, because its First Line Transport and other services were deducted from its 1,000 rifles, whereas the regimental systems of continental infantry provided these services from a separate establishment. The subalterns were dismounted officers whose commands varied as follows: British 50 men, German 80 men, French 50 men, United States 75 men. But in the British infantry a large proportion of the 50 men borne on the strength of the platoons were absent on other duties. They were signallers, machine-gunners, bandsmen, transport drivers or pioneers—and were in fact everything except fighting infantrymen, and they should never have been on the rolls of the fighting platoons. The British Treasury, however, ordained otherwise and thus made training and fighting difficult for every platoon commander.

Changes During 1914–18.—During the progress of the war the basic organization of the infantry of the belligerent powers was not materially altered. The changes were chiefly in the direction of additional weapons and a multiplication of kit, which reduced the infantry soldier to a beast of burden laden under a weight which destroyed his mobility. In 1915 the British infantry as compared with the German suffered from a paucity of machine-guns and was slow to make good this defect. At first an increase was made (up to four per battalion), and when manufacturers raised their output these were formed into machine-gun companies. They were gradually divorced from the infantry and formed into a machine-gun corps, firstly as brigade machine-gun companies and finally as divisional battalions. By the time this had been accomplished the lighter Lewis gun had made its appearance and had been allotted to infantry units. The first issue (not long before the battle of Loos, 1915) was only four guns per battalion.

The tendency at first was to use this weapon like a heavy machine-gun, but when its characteristics were better understood it took its place as a company weapon in 1916, and as a platoon weapon in Feb. 1917. By March 1918, two sections of the four in the platoon were armed with one Lewis gun each. The allotment of an automatic weapon on such a scale marked an important step in the tactics of infantry. One of these new weapons handled by only two men could deliver a stream of bullets equal to what could formerly be projected by 25 soldiers with rifles. This led to a reduction in the strength of the section—to one leader and six men. Thus the British subaltern officer's command in battle became 28 fighting men, as compared with 50 in 1914—but the Lewis guns increased the fire-power of the platoon out of all proportion to the number of its men and had also increased the load they carried.

The Germans were faced with the man-power problem before any of the other belligerents, and they also appreciated the value of the light machine-gun. In March 1917 they issued three to every company and afterwards raised this allotment to six by giving two guns to each platoon. Finally each German battalion consisted of a heavy machine-gun company of 12 guns and three infantry companies armed with six light machine-guns each, without counting the special machine-gun companies allotted to divisions for every battle. This tremendous increase in automatic weapons had an inevitable effect on infantry formations. The costly attacks on narrow frontages were abandoned. The successive lines or waves of men gave place to open formations. The four sections of a platoon were gradually separated from one another and compelled to manoeuvre and fight under their own leaders. The frontages allotted to the leading platoons were increased, and in 1918 we find platoons attacking on frontages of 200–300 yd. with very small effectives. Fire-power was at last beginning to be understood.

[1]Lieut.-General Sir Ivor (then Brigadier-General F. I.) Maxse was the chief advocate and pioneer of this reform.—Editor.

Special Weapons.—In addition to the Lewis gun, rifle-grenade and hand-grenade the Stokes light mortar proved to be a useful infantry weapon. Although it did not form an integral part of battalion equipment, the brigade light-mortar batteries drew their personnel from the infantry and the mortars were allotted to battalions during operations. The light mortar was the nearest approach to an infantry gun in the British Army and though not an ideal weapon rendered great help in reducing enemy machine guns and strong points. The German mortars in the summer of 1918 were distributed as follows: each regiment had a regimental "*minenwerfer*" company, organized in three sections, each with three light *minenwerfer*, and in addition two or three medium *minenwerfer*.

Post-War Organization.—The British infantry battalion was first reorganized on a basis of a battalion headquarters wing, which included a machine-gun platoon of eight guns, and four companies. Each company consisted of company headquarters and four platoons, each platoon of headquarters and four sections, two of which were armed with one Lewis gun each. In 1928, however, the British organization came into line with foreign armies, and to a slightly fuller recognition of the power of machine-guns, by replacing one of the four companies with a machine-gun company of 12 and ultimately 16 guns. The light mortar has been abandoned as too immobile. The Lewis gun is also considered too heavy and its replacement by the Browning is under consideration. In order to increase the manoeuvring power of the platoon various experiments have been tried, such as concentrating the Lewis guns of the company into one platoon and leaving the others as rifle platoons.

The French battalion comprises a headquarters group, three ordinary companies, a machine-gun company and a section of accompanying weapons (mortar or infantry gun). The company at war strength is composed of a headquarters section and four combat sections, and the section of three groups. The fighting group consisted at first of a team of riflemen and a team of automatic riflemen, each team comprising a corporal and five men. These teams (*équipes*) have now been merged in the group. In peace or when the strength is lowered by casualties the number of sections in the company or groups in the section may be reduced, but the actual groups are maintained at full strength. The French place their reliance upon the light automatic rather than on the rifle, and their new organization is the outcome. Although their group is stronger than the British section, to which it corresponds, the effort of all its ten men centres round the service and protection of the one *fusil-mitrailleur*, and the riflemen inevitably lose much of the value of their greater mobility. On the other hand the British organization though possessing somewhat greater freedom and power of manoeuvre, means that the platoon commander has the difficult rôle of combining four sections of which two are radically dissimilar in arms and in action to the other two. The German battalion also consists of three companies and a machine-gun company. A company is organized in three sections; each section (*Zug*) is divided into four or five groups (*Gruppe*) of eight men each—two light machine groups and either two or three rifle groups.

THE FUTURE OF INFANTRY

If we recognize as we must that infantry as constituted and trained to-day can make no headway against machine-guns in normal open country, where will be their place on a future battlefield? Should we be content to regard them merely as a human reservoir for supplying machine-gunners to the ranks of a defensive position and the tanks of a mobile force; or, for filling up conquered territory with a flood of military "police"? Even these two "residuary" rôles may be restricted. For military opinion is gradually coming to realize that it is not economy of force to employ six vulnerable men to man-handle one machine-gun in action when, if placed in a light tank, two men can bring it into action and out, switch it quickly to any required sector and maintain fire while in movement—thus, in Napoleon's phrase, multiplying "force by velocity." And although even advanced military opinion still believes that a crowd of infantry are necessary to play the "walking on" part of occupying conquered territory, it is a reasonable suggestion that this might be controlled as effectively and with less provocation, to the inhabitants—by a sprinkling of engineers protected by tanks and aircraft, sitting at the sources of light, heat, power and water supplies. Moreover, unless this vast "residue" is to wait at home until the war is won, they will be moved forward very slowly on their feet. If there is one feature of past wars which air power, even uncombined with gas, has relegated to the lumber room of history, it is that of sluggish marching columns on roads. It is not necessary to assert that they would be destroyed; mere alarms and consequent dispersal might prevent them reaching enemy territory or any battlefield until the enemy's defeat had been accomplished by more mobile instruments.

For all these reasons the conversion of the residuary bulk of the infantry to more effective service—or, in the case of conscript armies, to work in which they can swell the production of wealth in peace and munitions in wars—is indicated. The process will doubtless be slow so long as the public are content to pay high premiums for inadequate military insurance, and military authorities remain slow to shed old habits—whether of spending thought, spending lives or spending money.

There is however scope for a revived light infantry—a highly trained corps d'élite of small numbers compared with present standards. For although the decisive struggles of history have normally been fought in the plains, theatres of minor war include mountainous, wooded or otherwise difficult country where the man on foot—because of his unique locomobility—must still play an important, even the most important part. Again, while the use of infantry to attack in typically bare or rolling country, such as the greater part of Europe, is merely a homicidal enterprise, these commonly contain areas where fighting men on foot are useful, if not essential. Such areas include woods, broken ground, villages or defiles obstructed by natural or artificial obstacles. Here tanks, even the diminutive machines now being produced, may not be able to pass, and gunfire from a distance may prove ineffective.

Thus we see that as tanks were aptly called landships, so the infantry of the future will be land-marines—to act as the landing parties of the armoured "land-fleet" of to-morrow. For such a complementary rôle only a small portion of the infantry strength of to-day would be necessary, and this reduction might be made to enhance their effectiveness, directly and indirectly; directly, by renewing their pride of "arm" through allotting them a specialized, instead of a "general" rôle, and by diminishing their "superfluous" casualties through a real dispersion of the target which they offer. After the war, the new tactics of infiltration and manoeuvre were incorporated in the recast infantry doctrine but, in the tedious process of winning theoretical acceptance, their practical application was whittled away. How can the thousand men of an infantry battalion find room and cover to infiltrate and manoeuvre on a frontage of 800 yards or less, which is all the French doctrine accords, or even on a frontage of 1,000 yards, as is laid down as normal in the British manual? Such conceptions may be heading for another and more fatal Somme.

Indirectly, a reduction in numbers would contribute to mobility. For while no army could hope to provide sufficient mechanized transport for its present numbers of infantry, future "land-marines" might be carried in the vehicles of a mobile armoured force. Just as mounted infantry (*q.v.*) were trained to ride on horseback as well as to fight on foot, so, in this motoring age, there is no reason why men should not be trained both to drive a fighting vehicle and to act on foot as skirmishers, dismounting from their vehicles. With smaller numbers, too, pay can be higher and a higher standard of selection enforced. For in a professional army man-power and its upkeep is the dearest item. Similarly, when infantry work of wider scope and at greater range is needed, an armoured force might be accompanied by armoured infantry carriers. Even in this case we should fulfil the law of economy of force if such infantry were also qualified to form spare crews for fighting vehicles. What infantry might lose in numbers they would gain in status; the mockery of calling them "the decisive arm" will be no compensation for treating them as mere barrage-followers; but to be the picked light infantry of a mechanized army

would constitute a greater distinction than being called the cannon-fodder mass of past wars.

The Training of Infantry.—How should the training of infantry be developed in order to fit them for a new effective rôle? The answer is simpler, though more difficult of execution, than it seems. For the right training was foreshadowed in the methods devised in 1918. Unhappily, instead of being developed, they have been allowed to lapse. No greater error is current to-day than that infantry is the most easily trained arm, for none needs more care, more skill if it is adequately to play its part. And the reason why it is a difficult arm to train is because it possesses so few concrete elements. It is concerned with tactics and ground.

To train infantry to be tactically minded is to exercise an art, whereas to train gunners is to apply a science; the one requires an artist the other a calculator. The man in the ranks of the artillery, the tank corps, the air service, is often a mechanic—executing a concrete task in a definite manner. Initiative is the province of the officer, but even he in the subordinate ranks of other arms is largely concerned with producing a material effect. But the infantryman's use of material—his weapons—is only complementary to the use he makes of tactics and ground before he gets to grips with his enemy. Because of the variety of elements with which he has to deal, the infantry commander is apt to confine himself to such parts of the subject as he himself knows best. Hence a tendency to over-emphasize such matters as drill, musketry, bayonet fighting, which can be easily mastered by the intellect of the average officer. Hence also the neglect of tactical training, which demands thought and is difficult to learn and teach because it deals with moral and variable factors and requires a modicum of imagination.

The right tactics of infantry must be based on nature and human nature, not on mechanics or geometrical perfection. Yet it is almost incredible how in the past showy evolutions deduced from the parade-ground have persisted on the battle-field. The future infantry must be permeated by the best doctrine which the war can teach, and this doctrine must be expressed in language so simple and by metaphors and illustration so clear, that it can be as readily grasped by subalterns and corporals as by general officers. Its manual of instructions should be as intelligible to the Australian bushman as it is to the staff college graduate.

In 1806–15 the British were capable of a sustained effort in the theory of tactics as originated by Sir John Moore, and there is no reason why infantry should not to-day be trained to as high a pitch of comparative excellence. These tactics would be based on the little group of men following a corporal whom it knows because he has trained it. In the hurly-burly of modern war these little groups retain cohesion because men will follow a leader whom they see close to them, whose voice they can hear and whose presence is familiar. These groups will act by infiltration and manoeuvre, not fearing the isolation due to a wide dispersion of the groups, because they know that in dispersion lies safety, and because the comradeship within the group is a more real support than that of a continuous line, wherein each man felt himself a single peg in a long row.

For decades the infantries of all countries attempted to produce tactics suitable to new weapons and conditions of war, by multiplying the lines which were successfully used by their forerunners in the days of the musket—with its short-range and slow rate of fire—and of the case shot and solid shot of the artillery. They moved shoulder to shoulder with intervals. The idea of manoeuvre was absent. Even down to the closing stages of the World War the action of infantry units in battle—as distinct from a skirmish or an affair of outposts—was confined to frontal attacks. Manoeuvre was the weapon of the higher commanders only.

In any large action each of the infantry units was allotted only a fraction of the frontage of the force of which it formed a part. This narrow sector was hedged in on either side by neighbouring units of a corresponding size. How then was it possible for attack or defence on the part of infantry units to be aught but straight to their front? How can they manoeuvre if they have no space to move in? And how can they be expected to move to a flank if they possess no intervals and no flanks? The opportunity came when the range and deadliness of modern weapons began to enforce dispersion. But instead of exploiting it, military orthodoxy has rather sought to restrict it—as a deplorable evil—and clings to pre-war methods.

Before the World War lines of infantry in extended order made rushes and utilized ground; they fired in small bodies and opened at long ranges; at the decisive points they were gradually thickened up into a crowd. These crowds surged forward at a given signal and assaulted to their front. But the infantry soldier was so near his neighbour in these sham battles that he had scarcely sufficient space to load and fire his rifle without hitting one of his friends; the units became so mixed together in the process of thickening up that neither the corporal nor the subaltern could exercise control over his own men or any unit; often he could not find them during the decisive stage of the battle. Fortunately the "cease fire" sounded and re-organization took place; but in 1914–18 there was no "cease fire" and no umpires and the warring infantries were slow to learn. This was no doubt inevitable, and is a sufficient reason to try now to gather the lessons of 1918, but it must be remarked regretfully that the tactical experiences of 1918 have not been embodied in the tactical handling of units in 1928. Official manuals seem always to lag behind their own age, and in fact human nature did conquer the old line formation before the groups were officially sanctioned. The evolution was the more natural because the real opponent—the machine-gun—was also a firing "point" rather than a firing "line." These two factors, combined with the general dispersion of troops on the battlefield, served to bring about the articulation of infantry into independently moving "points" each and all capable of manoeuvre. This therefore should be the keynote of future infantry tactics. Infantry must only be used for attack in country which gives them adequate natural cover for infiltration and manoeuvre. They must be given frontages wide enough for them to find and use cover, and to ensure that their approach is more or less unsuspected. They must avoid stereotyped methods of movement. They must probably revert to individual weapons.

The only infantryman of use in modern warfare is one so highly trained in the use of cover that he can stalk machine-guns, and so highly trained as a shot that he can pick off their crews at close ranges. For volume of fire infantry cannot compete with mechanized arms—it is an arresting comparison that even the small and immature Armoured Force formed in 1927, which included but one battalion of tanks, had a greater "fire-pumping" capacity than a whole infantry division had previously. Extreme accuracy of fire is the only justification for the infantryman. In his training, too, the old instinct of alignment must be eradicated and replaced by a sense of direction. This is all the more important because the World War introduced a new element—smoke (*q.v.*). Mist or fog has often been a decisive but accidental factor in battle, but with the introduction of artificial fog which can be projected at the will of the user, the enemy's view is impeded while his own movements take place in daylight until he reaches close quarters. Thus smoke is an invaluable aid to infiltration, and although, like most other inventions it has been much neglected since 1918, it will be indispensable to the infantry of the future. Whereas the slender artillery of to-day can give the infantry no adequate barrage, it could provide an effective blanket of smoke with the same quantity of shells. Lastly, if infantry is to possess an adequate agility its weapons and equipment must be lightened. In fact the infantryman of the future must be equipped as an athlete.

The Control of Infantry.—Do these individualistic infiltration tactics involve a complete abandonment of control? By no means. The group itself was a step towards the restoration of control if only in the lowest grade. Reformed and modernized drill could be the means whereby the scale might be raised. In recent generations we have seen that armies retain drill movements for the parade-ground and throw them aside when they go on active service. As human nature in battle retains its instinctive habits it is scarcely surprising that in moments of crisis one has seen men advancing, against the deadly fire of machine-guns,

in close-packed bodies. But if drill were brought up to date on the lines of dispersed order and the group, it would constitute an ingrained method of control that could be used to quicken the manoeuvre of deployed units and direct them to take advantage of local situations. Voice control would be out of the question, but so long as signals were few and simple, visual control could be used particularly if a clearer means of signalling were devised.

Let anyone with experience of war ask himself if there were not moments in his recollection when he might, had his men been drilled in such a system, have saved precious minutes, an opportunity which never returned, by the use of a signal instead of the slow method of sending a message by runner. The old close order was under control but modern fire has made it impossible. With extended order the battle developed into the chaotic movements of an uncontrolled mob at the decisive point. An ingrained system of battle drill might enable a unit when deployed into its fractional parts, to be manoeuvred, to be opened or closed in "concertina" fashion according to the ground and local circumstances. Such a system was embodied in the post-war training manuals. But it was made an addition to instead of a substitute for the existing close order drill. Hence the claims of parade-ground ceremonial, always dominant in practice, have restricted its application. Thus we solemnly inculcate on the parade-ground a set of evolutions which date from the Crimean battlefields, but to-day bear no relation to tactics—as they were first meant to. (*See* SMALL ARMS; CAVALRY; TANKS; also STRATEGY; TACTICS; WAR.) (F. I. M.; B. H. L. H.)

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INFANT SCHOOLS. The provision in modern times of systematised training for children of pre-school age may be dated from the village school at Waldbach founded by Jean Frédéric Oberlin in 1774. Robert Owen started an infant school at New Lanark in 1800. Further impetus and a new direction were given to the movement by Friedrich W. A. Froebel, the creator of the kindergarten (*q.v.*), where play, nature-study, and handwork are directed to the development of the child's latent powers. Dr. Maria Montessori (*q.v.*) marks an epoch in infant training. Her experiments with mentally defective children showed her the educative value of sense and muscle training, and she devised an elaborate set of educative toys by which the children learn to observe sounds and forms and colours, numbers and size. Each child chooses his own activities and puzzles out problems as they present themselves to his own mind; there is a minimum of active intervention by the teacher, though her skill in quiet guidance is the key to the whole. Dr. Montessori's sensory training does actually lead to the beginnings of reading, writing and numbers. She precludes all learning by rote at this early stage, and so all recitation. The training of the social sense is secured by common domestic tasks, care of gardens and of pets. The genius of Rachel and Margaret McMillan and Grace Owen has created a type of school (*see* NURSERY SCHOOLS) which aims at providing the children of poor and crowded districts with something approaching the ideal nursery of their more fortunate fellows—fresh air, wholesome food and happy activity, with sleep at proper intervals.

United Kingdom.—Up to 1905 it was the general English practice since the Education Act of 1870 for education authorities to provide facilities for teaching children between three and five where the parents desired it. In 1905 Article 53 of the Code empowered them to refuse admission to children under five. In 1907 the Consultative committee of the Board of Education called attention to the gap between the care and advice given at baby clinics and the medical inspection at primary schools, and recommended the establishment of nursery schools to bridge this gap. The Education Act of 1918 empowered education authorities to supply or aid the supply of schools for children from the age of two "whose attendance at such a school is necessary or desirable for their health, physical or mental development." The 1923 act in Northern Ireland contained a similar provision. But the Prefatory Memorandum to the 1918 act deprecates the creation of a separate caste of nursery school teachers. In 1923 the Joint Parliamentary Advisory committee reported on the success of these schools, but added that "the cost *per capita* offers a serious bar to their extension." Sir George Newman, however, in his *Annual Reports* as Medical Officer to the Board of Education, repeatedly urges their value to health and pleads that a stitch in time saves nine. He urges that they might be amalgamated with the day nurseries where children whose mothers are out at work are cared for all day from the age of nine months. On March 31, 1926, there were 27 recognised nursery schools, 12 under local authorities and 15 maintained by voluntary effort.

The *Handbook of Suggestions for the Consideration of Teachers* (Board of Education, 1927) distinguishes the nursery stage (from 3 to 5) from the infant stage (from 5 to 8). In the nursery stage there are to be no formal lessons in reading, writing and arithmetic; the children are to form wholesome bodily habits, to sleep and play in the open air, and there is to be motor and sensory training. In the infant stage reading, writing and arithmetic are not to be forced, but may be begun. There is to be "direct contact with things as a means of learning." The actual practice in infant schools differs widely from the rigid formalism of the more old-fashioned schools to the freest use of individual methods.

Number of Pupils, 1924–5

Age	Boys		Girls		Total	
	England	Wales	England	Wales	England	Wales
3–4 . .	20,441	1,929	18,574	1,879	39,015	3,808
4–5 . .	84,195	10,381	74,566	9,649	158,761	20,030
5–6 . .	267,912	22,440	251,897	21,405	519,809	43,845
6–7 . .	229,220	22,585	221,753	21,554	450,973	44,139
7–8 . .	224,265	21,928	218,002	21,295	442,267	43,223
Total .	826,033	79,263	784,792	75,782	1,610,825	155,045

Other European Countries.—In Austria under the act of 1872 kindergartens were recognized as part of the public educational system. In 1879 the State established a kindergarten practising school. From 1889 Vienna began to establish municipal kindergartens. Since 1918 the city has rapidly developed *Volkskindergärten,* where working-class parents may leave children between two and six from 7 A.M. to 6 P.M. There are also *Normalkindergärten* with shorter hours. Nominal fees are charged, besides a small sum for breakfast and dinner in the *Volkskindergärten,* but these may be remitted or reduced. Montessori and Froebelian methods are combined except in one purely Montessori experimental school. There is frequent medical examination.

In Belgium, for children between three and six education is provided in the *écoles gardiennes.* They are free but not compulsory, are provided by the communes, receive a State grant, and are under government inspection. Private schools must conform to the conditions of the communal schools. The State first recognized these schools in 1833. In June, 1927, the Ministry issued a new set of model regulations, which the communes are free to adopt or modify. Froebelian and Montessori occupations are recommended. Reading, writing and arithmetic are excluded. No time is allowed for sleep. In all schools there is a *femme de service* to see to the cleanliness of the children and to their physical needs.

In France, the first regular infant school was established in Paris at the beginning of the 19th century. In 1828 a model school was started, followed shortly by similar institutions all over France. State recognition and inspection were granted. In 1848

the name *école maternelle*, which these schools have since borne, was given to them. Every commune must have one of these schools or a *classe enfantine*, which has now become simply an *école maternelle* attached to a primary school. Admission is free, but not compulsory, for children between two and six. New regulations were issued in 1921 and 1927. Reading, writing and arithmetic are taught to the older children. Classes are to be from 25 to 50 in size. All schools must have a *femme de service*.

Kindergartens and day nurseries (*Kleinkinderbewahranstalten*) for children under six in Germany are maintained voluntarily by local authorities and also by religious and charitable bodies, but they are subject to State inspection. Fees, if charged at all, are very low. In addition there are private kindergartens and day nurseries supported by the parents' fees. Froebelian methods are general, but a decree of the Prussian Ministry of Education (1920) makes the study of Montessori methods compulsory in recognized training courses for kindergarten teachers. There are few purely Montessori schools. The age of compulsory attendance is six.

Under the Act of 1891 in Hungary, kindergartens (in the larger communes) and day nurseries are established in addition to what is done by voluntary effort.

The first efforts to provide infant care and training in Italy were made by Ferrante Aporti, who established *asili infantili* early in the 19th century, and whose ideas in many ways resembled Froebel's. In 1907 Dr. Montessori opened a *casa dei bambini* in a tenement house, where she applied to normal infants the ideas formed by her experience in training mental defectives. In the year 1921–22 there were 5,902 *asili infantili* attended by children between three and six, including kindergartens, *casa dei bambini*, and *sale di custodia* (day nurseries), some communal, some private. Some are free, whilst others charge fees. The decree of December, 1923, authorises the establishment of *scuole materne* by voluntary effort in collaboration with the Ministry; also of training colleges for teachers in these schools; and allocates an annual State grant of five million lire.

Pre-school training has so frequently been the outcome of an attempt to cope with the evil effects of industrialism and overcrowding that it is not surprising to find it less developed in Scandinavia than in more highly industrialized countries. Norway has day nurseries and kindergartens in Oslo, both communal and private. A few Montessori trained teachers are at work in and near Oslo. Denmark has Froebelian "public gardens" in Copenhagen for children from three to six; the mothers are allowed to come also and bring their sewing. In Sweden the primary schools have infant departments for children between six and eight, but education is not compulsory before the age of seven.

In Switzerland each canton controls its own schools. Generally speaking the larger towns in German Switzerland have communal kindergartens and the smaller ones day nurseries, maintained by voluntary effort with a communal grant. In French Switzerland the *écoles enfantines* form the lowest division of the primary school under cantonal authority, and there is a more formal syllabus, though Froebelian methods are also practised. (*See* also KINDERGARTEN, MONTESSORI, MONTESSORI SYSTEM, NURSERY SCHOOLS and their bibliographies.)

The United States.—*See* NURSERY SCHOOLS, DAY NURSERY and KINDERGARTEN. (M. M. G.)

INFANT WELFARE: *see* MATERNITY AND INFANT WELFARE.

INFECTION: *see* BACTERIA; DISEASE; PARASITIC DISEASES.

INFECTIOUS FEVERS. For these *see* the articles on CHICKEN-POX, MEASLES, SCARLET FEVER, TYPHOID, TYPHUS, WHOOPING COUGH and similar diseases.

INFERENCE: *see* LOGIC.

INFERIORITY COMPLEX, a psychoanalytical term, signifying a complex, or pattern of emotionally toned ideas concerning what the subject feels to be his own inferiority. The inferiority may actually exist, or it may be imaginary. The emotions attaching to the ideas of inferiority are supposed to cause the subject to attempt to compensate for his inferiority in various unnecessary ways, such as causeless pugnacity, unprovoked attacks on others, or anti-social behaviour. The general concept is widely used but with little exactitude of definition, different writers referring to widely different types of feeling and behaviour under this term.

See A. Adler, *The Practice and Theory of Individual Psychology*.

INFINITE, a term used in mathematics, philosophy and theology with various meanings which are apt to cross each other and cause confusion. It is not possible to do more here than indicate the chief notions associated with the term.

Negative and Positive.—Speaking broadly, one may distinguish between the negative meanings of the term and its positive meanings, and also between its use in connection with what is quantitative, and its use in connection with what is not quantitative, but only qualitative. The negative meanings of the term may be expressed variously (according to context) by "indeterminate or endless in quantity or extent," etc., and "indefinite or indeterminate in quality."

The positive meanings may be expressed by the expressions "self-determined," "self-dependent," "complete" or "perfect," as the case may be. The negative use of the term is no doubt the older; it is the one most obviously suggested by the form and the etymology of the term (Latin *in*, "not," and *finis*, "end" or "limit"). The positive meanings were evolved later as the result of philosophical and mathematical reflection on the kind of objects commonly described as infinite. Such reflections have also led to the introduction of numerous distinctions among "infinites," such as "internal" and "external" infinites, "finite" and "infinite" infinites, "absolute" infinite and infinite "of its kind." "single," "double" and "treble," etc., infinite, and, of course, the infinitely great and the infinitely small (or "infinitesimal"). To explain all these distinctions adequately would take up too much space, but the main points should become clear from what follows.

The Infinite and God.—In the history of Western philosophy the term "infinite" (*τὸ ἄπειρον*) is met with, apparently for the first time, in the teaching of Anaximander (6th cent. B.C.). He used it to describe what he conceived to be the primal matter, "principle," or origin of all things. His teacher Thales had suggested that it was water; later thinkers identified it with air or fire, etc. What Anaximander probably meant to suggest was that the primal substance must have been something indeterminate or indefinite in quality as compared with such qualitatively definite substances as water, air, fire, etc., which emerged from it in course of time. Whether he conceived his primal substance as indeterminate in quantity as well as in quality is not certain, though highly probable.

At all events the notion of things indeterminate in quantity, or "without end," must have become familiar fairly early, especially in connection with ideas about space, time, number, and the existence and powers of God. Space, even perceived space, seems in a sense to have no boundaries—it seems to fade into a larger space beyond, and the space beyond can only be imagined or conceived as surrounded by more space, and so on indefinitely. Time too seems to have no limits—whatever the period of time or duration that we live through or imagine or conceive, it is always possible, indeed necessary, to supplement it with more time "before and after." The series of numerals likewise is endless—by adding and subtracting one can extend it both ends indefinitely. Similarly with ideas about God. Once the stage of limited, local deities was passed, God was gradually conceived to be unlimited in power, of infinite duration, and holding sway over endless space. Curiously enough it was not until recent times that there has been a return to some extent to the conception of a Deity of limited power. Deeply impressed with the reality of evil and suffering in the world, some thinkers have found themselves in the dilemma of having to choose between the infinite goodness and the infinite power of God; and they preferred to abandon the belief in His omnipotence. Whether the dilemma is valid, is a question that need not be discussed here. Some find no serious difficulty in reconciling the apparently conflicting alternatives, when due allowance is made for the implications of human free-will.

The Infinite and Vastness.—Intimately connected with the earlier conception of the infinite, especially in its application to

space and time, was the idea of immensity or vastness. This was a perfectly natural combination or fusion of ideas, which still clings to the popular use of the term infinite. In a sense the dissociation between "infinite" and "vast" was begun fairly early. Zeno's paradox that motion is impossible, because the moving body would have to pass through an infinite multiplicity of points or positions in order to reach even a near destination, obviously implies or even asserts that a finite line or distance contains something infinite, namely, an infinite multitude of points or positions. So that in some way a short finite distance having definite, known limits may still in some way be infinite, that is infinite internally (*i.e.*, infinitely divisible), though not externally (because its limits are fixed).

But the paradoxical method of Zeno failed on the whole to bring out the element of truth in his teaching. And the lesson had to be repeated by Spinoza, among others. His favourite illustration of the internal, finite infinite (or the infinite within a finite whole) is that of a small circle containing a still smaller circle with which it is not concentric. The space between the two circumferences is finite and small. The minimum distance and the maximum distance between them is known. Yet within this small finite space, and within the limits marked by the minimum and the maximum distance there is an infinite variety of distances between the two circumferences. The space is externally finite, internally infinite. So that the infinite is not necessarily "vast" (hence the poet's note about holding infinity in the palm of the hand), nor does it depend on the absence of "limits."

Infinity a Quality.—Infinity is rather some kind of positive character or quality. What this quality or character is, Spinoza does not make quite clear except in the case of the "absolutely infinite" and the "infinite of its kind." But what he says in this case is very suggestive, and rather like more recent conceptions of the "infinite" as formulated by Dedekind and various contemporary mathematicians. By "the absolutely infinite" Spinoza meant God as the perfect, complete, self-dependent, self-determined ground of all that is. Extension and Thought, which are "attributes" (that is, aspects of God or the Universe) are each "infinite of its kind," that is, each complete in its nature, but not, of course, the whole of Nature (or God). Finite things (or finite modes), on the other hand, are characterized by fragmentariness, incompleteness, dependence on other things outside themselves, though they are all ultimately parts of the infinite.

Now, this conception of the "infinite" is, from the standpoint of philosophy at all events, the most interesting and essential feature in the newer mathematical conception just referred to. This feature may be stated in the following quotation from A. E. Taylor's *Elements of Metaphysics* (Book II., Ch. iii.):—"The infinite must not be confounded with the indefinite or unfinished. Its fundamental property is not the merely negative one of having no end or 'last term,' but the positive one of having an internal structure which is the harmonious and complete expression of a single self-consistent principle. The finite, again, is finite not primarily merely because it has a 'last term,' *i.e.*, because there is something else outside it, but because its 'last term' is arbitrarily determined, *i.e.*, determined by something other than the principle of its internal structure. In other words, the essential defect of the finite is that it is not solely determined by its own structural principle. We can see this even in the simple case of the familiar 'infinite series' of arithmetic and algebra. Such a series as 1, ½, ¼ . . . is 'infinite' not merely because you never come to the last term, but because its character is determined from within, solely by the principle according to which each term is derived from the one before it; that the series has no end is a simple consequence of this positive property of self-determination. But suppose I take *n* terms of this series and no more, where *n* is a specified number, the resulting series is now *finite*, not primarily because there are more terms of the same kind outside it, but because the number of terms to be taken is not prescribed by the law of formation of the series, but fixed with reference to some object independent of the principle of the series itself. In other words, only the infinite is in the full sense of the words a completely self-determined whole. The finite is the imperfect, not primarily because there is something outside it, but because its contents are not solely prescribed by the principle of structure which they embody."

For the special uses of the notions "infinite" and "infinitesimal" *see* articles SERIES, FUNCTION, GEOMETRY and CALCULUS, *Infinitesimal.*

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INFINITESIMAL CALCULUS: *see* CALCULUS.

INFINITESIMAL GEOMETRY: *see* GEOMETRY.

INFINITIVE, a form of the verb, properly a verbal noun, but usually taken as a mood. (*See* GRAMMAR.) Latin grammarians gave it the name of *infinitus* or *infinitivus modus*, as not having definite persons or numbers. The infinitive form of the English verb consists of the preposition "to" coupled directly with the unaltered verb root as in "to see." When a word is inserted between the preposition and the verb the result is called a "split infinitive," as "to clearly see," "to freely give," etc.; this form is a bugbear of the strict grammarian.

INFINITY, a term employed in common usage for anything of vast size, but strictly applicable only with the implication of the immeasurably or innumerably great, or of the impossibility of being measured or counted. In the strict sense the term is employed in metaphysics and theology and mathematics. The term is from the Latin *in* (not) and *finis* (end) and thus has the etymological significance of "endless."

The unlimited straight line has length without limit; it cannot be measured off by the repeated application of any unit; it transcends all possibility of measurement, and in this sense it is said to be infinite. A line is also infinite as regards the number of points on it; between any two points on a line there is another, and indeed an infinitude of others; on any line segment there is a smaller line segment, and hence an infinitude of line segments such that each of the segments after the first is included in each of those which precede it. Thus a line exhibits both infinitude of measurement and infinitude of subdivision. Space likewise is infinite in extent and it possesses an infinitude of points, of lines, of planes and of bounded portions of space. Endlessness as regards extent or distance and endlessness as regards subdivision are characteristics of space by which it is seen under the aspect of the infinite. There is a shorter distance than any which we have measured and a longer than any which we can conceive. But boundlessness or endlessness is not equivalent to infinitude. A confusion of the two notions was current in antiquity and has appeared also among modern thinkers, as Hobbes, and Hegel, for instance. A circle, considered in the modern aspect of line is endless, but we would not apply to it the concept of infinitude as regards measurement, though as regards subdivision it exhibits the characteristic quality of infinitude. Space is endless and infinite, the circumference of a circle is endless but finite as regards extent.

The Infinite in Metaphysics and Theology.—Tracing history back to the earliest possible date, we are forced to postulate an earlier period still and then one preceding that, and so on without end. Looking forward we conceive vast stretches of the future; and beyond any time of which we can think we are forced to postulate a still later time to come. Distances on the earth are small compared with the distance to the sun, and that itself is small compared with the distances of some of the stars; and beyond the furthest reaches of our telescopes we imagine still unending stretches of space. We have never seen a thing so small that we cannot imagine a smaller, or measured a thing so great that we cannot conceive a greater. But we have never experienced the infinitely small or the infinitely great, though we have formed a notion of them. Infinity is a mental concept. In early Greek philosophy (*see* IONIAN SCHOOL OF PHILOSOPHY) it appeared under the aspect of the boundless (τὸ ἄπειρον), and as such it was discussed at great length by both Plato and Aristotle. They gave much thought to the question as to which is the more truly

real, the finite objects of sense or the universal idea of each thing laid up in the mind of God. They enquired concerning the nature of that unity which underlies the multiplicity of perceived objects: and the same problem, in various forms, has engaged the attention of philosophers throughout the ages.

In Christian theology God is conceived as infinite in power and knowledge and justice and goodness, uncreated and immortal. In some oriental systems, absorption in the infinite is the highest end of man, his perfection resting in the breaking down of human limitations.

The metaphysical and theological conception of the infinite is open to the objection that a finite mind cannot form an adequate or appropriate conception of such an object of thought and therefore cannot form trustworthy judgments concerning it; and the matter has been extensively debated. Sir William Hamilton's philosophy of the "unconditioned" and Herbert Spencer's doctrine of the infinite "unknowable" give evidence of this controversy. (*See* the articles on the thinkers mentioned, and also those on DESCARTES, MALEBRANCHE, SPINOZA and ZENO.)

The Mathematical Infinite.—If the law of variation of a magnitude x is such that x becomes and remains greater than any pre-assigned magnitude however large, then x is said to become infinite, and this conception of infinity is denoted by ∞. If the law of variation of a magnitude x is such that x becomes and remains less than any pre-assigned magnitude, however small, then x is called an infinitesimal and is said to approach the limit zero. These conceptions of the infinite and the infinitesimal are analogous to the metaphysical infinitudes of measurement and of subdivision; but they differ from the latter in a marked way in that the mathematical concepts are defined entirely in terms of that which is finite. The absolutely infinite is in no sense involved. What is described in each case is a type of variation. These conceptions are intimately involved in the articles: FUNCTION, LIMIT, SERIES, NUMBER SEQUENCES, and CALCULUS.

Through the doctrine of geometrical continuity (*q.v.*) and the application of algebra to geometry arose the important notion of infinity as a localized space-conception, so that mathematicians come to speak of points at infinity, lines at infinity, and planes at infinity. It is said, for instance, that two parallel lines intersect in a point at infinity; that all circles in a plane pass through two fixed points at infinity (the circular points), and that two spheres intersect in a fixed circle at infinity. (*See* GEOMETRY.)

The most remarkable mathematical doctrine of the infinite is that which is associated with the conception of infinite aggregates. In the case of any aggregate it is possible to pair the elements in such a way that each element in the aggregate is paired with an element of the aggregate. Thus in the set 1, 2, 3, we may take 1 with 2, 2 with 3, 3 with 1. In this case the first terms in the pairs exhaust the elements in the given set, and so do the second terms. In any way in which all the elements of a finite aggregate are paired uniquely with elements of the aggregate, the second terms in the pairs (as well as the first) exhaust the aggregate. This is the distinguishing quality of a finite aggregate as finite. The opposite quality characterizes infinite aggregates as infinite. Thus, in the case of the set of all positive integers, we may pair each integer with its double; the first terms in the pairs exhaust the aggregate of positive integers, but the second terms do not, since there is no odd number among them. In general an infinite aggregate is an aggregate such that its elements can all be paired uniquely with a part of its elements. This is the *positive* definition of an infinite aggregate, as opposed to the *negative* definition which characterizes it as one that is *not* finite.

If two aggregates are such that the elements of one may be made to correspond with the elements of the other in such a way that each element of either aggregate corresponds to one and just one element of the other aggregate, the relation so established is said to be a one-to-one correspondence between the aggregates. When a one-to-one correspondence is possible we say that the number of elements in one aggregate is the same as the number of elements in the other. In the case of finite aggregates this agrees with the usual conception of the sameness of number of two aggregates. The question arises whether two infinite aggregates have always the same number of elements; the answer is negative. The number of all integers is the same as the number of all rational numbers, but is less (in a suitably defined sense of the term) than the number of all real numbers. The number of points on the segment of a line is equal to the number on the whole line and in fact to the number in the whole of space, but is less than the aggregate of all functions of a real variable.

See E. W. Hobson, *Theory of Functions of a Real Variable*, vol. I. 3rd ed. (1927), Camb. Univ. Press; B. Bolzano, *Paradoxien des Unendlichen* (Leipzig, 1850); and L. Couturat, *De l'infini mathématique* (1896). (R. D. CA.)

INFLAMMATION AND ITS SEQUELS. The protean character of inflammation is sufficient explanation of the fact that none of the numerous attempts to define the condition has been entirely successful. The term represents the sum of changes locally produced in a living tissue by the action of an irritant, and since the constituents of the tissues and the characters of irritants vary within enormously wide limits, it follows that the phenomena of inflammation vary within wide limits also. Nevertheless, the four "cardinal signs" indicated by Celsus (A.D. 34) viz., redness, swelling, heat, pain, are in varying degrees present in every case of inflammation, and subsequent centuries only added to these four signs, a fifth, impairment of function.

From a clinical point of view inflammation may be acute, subacute or chronic, may be widespread or localized, may produce intense destructive changes or little obvious effect, may be relatively unimportant so far as life is concerned, or may endanger life from the outset. Essentially, however, the phenomena are the same in kind though individually varying in degree to an infinite extent. This is true even if the irritant evoking the inflammation be one and the same. The micro-organism known as staphylococcus aureus, lodged in the cardiac valves, produces valvular disease of the heart, with the entire chain of events that valvular disease entails; in the subcutaneous tissues, leads to a pustule; in the liver, to an abscess; within the skull, to cerebral abscess or meningitis, in the superficial layers of the skin, to a pustular dermatitis, to mention but a few examples. Here the different effects depend, in large measure, upon the seat of lodgement of the micro-organisms. Other variations depend upon the specific character of the infecting micro-organism. Lesions produced by B. tuberculosis, Treponema pallidum (syphilis), B. diphtheriae, B. perfringens (gas-gangrene), B. pestis (plague), V. cholerae asiatica, have peculiar characters, so that a cursory examination might fail to discover that essential identity of phenomena which underlies all of them.

Inflammation and Repair.—One of the greatest difficulties in visualizing inflammation lies in the fact that whatever may be the effect of the irritant upon the tissues at the focus of its maximum intensity, that focus is surrounded by concentric zones in which the intensity of the irritant action, by degrees, falls off to zero. In correspondence with this the reaction of the tissues shows concentric zones of variations which, in turn, shade off to zero. An example will make this clear. If a needle be raised to a dull red heat and the point be applied momentarily to the skin on the back of the hand, the reaction which ensues will occupy, say, a circle with a diameter of 0·5cm. In the centre there will be absolute death of certain epidermal cells, around this there will be a blistered zone, in its turn surrounded by a zone of redness, heat and pain, intense nearest the seat of injury and gradually shading into the normal skin of the periphery as one passes away from the centre. These phenomena depend upon the intensity of the heat acting on the tissues in each concentric zone and the effects of heat on the cells, from the centre outwards, are immediate death, injury so severe that recovery is impossible, injury sufficiently slight that recovery is possible, stimulation to increased normal activity. That increase of normal skin activity may follow on exposure to suitable temperatures is shown by the redness and sweating experienced on a summer day.

The peripheral appearances described above do not occur at the moment that the hot needle is applied, but take some time for their production, and disappear in reverse order until the normal condition of the skin is re-established. That is to say,

the local inflammation is followed by regeneration and repair. It is this essential association of reparative or stimulative processes with destructive or inflammatory processes that renders study of inflammation so difficult, but the two types of process must be entirely distinct, for stimulation occurs in the normal processes of life in which inflammation is completely absent, though these same stimulative processes are responsible for the regeneration and repair that normally follow inflammation. In a word, inflammation is essentially degenerative and destructive, but of necessity brings regeneration and repair in its train. Recognition of this principle is of fundamental importance in treatment, as it indicates that before repair can take place at a given spot every source of irritation, *i.e.*, of inflammation, must be removed. It is intelligible, too, that a tissue on the way to repair may itself fall under irritant action. Then the phenomena of repair and of inflammation are commingled; the result is chronic inflammation.

The Inflammatory Process.—A minute injury like that described above, with the vascular and tissue changes it induces, is an epitome of the phenomena of inflammation in general. Microscopical examination shows that in the inflamed area the blood vessels and the tissue elements are modified. The blood vessels are affected differently in the central and peripheral regions. Towards the centre of the area they are dilated and the blood therein is stationary, the red blood corpuscles have lost their individual contours and channels and blood may be represented by homogeneous red cylinders. Further out the vessels are dilated also, but the blood flow through them, though retarded, has not ceased, and outside the vessel walls are red corpuscles, polynuclear leucocytes and fluid that have escaped from within the lumen. Still further outwards the vessels are dilated and the rate of blood flow is much increased; this zone gradually merges into the region of normality. The essential cells of the part also share in the reaction, showing modifications varying from complete disintegration to cloudiness of cytoplasm and disruption of nuclei. Thus in every example of inflammation there are vascular changes associated with dilatation of vessels, modifications in rate of local blood flow, exudation of fluid, emigration of leucocytes, extravasation of red corpuscles, and disorganization of the essential tissue elements. Such differences as are introduced by variations in the type of injury and kind of tissue involved are differences of degree, not of kind. But, primarily, it is the local increase of blood flow that accounts for the "redness" and "heat," the exudation that accounts for the "swelling" and "pain," the tissue changes that account for the "impairment of function." Obviously, with a given injury, where the tissues are normally loose, *e.g.*, skin of back of hand, swelling will be relatively great, and pain relatively slight; where the tissues are normally tense, *e.g.*, the pulp of the fingers, swelling will be slight and pain great. The lack of distensibility of the teeth, and of the bony sockets of the jaw in which the teeth are set, amply explains the acute pain of toothache.

The phenomena associated with inflammation may be distressing to the patient, but of temporary importance; on the other hand, they may be so excessive that they constitute in themselves sources of irritation to the tissues in which they occur. A blow in the neighbourhood of the knee may lead to local inflammation, with so much pain and effusion that the joint is kept immobile sufficiently long for atrophy, from disuse, to occur in the muscles moving the joint, and occurrence of adhesions within the joint itself. Hence the primary irritant may be reinforced by secondary and subordinate irritants, and in many instances the latter lead to the greater degree of disability. Other examples of the dominating influence of these secondary irritants are seen in cases of pleural and pericardial adhesions, ascetic collections of fluid, necrosed bone (sequestra), renal and biliary calculi. In all instances, however, whether it be by way of primary or of subordinate irritants, the tissue elements involved determine the ultimate effects of the inflammation. According as they are nervous, muscular, renal, connective tissue, or of other kind, the features of the symptoms resulting from the inflammatory lesion are determined, and in proportion as the tissue cells themselves are relatively vulnerable and predominate in the affected region, the symptoms are produced by relatively low degrees of irritation. Particles of dust that are without effect on the skin or mucous membrane of the mouth may cause profound inflammation of the eye; oil of turpentine which, acting on the skin, merely reddens it, when acting on the secreting cells of the kidney, leads to an intense, possibly a fatal, nephritis.

Irritants, Non-organic and Organic.—Hitherto the irritants that have been mentioned may be regarded as non-living or unorganized, and such irritants are of the widest variety, chemical, physical, mechanical; the strong acids and alkalies, the poison injected by a bee, wasp, or stinging nettle, heat, cold, ultra-violet and other radiations, bullets, sprains, blows, cuts, are a few examples. There is even some reason for believing that, in hysterical subjects, irritants may be psychological, though all such statements must be received with caution in an individual case. In all the above-mentioned instances the irritant action is momentary, or at all events, limited, and the inflammation is correspondingly limited. It reaches its height, and so soon as the primary and consequential subordinate irritants have ceased to be effective, owing to their actual removal, dilution, neutralization, and so forth, the strictly inflammatory processes come to an end and resolution, regeneration and repair (*see* below) come into play.

But there is another, and in most respects, a far more important variety of irritant that leads to inflammation. The irritant here is living or organized, and the group embraces the whole range of pathogenetic bacteria and animal parasites that affect the solid tissues. The inflammatory phenomena are dominated by the fact that the irritant has the power of living and multiplying within the animal tissues, and though, fundamentally, the tissue reactions towards this type of irritant are identical with those towards non-organized irritants, the scales are weighted from the first in favour of the irritant and against the tissue it invades. To produce a given result a smaller initial injury is sufficient when the irritant is bacterial, because the irritant has in the toxin it produces a weapon that the non-organized irritant has not, has in its power of multiplication a power of escaping from the region where the tissues are opposing it and carrying its injurious action to a distance. And in the course of these activities it occasions such pathological conditions as abscess, ulceration, gangrene, necrosis, sepsis, fever, nervous symptoms; and the train of ill-effects extends indefinitely. Whether the patient succeeds in overcoming the primary and secondary irritants, and in repairing the damage they have caused, or succumbs under the attack, is determined by the factors influencing his immunity or susceptibility.

Mode of Operation of Bacterial Irritants.—It follows from what has been said that, theoretically, the entrance of a single pathogenic micro-organism into the tissues is sufficient, and actually the mere prick of an infected needle has in many instances led to severe general illness, sometimes to death. It follows, too, that the sequels of an inflammation caused by an organized (bacterial) irritant are more pronounced, last longer, and induce more damage to the tissues than those following the action of a non-organized irritant of comparable magnitude. This truth lies at the bottom of all antiseptic and aseptic surgery. It also furnishes the main explanation of abscess formation, ulceration, focal necrosis and gangrene, as pathological sequels of inflammation. An abscess, pathologically, is merely a collection of dead tissue cells, polymorphonuclear leucocytes and exuded blood plasma which, at first solid, has become liquefied by the proteolytic action of enzymes. That this destruction of tissue cells, migration of leucocytes, exudation of blood plasma, proteolysis, are on so great a scale that a *macroscopic* abscess results, depends upon the bacterial character of the irritant at work; pathologically, an identical condition, though of *microscopic* proportions occurs preparatory to the healing of every perfectly aseptic wound. For in both instances the irritant (bacteria or knife) causes death of tissue cells, vascular changes, passage of leucocytes and plasma from within the blood vessels to the lymph spaces outside, local coagulation of the exuded fluid and its subsequent proteolysis.

Here the danger must be indicated of considering inflammation

as merely a local process, though one at times affecting a large area. Granted that the local phenomena attract most attention, yet it is clear that the increased local blood flow can only be carried out by a re-arrangement of the circulation over the whole body, that the exuded fluid implies a general re-arrangement of the intra- and extra-vascular relations, that the localized collection of leucocytes, often in huge numbers, implies a redistribution of their numbers within the circulating blood, and often an increased output at the seats of their normal production. The experimental evidence for these statements lies in the altered specific gravity of blood and of tissues at distant parts of the body, and the altered corpuscular constitution of the blood (particularly concerning the numbers of polynuclear leucocytes) that accompany local inflammation. So, too, fever, general discomfort, disordered digestion, altered composition of the urine, are often other indications that the entire body shares in the changes. Finally, the production of specific anti-substances to antagonize bacterial irritants is a function of the tissues (*see* BACTERIA AND DISEASE), and such anti-substances are conveyed by the blood to the region where they are to act, *i.e.*, at the focus of inflammation.

THE SEQUELS

The sequels of inflammation are (*a*) physiological and (*b*) pathological. To the latter reference has been made repeatedly in the previous section, and it has appeared that they depend upon persistence of irritant action, whether primary or secondary. These pathological sequels do not call for further remark here. The physiological sequels are those which bring about a restoration of the inflamed part to a healthy condition. In some cases this may consist in a return to the normal, but in the majority the tissue is not exactly the same as it was before becoming inflamed, and often the original tissue is finally replaced by tissue of quite a different kind. The processes at work are termed resolution, regeneration and repair.

Resolution.—By this is meant that the processes indicated by the irritant, on the cessation of its action, return to normal in the reverse order to that in which they were called forth. The classical example of resolution occurs in acute lobar pneumonia caused by M. pneumoniae. Here the irritant leads to acute congestion of a large part of the lung, and the dilated blood-vessels pour into the air alveoli inflammatory exudation which coagulates and renders the affected part of the lung airless, solid and more voluminous than when normal. Great numbers of polynuclear leucocytes also pass from the blood-vessels and are entangled in the coagulum, together with small numbers of endothelial cells from the walls of the air alveoli. In an uncomplicated case the irritant action of the micrococcus now comes to an end because the body has elaborated the necessary anti-substances. The coagulated exudation is liquefied by proteolytic enzymes supplied by the polynuclear leucocytes, and the resulting fluid, with any dead and desquamated cells is removed by expectoration, drainage by lymphatics, re-absorption into the blood-stream. The normal calibre of the blood-vessels is re-established, defects in endothelium are remedied by division of neighbouring endothelial cells, the air-ways are re-opened and the lung returns to a condition that cannot be distinguished from the normal. Resolution in this complete sense, though the rule in lobar pneumonia, is the exception in other instances, though joints affected with acute rheumatism may also return to the normal. Even when the part apparently returns to normal, microscopic examination shows that this is not absolutely the case, *i.e.*, that not resolution alone, but repair also has played a part in the recovery.

Regeneration.—The re-formation of tissue in invertebrates is often complete even though a considerable mass has been removed; crustaceans such as the crab or lobster will re-form an entire limb. Amongst the vertebrates such regeneration is much more limited, though an amphibian like the tadpole or newt will re-form a complete tail if it has been removed. In higher vertebrates organs are not regenerated. It is true that if a portion of liver tissue be removed experimentally, the surrounding hepatic cells divide and produce a tissue having certain resemblances to liver tissue, and probably exercising hepatic functions. In some degree the same is perhaps true of renal tissue. The stimulus of each successive pregnancy, too, leads to a regeneration of uterine muscular, and probably also of mammary, secreting systems. But in the latter examples the meaning of regeneration is strained, and it is an undoubted fact that when uterus or breast has been subjected to inflammatory, as distinguished from physiological, action, *e.g.*, when either organ has been incised for surgical purposes, the defect is not filled by muscular or glandular tissue, but by scar tissue, *i.e.*, regeneration does not occur, but repair. Strictly speaking, in higher vertebrates regeneration to fill an artificial defect is confined to cells of the epithelial, endothelial and connective tissue systems and to blood-vessels. In all other systems a defect resulting from irritant action is repaired; the faulty tissue is not regenerated.

The regeneration of epithelium implies that certain cells of a like kind persist in the neighbourhood of the defect, and by their repeated division are able to re-construct the tissue. Physiologically an example of this occurs in the monthly reconstruction of the tubular glands of the normal endometrium. The bases of these glands reach into the muscular wall of the uterus, and persist when the endometrium, with the greater part of the glands, is cast off in menstruation; it is from these remnants that the entire glands are re-constructed. When a defect occurs in the superficial squamous epithelium, *e.g.*, at the seat of an ulcer, the intact epithelial cells at the periphery divide, and in time cover the denuded space. At the free edge the cells are but one layer thick, but they soon begin to divide parallel to the surface, until the new skin is stratified and several layers thick. This regenerative property of squamous epithelium is utilized in the surgical operation known as Tiersch grafting. Where a large superficial area is devoid of skin, small grafts are cut from normal parts reaching down to and including the germinal layer (*see* EPITHELIUM), and are applied to the granulating surface. Here, when a graft has "taken," it forms a centre for centrifugal growths of epithelium. In this way the covering-in of a large area left by a superficial burn, for example, is materially shortened. The specialized elements of the true skin and subcutaneous tissue, *i.e.*, papillae, touch corpuscles and other sensory organs, sweat glands, sebaceous glands, hair follicles, are not regenerated. Columnar and spheroidal epithelial cells also regenerate provided that corresponding cells persist from which regeneration can take place. When such cells line gland systems the composite system may or may not be regenerated. If the system be simple, *e.g.*, a tubular gland lined by columnar epithelium, it will probably be re-formed; if compound, *e.g.*, a racemose gland lined by spheroidal epithelium, it will probably not be re-formed.

The regeneration of endothelium occurs in one plane only, and it is doubtful whether fibrous tissue cells do not at times replace them in respect of their tegumentary function. The chief regenerative function of endothelial cells is represented in the new formation of blood-vessels, whereby the nutrition of the young tissue being formed to fill the defect is carried out. These new blood-vessels arise from pre-existing capillaries by the local formation of a solid endothelial bud, which grows towards the free surface of the wound and gradually becomes canalized. When two such buds from contiguous capillaries have nearly reached the free surface they bend over, their tips meet, fuse and are canalized; hence the two original capillaries are now connected by a newly-formed capillary loop. The tips of these loops can be seen with the naked eye on the floor of a healing ulcer as minute projecting bright red points or "granulations" that bleed on the slightest rough treatment. Should one of these capillaries ultimately become converted into an arteriole or venule the additional coats are formed by extensions from the corresponding coats of pre-existing vessels. This new formation of blood vessels is known as *vascularization*, and the tissue in which the new capillary loops occur is known as *granulation tissue*.

Regeneration of members of the connective tissue group is one of the most widespread processes following on inflammation. It accounts for the formation of scar tissue in repair of a defect, for the production of adhesions in serous cavities, for the repair of bones after fracture. It also accounts for the increase of

fibrous tissue in conditions like chronic fibrosis of kidney ("granular kidney") and liver (cirrhosis) and sclerosis of bone, though the association of such increased fibrous or bony formation, with an antecedent inflammation is doubtful in some cases. The chief tissues thus regenerated are fibrous tissue with its variants, fatty and mucoid tissue, neuroglia and bone. In all instances the new tissue is formed from pre-existing cells, fibroblasts in the case of fibrous tissue, neuroglia cells in the case of neuroglia, periosteal and endosteal osteogenetic cells in the case of bone. Cartilage both yellow elastic and white hyaline, is regenerated with far less frequency, especially the former variety; their place when destroyed is usually taken by white fibrous tissue. When regenerated the new material is formed from pre-existing remnants of cartilage, but there is reason to believe that in some cases of bone regeneration a cartilaginous stage is interposed between the fibrous and osseous stages, as in the normal formation of bone through cartilage. Usually, however, repair of bone takes place by direct calcification and ossification without the interposition of a cartilaginous stage, thus resembling so-called membranous bone formation. In all essential details the newly-formed fibrous tissue or bone resembles the normal tissue, but often it ends by being denser and less regular in its general arrangement. Corresponding with this, cells are more scanty and the inter-cellular substance more pronounced. Calcium salts may be deposited in fibrous tissue formed as a sequel to inflammation, as in the calcareous nodules occurring in pleuritic or pericardial adhesions, or it may become the seat of overgrowth reminiscent of tumour formation (keloid). In all cases the amount of fibrous tissue formed after inflammation is excessive, at least at first, but for some reason that is not fully clear, inflammatory fibrosis reacts readily to X-radiation, so that redundancy is often treated successfully by this means.

In the case of nerves, the term regeneration is often used, but the return of function which may be observed after the severed ends of a nerve have been sutured, is not regeneration in the strict sense. In all the instances described above, regeneration of tissue depends upon re-formation of cells by division of pre-existing cells, but nerve cells once destroyed are never re-formed, and the return of function depends merely upon centrifugal growth of the axis cylinder from the still intact nerve cell along the scaffolding provided by the anatomical nerve, whose continuity has been restored by suture. Experiments that have been regarded by their authors as indicating that the functional nerve is restored by longitudinal apposition of proliferated neuroglial cells, do not carry conviction.

Repair.—The phenomena described above play varying parts in the production of repair, so that the interaction of inflammation and repair and the essential similarity of processes in clinically dissimilar conditions can best be brought out by tracing them in a few illustrative cases.

(1) *An Aseptic Surgical Wound.*—The irritant here is the knife, and subordinate irritants are reduced to a minimum, probably being represented by the stitches, a small number of tissue cells on the cut surfaces that are injured beyond recovery, and small amounts of blood clot. As the result of these local dilatation of vessels occurs, exudation is poured out in the superficial layers of the opposed cut surfaces, and between them and by coagulation, temporarily binds them together. Polynuclear leucocytes migrate from the blood stream and by phagocytosis (*q.v.*) remove dead tissue and remnants of blood clot, and later the fibrin filaments of the coagulum. At the same time newly-formed capillaries bridge the gap between the two cut surfaces, travelling along the fibrin filaments in the intervening coagulum. Fibroblasts, derived from pre-existing connective tissue corpuscles, range themselves along the new capillaries and build up fibrous tissue whereby the two opposed surfaces are definitely united. On the surface, squamous epithelial cells divide and fill the skin defect and healing is complete. As the newly-formed fibrous tissue grows older it contracts and obliterates the majority of the newly-formed capillaries, so that the scar tissue, which at first was red and excessive, becomes dead-white and contracted.

(2) *Fracture of a Long Bone.*—(*a*) the fracture is simple and aseptic. Here the irritant is the force that leads to the fracture, and subordinate irritants, consisting of effused blood from ruptured blood-vessels, torn muscles and ligaments, ruptured medulla of bone, play an important part in respect of their volume, while movement between the fractured ends of the bone may further enhance these. Nevertheless, coagulation of the effused blood occurs about the ends of the bones and holds them together as a preliminary. The essential difference between the processes here and those obtaining in an aseptic surgical wound consists in the greater mass of material that has to be removed, the greater space that has to be bridged by newly-formed capillaries, the greater distance the migrated polynuclear cells have to travel, and the fact that the endosteum and periosteum, with their osteogenetic cells, are involved instead of white fibrous tissue. In time the blood coagulum around, between and within the fractured ends of the bones, is replaced by a mass of soft bone (temporary callus) derived from periosteum and endosteum, and of this the greater portion is ultimately removed by osteoclastic (*i.e.*, phagocytic) action, while between the fractured ends there remains newly-formed bone that becomes denser and unites the fracture (definitive callus). Where the fractured ends are widely separated bony new formation may be impossible and the ends are united, if at all, by fibrous tissue: (*b*) the fracture is compound and septic. Here the irritant action is increased by the presence of pathogenetic bacteria and their toxins in damaged, dying and dead material resulting from the fracture itself. The pathological sequels of inflammation, suppuration and necrosis, are therefore superposed upon the already important secondary irritants occasioned by the fracture. Even assuming that the bacterial infection does not become generalized and lead to septicaemia or pyaemia (*see* SEPSIS) the original amount of damage to tissues will be increased by that amount, which is due to the bacterial action as such. When and if these potent adjuvants of the original irritant action have been overcome, and only at those spots at which this occurs, do strictly reparative processes take place, but they are identical with those occurring in an aseptic fracture. In other words, the first object of the body is to render the condition aseptic, and this object the surgeon copies in his treatment of every compound fracture. It can be understood that whereas the healing of an aseptic surgical wound with surfaces well apposed is a matter of days, the healing of a simple, aseptic fracture of bone is a matter of weeks, and the healing of a compound, septic fracture is one of months.

(3) *A Focus of Pulmonary Tuberculosis.*—Here the primary irritant is B. tuberculosis, and an apparent difference from the processes summarized above lies in the facts that the reaction of the lung tissue to the bacillus is cellular only, and contains so-called giant cells, and that blood vessels are absent from the minute nodule or tubercle. The caseation so characteristic of tuberculosis is dependent upon these differences (*see* TUBERCULOSIS), which are correlated with the relative chronicity of the process. But the tubercle when formed, besides replacing a certain amount of lung tissue, is a foreign body, and as such leads to inflammation in the surrounding tissues, often with a degree of congestion that explains the haemoptysis that may accompany early tuberculosis. If it be situated on the surface of the lung the tubercle induces inflammation of the pleura, local death of endothelial cells, and subsequently the production of fibrous tissue in the form of a pleural adhesion. Within the lung itself the tubercle, after undergoing caseation and, perhaps, calcification, becomes surrounded by fibrous tissue in the same way, and by the same local proliferation of fibroblasts, that a fibrous capsule is formed around an aseptic bullet lodged in the tissues. Should the tubercles be numerous and uncomplicated the resulting fibrosis may be irregular and extensive, and should the lesion be complicated by access of pyogenetic micro-organisms, suppuration and the formation of a phthisical abscess cavity (vomica) are super-added. But even in the latter case, if the primary and subordinate irritants be overcome, the defect of lung is repaired by newly-formed fibrous tissue, which is as surely scar tissue as in any of the other instances that have been adduced.

(4) *An Abscess and an Ulcer.*—These two conditions are

bracketed because an ulcer may be regarded as an abscess from which part of the wall restraining the pus is wanting. Hence the pus produced on the floor of an ulcer drains away as it is formed, whereas in the abscess it accumulates within the abscess cavity. Microscopically, however, the floor of an ulcer and the wall of an abscess are composed of the same elements arranged in the same fashion. When the bacterial irritant has become lodged within a tissue, and has multiplied sufficiently and produced enough toxin to destroy the neighbouring tissue cells, by the ordinary processes of inflammation it produces a hard, hot, painful swelling which consists of coagulated exudation, numbers of polynuclear leucocytes, dead tissue cells, and living and dead bacteria, the central part becoming liquefied later by proteolytic action and constituting the pus. This focus of inflammation is surrounded, as has been said earlier, by a zone in which the irritant action has fallen off in intensity to a level at which it ceases to be an irritant and becomes a stimulus. At some less or greater distance from the focus of inflammation, therefore, the necessary factors for the formation of new capillary blood vessels, the proliferation of connective tissue cells and the production of young fibrous tissue, *i.e.*, the formation of granulation tissue, are present. Obeying hydrostatic laws, the pus within the abscess "points," and by destruction of superficial layers of tissue, ultimately escapes. Relieved of this subordinate source of irritation the wall of the abscess contracts, and the reparative fibrous tissue constituting the wall goes on to the formation of definite scar tissue instead of breaking down to swell the contents of the abscess. It is at this stage that the abscess and ulcer are identical in composition. In both instances the most superficial layers of the granulation tissue break down into pus, which drains away, and the final healing only takes place when the surrounding epithelium (or in the case of an abscess in an internal organ covered by serous membrane, the endothelium) has regenerated a covering for the newly-formed scar tissue, and has thereby eliminated the possibility of bacterial irritant action.

By application of the principles outlined above a rational explanation of most examples of inflammation and the phenomena associated therewith can be obtained. Naturally, factors arise that are difficult, even impossible in our present state of knowledge, to explain. One of these is the relation of irritative to stimulative action. According to some authorities, the repair that follows inflammation is initiated by hormones produced by the injured tissues. They see in the formative processes following inflammation something akin to the processes which, under other conditions, lead to the production of neoplastic tumours. (W. S. L.-B.)

INFLATION AND DEFLATION. If we define inflation as an abnormal increase in the quantity of purchasing power, and deflation as an abnormal decrease in the quantity of purchasing power, the first issue which arises is: under what technical conditions are inflation and deflation respectively possible? This question cannot be answered without taking into account the circumstances which lead to inflation and deflation. Inflation is necessarily accompanied by a fall in the value of money per unit: deflation is accompanied by a rise in the value of money per unit, and these changes in the value of the monetary unit in themselves mainly depend upon the degree of inflation and deflation and on the psychological reactions thereby set up.

The object of inflation is not the increase in the volume of purchasing power for its own sake. Purchasing power is increased for the purpose of increasing the consuming power of a given social group. In the modern world the two groups of most importance in this connection are Governments and business men (including both producers and traders). Governments require consuming power at all times, but particularly in periods of war, and in this case require it on an unlimited scale. For psychological reasons that is, "to keep up the war spirit" heavy taxation is unpopular. Borrowing in a form which diminishes spending power by the lenders has equally its limits. Governments resort to inflation, to an increase in the volume of money, and, since they can alter legislation if that stands in the way, they proceed to do so. The fundamental condition is that if inflation is to be practised the currency must no longer be fixed in amount. This implies in practice that the currency, if linked directly or indirectly with a metallic standard, must be released from such dependence. It must be made inconvertible into gold or foreign exchange, and must be freed from any legislative limit restricting its amount. Business men desire to borrow more whenever they believe that trade prospects are improving. If the currency is linked to gold or some other metal, their borrowing has the effect of imperilling the gold or foreign exchange reserves of the banking system. The consequence is that the banks in their own interests are driven to restrict inflation to the degree consistent with the maintenance of the standard. Government relieves, or can relieve the banks of any such limit, and, having freed the banks, can bring powerful pressure to bear to exploit the freedom conferred.

Abolition of Metallic Standards.—To sum up: unlimited inflation involves the abolition of metallic standards. Governments can achieve this more easily than business men. Hence inflation pursued for the benefit of Governments can be carried to much further lengths than inflation for the benefit of the business classes. And, in fact, experience bears this out. The ten or 15% variation in prices which is associated with the cyclical movements of trade weigh very lightly in the scale compared to the enormous variations in the value of money during the last ten years. But once an inflationist movement has been begun by Government it may be continued by industry, as happened in 1919 to 1920 in the United States.

Deflation to be possible to an unlimited extent also requires a currency system not linked to any metallic standard. But, in contradistinction to inflation, it is not likely to be carried to any considerable extent, even if the technical conditions permit of it. Deflation involves a rise in the value of money and therefore increases the value of debts. Even if, in the interests of prestige or of social justice, a Government desires to deflate, it will hesitate to do so if the amount of deflation required is considerable: it would prefer to *devaluate* the currency, that is, to give it a fixed value in terms of gold lower than the value before inflation. In practice, since inflationary legislation does not repeal the right to obtain currency for gold or foreign exchange but only the right to obtain gold or foreign exchange for currency, the limit to deflation comes when the local currency threatens to become more valuable than gold: gold is then presented in exchange for local currency and the fall of prices is checked. When deflation is enforced by banks in order to restore their reserves of gold or foreign exchange after they have been threatened by a business boom the amount of deflation involved is relatively small because the previous degree of inflation has been small also.

The pursuit of an inflationary policy by Government necessarily involves an "unbalanced budget," that is, a budget which can only be balanced if the surplus of expenditure over revenue is met by means of inflation, so long as the Government inflates by means of its own notes. If the inflation takes the form of loans by a bank to those who only borrow for re-lending to Government, there will be concealed inflation. When a Government proposes to deflate, that is, to reduce its own note circulation, it must necessarily have a surplus: that surplus of income over expenditure it applies to wiping out the excess notes. When it has itself borrowed from a bank, it must use the surplus to cancel indebtedness to the bank and the bank must use the proceeds to cancel notes. The same is true when the Government has borrowed from third parties, who have themselves borrowed from a bank. The surplus revenue flows from the Government to its creditors, from these to the lending bank or banks, and is by them utilised to cancel purchasing power. If the banks were to re-lend the money repaid to them, there would be no deflation. In the case of inflation and deflation originating in connection with the movements of trade and production, there is of course no difficulty in understanding how the purchasing power is issued and withdrawn: inflation swells the commercial loans and the liabilities of the banks to their customers: deflation involves repayment of loans, a reduction of the assets in the shape of discounts and overdrafts and a cancellation of deposits and of currency.

Economic Limits.—The technical questions so far discussed throw no light on the two main problems connected with inflation and deflation: viz., the economic limits to the processes and their social consequences. The limit which is set to inflation is given by the progressive fall in the value of the currency issued, which, as experience has shown, proceeds in the end at a rate much more rapid than the quantitative increase in the currency itself. The result is that as the quantity rises, the profit to be made out of the issue of further currency diminishes more than in proportion to the amount of issue. Thus, at the end of 1919, the aggregate German currency stood at 41 milliards of marks, which still possessed a gold value of 11 milliards of gold marks. At the end of 1923, the total amount of issue stood at 74,954,803 billions (that is, 12 noughts omitted) and yet this inconceivable amount of currency had a value of only 722 millions of gold marks, on the basis of the dollar exchange. The 56 milliards of roubles in circulation at the end of 1918, had still a value of some 376 million dollars on the most favourable estimate; by the end of 1922 the 1,479,218 milliards had a value of only 69 million dollars at most. Whilst the net revenue accruing to the issuer thus ultimately falls almost to vanishing point disastrous results are produced in the sphere of public finance generally. For, owing to the fact that an interval of time necessarily elapses between the assessment of a tax and its collection, the proceeds of taxation do not keep pace with the decline in the value of money. The State thus finds itself with only a single resource available, and that one of diminishing value. On the other hand, though the fall in the value of money means a progressive diminution in the burden of national debts (from this point of view inflation is equivalent to repudiation) its other expenses mount with the price level. For a time the rise in expenditure can be held down by non-adjustment of salaries and wages: this device cannot be made use of indefinitely. In short, there is a limit to inflation: arising from the progressive fall in the value of the money issued (and this is a sign of the increasing unwillingness to accept it), and the consequential unprofitableness of trying to issue more of it.

The unwillingness to accept a currency the value of which is constantly falling is part of the very complex economic consequences which flow from inflation, consequences which have been illustrated on a tragic scale in Europe, in particular in the period 1919 to 1925, because the degree of inflation was then far in excess of anything previously known.

Economic Consequences.—In discussing economic consequences, a distinction must be drawn between the effects of inflation on *particular social classes* and on the *national economy as a whole*. Particular social classes gain or lose relatively to one another, according as to whether their income in terms of money keeps pace with the fall in the value of money or not. The recipients of incomes fixed in amount, whether by law or custom, suffer in proportion to the rigidity of their income and the rise in the price level. The higher classes of civil servants, teachers, professional men paid by customary fees, the owners of fixed interest-bearing investments, pensioners and the like all suffer. On the other hand, individuals whose incomes are adjusted to the changes in the price level need not suffer or gain anything at all, except when the changes in the price level are so rapid that it is impossible to keep pace with them. The wage-earning class as a whole comes into this intermediate category, though the position of the skilled worker is usually worse than that of the unskilled in respect of the adjustment of wages to price levels, and in all cases there is in the early stages of inflation a time-lag which is due to ignorance of what is happening. Lastly come those classes of the community whose incomes represent residual gains: ordinary shareholders and business men generally, whose incomes are derived from the margin between selling prices and expenses. These benefit from inflation, since their costs do not all of them rise as rapidly as the price level rises. The proportion of the total real income of the community which falls to their lot goes up in periods of inflation. But, though the relative position may alter to their advantage, their absolute position may be worse than it was before, in common with the absolute worsening of the position of other classes, for the reason that inflation may reduce the total productivity of society, and is certain to do so if carried to great lengths.

Inflation, in so far as it is relatively moderate, will not much affect the willingness to hold money, and operates simply to increase the proportion of the total income (real and nominal) falling to the beneficiaries of inflation. But rising prices act as a stimulus to producers and to this extent invigorate forces tending to mitigate the rise in the price level, whilst at the same time unemployment falls, since real wages lag a little behind prices and the real cost of labour to the employer therefore falls. But if inflation reaches such a stage that the fall in the value of money becomes obvious everyone will try to protect himself against the further fall which is then expected. Goods are bought so far as they are available: everyone will hold real things, if possible, rather than money. The liquid capital, that is, money stocks of employers, diminishes in value: they try to protect their profits by expanding their fixed plant. Traders holding stocks of goods will be reluctant to sell since prices may go up still more. The workers push up money wages and, the time-lag being wiped out, a particular source of profit to employers disappears. The "flight from the currency" withdraws part of the funds available abroad, so that the supply of raw materials, etc., falls off. The constantly rising price level produces "paper profits" and stimulates extravagance. The result of all these factors is that there is a maldistribution of capital between fixed and liquid forms: that the aggregate of all savings declines and that the national income falls off in total amount. In the end no one has benefited from inflation; everyone would have gained from its cessation at an earlier stage.

The direct effects of deflation on the relative position of different social classes are the opposite of those of inflation. Deflation involves falling prices; it therefore reduces the money yield of taxation, reduces the profits of business men and of traders, and adds to the real income of all classes of the population whose money incomes are fixed, whilst prices are falling. It has therefore the effect of increasing the weight of all fixed debts; a particularly important matter after a great war when the National Debt stands at a large figure. Since deflation involves falling prices, it increases the volume of unemployment and diminishes the inducement to hold stocks of goods, since these are falling in value. On the other hand, since prices are falling deflation makes saving easier, and since it involves, owing to industrial depression, a slackening in the demand for fresh industrial capital, it is accompanied by falling interest rates, which facilitate conversion operations and thus mitigate the burden of fixed charges. The falling yield of taxation is thus offset in part, by the fall in expenditure on current goods and services, in part by the fall in interest rates.

For reasons already set forth, the practical limits of deflation are reached sooner than the practical limits of inflation. Severe though the sufferings imposed by deflation may be (particularly when represented by widespread unemployment) it is not doubtful that the sufferings actually covered by inflation have in Europe been much greater than those imposed by deflation; for the degree to which the value of money has been raised by deflation has never been equal to the degree to which inflation has in special cases reduced it. (*See* further, QUANTITY THEORY OF MONEY; MONEY; CURRENCY.) (T. E. G.)

INFLEXION, the action of bending inwards, or the condition of being bent or curved (from Lat. *inflectere,* to bend). In optics, the term "inflexion" was used by Newton for what is now known as "diffraction of light" (*q.v.*). For inflexion in geometry *see* CURVE. Inflexion of the voice is a change in tone, pitch or expression. In grammar (*q.v.*) inflexion denotes the changes which a word undergoes to bring it into correct relations with the other words with which it is used. In English grammar nouns, pronouns, adjectives (in their degrees of comparison), verbs and adverbs are inflected.

INFLORESCENCE, the arrangement of the flowers on the axis, or the ramification of the floral axis, composed of the *rachis,* which forms the stalk supporting the flower or cluster of flowers,

called the *peduncle*. A flower having no stalk is called *sessile*. The floral axis may be shortened, assuming a flattened convex or concave form and bearing numerous flowers as in the artichoke, daisy, etc. There are two distinct types of inflorescence (1) *indeterminate, indefinite* or *axillary* and (2) *determinate, definite* or *terminal*. A third series of inflorescence is termed *mixed*. In the *compound indefinite* inflorescence the lateral shoots develop centripetally upon a primary axis into a group of racemes or compound racemes. *See* FLOWER.

INFLUENCE, in astrology (*q.v.*) an ethereal fluid, supposed to flow from the stars, which affected the course of events on earth and the destiny and character of man. The word is derived from Lat. *influere,* to flow in. For the law as to "undue influence" *see* CONTRACT.

INFLUENCE LINE, in engineering, a curve showing, for one component part of a beam or truss, the shearing force, bending moment, stress or deflection for all positions of a moving load. (*See* BRIDGES: *Construction.*)

INFLUENZA. The term influenza will be used to imply "a pandemic outburst of disease characterized, clinically, by a rapid course, catarrh of the respiratory tract, pyrexia and some degree of prostration; and epidemiologically, by a tendency to occur in several successive waves at short intervals of time." This provisional definition is applicable to the visitation of 1918–19, and to other outbreaks of febrile respiratory catarrh more remote in time and about the distribution of which less is known, but is not applicable to the sporadic cases or even the localized epidemics of respiratory catarrh to which the name influenza has been so often applied, especially in the years following fairly closely upon pandemic outbursts.

The Influenza Pandemic of 1918–19.—This pandemic swept over the world in three successive waves, the first appearing quite suddenly in May and June 1918, the second starting at the end of September or early in October and waning in December, and the third wave, less uniform in character, appeared early in March 1919. This outbreak, attributed by France to Spain, by Spain to France and by America to eastern Europe, seems to have appeared almost simultaneously amongst the nations on the Western front, and showed the explosive character that is possible only for a highly invasive infection assisted by conditions of swift communication such as obtain in modern war.

This first wave made its appearance a little later amongst the Central Powers and their neighbours. Early in July it attained its full proportions in Germany, Austria, Norway, Sweden and Denmark, Holland and Switzerland. In several large areas of the world's surface, in the South American republics, in Bermuda, the British West Indies, the Azores and in the islands of the Pacific and Australia, the summer of 1918 passed without an influenzal outbreak. In New Zealand, cases are said to have appeared in August, the harbingers, perhaps, of the autumn, rather than the first manifestations of the summer, wave.

This first wave passed rapidly, so that a "frequency curve" by weeks, in which the incidence in the worst week is taken as 100%, shows a steep ascent to a maximum, followed by an equally steep and almost symmetrical fall, the whole episode passing within a few weeks. The death-rate was inconsiderable, but there was an ominous tendency to a higher mortality amongst the later cases, just before the wave came to an end, seeming to suggest an increase in virulence. The first batch of cases looked "like a mild attack of measles without a rash." Respiratory catarrh, congested conjunctivae, headache, lassitude, pyrexia of short duration, a feeling of prostration with the return of temperature to normal, and then a rapid recovery of health; such was the course in the vast majority of the cases during the first wave. Complications were almost unknown. A few cases which developed broncho-pneumonia or haemorrhagic oedema of the lungs towards the end of the wave sent up the case mortality. In all these characters, the first wave closely resembled the outbreak of 1890, except that in 1890 the death-rate was greatest amongst the middle-aged and elderly, while in 1918 the chief sufferers were amongst the "young adult" groups.

The Second Wave.—Towards the end of September or early in October, the second wave suddenly gathered force and swept over the world. St. Helena is said to have escaped. Mauritius, too, had a reprieve; and the quarantine measures applied by Australia were successful for the moment but this fatal pandemic spread throughout Europe, America, Asia and Africa.

The upward curve of morbidity was almost precisely similar to that of the summer and the maximum was reached as quickly as in the previous wave, but the fall was much slower and less regular. The outstanding difference between the two waves was the marked tendency to pulmonary complications and the high death-rate of the second. The singularly uniform syndrome of the summer epidemic gave place, in the autumn, to several varieties of clinical picture depending on varying combinations of several factors, amongst which might be reckoned the virulence of the microbic invader, the resistance of the patient, the nature of the bacterial flora of his respiratory tract, and environmental conditions such as occupation, wages and housing. As a rule, the attack was ushered in by the catarrhal and pyrexial symptoms noted in May and June. In many cases, especially where circumstances permitted of immediate rest and treatment, the disease took a favourable course towards recovery, although prostration was clearly always a more marked feature than in the summer. In others, the early pyrexial catarrh was sometimes followed by intense toxaemia leading so rapidly to a fatal issue that there was no time for pulmonary complications to develop. But frequently the lungs became severely affected and the patient passed into a state of anoxaemia recalling that due to exposure to the "pulmonary irritants" of gas warfare.

But there was a formidable difference between the two conditions. While the "phosgene" patient had to deal with a sterile exudate, evoked by a chemical irritant and capable of rapid absorption if vitality was maintained, the lungs of the influenza patient were charged with an exudate evoked by a living virus which had already overcome tissue resistance and could offer to "secondary invaders" conditions of symbiosis favourable to their growth. Here lay the danger. The virus of influenza could open, as it were, the door to the *streptococci, pneumococci, staphylococci* and other organisms normally held within safe numerical limits upon the respiratory mucous membrane. The *post-mortem* appearances, while tending to have certain basal characters in common, varied considerably with the nature of the "secondary invaders" and other factors. In nearly all cases, there was a haemorrhagic tendency not often seen in other acute lung affections; and this sometimes amounted to a haemorrhagic oedema involving the greater part of both lungs. "Wet lungs," "dripping lungs," were expressions frequently heard in the *post-mortem* room. Areas suggesting haemorrhagic infarcts with their bases extending under the pleura were often noticed. The cut surface of the lungs showed, as a rule, peribronchiolitis and patches of broncho-pneumonia with a general state of oedema throughout the parenchyma of the lung; or a whole lobe might give the appearance of red, or in older cases, grey hepatization (*see* Major Tytler, R.A.M.C., *Special Report Series No. 36,* Med. Res. Coun., 1919). The third wave had no distinctive characters. It resembled the first wave rather than the second, though pulmonary complications and fatal cases were fairly numerous.

Etiology.—As to the causative organism of influenza we remain, even now, still in doubt. The view that the *Bacillus influenzae* (Pfeiffer) was the cause of the disease, received little support from investigations carried out since 1918. This work was directed, for the most part, to the search for a "filter-passing virus." During the second wave of 1918, the researches of C. Nicolle and Lebailly in the French war zone, of H. G. Gibson, F. B. Bowman and J. I. Connor at Abbeville, and of J. A. Wilson at Étaples, in the zone of the British armies in France, afforded highly significant evidence in favour of a filterable virus, although the restrictions imposed upon bacteriological work by war conditions and the transitory nature of the epidemic rendered conclusive findings impossible.

In 1919, an investigation was undertaken by Zamanouchi, Sakakami and Iwashrima, in which the filtered and unfiltered emulsions of sputum from 43 cases of influenza were injected

into the throats and noses of 24 healthy volunteers, six of whom had recently suffered from influenza. Of the 18 previously uninfected persons, all developed influenza after an interval of two or three days, but the six who had had the disease remained in good health. Similar results were obtained with the filtered blood of patients. At the same time, the spraying of cultures of Pfeiffer's bacillus, sometimes "pure," sometimes mixed with other respiratory bacteria, into the throats of 14 healthy persons failed to lead to illness of any kind.

P. K. Olitsky and F. L. Gates in the laboratories of the Rockefeller Institute for Medical Research were able to approach the subject with much more deliberation and with a much better equipment than was available in France; and their results are proportionally more convincing. Like Gibson and his co-workers, they produced in rabbits a condition closely resembling human influenza by means of filtered or unfiltered nasal secretions taken from human patients during the earliest stages of the attack. They provided independent confirmation of the discovery of Gibson and Bowman that "cultures" in Nogouchi medium were capable of transmitting the disease to animals, and showed that the anaerobic and filterable organism thus cultivated retained its activity after long exposure to glycerine and possessed antigenic properties. To the minute organism isolated by them in the course of this inquiry, they gave the name of *Bacterium pneumosintes*.

Their work received speedy confirmation at the hands of Dr. M. H. Gordon, C.M.G., F.R.S., in the course of an influenzal outbreak among the nursing staff of St. Bartholomew's hospital, London, in 1922. Still further support for a "filter-passer" as the virus of influenza was later provided by Sir Spenser Lister in South Africa. These independent inquiries, leading to similar findings in America, England and South Africa, go far to establish the "case" for a filterable virus as the causative agent of influenza; but caution is still needed in drawing final conclusions until a more precise knowledge is available as to "filter-passers" in general (*see* FILTER-PASSING VIRUSES).

Epidemiology.—In the absence of final knowledge as to the causative agent, many points of fundamental importance still remain obscure.

The first wave coincided with the arrival of the first drafts of American troops in Europe, who must have brought into common circulation pathogenic strains long dormant in isolated and relatively immunized communities. The crowded troopships afforded just the incubation places that would permit of the maturation of such an infection; and Europe, with its crowded concentration areas and billets, offered an unequalled opportunity for its spread. The last influenzal pandemic had occurred just 28 years before. There might be a few scattered "carriers" and perhaps some residual immunity among the middle-aged and the elderly; but the adolescents and the young adults would in 1918 be "virgin soil." It was just these lower age-groups that suffered most.

How, then, explain the second wave with its greater severity? —and the third? Surely, if immunity played a part, these waves should have been much less extensive, much more benign, and confined to those persons who had previously escaped. These are good, but not final, arguments. The passage of the first wave may have left behind it a virus of exalted virulence, many "carriers" and many "allergic" subjects whose behaviour to reinfection might betray the phenomena of hypersensitiveness of the respiratory surfaces and a tendency to inflammatory exudates on contact with the air-borne virus. Under such conditions a fresh outbreak would be specially likely to arise in the fall of the year, a period of rapid fluctuations of temperature when the chill evenings drive men into the warmth and close contact of crowded dug-outs, shelters and billets.

It is impossible to believe that the so-called "influenza" to which deaths were attributed every year between 1892 and 1918 was the same disease as the fulminating pandemic that followed. Apart from the extreme contrast in invasive power, the distribution of "influenza" mortality by age-groups emphasizes the essential difference between, let us say, the death-rates for 1917 and 1918, the one having a preponderating death-rate amongst the old, the other, amongst the young. Such differences can hardly leap into existence within a few months. The known facts of increase and diminution of bacterial virulence do not support the idea that such a vast alteration is probable or even possible in so short a time.

Acquired Immunity.—Evidence that morbidity and mortality were less marked, in the second wave, amongst those who had been attacked in the first, when thoroughly analysed (*Rep. Min. Health*, 1918–19), was found to indicate that "these data show a considerable immunizing power in the summer attacks and we conclude, although with natural hesitation, that it is probable, on the average, that an appreciable degree of active immunity was attained by those who passed through an attack in its first and mildest manifestations."

The evidences for immunity are of varying efficiency in different places, and the populations of many areas show no tendency to acquire resistance to infection as judged by a comparison between the behaviour of those attacked and those missed by the first wave when confronted by the second.

We believe these data to be unsound as a basis for comparison. It is highly probable that many persons were infected during the summer and yet failed to show appreciable illness. The vast difference that may exist between the numbers *infected* and the numbers *affected* by a bacterial invasion can be judged from what we know of the meningococcus and the diphtheria bacillus. And yet these latent infections may confer active immunity, as we know from the "Schick Reaction" in the case of diphtheria and from other examples. The mere fact of a previous "attack" is not a safe guide in classifying populations for inquiry as to their relative immunities. The best evidence of the acquisition of immunity is to be found in the phenomena of natural recovery of the individual and of the disappearance of pandemic waves from the community. The fact that these groups of pandemics are separated by long and fairly regular intervals, as a rule about 20 years, is not without significance in this connection, since at least this period might be necessary to reduce the residual "immune population" from the last pandemic to an ineffective number.

Artificial Immunity.—No vaccine can be entirely satisfactory unless it is known to contain the virus or germ of the disease in question. The vaccine issued by the War Office and afterwards by the Ministry of Health was confessedly of a provisional nature since the causative agent was still uncertain. Its formula was as follows:—

	Per cu.cm. of vaccine
Bacilli influenzae (Pfeiffer)	400,000,000
Pneumococci	200,000,000
Streptococci	60,000,000

Unless Pfeiffer's bacillus be accepted as the causative agent, this vaccine must be described as consisting entirely of the "secondary invaders." As such, its issue was entirely justifiable and its effects were such as might be expected: satisfactory in diminishing complications and mortality but practically *nil* in preventing the disease. Vaccine, then, cannot, as a prophylactic, help us much at present; nor can we, in the light of recent experience, hope for great results from general measures of hygiene.

Symptoms.—These vary somewhat in different epidemics but in the main they accord with the description given by Dr. Bruce Low from observations made in St. Thomas's hospital, London, in Jan. 1890:—

"The invasion is sudden; the patients can generally tell the time when they developed the disease; *e.g.*, acute pains in the back and loins came on quite suddenly while they were at work or walking in the street, or in the case of a medical student, while playing cards, rendering him unable to continue the game. A workman wheeling a barrow had to put it down and leave it; and an omnibus driver was unable to pull up his horses. This sudden onset is often accompanied by vertigo and nausea, and sometimes actual vomiting of bilious matter. There are pains in the limbs and general sense of aching all over; frontal headache of special severity; pains in the eyeballs, increased by the slightest movement of the eyes; shivering; general feeling of misery and weakness, and great depression of spirits, many patients, both men and women, giving way to weeping; nervous restlessness; inability to sleep, and occasionally delirium. In some cases catarrhal symptoms develop, such as running

at the eyes, which are sometimes infected on the second day; sneezing and sore throat; and epistaxis, swelling of the parotid and submaxillary glands, tonsilitis and spitting of bright blood from the pharynx may occur. There is a hard, dry cough of a paroxysmal kind, worst at night. There is often tenderness of the spleen, which is almost always found enlarged, and this persists after the acute symptoms have passed. The temperature is high at the onset of the disease. In the first twenty-four hours its range is from 100° F. in mild cases to 105° F. in severe cases.

Several writers have distinguished four main varieties of the disease—namely, (1) nervous, (2) gastro-intestinal, (3) respiratory, (4) febrile, a form chiefly found in children. Clifford Allbutt said, "Influenza simulates other diseases." Many forms are of typhoid or comatose types. Cardiac attacks are common, not from organic disease but from the direct poisoning of the heart muscle by influenza.

Perhaps the most marked feature of influenza, and certainly the one which victims have learned to dread most, is the prolonged debility and nervous depression that frequently follow an attack. In the Paris epidemic of 1890 the suicides increased 25%, a large proportion of the excess being attributed to nervous prostration caused by the disease. Of insanities traceable to influenza, melancholia is twice as frequent as all other forms put together. Other common after-effects are neuralgia, dyspepsia, insomnia, weakness or loss of the special senses, particularly taste and smell, abdominal pains, sore throat, rheumatism and muscular weakness. The feature most dangerous to life is the special liability of patients to inflammation of the lungs. This affection must be regarded as a complication rather than an integral part of the illness.

The deaths directly attributed to influenza vary in different epidemics and at different times in the same epidemic, but on the whole, are few in proportion to the number of cases. In the milder forms it offers hardly any danger to life if reasonable care be taken, but in the severer forms it is a fairly fatal disease. In eight London hospitals the case-mortality among in-patients in the 1890 outbreak was 34·5 per 1,000; among all patients treated it was 1·6 per 1,000. In the army it was rather less.

The infectious character of influenza having been recognized, suggestions were made for its administrative control on the familiar lines of notification, isolation and disinfection, but this has not hitherto been found practicable.

There is no routine treatment for influenza except bed. In all cases bed is advisable, because of the danger of lung complications, and in mild ones it is sufficient. Severer ones must be treated according to the symptoms. Quinine has been much used. Modern "anti-pyretic" drugs have also been extensively employed, and when applied with discretion they may be useful, but patients are not advised to prescribe them for themselves.

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IN FORMA PAUPERIS: *see* PRACTICE AND PROCEDURE.

INFORMATION, in English law, a proceeding on behalf of the crown against a subject otherwise than by indictment is either criminal or civil. Criminal informations are *ex officio* or by the Master of the Crown office. An *ex officio* information is a proceeding in the King's Bench by the attorney-general without the intervention of a grand jury. The attorney-general, or, in his absence, the solicitor-general, has a right *ex officio* to file a criminal information in respect of any misdemeanour, but not for treason, felonies or misprision of treason. It is, however, seldom exercised, except in cases which might be described as "enormous misdemeanours," such as those peculiarly tending to disturb or endanger the king's government, *e.g.*, seditions, obstructing the king's officers in the execution of their duties, etc.

There are informations also which are the first step in proceedings in permits of summary jurisdiction leading to the issue of summonses or warrants. They relate to proceedings of a cr nature as opposed to complaints which are the initiatory st proceedings of a civil nature in these courts.

Civil informations are of two kinds and are filed on the Re side of the King's Bench Division. The Latin information way in which the Crown recovers money or other chattel these informations are either *in rem* or *in personam*. Ini tions *in rem* are used chiefly where the Crown lays a cla property and are usually resorted to where such property is a to have become forfeited under customs or inland revenue utes. Informations *in personam* are largely used to recover a to the Crown whether such debt is payable by penalty another way. The other form of civil information is the E information and is generally used to recover corporeal or poreal hereditaments and also debts to the Crown where disc and an account are sought.

In the United States the Federal Constitution (Amendi Art. V.) forbids the use of informations by providing tha person shall be held to answer for a capital or otherwise infa crime, unless on presentment or indictment of a grand with certain exceptions in the land or naval forces and the m Attempts at evasion of the revenue laws and other minor off are sometimes prosecuted by information in the Federal c In a number of States all misdemeanours except misprisi treason may be prosecuted by information. This process also be used in civil cases, such as a proceeding against a poration for violation of charter.

INFORMER, the term applied to a person who prosecut any of the courts of law those who break any law or penal sta without any direct injury having been done to himself. St person is called a common informer when he furnishes evic on criminal trials or prosecutes for breaches of penal laws s for the purpose of obtaining the penalty recovered, or a sha it. An action by a common informer is termed a *popular* o *tam* action, because it is brought by a person *qui tam pro do rege quam pro se ipso sequitur*. A suit by an informer mu brought within a year of the offence, unless a specific time is scribed by the statute. The term informer is also used of a complice in crime who turns what is called "king's evidence" ACCOMPLICE). In Scotland, informer is the term applied tc party who, in criminal proceedings, sets the lord advocat motion.

INFUSORIA, a name for the group of single-celled ani (Protozoa) usually called Ciliata, and distinguished by numer hair-like, protoplasmic processes (so-called *cilia*), which are in locomotion and function like oars. The Infusoria are also p liar in having two different kinds of nuclei (macronuclei micronuclei), and a peculiar modification of the process of co gation. (*See* PROTOZOA.)

INGE, WILLIAM RALPH (1860–), English div was born June 6, 1860, at Crayke, Yorks., the son of Will Inge, sometime provost of Worcester college, Oxford, and educated at Eton, and at King's college, Cambridge. From 1 to 1888 he was a master at Eton, and during the last two y of that time was fellow of King's college, Cambridge. F 1889 to 1904 he was fellow of Hertford college, Oxford. Bamp lecturer in 1899, and Paddock lecturer in New York in 1906, f 1905 to 1907 he was vicar of All Saints', Ennismore Gardens, L don, and in 1907 was made Lady Margaret professor of divinit Cambridge. In 1911 he became dean of St. Paul's, where his mons attracted great attention owing to their originality, t caustic criticism of the tendencies of modern life and a somew pessimistic tone which earned for him the sobriquet of " gloomy dean."

Among Inge's numerous works may be mentioned *Society in R under the Caesars* (1888); *Christian Mysticism* (1899); *Types Christian Saintliness* (1915); *Philosophy of Plotinus* (1918); *C spoken Essays* (1919, Second Series 1922); *Personal Religion and Life of Devotion* (1924); *The Church in the World: Collected Ess* (1928); *see* also the article PLOTINUS.

INGEBORG (INGEBURGE, INGELBURGE, INGELBORG, ISE BURGE, Dan. INGIBJÖRG) (*c.* 1176–1237 or 1238), queen of Fran was the daughter of Valdemar I., king of Denmark. She marr

in 1193 Philip II. Augustus, king of France, but on the day after his marriage the king took a sudden aversion to her. The council of Compiègne acceded (Nov. 5, 1193) to his demand for a declaration of nullity, but the popes Celestine III. and Innocent III. successively took up the defence of Ingeborg. Philip, having married Agnes of Meran in June 1196, was excommunicated, and as he remained obdurate, the kingdom was placed under an interdict. Agnes was finally sent away, but Ingeborg was shut up in the château of Étampes until, in 1213, Philip, hoping perhaps to justify by his wife's claims his pretensions to England, was reconciled with her. She survived him more than fourteen years, passing the greater part of the time in the priory of St. Jean at Corbeil, which she had founded.

See Robt. Davidsohn, *Philip II. August von Frankreich und Ingeborg* (Stuttgart, 1888); and E. Michael, "Zur Geschichte der Königin Ingelborg" in the *Zeitschrift für Katholische Theologie* (1890).

INGELHEIM (Ober-Ingelheim and Nieder-Ingelheim), the name of two contiguous market-towns of Germany, in the republic of Hesse, on the Selz, near its confluence with the Rhine, 9 m. W.S.W. of Mainz on the railway to Coblenz. Ober-Ingelheim, formerly an imperial town, is still surrounded by walls. Its chief industry is the manufacture of red wine. Pop. (1925) 3,680. Nieder-Ingelheim has in addition to wine, manufactories of machinery, chemicals, malt and limestone quarries. Pop. (1925) 4,438.

Nieder-Ingelheim is, according to one tradition, the birthplace of Charlemagne, and it possesses the ruins of an old palace built by that emperor between 768 and 774.

INGELOW, JEAN (1820–1897), English poet and novelist, was born at Boston, Lincs., on March 17, 1820, and died in London on July 20, 1897. Jean Ingelow, who was the daughter of a Boston banker, is famous for one poem, "High Tide on the Coast of Lincolnshire"; many of her ballads and songs were set to music in the '70s and had a great vogue. Her works include *Poems* (1863); *The Story of Doom and other Poems* (1867); *Poems* (1885); several novels, of which *Sarah de Berenger* (1880) is perhaps the best known, and a number of excellent children's books, including *Mopsa the Fairy* (1869).

INGEMANN, BERNHARD SEVERIN (1789–1862), Danish poet and novelist, was born at Torkildstrup, Falster, on May 28, 1789. He was educated at the grammar school at Slagelse, and entered the University of Copenhagen in 1806. All his early and unpublished writings were destroyed when the English burned the town. In 1811 he published his first volume of poems, and in 1812 his second, followed in 1813 by a book of lyrics entitled *Procne* and in 1814 the verse romance, *The Black Knights*. In 1815 he published two tragedies, *Masaniello and Blanca*, followed by *The Voice in the Desert, The Shepherd of Tolosa*, and other romantic plays. In 1818 he went to Rome, where he wrote *The Liberation of Tasso*. In 1820 he began to display his real power in a volume of delightful tales. His last comedy, *Magnetism in a Barber's Shop*, appeared in 1821. In 1822 the poet was nominated lector in Danish language and literature at Sorö college, and in 1846 director. *Valdemar the Great and his Men*, an historical epic, appeared in 1824. The next few years were occupied with his best and most durable work, his four great national and historical novels of *Valdemar Seier* (1826); *Erik Menved's Childhood* (1828); *King Erik* (1833); and *Prince Otto of Dennark* (1835). He then returned to epic poetry in *Queen Margaret* (1836) and in a cycle of romances, *Holger Danske* (1837). His last publication was *The Apple of Gold* (1856). Ingemann died on Feb. 24, 1862. During his lifetime he enjoyed a popularity unapproached even by that of Öhlenschläger.

Ingemann's works were collected in 41 vols. at Copenhagen (1843–1865). His autobiography was edited by Galskjöt in 1862; his correspondence by V. Heise (1879–81); and his letters to Grundtvig by S. Grundtvig (1882). *See* also H. Schwanenflügel, *Ingemanns Liv og Digtning* (1886); and Georg Brandes, *Essays* (1889).

INGERSOLL, ROBERT GREEN (1833–1899), American lawyer and lecturer, was born in Dresden (N.Y.), Aug. 11, 1833. His father was a Congregational minister, who removed to Wisconsin in 1843 and to Illinois in 1845. Robert Ingersoll was admitted to the bar in 1854, and practised law with success in Illinois. During the Civil War he organized a cavalry regiment, of which he was colonel, until captured at Lexington (Tenn.), Dec. 18, 1862, by the Confederate cavalry under Gen. N. B. Forrest. He was paroled, waited in vain to be exchanged, and in June 1863 resigned from the service. He was attorney-general of Illinois in 1867–69, and in 1876 his speech in the Republican national convention, naming James G. Blaine for the presidential candidate, won him a national reputation as a public speaker. As a lawyer he distinguished himself particularly as counsel for the defendants in the "Star-Route Fraud" trials. He was most widely known, however, for his public lectures attacking the Bible, and his anti-Christian views were an obstacle to his political advancement. Ingersoll was an eloquent rhetorician rather than a logical reasoner. He died at Dobbs Ferry (N.Y.), July 21, 1899.

His principal lectures and speeches were published under the titles: *The Gods and Other Lectures* (1876); *Some Mistakes of Moses* (1879); *Prose Poems* (1884); *Great Speeches* (1887). His lectures, entitled "The Bible," "Ghosts," and "Foundations of Faith," attracted particular attention. His complete works were published in 12 vols. in New York in 1900.

INGERSOLL, a town and port of entry of Oxford county, Ontario, Canada, 19 m. E. of London, on the river Thames and the Canadian National and Canadian Pacific railways. Pop. (1921) 5,150. The principal manufactures are agricultural implements, furniture, pianos and screws. There is a large export trade in cheese and farm produce.

INGHIRAMI, the name of an Italian noble family of Volterra. The following are its most important members:

TOMMASO INGHIRAMI (1470–1516), a humanist, is best known for his Latin orations, seven of which were published in 1777. His success in the part of Phaedra in a presentation of Seneca's *Hippolytus* (or *Phaedra*) led to his being generally known as *Fedra*. He received high honours from Alexander VI., Leo X. and Maximilian I.

FRANCESCO INGHIRAMI (1772–1846), a distinguished archaeologist, fought in the French wars (1799), and afterwards devoted himself especially to the study of Etruscan antiquities. He founded a college at Fiesole and collected a mass of valuable material in his *Monumenti etruschi* (10 vols., 1820–27), *Galleria omerica* (3 vols., 1829–51), *Pitture di vasi fittili* (1831–37), *Museo etrusco chiusino* (2 vols., 1833), and the incomplete *Storia della Toscana* (1841–45).

His brother, GIOVANNI INGHIRAMI (1779–1851), was an astronomer of repute. He was professor of astronomy at the Institute founded by Ximenes in Florence and published *Effemeridi dell' occultazione delle piccole stelle sotto la luna* (1809–30); *Effemeridi di Venese e Giove all' uso de' naviganti* (1821–24); *Tavole astronomichi universali portatili* (1811); *Base trigonometrica misurata in Toscana* (1818); *Carta topografica e geometrica della Toscana* (1830).

INGLEBY, CLEMENT MANSFIELD (1823–1886), English Shakespearian scholar, was born at Edgbaston, Birmingham, on Oct. 29, 1823, studied at Trinity college, Cambridge, and eventually became partner in the business of his father, a solicitor. But in 1859 he came to London, commenced journalism, and from 1874 devoted himself exclusively to work on Shakespeare. Ingleby exposed the manipulations of J. P. Collier as early as 1859 in his *The Shakespeare Fabrications*. He was at one time vice-president of the New Shakspere Society, and was one of the original trustees of the "birthplace." His other works include: *Shakespeare Hermeneutics* (1875); *Shakespeare: The Man and the Book* (1877–81); and *Shakespeare's Bones* (1882), in which he recommended disinterment and examination of Shakespeare's skull.

INGLEFIELD, SIR EDWARD AUGUSTUS (1820–1894), British admiral and explorer, was born at Cheltenham, on March 27, 1820, and educated at the Royal Naval College, Portsmouth. The boy went to sea at fourteen, saw service on the Syrian Coast in 1840, and in 1845 was promoted commander for gallant conduct at Obligado. In 1854 he was sent out on the Admiralty's last attempt to find Sir John Franklin. In the Crimean War Captain Inglefield took part in the siege of Sevastopol. He was promoted admiral in 1877. Besides being an ex-

cellent marine artist, he invented the hydraulic steering gear and the Inglefield anchor. He died on Sept. 5, 1894.

INGLE NOOK, originally the corners of a large fire-place, under the main chimney-breast opening, and on either side of the spot where the fire was built. In many Tudor, Jacobean and early American fire-places there is sufficient width and depth to place a wooden bench or settle on each side, within the opening. In modern usage, the term is applied more loosely to any recess or alcove containing a fire-place at the end and usually furnished with settles or seats at the sides.

INGLIS, ELSIE MAUD (1864–1917), British physician and surgeon, was born at Naini Tal, India, on Aug. 16, 1864. After a childhood spent in India and Australia, in 1878 she settled with her family in Edinburgh. She studied at the school of medicine for women in Edinburgh, and at St. Margaret's college, Glasgow, graduating M.B. and C.M. In 1895 she took up private practice in Edinburgh and was instrumental in establishing a second school of medicine for women in that city. Dr. Inglis became one of the most prominent suffrage workers in Scotland. She became in 1892 house-surgeon to the New Hospital for Women, London (afterwards the Elizabeth Garrett-Anderson hospital), and later on co-surgeon at an Edinburgh dispensary. She was one of the founders of the Edinburgh hospice for women (est. 1901), at that time the only maternity training centre in Scotland managed by women. She began private practice in Edinburgh in 1895. In Aug. 1914, inspired by her, a special committee of the Scottish Federation of Women's Suffrage Societies, aided by the National Union of Women's Suffrage Societies, undertook the organization of the Scottish women's hospitals for foreign service, and raised £449,000. She first went to Serbia in April 1915 to relieve Dr. Soltau at Kragujevac. In November, during the enemy invasion of Serbia, Dr. Inglis and a few others remained behind until Feb. 1916 as prisoners of the enemy to care for the Serbian wounded. In Aug. 1916 she took a unit to the Dobruja for service with the newly-formed Serbian division attached to the Russian army. She was seriously enfeebled by the hardships endured, and died (Nov. 26, 1917) the day after landing in England.

See Lady Frances Balfour, *Dr. Elsie Inglis* (1918); and Mrs. Shaw McLaren, *Elsie Inglis* (1920).

INGLIS, SIR JOHN EARDLEY WILMOT (1814–1862), British major-general, son of John Inglis, third bishop of Nova Scotia, was born in Nova Scotia on Nov. 15, 1814. In 1833 he joined the 32nd Foot, in which all his regimental service was passed. In 1837 he saw active service in Canada and in the Punjab (1848–49), being in command at the storming of Mooltan and at the battle of Gujarat. In 1857, on the outbreak of the Indian Mutiny, he was in command of his regiment at Lucknow. Sir Henry Lawrence being mortally wounded during the siege of the residency, Inglis continued the defence for 87 days against an overwhelming force. He was promoted to major-general and made K.C.B. He was, in 1860, given command of the British troops in the Ionian Islands. He died at Hamburg on Sept. 27, 1862.

INGLIS, SIR WILLIAM (1764–1835), British general, born in 1764, entered the army in 1781. After ten years in America he served in Flanders, taking part in the capture of St. Lucia. In 1809 he commanded a brigade in the Peninsula, taking part in the battle of Busaco (1810) and the first siege of Badajoz. At Albuera his regiment, the 57th, occupied a most important position, exposed to a deadly fire. "Die hard! Fifty-seventh," cried Inglis, "Die hard!" The regiment's answer has gone down to history. Out of a total strength of 579, 23 officers and 415 rank and file were killed and wounded. Inglis himself was wounded. On recovering, he saw further Peninsular service. He died at Ramsgate on Nov. 29, 1835.

INGOLSTADT, a town of Germany, in the republic of Bavaria, on the left bank of the Danube at its confluence with the Schutter, 52 m. N. of Munich, at the junction of the main lines of railway, Munich, Bamberg and Regensburg-Augsburg. Pop. (1925) 26,630. Ingolstadt, known as *Aureatum* or *Chrysopolis*, was a royal villa in the beginning of the 9th century, and received its charter of civic incorporation before 1255, and later became the capital of a dukedom which merged in that of Bavaria-Munich. The fortifications were erected in 1539. In 1800 the French, under General Moreau, took the town, and dismantled the fortifications. They were rebuilt on a much larger scale under King Louis I., and after 1870 Ingolstadt ranked as an important fortress. The principal buildings are the old palace of the dukes of Bavaria-Ingolstadt; the remains of the earliest Jesuits' college in Germany, founded in 1555; the former university buildings, now a school; and the large Gothic Frauenkirche, founded in 1425, with two massive towers, containing the tomb of Dr. Eck, Luther's opponent. In 1472 a university was founded in the town by the Bavarian duke, Louis the Rich, which at the end of the 16th century was attended by 4,000 students. In 1800 it was removed to Landshut, whence it was transferred to Munich in 1826. The industries are metal founding and the manufacture of locomotives and machinery.

INGOT, originally a mould for the casting of metals, but now a mass of metal cast in a mould, and particularly the small bars of the precious metals, cast in the shape of an oblong brick or wedge with slightly sloping sides, in which form gold and silver are handled as bullion at the Bank of England and the Mint. Ingots of varying sizes and shapes are cast of other metals, and "ingot-steel" and "ingot-iron" are technical terms in the manufacture of iron and steel (*see* IRON AND STEEL).

INGRAM, ARTHUR FOLEY WINNINGTON (1858–), English divine, was born in Worcestershire on Jan. 26, 1858, and educated at Marlborough College, and Keble College, Oxford. His first curacy was at St. Mary's, Shrewsbury, in 1884; in 1885 he became private chaplain to the Bishop of Lichfield and in 1889 head of the Oxford House, Bethnal Green, where he became much loved for his devoted work among the poor. In 1897 he was appointed suffragan bishop of Stepney, which carried with it a canonry in St. Paul's. In 1901, after the death of Dr. Mandell Creighton, he was nominated by the Crown to the see of London. The appointment, which had hitherto been reserved for men who had made their mark as scholars and administration rather than in pastoral work, excited much comment; but it was undoubtedly popular. As a preacher Dr. Ingram attracted great audiences. During the World War he threw himself into the work of providing religious instructions for the fighting men, visiting both the French front and the Grand Fleet. He went on a world tour in July 1926, returning in May 1927. He visited several Canadian towns and delivered an address at the centenary celebration of the foundation of Ottawa. Dr. Ingram also took a prominent part in the discussions on the proposals for the revision of the Prayer-book in 1927 and 1928.

INGRAM, JAMES (1774–1850), English antiquarian and Anglo-Saxon scholar, was born near Salisbury on Dec. 21, 1774. From 1803 to 1808 he was professor of Anglo-Saxon at Oxford, and in 1824 was made president of Trinity college and D.D. He was the pre-eminent Anglo-Saxon scholar of his time. He died on Sept. 5, 1850. He published an edition of the *Saxon Chronicle* (1823), *Memorials of Oxford* (1832–37); and *The Church in the Middle Centuries* (1842).

INGRAM, JOHN KELLS (1823–1907), Irish scholar and economist, was born in Co. Donegal, Ireland, on July 7, 1823, and educated at Newry school and Trinity college, Dublin. Elected fellow of his college in 1846, he became successively professor of oratory and English literature (1852–66), regius professor of Greek (1866), and librarian (1879). Always remarkable for his versatility, he made a reputation in the fields of literature, philosophy and science, as well as political economy. He contributed an historical and biographical article on economics to the 9th edition of the *Encyclopædia Britannica* which was translated into many European languages. He died in Dublin on May 18, 1907. His principle works are *Greek and Latin Etymology in England; The Etymology of Liddell and Scott; The Outlines of the History of Religion* (1900); *Human Nature and Morals According to A. Comte* (1901); *Practical Morals* (1904); *The Final Transition* (1905); and *Sonnets and Other Poems* (1900).

INGRES, JEAN AUGUSTE DOMINIQUE (1780–1867), French painter, was born at Montauban, on Aug. 29, 1780. His father has described himself as *sculpteur en plâtre*. In consequence of the son's talent for music—the lad's performance of a concerto of Viotti's was applauded at the theatre of Toulouse—his father at first wished him to take up music. At Toulouse, whither his father had removed from Montauban in 1792, Ingres received lessons from Joseph Roques, from Vigan, professor at the academy of fine arts, and from Briant, a landscape-painter. The sight of a copy of Raphael's "Madonna della Sedia" came to him as a revelation and confirmed him in his desire to become a painter.

He started for Paris about the close of 1796. He was admitted to the studio of David, for whose lofty standard and severe principles he always retained a profound appreciation. Ingres, after four years of devoted study, during which (1800) he obtained the second place in the yearly competition, finally carried off the Grand Prix (1801). The work thus rewarded—the "Ambassadors of Agamemnon in the Tent of Achilles" (École des Beaux Arts)—was much admired by Flaxman. In 1804 Ingres exhibited "Portrait of the First Consul" (Musée de Liége), and portraits of his father and himself (Musée Ingres and Chantilly); these were followed in 1806 by "Portrait of the Emperor" (Invalides), and portraits of Mme. and Mlle. Rivière (Louvre). It was not until 1806 that the state of public affairs admitted of the re-establishment of the Academy of France at Rome. The first year in Rome Ingres produced the portraits of Granet (Musée Aix) and of Madame Devauçay (Musée Chantilly). In 1808 followed "Oedipus and the Sphinx" and the "Grande Baigneuse" (both in the Louvre). These works were followed by some of his best portraits, that of M. Bochet (Louvre), and that of Mme. la Comtesse de Tournon; in 1811 he finished "Jupiter and Thetis," an immense canvas now in the Museum of Aix, and in 1812 "Romulus and Acron" (École des Beaux Arts). "Don Pedro of Toledo Kissing the Sword of Henry IV." (Collection Deymié; Montauban) was exhibited at the Salon of 1814, together with the "Chapelle Sistine" (Collection Madame Pougin de la Maisonneuve) and the "Grande Odalisque" (Louvre). In 1813 Ingres executed "Raphael and the Fornarina" (Museum of Riga).

During all these years Ingres's reputation in France did not increase. The interest which his "Chapelle Sistine" had aroused at the Salon of 1814 soon died away; amongst his brother artists Ingres found scant recognition. The strict classicists looked upon him as a renegade, and strangely enough Delacroix and other pupils of Guérin—the leaders of that romantic movement for which Ingres, throughout his long life, always expressed the deepest abhorrence—alone seem to have been sensible of his merits. The weight of poverty, too, was hard to bear. In 1813 Ingres had married Madeleine Chapelle, who speedily acquired a faith in her husband which enabled her to combat the difficulties which beset their existence, and which were increased by their removal to Florence.

The good offices of his friend Bartolini, and of one or two other persons, could only alleviate the miseries of this stay in a town where Ingres was all but deprived of the means of gaining daily bread by the making of those small portraits for the execution of which, in Rome, his pencil had been constantly in request. Before his departure he had, however, been commissioned to paint for de Pastoret the "Entry of Charles V. into Paris," and de Pastoret now obtained an order for Ingres from the Administration of Fine Arts; he was directed to treat the "Voeu de Louis XIII." for the cathedral of Montauban. This work, exhibited at the Salon of 1824, met with universal approbation. On his return Ingres was received at Montauban with enthusiastic homage, and found himself celebrated throughout France.

In the following year (1825) he was elected to the Institute, and his fame was further extended in 1826 by the publication of Sudre's lithograph of the "Grande Odalisque," which, having been scorned by artists and critics alike in 1819, now became widely popular. A second commission from the government called forth the "Apotheosis of Homer" (Louvre), originally meant for a ceiling decoration. One of the finest portraits of this period is that of "Bertinainé" (Louvre). From this date up till 1834 the studio of Ingres was thronged. Whilst he taught with despotic authority and admirable wisdom, he steadily worked; and when in 1834 he produced his great canvas of the "Martyrdom of Saint Symphorien" (cathedral of Autun), it was with angry disgust and resentment that he found his work received with the same doubt and indifference as had met his earlier ventures.

Ingres gladly availed himself of the opportunity to return to Rome, as director of the École de France, in the room of Horace Vernet. There he executed "La Vierge à l'Hostie" (Leningrad), "Stratonice" (Mus. Chantilly), "Portrait of Cherubini" (Louvre) and the "Petite Odalisque" (Coll. Gust. Pereire). The "Stratonice," executed for the duke of Orleans, had been exhibited at the Palais Royal for several days after its arrival in France, and the beauty of the composition produced so favourable an impression that, on his return to Paris in 1841, Ingres found himself received with deference. A portrait of the duke of Orleans (Mus. Versailles) was one of the first works executed after his return. In 1845 he painted Madame d'Haussonville (Château Coppet), one of his best female portraits; shortly afterwards he began the decorations of the great hall in the Château de Dampierre, which were begun with an ardour which gradually slackened, until in 1849 Ingres abandoned all hope of their completion, and the contract with the duc de Luynes was cancelled.

Ingres's next considerable undertaking (1853) was the "Apotheosis of Napoleon I.," painted for the ceiling of a hall in the Hôtel de Ville (destroyed); "Jeanne d'Arc" (Louvre) appeared in 1854; and in 1855 Ingres consented to rescind the resolution, more or less strictly kept since 1834, in favour of the International Exhibition, where a room was reserved for his works. Prince Napoleon, president of the jury, proposed an exceptional recompense for their author, and obtained from the emperor Ingres's nomination as grand officer of the Legion of Honour. With renewed confidence Ingres now took up and completed one of his most charming productions—"La Source" (Louvre). In 1862 Ingres completed "Christ and the Doctors" (Musée Montauban), a work commissioned many years before by Queen Marie Amélie for the chapel of Bizy.

On Jan. 14, 1867, Ingres died in his 88th year, having preserved his faculties in wonderful perfection to the last. In the same year was opened the Musée Ingres at Montauban, which contains the greatest collection of his paintings and drawings and constitutes a fine memorial to the artist. His art was wholly based on form and line. Except in his "Sistine Chapel," and one or two slighter pieces, Ingres kept himself free from any preoccupation as to depth and force of colour and tone; driven, probably by the excesses of the Romantic movement, into an attitude of stricter protest, "ce que l'on sait" he would repeat, "il faut le savoir l'épée à la main." His admiration for Raphael inspired the remark, "*Je suis donc un conservateur des bonnes doctrines et non un novateur.*" His constant and keen study of nature, however, prevented his becoming an eclectic, and we find him at his best whenever he worked from nature. It is not by his wonderful portraiture alone that his art will live. His drawings are cherished by all lovers of art and his picture the "Grande Odalisque" ranks as one of the finest interpretations of the nude. He had many pupils; the most important was Chassériau; but his influence extended beyond his class and is felt in modern painting. He was worshipped by Gauguin, Puvis, Degas; and the cubists claim him as a kindred spirit.

See H. Lapauze, *Ingres, sa Vie et son Oeuvre* (1911).

INGRESS, entrance as opposed to exit or egress; in astronomy, the apparent entrance of a smaller body upon the disc of a larger one, as it passes between the latter and the observer; in this sense it is applied especially to the beginning of a transit of a satellite of Jupiter over the disc of the planet.

INGUSHETIA, an autonomous area created in July, 1924, within the North Caucasian Area, occupying 3,199 sq.km. The watershed of the Caucasus forms its southern boundary, where Georgia borders it, the Kabardian territory lies to the north, the Chechen to the east and the North Ossetian to the west. The mountain region consists of the peaks, ridges and deep ravines of

the main crest of the Caucasus lying east of Kazbek; the lowland is the eastern extension of the Vladikavkaz valley, and merges into the Kabardian plain. This small lowland area is only 200 metres above sea level, but much of Ingushetia is 4,000 metres, with scattered peaks rising even higher. It is drained by the Terek and its tributaries the Armkhi, Sunzha, Kambileyevka; the Ossa river, a tributary of the Sunzha, is the main stream in the district. The climate varies with the relief; the annual rainfall may be 500 to 840 mm., and is greatest from the end of spring to midsummer, with a further fall at the beginning of winter. This type of rainfall favours the growth of maize, but is bad for wheat. There are seven meteorological stations in Ingushetia which record average January temperature −4·5° to −5·4° C and July 20·6° to 22·2° C. The temperature is rarely higher than 22·6° C. The north of the valley of the Armkhi, on the Stolovoi slopes, is, however, practically rainless and the hill meadows are parched in summer, while the south below the snow-line is covered with mixed pine and deciduous forest where health resorts could be favourably developed. Near Kabardia the climate approximates to the dry continental type of the North Caucasian Area, and the soil is a transition type between chestnut coloured and black earth (*see* RUSSIA, *Soils*); typical steppe vegetation is found here. On the southern slopes of the hills are forests of ash, lime, oak, wild cherry and a great variety of shrubs; on the northern are birch and willow. In the Black mountain region, beech occupies 70% of the forest, the rest being lime, hazel, oak, apple and pear. On the higher slopes are pine forests and alpine and sub-alpine meadows. Agriculture is the chief occupation; there are no settlements large enough to be called towns, the administrative offices are in Vladikavkaz. The cultivation of maize occupies the first place in the local economy; in 1926, of 50,800 hectares of cultivated land 97·4% were under maize. Livestock breeding, mainly of a nomad type relying on pasturage, supplemented in the winter by maize forage, comes next. In 1926 there were roughly 55,000 sheep, 52,000 working cattle, 21,600 horses and 5,500 goats, *i.e.*, about 75% of the number in 1913. Potatoes, vegetables, fruit, melons and cucumbers are grown and could be profitably developed for the market if transport facilities were provided. Beekeeping forms a supplementary occupation. The tiny scattered hamlets in the higher valleys rely almost exclusively on their flocks of sheep, goats and chamois which provide them with wool for homespun and with leather, meat and milk. The Ingushetes in these regions are wild and lawless; the blood feud is common and trade is of an exchange and barter type. Their homes are smoky, windowless hovels, and eye diseases are common. The valley Ingushetes are settled cultivators and their easier contact with their Russian neighbours has considerably modified their customs. The absence of transport facilities is marked, roads are non-existent in many places, and the hill streams are impossible for navigation. Only 7 km. of the westward railway from Groznyi comes into the area, with Nazran as its stopping place. Until communications have improved, the timber wealth of the region will remain unexploited; at present it has not been surveyed completely. Nor, as yet, has a geological survey been completed. A westward extension of the Groznyi naphtha beds exists in the Achalukov region, in which also copper and sulphur pyrites are known to exist, but they are not worked. It is estimated that there must also be layers of copper, asbestos, coal and saltpetre in other regions. Mineral springs exist, and those at Achaluk are much resorted to by the native tribes. At present, the only mining activity is carried on by peasant *artels* working salt, lime and ochre. There are two factories which export products outside Ingushetia, one a brandy distillery, and the other a starch factory. According to the 1926 census the population was roughly 75,200, of whom more than 90% were Ingushetes. The literacy rate is about 6% for men and less than 1% for women. Education in a hill community with poor communications and a slender budget presents great difficulties; the number of primary schools in 1925–6 was 22, and there were 1,260 scholars; it is evident that in such circumstances the rate of literacy cannot increase rapidly. Health services are poor; there is one hospital, with 20 beds, for the whole area. Government stations for dealing with malaria, tuberculosis and social diseases have recently been established. The Ingushete language is closely allied to that of the Chechens, and both Ingushetians and Chechens call themselves "nakhchi" (people). The Ingushetes also call themselves "Lamur," "Galgai" or "Nazranovs." In physical type they are extremely varied, and dark brown, blue and light grey eyes are common; the prevailing hair shades are dark red and black, and a large proportion is dolichocephalic.

In 1926 an Ingushetian Research Institute was founded in Vladikavkaz. The district is full of interest because it has preserved its ancient customs to so late a date. Numerous cist burials, associated with Bronze and Iron cultures, have been discovered, some crouched and some extended, but all with the head oriented to the west. Until the middle of the 19th century burials took place in "kashi," or two storied chambers, some hut-shaped with pyramidal roofs and some cone shaped. The corpses were piled up to the ceiling buried in their ordinary garments, and with utensils and weapons for use in the next world. These sepulchres were built of stone cemented with clay or lime and were whitewashed on the outside; the window was to the east and the roof of the lower chamber vaulted, with a window in the north leading to the upper chamber. Owing to the dryness of the atmosphere, the corpses became partially mummified. A marked feature of Ingushete "auls" or mountain villages from the 15th century to modern times is the erection of military and residential turrets, mostly square at the base and tapering towards the top: the military turrets are often 70 ft. high with 4 or 5 storeys. They are an indication of the state of perpetual tribal warfare existing in the region. In the 11th century the Ingushetes were dependent on Georgia, but in the early 15th century the Kabardians conquered them and exacted tribute so oppressively that the Ingushetes placed themselves under Russian protection in 1770. The Kabardians resented this and a Russian regiment under General Medemom was sent to pacify the district. From that time onwards sporadic outbreaks of unrest continued, in which religious fanaticism played its part. The Ingushetes are Mohammedans of the Sunni sect, and joined the rebellion under Shamil (*q.v.*). The building of the Georgian military road, the establishment of Cossack military outposts and finally the building of the railway to Vladikavkaz gradually pacified the district, but the bands of Ingushete highway robbers, retreating to their inaccessible mountain fastnesses, have been a thorn in the side of settled government.

See N. Yakovlev, *Ingushi* (Moscow, 1925).

INHAMBANE, a seaport of Portuguese East Africa, in 23° 50′ S., 35° 25′ E., 280 m. from Beira and 248 from Delagoa bay. It is situated on a river of the same name which enters Inhambane bay. In 1921 the maximum temperature was 90° and the minimum 58°. The town dates from the middle of the 16th century. The principal church is built with stone and marble brought from Portugal. A water supply and the electric light have recently been installed. Trade was formerly mostly in ivory and slaves. In 1834 Inhambane was taken by a Zulu horde under Manukosi (*see* GAZALAND). It was not until towards the close of the 19th century that the trade of the town revived. In 1926, 160 tons of mafurra, 200 tons of copra, and 490 tons of sugar were exported among other products. Cotton goods and cheap wines (for consumption by natives) are the principal imports. The harbour is about 9 m. long by 5 wide. The bar and channels are marked by illuminated buoys. The depth of water over the bar varies from 17 to 28 ft. The port has a ferro-concrete wharf, 379 ft. long, at which large steamers can berth. The depth at low spring tides is 23 ft. In 1925–6, 103 ships left the port with 352,280 tons of cargo. Goods landed amounted to 71,138 tons.

Inhambane is the natural port for the extensive and fertile district between the Limpopo and Sabie rivers. This region is the best recruiting ground for labourers in the Rand gold mines. Mineral oils have been found within a short distance of the port. The town has official primary schools. Trade schools have been established in nearly all the circumscriptions of the district. There is a wireless station with a range of 300 miles.

See *Delagoa Bay Directory* (1927).

INHERITANCE. In English law the heir is simply the person on whom the real property of the deceased devolved by operation of law if he died intestate (*see* HEIRS). Until 1926 the devolution of an inheritance in England was regulated by the rules of descent, as altered by the Inheritance Act 1833, amended by the Law of Property Amendment Act 1859.

1. The first rule was that inheritance shall descend to the issue of the last "purchaser.". A purchaser in law means one who acquires an estate otherwise than by descent, *e.g.*, by will, by gratuitous gift or by purchase in the ordinary meaning of the word. Under the earlier law descent was traced from the last person who had "seisin" or feudal possession. 2. The male was admitted before the female. 3. Among males of equal degree in consanguinity to the purchaser, the elder excluded the younger; but females of the same degree took together as "coparceners." 4. Lineal descendants took the place of their ancestor. 5. If there were no lineal descendants of the purchaser, the next to inherit was his nearest lineal ancestor. 6. The sixth rule was thus expressed by Joshua Williams in his treatise on *The Law of Real Property*:—

> The father and all the male paternal ancestors of the purchaser and their descendants shall be admitted before any of the female paternal ancestors or their heirs; all the female paternal ancestors and their heirs before the mother or any of the maternal ancestors or her or their descendants; and the mother and all the male maternal ancestors and her and their descendants before any of the female maternal ancestors or their heirs.

7. Kinsmen of the half-blood might be heirs; such kinsmen shall inherit next after a kinsman in the same degree of the whole blood, and after the issue of such kinsman where the common ancestor is a male and next after the common ancestor where such ancestor is a female. 8. In the admission of female paternal ancestors, the mother of the more remote male paternal ancestor and her heirs were preferred to the mother of the less remote male paternal ancestor and her heirs; and, in the case of female maternal ancestors, the mother of the more remote male maternal ancestor was preferred to the mother of a less remote male maternal ancestor. Failing heirs of all kinds, the lands of an intestate purchaser, not alienated by him, would revert by "escheat" (*q.v.*) to the next immediate lord of the fee, who would generally be the crown.

By s. 45 of the Administration of Estates Act 1925, all existing modes, rules and canons of descent were abolished and new rules were substituted. (*See* INTESTACY.)

Scotland.—In Scotland the rules of descent differ from the above in several particulars. Descent is traced, as in England before the Inheritance Act, to the person last seized. The first to succeed are the lineal descendants of the deceased, and the rules of primogeniture, preference of males to females, equal succession of females (heirs-portioners), and representation of ancestors are generally the same as in English law. Next to the lineal descendants, and failing them, come the brothers and sisters, and their issue as collaterals. Failing collaterals, the inheritance ascends to the father and his relations, to the entire exclusion of the mother and her relations. Even when the estate has descended from mother to son, it can never revert to the maternal line. As to succession of brothers, a distinction must be taken between an estate of heritage and an estate of conquest. Conquest is where the deceased has acquired the land otherwise than as heir, and corresponds to the English term purchase in the technical sense explained. Heritage is land acquired by deceased as heir. The distinction is important only in the case when the heir of the deceased is to be sought among his brothers; when the descent is lineal, conquest and heritage go to the same person. And when the brothers are younger than the deceased, both conquest and heritage go to the brother (or his issue) next in order of age. But when the deceased leaves an elder and a younger brother (or their issues), the elder brother takes the conquest, the younger takes the heritage. Again, when there are several elder brothers, the one next in age to the deceased takes the conquest before the more remote, and when there are several younger brothers, the one next to the deceased takes the heritage before the more remote. When heritage of the deceased goes to an elder brother (as might happen in certain eventualities), the younger of the elder brothers is preferred.

The position of the father, after the brothers and sisters of the deceased, will be noticed as an important point of difference from the English axioms; so also is the total exclusion of the mother and the maternal line. As between brothers and sisters the half-blood only succeeds after the full blood. Half-blood is either consanguinean, as between children by the same father, or uterine, as between children having the same mother. The half-blood uterine is excluded altogether. Half-blood consanguinean succeeds thus: if the issue is by a former marriage, the youngest brother (being nearest to the deceased of the consanguinean) succeeds first; if by a later marriage than that from which the deceased has sprung, the eldest succeeds first.

In many of the British dominions and colonies the English law of inheritance has been greatly modified by legislation.

(W. A. B.)

United States.—American law borrowed its rules of descent of real estate considerably more from the civil law than the common law. "The 118 novel of Justinian has a striking resemblance to American law in giving the succession of estates to all legitimate children without distinction and disregarding all considerations of primogeniture. There is one particular in which the American law differs from that of Justinian, that while generally in the United States lineal descendants if they stand in an equal degree from the common ancestor share equally *per capita;* under the Roman law regard was had to the right of representation, each lineal branch of descendants taking only the portion which their parent would have taken had he been living, and the division being *per stirpes* and not *per capita.* But in some of the states the rule of the Roman law in this respect has been adopted and retained." When such lineal descendants stand in unequal degrees of consanguinity the inheritance is *per stirpes* and not *per capita* (In re Prote, 1907; 104 N.Y. Supplement 581). This is the rule in practically all the States.

The entire subject of descent has, substantially, become statutory. The principal changes have been in uniformity of rules as between real and personal property and a more substantial provision for the wife. An important feature at common law—"the blood of the ancestor"—is no longer of importance.

But as in no two States are the rules of descent identical, the only safe guides are the statutes and decisions of the particular State in which the property to be inherited is situated. In 41 States the rules for the descent of real and personal property are the same, in seven States they still differ. The law of primogeniture as understood in England is abolished throughout the United States, and male and female relatives inherit equally.

The distinction between relatives of the whole and half blood is not ordinarily in force. In a few States it is abolished by statute. In three States those of full blood are preferred.

The English rule that natural children not subsequently legitimated have no inheritable blood has been greatly modified. In several States inheritable blood exists between a natural child and its mother. In Pennsylvania, this is extended to its maternal grandparents. In Arizona there is no distinction. In some States, a subsequent marriage removes the bar as does recognition by the father in some States. Common law dowers have been largely regulated by statutes which give certain rights to the surviving wife in lieu thereof—usually more favourable to her than her common law dower. In several States she takes a third interest in fee in land alienated by her husband in his lifetime without joining her in the deed—usually one-third; in Kansas one-half interest in fee. Curtesy has likewise been very generally abolished and certain statutory rights given to a surviving husband instead. In the States which came in through the Spanish or French titles, dower and curtesy had no place.

In default of issue and subject to the share of the spouse, the parents usually take, and failing parents, collaterals take. A usual form of statute gives the wife one-half where there is but one child; if there be more than one child, the wife takes a child's share.

Degrees of kindred in the United States generally are com-

puted according to the civil law, *i.e.*, by adding together the number of degrees between each of the two persons whose relationship is to be ascertained and the common ancestor. Thus, relationship between two brothers is in the second degree; between uncle and nephew in the third degree; between cousins, in the fourth, etc. In a few States such degrees are computed according to the common law, *i.e.*, by counting from the common ancestor to the more remote descendant of the two from him—thus, brothers would be related in the first degree, uncle and nephew in the second, etc. In most States representation amongst collaterals is restricted—in some to the descendants of brothers and sisters, in others to their children only.

In eight States (California, Louisiana, Texas, Arizona, Idaho, Nevada, New Mexico and Washington) the law of "community property" of husband and wife prevails. This is derived from the French and Spanish law existing in the territories out of which those States were formed as the result of the Spanish and French occupation. The foundation idea is an equal division at the death of either party of all property acquired during their marriage except by gift, devise or descent. In general the husband has the control and management thereof during the marriage, and the survivor has the administration of the moiety of the one deceased. (F. R.)

INHERITANCE: ECONOMIC ASPECTS. There are no ideas of inheritance which can be shown to be "natural" or absolute, as may well be seen by comparing the ideas prevailing in different countries at the same time, or in the same country at different times. It has been well said "Most Englishmen who have not studied comparative law, will think it natural that the ownership of their property after their death should be governed by their last will and testament. Most Frenchmen, in like case, will think it natural that the operation of their will should be subject to the law of the *légitime*. But many Indians, far from thinking the disposition of property by will to be natural, will find great difficulty in understanding what the mere idea of a will signifies and implies. Indeed, Maine has pointed out that to the vast majority of mankind throughout recorded history the idea would be quite incomprehensible" (H. Dalton, *Inequality of Incomes*).

The rights of Inheritance and Bequest are commonly confused. In general, by an absolute right of bequest is meant the freedom to leave one's possessions exactly as one pleases, whereas an absolute right of inheritance is actually an inalienable right to possess what someone has left according to a rule that commends itself to our sense of natural fitness. An Englishman, finding that his parents have left their wealth to some stranger, may be pardoned for emphasizing moral rights of inheritance. A Frenchman, finding that a substantial part of his hardly accumulated fortune must go, whether he likes it or not, to a son who has, by his conduct, no moral claim upon it, may be excused for discussing the right of bequest. One in either nation who has neither wealth to leave nor to receive, may well be pardoned when he questions the social utility of any system which acts as a conduit pipe for much current production into areas where he has no claim.

Family Inheritance and Incentive to Work.—Much of the philosophy of bequest and inheritance is bound up in the philosophy of private property, and in so far as individuality in the production, as well as the spending and direction of wealth, is for the social good, the right of bequest, it may be argued, is an important attribute of private ownership. But the right to make *family* bequest and the right to make bequest in *any* direction are very different in social importance. It is probable that the incentive to work and to save would be very seriously impaired if family inheritance were not allowable, whereas restrictions in the wider right of general bequest might well exist without untoward social effects.

"The permanence of the family has a social value which the right of inheritance helps to maintain." Similarly "the practice of charitable bequest led at an early date to the recognition by law that there are certain purposes which may well be made more permanent than the lives of the individuals who serve them." It is fairly generally agreed that *some* rights of inheritance, however limited and controlled, are essential to the full economic advantage of property as a social institution, and the precise degree is a matter relative to the stage of social development.

The philosophical theory that the "mixing" of labour with material, in whatever proportions, constituted a natural right in the material, however valid for the lifetime of the worker, gave little guidance as to the rights of heirs who had not worked upon it, and failed to provide a self-evident principle. Locke thought that liberty of bequest was obvious or natural. The fact that three distinct systems prevailed, even in England, for intestacy, could only be accounted for by assuming that a law of nature had been modified by State-made law, based upon the social contract. But as Hastings Rashdall points out, the obligation to keep the contract rests upon a principle of natural law, and these principles seem to be in conflict. Any system which supports the right of primogeniture must prove to be illogical on a Lockian basis.

Right of Bequest.—Some right of inheritance in practice, but never unconditional rights, are found in the earliest times. In England the laws of inheritance have tended to give way to the absolute right of bequest. The power to dispose of lands by will dates from Henry VIII., and there is now an unlimited power of disposition except for entailed estates, so that there are no rights of wife or children which cannot be set aside. Where the will of the owner has not been actually expressed by him, the rights have differed widely up to 1926 according to whether the property was real or personal estate. The widow had a life interest in one-third, the husband, if there were children, had a life interest in the whole. But under Kentish gavelkind custom, their interests were one-half each, the wife's continuing until remarriage. Under "Borough English" the younger son took preference. The somewhat arbitrary character of succession to land illustrates the absence of "natural" law. Males are preferred to females. Where two or more males with equal relationship are in question, the eldest inherits, but if they are females they take equally. The father, his issue, and his ancestors, however distant, take priority over the mother and her ancestors. "A more remote male ancestor and his issue are excluded by a nearer male ancestor and his issue, but the mother of a more remote male ancestor and her issue are *preferred* to the mother of a nearer male ancestor and her issue. Thus land goes to remote relations on the father's side before it can go to even the mother on the mother's side. "It would be hard to justify the continuance of such rules in a modern civilized country, and it is only the complete freedom of will making which has prevented them from being found intolerable" (Geldart).

In personalty, the husband took all his intestate wife's property, but the wife could take only one-third (or one-half if there were no issue). Even if he had no ascertainable relatives the wife was restricted to half, the rest went to the Crown. By a recent legislation (1926) the old rules of intestate succession are repealed, and the principle has been to distribute property much more in accord with what most deceased persons would have adopted if they had made a will. Now the husband (or wife) takes all personal chattels absolutely, £1,000 free of death duty, the whole residue if there are no children, or one-half if there are. The degree of relationship entitled to benefit now goes no further than first cousins and their issue, and the residue goes to the Crown.

There are general restrictions on the power to will property in England, for property may not be left to waste, or accumulate perpetually; nor can a succession of owners be prescribed beyond a period of 21 years after the death of persons alive at his own death. But otherwise the claims of the nearest kin can be almost ignored. The British ideas extend to the dominions and most of the United States, though in the United States a widow is generally entitled to one-third of the personalty, and a life interest in one-third of her realty. But on the continent of Europe the *légitime* prevails, when near relatives are secured by definite rights. In France, the right of free bequest extends only to a fraction. In Italy, one-half of the property has followed a settled rule. The French form has narrowed, through the Napoleonic régime, from an earlier form (to which Quebec is still attached) whereas

England (as distinct from Scotland) broadened from narrower ideas.

Ideas upon Limitations of Rights.—If unlimited freedom of inheritance and of bequest are not natural rights, it at once becomes an important question how they may be limited, and in general the test applied is that of "social desirability." But the definition of what is socially desirable has proceeded in the past too much upon distinctions as to abstract justice or fairness, and very little examination has been made, or estimate attempted, of the effects upon production of different practices. Although diffusion of wealth and "better" distribution of wealth have been used as reasons for limitation and legal direction, the economic consequences are not clearly known or distinguished. Thus Jeremy Bentham (1795) wished to abolish intestacy, passing all property to the State, and where wills were made, to limit the powers of those who had no direct heirs. In any case, the State was to have half share of sums going under a will to grandparents, uncles, nephews, and also a reversionary interest in what went to childless heirs. Bentham had the ideas of just taxation most in mind, based on the absence of any *natural* right of inheritance, and the fact that extensive privileges to collateral relatives were only defensible to a limited extent. Graduation of such a tax according to degree of relationship was a corollary.

J. S. Mill thought the right to make bequest was inherent in the idea of property, but the right to inherit was not. His pleas for limitation of bequest were mostly on ethical grounds, but he was not blind to economic considerations, for he recognized: (a) an economic disadvantage in the past, in letting family property be broken up, and a little commonwealth dispersed, and this created an inherent right in children to the possessions of their ancestors; (b) that the advantages of the incentive to be found in family fortunes were outweighed by the mischiefs to society of perpetuities; (c) the value of the French system in breaking down the tendency of primogeniture to aggregate property in masses; (d) the economic value of having a section of society relieved from immediate pressure.

Heavy taxation of bequest through death duties has been advocated on lines which are intended: (a) to produce a maximum revenue without hurting the subject of assessment; (b) to correct the natural anomalies of the bequest system; (c) to redistribute wealth; (d) to socialize or nationalize wealth.

The most modern and most considered scheme for virtual abolition of continuous inheritance is the Rignano proposal for death duties of a special type, progressive in point of time by the number of successions. When a man dies, under this system a large tax would be laid upon all wealth acquired by him through inheritance, and only a small one upon wealth saved by him in his own lifetime. As a result a certain corpus of wealth passes to his heir, and to that heir it is all inherited wealth, so that on his death in turn it would be very heavily taxed. It is claimed that every one would have to work and save hard, for it would only be from such self made wealth that the children could benefit. There are several Rignano schemes, varying in severity, from a mere modification of existing death duties, to the maximum profit which passes any given block of property into the hands of the State in two generations. The Colwyn Committee on Taxation and the National Debt reported against the Rignano plan as a scheme of taxation.

Economic Consequences of Inheritance.—The precise effects of a system of inheritance have never yet been worked out, so far as influence upon production, total savings and total national wealth is concerned. It is not known, for example, whether the European system of compulsory family division, or the British system of primogeniture combined with free bequest, have like effects. It is generally considered that primogeniture has concentrated landed estates, whereas the *légitime* has unduly dispersed them but it is not known whether the *total* economic product of the one can be said to be greater than the other. The small experience of a complete absence of rights of inheritance during the short period when this obtained in Russia, is too confused with other influences for any lesson to be drawn as to relative total productivity of the economic organism with or without the inheritance system. In so far as the right to found a family and to make free bequests respectively—two quite different economic motives—are influences in the accumulation of capital, the British system may be said to be an influence in favour of maximum production. On the other hand, in so far as a number of capable individuals in society are enabled to draw to themselves a substantial portion of the annual national production without making any contribution to it, and in so far as the sight of this has a depressing influence on the producers, then important influences are at work restricting total production. Obviously these are questions of degree, and if the numbers of the idle rich are very great and the sentiment of resentment is proportionately strong, then the economic restriction through the system will be great enough to be an important offset to the psychology of saving.

With the invention of modern finance and joint stock enterprise, large aggregations of wealth can be secured for production in a way that was formerly only possible with inherited aggregations. To this extent we are less dependent upon concentration of wealth through inheritance. Moreover, the importance of continuity of family management in private business is becoming rapidly less with the growth of a salaried managing class. It may be said, therefore, that the advantages of a system of inheritance from the point of view of national production rest almost entirely in its psychological influence upon saving, and not upon objective forms of production made possible only by the system.

Relation to Distribution of Wealth.—The more important economic considerations relate, however, to the *distribution* of wealth rather than to total wealth, especially as men are so constituted that they prefer to have a large share of an aggregate they do not realize is small, than a small share of an aggregate that would be much greater. In other words, it is the comparative share of wealth rather than the absolute amount that affects many people's economic contentment and their economic motives. It is often held that inherited wealth is the main determining factor in the extremely unfair distribution of wealth; but while it is undoubtedly contributory, the question as to the extent to which unevenly distributed wealth is an economic, as distinct from a moral, evil remains unsolved, and whether inheritance is really the predominant factor, is also undetermined. Some doubt is thrown upon the assumption that a very large portion of existing estates has not actually been amassed in the lifetime of the deceased, when one bears in mind that the total national wealth of one or two generations ago is only a small proportion of the present total. Moreover, real property, to which aggregation through primogeniture formerly applied to a marked extent, is a decreasing portion of the total national wealth. The actual average destination of a given fortune, *i.e.*, whether it tends to form part of a larger aggregate higher up the scale of distribution, or to split into small fragments amongst a number of holders lower down the scale, is by no means certain. There are indications, moreover, that the number of people holding large inherited fortunes, who are capable of contributing to the national income, is popularly over-estimated, when one eliminates children, old people and those who render important public services for no direct payment. The economic effects, in general, of inheritance are much less clearly known than is assumed in popular discussion. A Committee of the British Association for the Advancement of Science, Section "F," has recently been appointed to endeavour to obtain more exact knowledge upon the subject.

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INHIBITION, an act of restraint or prohibition, an English legal term, particularly used in ecclesiastical law, for a writ from a superior to an inferior court, suspending proceedings in a case under appeal. It applies also to the suspension of jurisdiction of a bishop's court on the visitation of an archbishop, and for that of an archdeacon on the visitation of a bishop. It is more particularly applied to a form of ecclesiastical *censure*, suspending an offending clergyman from the performance of any service of the Church, or

other spiritual duty, for the purpose of enforcing obedience to a monition or order of the bishop or judge. Such inhibitions are at the discretion of the ordinary if he considers that scandal might arise from the performance of spiritual duties by the offender (Church Discipline Act 1860, re-enacted by the Clergy Discipline Act 1892, s. 10, and now extended widely and regulated by the Benefices [Ecclesiastical Duties] measure of 1926). By the Sequestration Act 1871, s. 5, similar powers of inhibition are given where a sequestration remains in force for more than six months, and also, by the Benefices Act 1898, in cases where a commission reports that the ecclesiastical duties of a benefice are inadequately performed through the negligence of the incumbent.

INIA (*Inia geoffrensis*), the fresh-water dolphin of the Amazon basin, reaching 8 ft. in length and pink, or black and pink in colour. (*See* CETACEA.)

INISFAIL, a poetical name for Ireland. It is derived from *inis* "island" and *Lia-fáil,* the celebrated stone, identified in Irish legend with the stone on which the patriarch Jacob slept when he dreamed of the heavenly ladder. The Lia-fáil was supposed to have been brought to Ireland by the Dedannans and set up at Tara as the "inauguration stone" of the Irish kings; it was subsequently removed to Scone where it became the coronation stone of the Scottish kings, until it was taken by James VI. of Scotland to Westminster and placed under the coronation chair in the Abbey, where it has since remained. Inisfail was thus the island of the Fáil, the island whose monarchs were crowned at Tara on the sacred inauguration stone.

INITIALS, the first letters of names. In English law it has been held that it is sufficient if a person affixes to a document the usual form in which he signs his name, with the intent that it shall be treated as his signature. So, signature by initials is a good signature within the Statute of Frauds (*Phillimore* v. *Barry,* 1818, 1 Camp. 513), and also under the Wills Act 1837 (*In re Blewitt,* 1880, 5 P.D. 116). (*See* SIGNATURE; AUTOGRAPH.)

INITIATIVE. The initiative is the form of direct legislation which enables the voters popularly to frame or direct a legislative body to enact a certain law. It is the companion popular agency to the referendum, which is the reference to the voters of an act of the legislature for approval or disapproval. The referendum may be either compulsory or optional, the difference being that if the former, it is inoperative until approved by the voters.

In the United States the first initiative and referendum law was passed by South Dakota in 1898. Utah followed in 1900, Oregon in 1902, Nevada in 1904, Montana in 1906, Oklahoma in 1907, Maine, Missouri and Michigan in 1908, Arkansas and Colorado in 1910, California and Arizona in 1911, Idaho, Ohio, Nebraska and Washington in 1912, Mississippi and North Dakota in 1914 and Massachusetts in 1918. New Mexico passed a referendum law in 1911 and Maryland in 1915. The New Mexico and Utah laws have never been used because of difficult requirements for the petitions. The Mississippi law was declared unconstitutional. Many cities in other States under the commission and managerial forms of government have adopted the initiative and referendum.

Petitions must be circulated and signed by a requisite number of voters before a matter may be initiated before the legislature, or an act already passed may be submitted in referendum to the voters. The legislature may, by its own volition, submit an act to a referendum.

The Federal constitutionality of the initiative and referendum were tested in 1906, when the Oregon law was attacked as in violation of the guarantee to each State of a republican form of government as provided by s. 4 of Article IV. of the Constitution. The Supreme Court held in *Pacific States Telephone Co., etc.,* v. *Oregon,* 223 U.S. 118, that it was a political rather than a judicial case, thus dismissing it.

The initiative and referendum are used principally in acts and proposed acts involving the direct primary, State prohibition enforcement, regulation of public utilities, education and taxation. Oregon, Montana, Oklahoma, California, Arizona, Colorado, Nebraska, Ohio, Washington, Utah, North Dakota and Massachusetts have passed laws providing for the distribution of pamphlets to the voters concerning the questions to be voted upon. The Colorado act remains inoperative because of the failure to repeal a conflicting provision in the State Constitution.

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INJECTOR, an induced current apparatus which by means of a jet of steam feeds water to a boiler. The invention of Henri Giffard, its introduction in 1859 created great interest, because it seemed impossible that a jet of steam from a boiler could force itself and the water back into the boiler. Yet not only this was done, but later researches proved that exhaust steam at atmospheric pressure could be utilized, and it is possible now to deliver against a pressure of 150 lb. per sq. in. The Davies and Metcalfe exhaust injector will do this, and with the help of a small supplementary jet of live steam it will feed against a pressure of 250 lb. per sq. in. Exhaust steam has no velocity in the atmosphere, but if issued into a vacuum it acquires a very high velocity; hence by condensing the steam by contact with the feed water such a vacuum is produced, the velocity of the steam, imparted to the water, giving sufficient force to carry the latter into the boiler. (*See* also EJECTOR; STEAM, GENERATION OF.)

INJUNCTION, in English law, the name for a judicial command whereby a party is required to refrain from doing a particular thing according to the exigency of the writ. Formerly it was a remedy peculiar to the court of chancery, but under the present constitution of the judicature, the injunction is now equally available in all the divisions of the high court of justice, and it can no longer be used to prevent an action in any of them from proceeding in the ordinary course.

Although an injunction is properly a restraining order, there are instances in which, under the form of a prohibition, a positive order to do something is virtually expressed by what is known as a "mandatory" injunction. The injunction was used to stay proceedings in other courts "wherever a party by fraud, accident, mistake or otherwise had obtained an advantage in proceeding in a court of ordinary jurisdiction, which must necessarily make that court an instrument of injustice." As the injunction operates personally on the defendant, it may be used to prevent applications to foreign judicatures; but it is not used to prevent applications to parliament, or to the legislature of any foreign country, unless such applications be in breach of some agreement, and relate to matters of private interest. The jurisdiction of the court to prevent breaches of contract has been described as supplemental to its power of compelling specific performance; thus, *e.g.,* in the case of an agreement of a singer to perform at the plaintiff's theatre and at no other, the court, although it could not compel her to sing, could by injunction prevent her from singing elsewhere in breach of her agreement.

An injunction may as a general rule be obtained to prevent acts which are violations of legal rights, except when the same may be adequately remedied by an action for damages at law. Thus the court will interfere by injunction to prevent waste, or the destruction by a limited owner, such as a tenant for life, of things forming part of the inheritance. Injunctions may also be obtained to prevent the continuance of nuisances, public or private, the infringement of patents, copyrights and trade marks. Trespass might also in certain cases be prevented by injunction. Purely temporary injunctions may be obtained *ex parte* but others only on notice to the other side.

An injunction obtained on interlocutory application during the progress of an action is called an "interim" injunction, which is superseded by the trial. It may be continued either provisionally or permanently. (*See* MANDAMUS.)

For the analogous practice in Scots law *see* INTERDICT. (X.)

United States.—Despite the administration of law and equity by a single court, as is true of most American States, the remedy by injunction retains its essentially equitable character. Its issuance is governed, in the main, by the accepted precedents of equity. A recent extension of the injunction on the principle of

equitable jurisdiction over nuisances is the use of the remedy to aid in the enforcement of criminal laws. The fact that the proceedings relating to the issuance and enforcement of injunctions are conducted before a judge alone, eliminates the inevitable discretion that under the common law system is vested in a jury. Consequently, when the enforcement of a particular law becomes difficult because of the opposition of a particular community as manifested in the tendency of juries to acquit in criminal prosecutions, resort has been made to this head of equity jurisdiction. The popularly termed "padlock injunction" established by the National Prohibition Act, which results in prohibiting for a period of time any use of the premises in which liquor has been sold, is the most marked example of this type. Its effectiveness is attested to by the adoption of similar remedies by the numerous State prohibition acts.

Peculiar to the American federalist system is the problem of Federal courts enjoining proceedings in State courts and vice versa. The general principle is that no such injunctions shall issue; but being courts of concurrent jurisdiction either court that first obtains jurisdiction of the subject matters regards itself as entitled to retain that jurisdiction to the exclusion of the other court and employs the injunction in aid of this purpose. The friction that might result from a liberal use of the injunction was foreseen at an early date, and in 1793 Congress prohibited the use of the injunction by the Federal courts for this purpose save in bankruptcy cases. The Federal courts have, however, by a series of judicial decisions established numerous exceptions to this broad statutory provision among which is that noted above and the principle that the injunction will issue in aid of the exclusive jurisdiction of the Federal courts. A second ground of irritation concerned the use of the injunction by the Federal courts to restrain the enforcement of State statutes on the ground of their constitutionality. An appeal from such action lay to the U.S. Supreme Court, but during the interim a single Federal judge was able to set at naught the entire administrative authority of a State. The incongruity of this result led Congress by a series of statutes beginning in 1910 to prohibit the issuance of such injunctions before a court consisting of less than three judges, one of whom should be a circuit judge, and to provide for expediting an appeal therefrom to the Supreme Court. Limitations have also been imposed upon the power of Federal judges to issue *ex parte* restraining orders pending an application for a temporary injunction. (J. M. La.)

Injunctions in Labour Disputes.—The devices to induce the employer to yield to demands of organized labour through economic and social pressure are, broadly, the strike, the picket line, the boycott. The application of these instruments is illegal in all jurisdictions when accompanied by violence, intimidation or physical coercion; but is permissible in many States when free from those vices if the end sought to be achieved thereby be deemed a justification for the immediate damage inflicted upon the complainant. The Anglo-Saxon legal system provides three remedies for acts that cause damage unjustifiably: an action at law for damages, criminal proceedings if the infliction of damage amounts to a crime, and the equitable action for an injunction to restrain the commencement or continuance of damaging acts threatened or begun. The English case of *Springhead Spinning Co.* v. *Riley* (1868) L.R. 6 Eq. 551, in approving injunctive relief against the publishing of placards of an intimidating nature in the course of a labour dispute, supplied the precedent for the earliest American cases in the decade following 1884. The *Debs case* in 1895 (158 U.S. 564), which granted an injunction at the suit of the national Government, gave final sanction to the propriety of equitable relief in labour controversies. Within the next decade instances of labour injunctions multiplied so extensively as to evoke, in the words of a Supreme Court justice, a "controversy over the remedy (that) overshadowed in bitterness the question of the relative substantive rights of the parties" (*Truax* v. *Corrigan*, 257 U.S. 312, 366). In the period prior to the enactment of corrective legislation in 1914, there issued from American courts well over 500 injunctions; and after 1914, despite the Federal legislation, duplicated in many States, the number of injunctions continued unabated.

Practice.—The propriety of equitable relief in labour controversies has been sustained upon the grounds of actual or imminent injury to the complainant's property rights, inadequacy of the remedy at law, the financial irresponsibility of the individual defendants and the desirability of avoiding a multiplicity of actions at law.

Injunctions are of three general classes: (1) the temporary restraining order or injunction *ad interim*, which issues upon the filing of the bill of complaint, without notice to the opposing side or opportunity to be heard, on the ground that irreparable damage might be inflicted before a hearing could be had; (2) the temporary injunction or injunction *pendente lite*, which issues after notice and opportunity of the defence to be heard upon its countervailing affidavits. This hearing is only full enough to enable the judge to decide upon the probabilities of the situation. The court's discretion is "of the broadest and is seldom interfered with"; (3) the permanent injunction which issues after extended hearings and final decision on the merits.

The case is given a formal hearing before a judge and without a jury; facts are generally ascertained through sworn written statements or affidavits rather than through testimony in open court tested by cross-examination. A violation of the injunction, at any of its stages, whether or not the act is independently a crime, is a contempt of court. The alleged contemnor is tried before the judge who granted the injunction and (in the absence of contrary legislation) without a jury; the normal mode of proof is by affidavit, though some courts in recent years have summoned witnesses to establish the facts; the punishment of those adjudged guilty is in the discretion of the court and in fact has ranged from a small fine to imprisonment for days and months.

The injunction issues against the parties defendant who have been subjected to the court's jurisdiction. Frequently, especially in the Federal courts, an *omnibus* clause is added in order to extend the prohibitions of the decree to "all persons combining and conspiring with the defendants and all other persons whomsoever" (e.g., *In re Debs*, 158 U.S. 564); then the persons served with the decree and "all persons generally" who have actual knowledge thereof are bound to its obedience at the peril of being cited for contempt of court (*Ex parte Lennon*, 166 U.S. 546). The restraining clauses of the injunction, intended to embrace whatever conduct the court deems illegal, have become more and more elaborate, owing in large degree to the fact that the decree is customarily approved as prepared by counsel for the complainant. The proscriptions have included not only acts of violence, intimidation and threats, but also the display of "unfair" banners and placards, "unlawful persuasion" of employees to quit work or of customers to withhold patronage, the payment of strike benefits and, at times, the calling of a strike or its conduct by trade union officers. They have included restrictions upon speech—"abusive language," "bad language," "opprobrious epithets," "jeers, entreaties, argument, persuasion, taunts." They have incorporated *omnibus* interdictions by restraining damage "in any way," "in any way whatsoever," "in any manner directly or indirectly." (See text of restraining clauses of two Federal injunctions in 37 *Harvard Law Rev.* 1101.)

More recently, however, appellate courts have modified decrees whose phrasing barred lawful acts with the unlawful; they have even given affirmative suggestions as to what acts remained permissible and have defined them in detail.

Criticism.—Criticism, with more or less virulence, has been continuous since the *Debs case*. It has been said that equity replaces the enforcing agencies of the criminal law by a summary procedure lacking the traditional safeguards for the accused. Observation has been made that injunctions have abridged the constitutional guaranties of free speech, free press and peaceful assembly; that they are of broad scope and vague terminology, encircling the obviously lawful activities with undefined fringes that make of the whole merely "sweeping injunctions to obey the law"; that, as a result, the persons affected are paralyzed even in the exercise of conceded rights, for they are left guideless in the determination of what conduct remains permitted them in the

carrying on of the struggle, any effective activity inviting prosecution for contempt. In later years, much of the resentment has centred upon the temporary restraining order which is granted without substantial proof, and upon the temporary injunction. The crucial issues are preponderantly controversies of fact. But courts often resolve them from diametrically contradictory affidavits, by granting the decree on the theory that only illegal conduct is restrained thereby and that possible errors will be corrected upon the final hearing. It has been pointed out that the temporary injunction is for all practical purposes the final stage in the litigation: owing to the termination of the strike meanwhile, lack of funds, or a consciousness of futility, the defendants infrequently carry on the contest. On the other hand, the injunction in labour disputes has been defended as the most efficient device to stay the illegal damage to persons and property frequently incidental to a strike.

Legislation.—The serious criticism of the propriety of the injunctions in labour disputes provoked State legislatures and Congress to efforts at corrective measures. Arizona in 1913 enacted legislation forbidding the issue of injunctions in labour disputes "unless necessary to prevent irreparable injury to property" and denying the power of courts of equity to restrain "any person or persons from terminating any relation of employment or from ceasing to perform any work or labour or from recommending, advising, or persuading others by peaceful means so to do; or from attending at or near a house or place where any person resides or works, or carries on business, or happens to be for the purpose of peacefully obtaining or communicating information, or of peacefully persuading any person to work or to abstain from working; or from ceasing to patronize or to employ any party to such dispute; or from recommending, advising, or persuading others by peaceful means so to do. . . ." The Supreme Court of the United States (four justices dissenting) held the statute to entail a deprivation of property without due process of law, a denial of the equal protection of the laws and, therefore, a contravention of the 14th amendment to the Constitution of the United States (*Truax* v. *Corrigan*, 1921, 257 U.S. 312).

The Clayton Act passed by Congress in 1914 used language (s. 20) essentially similar to that of the Arizona statute but was construed by the U.S. Supreme Court as "merely declaratory of what had always been the law and the best practice in equity"; the injunction might still issue against picketing deemed unlawful by the court (*American Steel Foundries* v. *Tri-City Trade Council*, 1921, 257 U.S. 184) and against the secondary boycott (*Bedford Cut Stone Co.* v. *Journeymen Stonecutters' Assoc.*, 1927, 274 U.S. 37). Subsequent State legislation, following s. 20 of the Clayton Act, received a corresponding construction (*Gevas* v. *Greek Restaurant Workers' Club, et al.*, 1926, 99 N.J. Eq. 770).

Section 22 of the Clayton Act granted the right of jury trial in proceedings for indirect contempt, where the act alleged to constitute the contempt is also a crime. This provision survived an attack based upon the doctrine that the power of a court of equity could not be restricted because inherent and derived from the constitutional grant of judicial power (*Michaelson* v. *United States*, 1924, 266 U.S. 42). In Massachusetts, the doctrine of separation of powers prevailed (*Walton Lunch Co.* v. *Kearney*, 1920, 236 Mass. 310). Section 17 of the Clayton Act restricted the issue of temporary restraining orders without notice and required a hearing to be held within ten days after issue of such order; s. 19 required the injunction to be specific in terms. In the 70th Congress (Dec., 1927), new legislation was introduced, further restricting the use of injunctions in labour disputes in the Federal courts.

BIBLIOGRAPHY.—The decisions of most importance and interest in the U.S. Supreme Court and in the lower Federal courts in addition to those mentioned above are: *Gompers* v. *Bucks Stove and Range Co.* (1911) 221 U.S. 418; *Hitchman Coal and Coke Co.* v. *Mitchell* (1917) 245 U.S 229; *Duplex Printing Press Co.* v. *Deering, et al.* (1920) 254 U.S. 443; *U.S.* v. *Ry. Employees' Dept. of American Fed. of Labor, et al.* (D.C. N.D. Ill. 1922) 283 Fed. 479, 286 Fed. 228, 290 Fed. 978; *Great Northern Ry. Co.* v. *Brosseau* (D.C.N. Dak. 1923) 286 Fed. 414.

Decisions in State Courts are *Bossert* v. *Dhuy* (1917) 221 N.Y. 342; *Auburn Draying Co.* v. *Wardell* (1919) 227 N.Y. 1; *Exchange Bakery and Restaurant, Inc.* v. *Rifkin, et al.* (1927) 245 N.Y. 260; *Interborough Rapid Transit Co.* v. *Lavin* (1928) 247 N.Y. 65; *Vegelahn* v. *Guntner* (1896), 167 Mass. 92; *Pierce* v. *Stablemen's Union* (1909), 156 Cal. 70; *Greenfield* v. *Central Labor Council* (1922), 104 Oregon 236; *Keufel and Esser* v. *Int. Assoc. Machinists* (1922), 93 N.J. Eq. 429; *Jefferson and Indiana Coal Co.* v. *Marks, et al.* (1926), 287 Pa. 171.

The most important collection of source authorities is Sayre, *Cases on Labor Law* (1922). The leading legal discussions of the subject are:—W. H. Dunbar, "Government by Injunction" (1897), 13 *Law Quarterly Review* 347; E. E. Witte, "Value of Injunctions in Labor Disputes" (1924), 32 *Journal of Pol. Econ.*, and "Results of Injunctions in Labor Disputes" (1922), 12 *Amer. Labor Legisl. Rev.*; G. W. Pepper, "Injunctions in Labor Disputes" (1924), 49 *Rep. of the Amer. Bar Assn.*, 174; Frankfurter and Greene, "The Use of the Injunction in American Labor Controversies" (1928), 44 *Law Quart. Review* 164, 353; T. R. Powell, "The Supreme Court's Control over the Issue of Injunctions in Labor Disputes," 13 *Proceedings of the Academy of Political Science* (June, 1928); Mason, *Organized Labor and The Law* (1925); Commons and Andrews, *Principals of Labor Legislation* (1920); Annotations in 34 *Harv. L. Rev.* 884, 40 *Harv. L. Rev.* 886, 41 *Harv. L. Rev.* 908.

Testimony taken in the course of Congressional hearings is valuable. The references to 1914 are collected by Mr. Justice Brandeis in his dissenting opinion to *Truax* v. *Corrigan* (1921), 257 U.S. 312, 354, 369–370. Add Senate hearings on S. 1482, 70th Cong. 1st Sess. (Feb.–March 1928), limiting scope of injunctions in labor disputes. (N. G.)

INK, in its widest signification, a substance employed for producing graphic tracings, inscriptions, or impressions on paper or similar materials. The term includes two distinct conditions of pigment or colouring matter; the one fluid, and prepared for use with a pen or brush, as writing ink; the other a glutinous adhesive mass, printing ink, used for transferring to paper impressions from types, engraved plates and similar surfaces.

Writing Inks.—Writing inks are fluid substances which contain colouring matter either in solution or in suspension, and commonly partly in both conditions. They may be prepared in all shades of colour, and contain almost every pigment which can be dissolved or suspended in a suitable medium. The most important of all varieties is black ink, after which red and blue are most commonly employed. Apart from colour there are special qualities which recommend certain inks for limited applications, such as marking inks, ineradicable ink, sympathetic ink, etc. A good writing ink for ordinary purposes should continue limpid, and flow freely and uniformly from the pen; it should not throw down a thick, sludgy deposit on exposure to the air; nor should a coating of mould form on its surface. It should yield distinctly legible characters immediately on writing, not fading with age; and the fluid ought to penetrate into the paper without spreading, so that the characters will neither wash out nor be readily removed by erasure. Further, it is desirable that ink should be non-poisonous, that it should as little as possible corrode steel pens, that characters traced in it should dry readily on the application of blotting paper without smearing, and that the writing should not present a glossy, varnished appearance.

Tannin inks are prepared from galls, or other sources of tannin, and a salt of iron, with the addition of some agglutinant in the case of the so-called oxidized inks, or a colouring matter in the case of unoxidized inks. Such mixtures form the staple black inks of commerce; they are essentially an insoluble iron gallate in extremely fine division held in suspension in water or a soluble compound dissolved in water. On long exposure to air, as in inkstands or otherwise, tannin inks gradually become thick and ropy, depositing a slimy sediment.

Ordinary Black Ink.—The essential ingredients of ordinary black ink are—first, tannin-yielding bodies, for which Aleppo or Chinese galls are the most eligible materials; second, a salt of iron, ferrous sulphate (green vitriol) being alone employed; and third, a gummy or mucilaginous agent to keep in suspension the insoluble tinctorial matter of the ink. For ink-making the tannin has first to be transformed into gallic acid. In the case of Aleppo galls this change takes place by fermentation when the solution of the galls is exposed to the air, the tannin splitting up into gallic acid and sugar. Chinese galls do not contain the ferment necessary for inducing this change; and to induce the process yeast must be added to their solution. To prepare a solution of Aleppo galls for ink-making, the galls are coarsely powdered, and intimately mixed with chopped straw. This mixture is thrown into a

narrow, deep oak vat, provided with a perforated false bottom, and having a tap at the bottom for drawing off liquid. Over the mixture is poured lukewarm water, which, percolating down, extracts and carries with it the tannin of the galls. The solution is drawn off and repeatedly run through the mixture to extract the whole of the tannin, the water used being in such proportion to the galls as will produce as nearly as possible a solution having 5% of tannin. The object of using straw in the extraction process is to maintain the porosity of the mixture, as powdered galls treated alone become so slimy with mucilaginous extract that liquid fails to percolate the mass. For each litre of the 5% solution about 45 grams of the iron salt are used, or about 100 parts of tannin for 90 parts of crystallized green vitriol.

These ingredients when first mixed form a clear solution, but on their exposure to the air oxidation occurs, and an insoluble blue-black ferrosoferric gallate in extremely fine division, suspended in a coloured solution of ferrous gallate, is formed. To keep the insoluble portion suspended, a mucilaginous agent is employed, and those most available are gum senegal and gum arabic. An ink so prepared develops its intensity of colour only after some exposure; and after it has partly sunk into the paper it becomes oxidized there, and so mordanted into the fibre. As the first faintness of the characters is a disadvantage, it is a common practice to add some adventitious colouring matter to give immediate distinctness, and for that purpose either extract of logwood or a solution of indigo is used. When logwood extract is employed, a smaller proportion of extract of galls is required, logwood itself containing a large percentage of tannin. For making an unoxidized or blue-black ink indigo is dissolved in strong sulphuric acid, and the ferrous sulphate, instead of being used direct, is prepared by placing in this indigo solution a proper quantity of scrap iron. To free the solution from excess of uncombined acid, chalk or powdered limestone is added, whereby the free acid is fixed and a deposit of sulphate of lime formed. A solution so prepared, mixed with a tannin solution, yields a very limpid sea-green writing fluid, and as all the constituents remain in solution no gum or other suspending medium is necessary. In consequence the ink flows freely, is easily dried and is free from the glossy appearance which arises through the use of gum.

Chinese Ink.—China ink or Indian ink is the form in which ink was earliest prepared, and in which it is still used in China and Japan for writing with small brushes instead of pens. It is extensively used by architects, engineers and artists generally, and for various special uses. China ink is prepared in the form of sticks and cakes, which are rubbed down in water for use. It consists essentially of lamp-black in very fine condition, baked up with a glutinous substance; and the finer oriental kinds are delicately perfumed.

Logwood Ink.—Under the name of chrome ink a black ink was discovered by Runge, which held out the promise of cheapness combined with many excellent qualities. It is prepared by dissolving 15 parts of extract of logwood in 900 parts of water, to which four parts of crystallized sodium carbonate are added. A further solution of one part of potassium chromate (not bichromate) in 100 parts of water is prepared, and is added very gradually to the other solution with constant agitation. The ink so obtained possesses an intense blue-black colour, flows freely and dries readily, is neutral in reaction and hence does not corrode steel pens, and adheres to and sinks into paper so that manuscripts written with it may be freely washed with a sponge without danger of smearing or spreading. It forms a good copying ink, and it possesses all the qualities essential to the best ink; but on exposure to air it very readily undergoes decomposition, the colouring matter separating in broad flakes, which swim in a clear menstruum. It is affirmed by Viedt that this drawback may be overcome by the use of soda, a method first suggested by Böttger.

Logwood forms the principal ingredient in various other black inks used especially as copying ink. A very strong decoction of logwood or a strong solution of the extract with ammonium-alum yields a violet ink which darkens slowly on exposure. Such an ink is costly, on account of the concentrated condition in which the logwood must be used. If, however, a metallic salt is introduced, a serviceable ink is obtained with the expenditure of much less logwood. Either sulphate of copper or sulphate of iron may be used, but the former, which produces a pleasing blue-black colour, is to be preferred.

Aniline Inks.—Solutions of aniline dyestuffs in water are widely used as inks, especially coloured varieties. They are usually fugitive. Nigrosine is a black ink, which, although not producing a black so intense as common ink, possesses various advantages. Being perfectly neutral, it does not attack pens; it can easily be kept of a proper consistency by making up with water; and its colour is not injuriously affected by the action of acids. Its ready flow from stylographic pens led to the name "stylographic ink." Other aniline inks are mentioned below.

Ink which yields by means of pressure an impression, on a sheet of damped tissue paper, of characters written in it is called copying ink. Any ink soluble in water, or which retains a certain degree of solubility, may be used as copying ink. Runge's chrome ink, being a soluble compound, is, therefore, so available; and the other logwood inks as well as the ordinary ferrous gallate inks contain also soluble constituents, and are essentially soluble till they are oxidized in and on the paper after exposure to the air. To render these available as copying inks it is necessary to add to them a substance which will retard the oxidizing effect of the air for some time. For this purpose the bodies most serviceable are gum arabic or senegal, with glycerin, dextrin or sugar, which last, however, renders the ink sticky. These substances act by forming a kind of glaze or varnish over the surface of the ink which excludes the air. At the same time when the damp sheet of tissue paper is applied to the writing, they dissolve and allow a portion of the yet soluble ink to be absorbed by the moistened tissue. As copying ink has to yield two or more impressions, it is necessary that it should be made stronger, *i.e.*, that it should contain more pigment or body than common ink. It, therefore, is prepared with from 30 to 40% less of water than non-copying kinds; but otherwise, except in the presence of the ingredients above mentioned, the inks are the same. Copying ink pencils consist of a base of graphite and kaolin impregnated with a very strong solution of an aniline colour, pressed into sticks and dried.

Red and Blue Inks.—The pigment most commonly employed as the basis of red ink is Brazil-wood. Such an ink is prepared by adding to a strong decoction of the wood a proportion of stannous chloride (tin spirits), and thickening the resulting fluid with gum arabic. In some instances alum and cream of tartar are used instead of the stannous chloride. Cochineal is also employed as the tinctorial basis of red ink; but, while the resulting fluid is much more brilliant than that obtained from Brazil-wood, it is not so permanent. A very brilliant red ink may be prepared by dissolving carmine in a solution of ammonia, but this preparation must be kept in closely stoppered bottles. A useful red ink may also be made by dissolving the rosein of Brook, Simpson and Spiller in water, in the proportion of one to from 150 to 200 parts.

For the production of blue ink the pigment principally used is Prussian blue. It is first digested for two or three days with either strong hydrochloric acid, sulphuric acid or nitric acid, the digested mass is next very largely diluted with water, and after settling the supernatant liquid is siphoned away from the sediment. This sediment is repeatedly washed, till all traces of iron and free acid disappear from the water used, after which it is dried and mixed with oxalic acid in the proportion of eight parts of Prussian blue to one of the acid, and in this condition the material is ready for dissolving in water to the degree of colour intensity necessary. An aniline blue ink may be prepared by dissolving one part of bleu de Paris in from 200 to 250 parts of water.

Marking Ink.—The ink so called, used principally for marking linen, is composed of a salt of silver, usually the nitrate, dissolved in water and ammonia, with a little provisional colouring matter and gum for thickening. The colour resulting from the silver salt is developed by heat and light; and the stain it makes, although exceedingly obstinate, gradually becomes a faint brownish-yellow. Many vegetable juices, *e.g.*, of *Coriaria thymifolia*, *Semecarpus anacardium*, *Anacardium occidentale* (Cashew), are inks of this type.

Gold and silver inks are writing fluids in which gold and silver, or imitations of these metals, are suspended in a state of fine division. In place of gold, Dutch leaf or mosaic gold is frequently substituted, and bronze powders are used for preparing a similar kind of ink. The metallic foil is first carefully triturated into a fine paste with honey, after which it is boiled in water containing a little alkali, and then repeatedly washed in hot water and dried at a gentle heat. A solution is prepared consisting of one part of pure gum arabic and one part of soluble potash glass in four parts of distilled water, into which the requisite quantity of the metallic powder prepared is introduced. Owing to the superior covering nature of pure gold, less of the metal is required than is necessary in the case of silver and other foils. In general one part of foil to three or four parts of solution is sufficient. The metallic lustre of writing done with this solution may be greatly heightened by gently polishing with a burnishing point. Another gold ink depends upon the formation of purple of Cassius; the linen is mordanted with stannous chloride, and the gold applied as a gummy solution of the chloride.

Indelible or incorrodible ink is the name given to various combinations of lamp-black or other carbonaceous material with resinous substances used for writing which is exposed to the weather or to the action of strong acids or alkaline solutions. An ink having great resisting powers may be conveniently prepared by rubbing down Indian ink in common ink till the mixture flows easily from the pen. Other combinations have more the character of coloured varnishes.

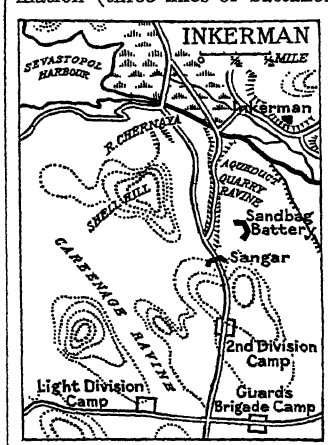
Sympathetic inks are preparations used for forming characters which only become visible on the application of heat or of some chemical reagent. Many chemicals which form in themselves colourless solutions, but which develop colour under the influence of reagents, may be used as sympathetic ink, but they are of little practical utility. Characters written in a weak solution of galls develop a dark colour on being treated with a solution of copperas; or, vice versa, the writing may be done in copperas and developed by the galls solution. Writing done in various preparations develops colour on heating which fades as the paper cools. Among such substances are solutions of the chlorides of cobalt and of nickel. Very dilute solutions of the mineral acids and of common salt and a solution of equal parts of sulphate of copper and sal-ammoniac act similarly. Writing with rice water and developing with iodine was a device much used during the Indian Mutiny.

Printing Inks.—Printing inks are essentially mixtures of a pigment and a varnish. The varnish is prepared from linseed oil, rosin and soap; the oil must be as old as possible; the rosin may be black or amber; and the soap, which is indispensable since it causes the ink to adhere uniformly to the type and also to leave the type clean after taking an impression, is yellow, or turpentine soap for dark inks, and curd soap for light inks. The varnish is prepared as follows: The oil is carefully heated until it "strings" properly, *i.e.*, a drop removed from the vessel on a rod, when placed upon a plate and the rod drawn away, forms a thread about ½in. long. The rosin is carefully and slowly added and the mixture well stirred. The soap is then stirred in. The ink is prepared by mixing the varnish with the pigment, and grinding the mass to impalpable fineness either in a levigating mill or by a stone and muller. For black ink, lamp-black mixed with a little indigo or Prussian blue is the pigment employed; for wood engravings it may be mixed with ivory black, and for copper plates with ivory or Frankfurt black; for lithographic reproductions Paris black is used. Red inks are made with carmine or cochineal; red lead is used in cheap inks, but it rapidly blackens. Blue inks are made with indigo or Prussian blue; yellow with lead chromate or yellow ochre; green is made by mixing yellow and blue; and purple by mixing red and blue.

INKBERRY (*Ilex glabra*), a North American shrub of the holly genus (family Aquifoliaceae), known also as evergreen winter-berry and Appalachian tea, native to sandy soil from Nova Scotia to Florida and west to Louisiana, mostly near the coast. It is a small shrub, 2 ft. to 6 ft. high, with leathery, evergreen, oblong, usually slightly toothed leaves; small white flowers, solitary or sometimes two or three together, borne on short slender stalks in the axils of the leaves, and black berry-like (drupe), about ⅜ in. in diameter, ripening in autumn. Among other plants called ink-berry are the West Indian indigo-berry (*Randia aculeata*) and the widely distributed poke-berry (*Phytolacca decandra*). The Australian or Queensland ink-berry is *Mollinedia macrophylla*, a plant of the family Monimiaceae. (*See* HOLLY; POKE-BERRY.)

INKERMAN, BATTLE OF, fought on Nov. 5, 1854, between a portion of the allied British and French army besieging Sevastopol and a Russian army under Prince Menshikov (*see* CRIMEAN WAR). This battle derives its name from a ruin on the northern bank of the river Tchernaya near its mouth, but it was fought some distance away, on a nameless ridge (styled Mt. Inkerman after the event) between the Tchernaya and the Careenage Ravine, which latter marked the right of the siege-works directed against Sevastopol itself. Part of this ridge was occupied by the British, while farther to the south a French corps under General Bosquet was posted to cover the rear of the besiegers. The Russians arranged for a combined attack on the ridge by part of Menshikov's army (16,000) and a corps (19,000) that was to issue from Sevastopol. This attack was to have, beside its own field artillery, the support of 54 heavy guns, and the Russian left wing on the Balaklava battleground was to keep Bosquet occupied. If successful, the attack on the ridge was to be the signal for a general attack all along the line. It was apparently intended by Menshikov that the column from the field army should attack the position from the north, and that the Sevastopol column should advance along the west side of the Careenage Ravine. But he only appointed a commander to take charge of both columns at the last moment, and the want of a clear understanding as to what was to be done militated against success from the first. Soimonov, with the Sevastopol column, assembling his troops before dawn, led them on to the upland east of Careenage Ravine, while the field army column, under Pavlov, crossed the Tchernaya near its mouth, almost at right angles to Soimonov's line of advance.

The British troops on or near the ground were the 2nd Division, 3,000, encamped on the ridge; Codrington's brigade of the Light Division, 1,400, on the slopes west of the Careenage Ravine; and the Guards Brigade, 1,350, about ¾m. in rear of the 2nd Division camp. No other forces, French or British, were within 2m. except another part of Sir George Brown's Light Division. A mist overhung the field and the hillsides were slippery with mud. Soimonov, with his whole force deployed in a normal attack formation (three lines of battalion columns covered by a few hundred skirmishers) pushed forward along the ridge (6 A.M.) without waiting for Pavlov or for Dannenberg, the officer appointed to command the whole force. Shell Hill, guarded only by a picquet, was seized at once. The heavy guns that had been brought from the fortress were placed in position on this hill, and opened fire (7 A.M.) on the knoll, 1,400 yds. to the south, behind which the 2nd Division was encamped. The Russian infantry halted for the guns to prepare the way, and the heavy projectiles both swept the crest of the British knoll and destroyed the camp in rear.



But already General Pennefather, commanding the division, had pushed forward one body of his infantry after another down the forward slope, near the foot of which they encountered the Russians in great force. On his side, Soimonov had been compelled to break up his regular lines of columns at the narrowest part of the ridge and to push his battalions forward a few at a time. This and the broken character of the ground made the battle even in the beginning a mêlée. The mist, which had at first allowed the big battalions to approach unobserved, now favoured the weaker side. Soimonov himself, however, formed up some

9,000 men, who drove back the British left wing—for the whole of Pennefather's force at the time was no more than 3,600 men. But the right wing, not as yet attacked, either by Soimonov or by Pavlov, held on to its positions on the forward slope, and a column of Russian sailors and marines, who had been placed under Soimonov's command and had moved up the Careenage Ravine to turn the British left, were caught, just as they emerged on to the plateau in rear of Pennefather's line, between two bodies of British troops hurrying to the scene of action. On the front, too, the Russian attack came to a standstill and ebbed, for Soimonov's overcrowded battalions jostled one another and dissolved on the narrow and broken plateau. Soimonov himself was killed, and the disciplined confidence and steady volleys of the defenders dominated the chaotic *élan* of the Russians. Thus 3,300 defenders were able to repulse and even to "expunge from the battlefield" the whole of the Sevastopol column, except that portion of it which drifted away to its left and joined Pavlov. This stage of the battle had lasted about 40 minutes. But, brilliant as was this overture, it is the second stage of the battle that gives it its epic interest.

The first attack made by Pavlov's advanced guard, aided by parts of Soimonov's corps, was relatively slight, but General Dannenberg now arrived on the field, and arranged for an assault on the British centre and right, to be delivered by 10,000 men (half his intact forces) chiefly by way of the Quarry Ravine, the attack to be prepared by the guns of Shell Hill. Pennefather had been reinforced by the Guards Brigade and a few smaller units. Not the least extraordinary feature of the battle that followed is the part played by a sangar of stones at the head of Quarry Ravine and a small battery, called the Sandbag Battery, made as a temporary emplacement for two heavy guns a few days before. The guns had done their work and been sent back whence they came. Nevertheless, these two insignificant works, as points to hold and lines to defend on an otherwise featureless battlefield, became the centres of gravity of the battle.

The sangar at first fell into the hands of the Russians, but they were soon ejected, and small British detachments reoccupied and held it, while the various Russian attacks flowed up and past it and ebbed back into the Quarry Ravine. Possession of the Sandbag Battery was far more fiercely contested. The right wing was defended by some 700 men of the 2nd Division, who were reinforced by 1,300 of the Guards. The line of defence adjacent to the battery looked downhill for about 300yd., giving a clear field of fire for the new Enfield rifle the British carried; but a sharp break in the slope beyond that range gave the assailants plenty of "dead ground" on which to form up. For a time, therefore, the battle was a series of attacks, delivered with great fierceness by the main body of Pavlov's corps, the repulse of each being followed by the disappearance of the assailants. But the arrival of part of the British 4th Division under Sir George Cathcart gave the impulse for a counter-attack. Most of the division indeed had to be used to patch up the weaker parts of the line, but Cathcart himself with about 400 men worked his way along the lower and steeper part of the eastern slope so as to take the assailants of the battery in flank.

He had not proceeded far, however, when a body of Russians moving higher up descended upon the small British corps and scattered it, Cathcart himself being killed. Other counter-strokes that his arrival had inspired were at the same time made from different parts of the defensive front, and had the effect of breaking up what was a solid line into a number of disconnected bands, each fighting for its life in the midst of the enemy. The crest of the position was laid open and parts of the Russian right wing seized it. But they were flung back to the lower slopes of the Quarry Ravine by the leading French regiment sent by Bosquet. This regiment was quickly followed by others. The last great assault was delivered with more precision, if with less fury than the others, and had Dannenberg chosen to employ the 9,000 bayonets of his reserve, who stood idle throughout the day, to support the 6,000 half-spent troops who made the attack, it would probably have been successful.

As it was, supported by the heavy guns on Shell Hill, the assailants, though no longer more than slightly superior in numbers, carried not only the sangar, but part of the crest line of the allied position. But they were driven back into the Quarry Ravine, and, relieving the exhausted British, the French took up the defence along the edge of the ravine, which, though still not without severe fighting, they maintained till the close of the battle. Inkerman, however, was not a drawn battle. The allied field artillery, reinforced by two long 18-pr. guns of the British siege train and assisted by the bold advance of two French horse-artillery batteries which galloped down the forward slope and engaged the Russians at close range, gained the upper hand. Last of all, the dominant guns on Shell Hill thus silenced, the resolute advance of a handful of British infantry decided the day, and the Russians retreated. The final shots were fired about 1.30 P.M.

The total British force engaged was 8,500, of whom 2,357 were killed and wounded. The French lost 939 out of about 7,000 who came on to the field, though not all these were engaged. The Russians are said to have lost 11,000 out of about 42,000 present. The percentage (27·7) of loss sustained by the British is sufficient evidence of the intensity of the conflict, and provides a convincing answer to certain writers who have represented the battle as chiefly a French affair. On the other hand, the reproaches addressed by some British writers to General Bosquet for not promptly supporting the troops at Inkerman with his whole strength are equally unjustifiable, for apparently Sir George Brown and Sir George Cathcart both declined his first offers of support, and he had Prince Gorchakov with at least 20,000 Russians in his own immediate front. He would therefore have risked the failure of his own mission in order to take part in a battle where his intervention was not, so far as he could tell, of vital importance. When Lord Raglan definitely asked him for support, he gave it willingly and eagerly, sending his troops up at the double, and it must be remembered that several British divisions took no part in the action for the same reason that actuated Bosquet. But, in spite of the seemingly inevitable controversies attendant on an "allied" battle, it is now generally admitted that, as a "soldiers' battle," Inkerman is scarcely to be surpassed in modern history.

INLAND REVENUE, BOARD OF. The period following the English Revolution of 1688 is on many accounts notable in the history of British public finance. Taxation, in particular, under the pressure of war with France, was reorganized in extent and character. In 1689 the Excise Board was reconstituted. Stamp duties were imposed and a Board of Stamps formed in 1694. A new tax on the yearly value of property, first imposed in 1692, was continued from 1697 by annual acts. For this, the ancient machinery for a time sufficed under which commissioners for divisions of every country had raised "aids" voted by parliament. A Board of Taxes was appointed in 1718. In 1797 Great Britain and Ireland were covered by six boards, of excise, stamps and taxes severally. Three excise boards were united in 1823. Ten years later stamps and taxes passed under joint administration. Finally, in 1849, the first Board of Inland Revenue embraced excise, stamps and taxes. In 1909 the excise passed to the Board of Customs, the Board of Inland Revenue retaining its title.

The board is constituted by letters patent, and consists of a chairman, a deputy chairman and three commissioners who are secretaries of the department and commissioners *ex officio*. The office is at Somerset House, London.

Scope and Functions.—The following are the sources of inland revenue:—

1. *Stamp Duties.* On documents of various kinds, which are inadmissible in evidence unless duly stamped.

2. *The "Death Duties."* These are stamp duties on documents connected with the administration of estates by executors and next of kin, or the receipt of property by beneficiaries. They comprise the estate duty, which is a tax on the capital value of property passing upon death, together with the legacy and succession duties.

3. *Income Tax and Super Tax.* The former is a flat-rate tax upon annual income or profits, as such. The latter is a surtax at rates graduated by reference to total income of the individual where this exceeds a certain sum. The surtax on the more affluent,

and a system of personal allowances and reliefs which effectively reduce the burden on smaller incomes, form the means of adjusting the incidence upon individuals. Other taxes included in inland revenue are comparatively insignificant.

In relation to income tax and the super tax, or surtax, the functions of the department extend to Great Britain and Northern Ireland; otherwise, to Great Britain alone.

Organization and Methods.—Stamp duties on documents requiring assessment are ascertained in the branch of the controller of stamps, at Somerset House. In commercial practice, the proper duty is often clear, and in such cases the document is normally drawn on stamped material. The stamps are for the most part impressed by means of dies, but adhesive stamps may be employed in certain cases. The death duties are assessed in the estate duty office at Somerset House.

Income Tax Methods.—Income tax is assessed locally. The income tax when imposed in 1842 was a lineal successor of the annual property tax of 1697. Local assessment was an inherited feature of the tax, which was, and still is, assessed by honorary commissioners for divisions of each county, with a surveyor of taxes intervening to safeguard the Crown. Appeals against assessments are also determined by these commissioners, and their functions in this respect constitute the most valuable and responsible part of their duties. Modern conditions have rendered the ascertainment of taxable profits often highly intricate, and liability is wherever possible, agreed by the surveyor (now the inspector) of taxes, before assessment. The tax inspectorate, organized in district offices, forms a branch under the direction of the chief inspector of taxes at Somerset House.

The district inspectors are also concerned in the reduction by the local commissioners where necessary, of income tax assessments, in carrying out the allowances and reliefs due to individual taxpayers, and in repayments. Income tax upon profits, being charged upon the business by which the profits are earned, is deducted from interest and dividends before receipt by the taxpayer (*collection "at the source"*) who therefore in numerous cases requires repayment.

Certain income tax assessments and all super tax, or surtax, assessments are made by the special commissioners of income tax, a body appointed by the Treasury. The basis of liability for super tax is income tax liability already determined, and the inspector of taxes therefore does not intervene. The special commissioners also determine appeals against assessments, and exercise their most important functions in this judicial capacity. As a judicial body the special commissioners, like the local commissioners, are independent of the Board of Inland Revenue.

In addition to the system of income tax and super tax appeals, there exists appropriate machinery for determination of all cases of disputed liability to revenue duties. The procedure issues ultimately in reference, where and so far as necessary, to the law Courts. A legal branch is maintained under the solicitor of inland revenue.

Payment of duties other than income tax is made direct to the department. Income tax is largely gathered by collectors, appointed locally. The accountant-general at Somerset House receives and makes payments, keeps necessary accounts and controls repayments and all expenditure. A valuation office is employed to value lands, tenements and hereditaments upon which death duties are payable. The branch of the director of stamping at Somerset House is responsible for the mechanical work of producing revenue stamps, and constitutes a factory of moderate size. A central office at Edinburgh, under the comptroller of stamps and taxes, Scotland, performs duties corresponding to those of the executive and accounting branches in London.

A report made by the board is annually laid before parliament. All accounts are audited by the comptroller and auditor-general, who is independent both of the department and of the Treasury.

The total cost of inland revenue services represents some 1·7% of the gross receipts. (*See* ESTATE DUTIES; INCOME TAX.)

BIBLIOGRAPHY.—*Reports of the Commissioners of Inland Revenue* (1857 and annually); *Report and Minutes of Evidence of Royal Commission on Income Tax* (1920). (W. V. BR.)

INLAND REVENUE DUTIES. These duties are described under the headings ESTATE DUTIES; INCOME TAX; DEATH DUTIES; STAMP DUTIES; LAND TAXES, etc.; *see* also the relevant sections of the articles GREAT BRITAIN and UNITED STATES.

INLAND WATER TRANSPORT. Transport by navigable waterways in the last years before the World War reached very high figures indeed. In 1875, 10,400,000 tons were carried by water in Germany; in 1910, 64,750,000 tons. The bulk of the increase was on the large rivers and canals; the less important waterways showed no advance, and in some cases actually a falling-off. In the Netherlands and Belgium the ports of Rotterdam, Amsterdam and Antwerp benefited by the great development of Rhenish industry in Germany, the Rhine being admirably suited for carrying both ores and coal. In the riparian states of the Danube the movement of industrial products downstream and of cereals and oil upstream has produced a similar increase in waterborne traffic.

This general development of traffic by navigable waterways everywhere led to the undertaking of important hydraulic work in the construction of new waterways and the improvement of existing ones. Steps were taken to regulate and canalize rivers; canals were cut to link up important rivers; existing canals were enlarged so as to be navigable by vessels of larger tonnage; and gradually a whole network of navigable waterways has spread over central and western Europe. The total length of the navigable waterways in France before the war was more than 11,000 kilometres. In Germany it exceeded 10,000. The capacity of the German waterways was on the whole greater than that of the French, since many of the canals in France were navigable only for vessels of 300 tons or less.

Effects of the War.—The World War interrupted the development of inland navigation, and its termination was followed by a transport crisis due mainly to the disorganization of the railways through the wear and tear of rolling stock and rails, and the destruction of considerable portions of tracks and railway installations. Normal currents of traffic had to be re-established, and demobilization raised a difficult transport problem. Even the full use of navigable waterways was insufficient to meet immediate requirements. The destruction of many waterways with their works (bridges, locks, etc.) and of many vessels used in inland navigation, helped to make matters more difficult. But repairs were fairly quickly effected and in 1920–21, indeed, when the railway crisis was still acute in consequence of a shortage of rolling stock, there was a surplus of inland navigation tonnage owing to the considerable increase in freights due to the rise in the cost of living. Governments avoided or took measures to prevent any great increase in railway rates until the existence of large deficits showed that it was necessary to adapt rates to the increased expenditure. Navigation, on the other hand, being entirely in the hands of private individuals, had to adapt itself immediately to the increased working expenses.

Furthermore, governments in some cases used the railways to establish new currents of transport, which had become desirable in consequence of altered frontiers, or to help national seaports to compete with foreign seaports. Sometimes, too, by instituting competitive rates on the railways, governments tried to obtain larger receipts which would enable them to meet the deficit of the railway budget. Another factor which unfavourably affected the financial results of inland navigation concerns was the absence of proper upkeep of the waterways during the years 1914–18. Rivers which require constant attention suffered to a large extent in this respect, and it proved impossible to employ the rivercraft to their full capacity.

But the main cause of the bad conditions of inland navigation after the war was that financial and economic crises, the instability of the exchanges, and general impoverishment did not allow the resumption of transport which had been expected. Nevertheless, general improvement gradually took place.

In France the total amount of goods carried on rivers and canals, which was 41,896,754 tons in 1913, was only 21,500,000 in 1920. In 1924 the figure had risen to 36,758,000 tons, traffic assuming large dimensions in the north of France, especially in

regard to the port of Strasbourg. The following figures for the port of Paris may be noted: in 1913, 4,786,649 tons were loaded and 11,709,824 tons unloaded; the figures for 1924 were respectively 2,769,166 tons and 10.221,228 tons.

The total traffic for the Rhine, which in 1913 was 54,562,574 tons, had fallen in 1918 to 25,608,609 tons and by 1923 as low as 16,608,609 tons. In that year—a quite abnormal one, certainly, owing to the Ruhr occupation—traffic through the port of Duisburg-Ruhrort, which in 1913 was about 26,000,000 tons, and which was still 14,000,000 tons in 1922, fell to 3,980,412 tons.

The situation is exactly the same as regards traffic across the German-Dutch frontier near Lobith. Over 37,000,000 tons in 1913, it fell in 1918 to scarcely 5,000,000 tons, but by 1924 had risen again to 23,000,000 and in 1925 to about 40,000,000 tons. In 1926 (year of British coal strike) the traffic amounted to 52,000,000 tons of which nearly 38,000,000 was downstream.

On the Danube, in 1911, the total movement of goods was 6,802,639 tons and, in 1924, 3,757,010 tons. The year 1925 showed a considerable increase in traffic.

The same effects are observable in Russia, although, in this case, it is necessary to take account of the great disturbance caused by the collapse of the Tsarist régime in 1917 and the ensuing civil war, and the famine which ravaged the Volga basin in 1921. In 1913 the total weight of goods carried by water amounted to 2,281,900,000 pouds (approx. 38,000,000 tons), of which corn accounted for 229,000,000 pouds. In 1920 the total figure had fallen to 665,500,000 pouds. The corresponding figure for corn is negligible. For 1925 the total figure was, according to official statements, 1,405,200,000 pouds.

IMPROVEMENT SCHEMES

The question in relation to the improvement of navigable waterways was resumed after the war and, although many big schemes can hardly be expected to materialize, it is none the less true that a large number of far-reaching plans are already in course of being realized, or are ripe for execution.

Rhône-Rhine Navigation.—The navigable waterway which the canalization of the Rhône would establish from Marseilles through Lyons and Geneva (if the French and Swiss governments agreed about the régime for the Lake of Geneva), might be of first-class importance for traffic to Switzerland, and the eventual continuation of this waterway through Switzerland by the canal known as Entreroches (a scheme warmly supported by the Swiss Assn. for Rhône-Rhine Navigation), would increase its importance. This scheme for a navigable waterway between the Rhône and the Rhine through Switzerland seems still immature.

Rhine Navigation.—The second large scheme prepared by the French Government is for the great Alsace canal between Huningue and Strasbourg. This canal, which will serve both for navigation and the supply of water-power, is to follow a course nearly parallel to the Rhine over a distance of about 114 kilometres. The plan involves the erection of a weir across the Rhine bed. Further, eight power stations will be constructed on the canal and two locks placed at each station. The dimensions of this waterway would allow barges of 1,200 tons, normal type on the Upper Rhine above Mannheim. The scheme for this canal required the approval of the Central Commission for Rhine Navigation. After giving its consent to the construction of the first reach of the canal in 1922, the commission in April 1925 approved the scheme for the seven other reaches subject to certain conditions.

Switzerland has prepared a scheme for the regulation of the Rhine between Strasbourg and Basel. This scheme has also been conditionally approved by the Central Rhine Commission, and the work may therefore shortly be put in hand (*see* RHINE).

Communication from the Rhine to Antwerp.—A clause in the Treaty of Versailles provides for the possible construction of a deep-draught canal from Antwerp to the Meuse and the Rhine, ending in the neighbourhood of Ruhrort. The early execution of this scheme is unlikely because of the considerable expenditure involved, and also owing to the fact that the consent of Holland is necessary. The right solution for the improvement of the communication with Antwerp seems to be an Antwerp-Moerdijk canal, as was provided for in the Dutch-Belgian Treaty, which was, however, rejected by the First Chamber of the Dutch Parliament. Fresh negotiations have been entered into by the parties concerned and will undoubtedly permit of a satisfactory solution. It seems indicated that the new communication between Antwerp and the Rhine should be navigable for the large Rhine barges, that is to say for vessels up to 3,000 tons.

Meuse Canalization.—In the Netherlands the most important scheme now being carried out is the canalization of the Meuse on Dutch territory, which further involves a junction canal between the Meuse and the Waal and the Juliana canal from Maasbracht southwards, the latter intended to link up the mining centre with the navigable waterways of the country. The canalized Meuse will be navigable for boats of 2,000 tons. Locks 260 metres long will be able to take a tug and two barges of 2,000 tons each. The Meuse-Waal canal will be navigable for boats of the same tonnage.

Completion of Rhine-Vistula System.—In Germany two large schemes are being carried out. The Mittelland canal, which will connect Hanover with the Elbe near Magdeburg, will establish an uninterrupted navigable waterway between the Rhine and the Vistula. This canal will form the last section of the waterway begun with the construction of the Dortmund-Ems canal between 1889 and 1899, followed by the Rhine-Herne canal, opened in 1914, and the Bevergern-Misburg canal constructed during the War. The last-mentioned canal, which is 172km. long, is without locks. The total length without locks, including certain parts of adjacent canals, is no less than 213 kilometres. The Mittelland canal will be navigable for boats of 1,000 tons. It will cross the Elbe by a bridge, the plans for which have been submitted for the approval of the International Elbe Commission.

Rhine-Main-Danube Connection.—The second important scheme in process of execution is the junction between the Rhine, the Main and the Danube. The idea of linking up the Rhine and the Danube is a very old one. Charlemagne conceived the idea of constructing a canal, traces of which can still be seen. The Ludwig canal, opened in 1846, was only navigable by small boats up to 120 tons and has never been much used. It is anticipated that the area tapped by the Rhine-Main-Danube navigable waterway will exceed that of any other European river and canal system. The scheme involves the canalization of the Main, the construction of lateral canals and of a junction canal between the Main and the Danube, joining up with the latter near Kelheim. It also necessitates the regulation of the Danube between Regensburg and Hofkirchen, and between Passau and the frontier and in addition its canalization over the stretch between Hofkirchen and Passau, that is to say, in the Bavarian Kachlet. The waterway will be navigable for canal barges of 1,200 tons and for Rhine barges up to 1,500 tons. The scheme also provides for the utilization of hydraulic power; in fact, it is the production of electric power that has made the scheme practicable.

Other German Schemes.—Among the other plans for the construction of canals in Germany, such as the Hansa canal, the canal from the Weser to the Main, the Kuesten-Kanal and the junction canal between Neckar and Danube, only the last deserves serious consideration at present. The canalization of the Neckar might be of considerable value for the development of navigation and for the port of Mannheim. At one time it seemed that, mainly for political reasons, opinion in Germany was in favour of constructing the Weser-Main canal (the Weser being the only important river which has escaped internationalization) in order to direct part of the traffic from the Danube to Bremen, after the construction of the Main-Danube canal. The Weser could also carry some of the traffic normally carried by the Rhine and the Elbe. But the changed political situation makes it improbable that this scheme will be put into effect at any early date.

Italian Waterways.—In Italy a canal has been constructed from the Po to Brondolo on the Lagoon of Venice. A canal is also in course of construction from Milan to the confluence of the Adda and the Po, whereby Milan will be linked by waterway to Venice.

Czechoslovakian Waterways.—In Czechoslovakia, besides canalization work on the Elbe and the Moldau and the regulation of the Danube, the Government has carefully considered two canal

schemes, an Elbe-Danube canal and an Elbe-Oder canal navigable for vessels of 1,200 tons. The length of the Elbe-Danube canal would be about 300 kilometres. Its course would follow as far as possible the line of the most important towns. Financial considerations are retarding the execution of these schemes.

Polish Waterways.—At the request of the Polish Government the League of Nations Committee for Communications and Transit appointed three engineers (Case, *United States*, Nijhoff, *Netherlands*, Watier, *France*), to study the plan for a coal canal between the mining district of Upper Silesia and the mouth of the Vistula, and also the general problem of the development of the Polish navigable waterways considered as a whole, in particular the best technical methods for regulating the Vistula and for the construction of the East to West canal. The Committee of Engineers did not recommend the immediate construction of a coal canal, but urged the complete improvement of the Vistula, including a lateral canal from the coal basin to the Cracow district, prolonged by canalization of the river to the confluence of the San, and then, by regulation of the remainder of the river to its mouth. It was further recommended that work should be started on the Warta-Lake Goplo canal and on the great waterway Bug-Pripet. The entire East to West Branch will consist of the canalized Notec, the Bydgoszcz canal, the Brda, the Vistula up to Modlin, the Bug-Narev, the canalized Muchawiec, the improved Royal canal and the regulated Pripet. The latter would link up this waterway with the great navigable system of Russia through the Dnieper.

The Russian System.—The Russian rivers which are naturally navigable have suffered but little from the lack of upkeep in the course of the last 10 years. The proposal to construct the Rostov canal to unite the Volga and the Don may be carried into effect, though there are great technical difficulties in the way of this scheme. Its completion would reduce the cost of transport of oil from Baku, fish from Astrakhan, corn from the valleys of the Volga and the Kama, coal from the Donetz and merchandise from Persia. The importance of the proposed canal is obvious, as the immense system of the Volga, which is navigable for more than 16,000km., will thus be linked up with the Black sea, and the Baltic, Black and Caspian seas will be connected by navigable waterways. There is already a service between Leningrad via the Mariinsky system and the Volga to Astrakhan and thence to the Persian port of Enzeli. The immense territory of Russia may become of capital importance in the future from the point of view of inland waterway communications. The system of waterways is more than 200,000km. in length, of which at present some 40,000 are navigable. The Asiatic Russian system from the Ob-Yenesei mouths to Central Asia and Lake Baikal lies outside the scope of this article.

VALUE OF WATERWAYS

Economic considerations will play a part in decisions that may be taken for the improvement of existing waterways or the construction of new ones. The question will inevitably arise whether a railway would not prove more serviceable than a waterway. The preference will clearly go to whichever mode of transport is cheaper. In comparing the advantages of waterways and railways, we must distinguish between rivers and canals; and we must further discriminate between canals built across flat country and those constructed across land where there are marked differences in level.

Rivers not naturally navigable may generally be rendered navigable by regulation works, such as spur dikes or longitudinal dikes, or by canalization works such as the construction of dams across the bed of the river and locks to enable boats to pass. The forming of large reservoirs in the upper courses of waterways belonging to the basin of a large river may also constitute an excellent means of improving navigability by regulating the flow of water. In this way a greater minimum depth is obtained and the period of navigability during the year is lengthened.

In most cases the cost of building a railway having the same carrying capacity as a river is appreciably higher than the cost of making the river sufficiently navigable. Moreover, the cost of river-craft having a given loading capacity is less than that of railway rolling stock having the same capacity. Further, the haulage power of a locomotive is only a small fraction of that of a tug. This argument remains true even if a proper use of a waterway involves the execution of improvement works. Moreover, the economic development of the area served by the river leads to a considerable increase in passenger and parcels traffic, for which the railway is necessarily more suitable than the waterway, so that we always find railway lines alongside the river, connecting up the various important centres situated thereon. The argument that a river can compete with a railway holds good even if the traffic does not, strictly speaking, consist of heavy goods, such as ores or coal. The Danube is a case in point; before the World War the volume of traffic on that river amounted to nearly 7,000,000 tons.

The case is different, however, if it is an artificial navigable waterway, *i.e.*, a canal, which has to be built. As a rule such a work is not justified from the economic point of view unless the prospective traffic in heavy goods (ores, coal, building material, cereals and certain other agricultural products) is to amount to several million tons per annum. In order to determine the cost price of transport by canal we have to allow for possible profits and advantages derived from the exploitation of hydraulic power, and accordingly we have to make a distinction between a canal crossing flat country and a canal built in mountainous districts. Many projects for artificial waterways have been rendered feasible by the utilization of water power. Wherever the configuration of the ground has permitted, recent schemes have combined the construction of a navigable waterway with the exploitation of hydro-electric power. The question therefore whether, in any given case, it is preferable from the economic point of view to construct a canal rather than a railway cannot be answered so readily as when the alternatives are a railway and a river; the answer depends upon a very large number of factors.

International Rivers.—A special category of waterways is constituted by those which come under the scope of the Convention on the Régime of Navigable Waterways of International Concern concluded at Barcelona on April 20, 1921. The criteria adopted at Barcelona were the fact of crossing or separating a number of countries, and natural navigability to and from the sea. In addition to the obligations which devolve upon riparian states, particularly in connection with works of upkeep, the Barcelona Convention lays down the principle of freedom of navigation and equality of treatment for all flags.

The objection has sometimes been raised that two different ideas have been confused, namely, the territorial idea and the idea of international traffic. It is clear that if it is in the interest of international traffic that there should be no flag discrimination, this principle applies wherever international navigation is carried on, independent of whether the navigable waterway crosses or separates several States or not.

On the other hand it is only natural that, as regards international rivers, there was a desire to impose certain strict obligations on riparian States in connection with the hydraulic works to be carried out; these obligations, however, should rather be regarded as reciprocal obligations between riparian States. It would seem not impossible by drawing a clear distinction between the territorial idea and the idea of international traffic to lay down, for all navigable waterways on which international traffic can be carried on, contractual provisions similar to those which have been drawn up for maritime ports.

In the application of the Barcelona Statute, the following are declared to be navigable waterways of international concern:

1. All parts which are naturally navigable to and from the sea of a waterway which in its course, naturally navigable to and from the sea, separates or traverses different States, and also any part of any other waterway naturally navigable to and from the sea, which connects with the sea a waterway naturally navigable which separates or traverses different States.

It is understood that:

(a) Trans-shipment from one vessel to another is not excluded by the words "navigable to and from the sea";

(b) Any natural waterway or part of a natural waterway is termed "naturally navigable" if now used for ordinary commercial navigation,

or capable by reason of its natural conditions of being so used; by "ordinary commercial navigation" is to be understood navigation which, in view of the economic condition of the riparian countries, is commercial and normally practicable;

(c) Tributaries are to be considered as separate waterways;

(d) Lateral canals constructed in order to remedy the defects of a waterway of international concern, including its tributaries of international concern, are deemed to be "riparian States."

2. Waterways, or parts of waterways, whether natural or artificial, expressly declared to be placed under the régime of the General Convention regarding navigable waterways of international concern either in unilateral acts or the States under whose sovereignty or authority these waterways or parts of waterways are situated, or in agreements made with the consent, in particular, of such States.

Inquiry into Existing Conditions.—In accordance with a resolution of the Economic Conference of Genoa, which was approved by the Council and Assembly of the League of Nations; the Organization for Communications and Transit decided in 1924 to make inquiries of the various European governments concerned regarding the present situation of inland navigation in their respective territories. For the development of inland water transport in America *see* the articles GREAT LAKES, THE; and MISSISSIPPI RIVER. (*See* also CANALS.)

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INLAYING, a method of ornamentation by inserting in one material a substance differing therefrom in colour or composition. The art is practised in the fabrication of furniture and artistic objects in all varieties of wood, metal, shell, ivory, coloured and hard stone, and in compound substances. Forms of inlay include:

Niello (*q.v.*), is an ancient and much-practised method of inlaying silver and gold with various metals.

Demascening is the inlaying of gold wire in iron or steel.

Mosaic (*q.v.*) is generally applied to inlay work in hard stone, marble and glass, but the most important class of mosaics—those which consist of innumerable small separate pieces—do not properly come under the head of inlaying.

Pietra dura is a fine variety of inlaid mosaic in which hard and expensive stones—agate, cornelian, amethyst and the like—are used in relief.

Intarsia was originally a true inlay of one or more colours of wood upon a darker or lighter ground, and it is from this form of inlaying that marquetry and other wood inlays were developed.

Inlay and Marquetry.—Inlay is more often confined to woodwork, and the art of decorating the surfaces of furniture or wall panelling with small pieces of wood, ivory, tortoise-shell, etc., that are cut into various designs and set into the body of the surface. The term "inlay" is often confused with and sometimes used for the word "marquetry." Marquetry is composed of pieces of very thin wood, or other material of equal thickness, laid down upon a matrix with glue. Thus marquetry is a veneer process, while true inlay is what the term implies—"a laying in" of one material into another material called the "ground." Marquetry is a later development of the ornamental inlays of wood known by the name of Intarsia, which, although a true inlay as opposed to the thin veneer of marquetry, furnishes many examples wherein the process follows that of marquetry. For example in the cathedral of Ferrara, Italy, the backs of the stalls show the perspective lines of some of the subjects traced upon the ground where the marquetry has fallen off, but none of the "sinkings" would be there if the panels had been executed as true inlays instead of veneers.

Process.—The design for a panel is drawn on paper, the lines being pricked through to underlying sheets to make the necessary number of copies, or the pricked sheet is dusted over with a coloured powder which passes through the perforations and marks the design faintly on the paper underneath. The pieces of paper are then cut up and stuck on to several pieces of wood which form the design, one whole print being reserved to paste complete on to the ground or field. Each piece may be cut separately, but they are all bound to fit into the complete pattern when this is cut out of the ground, because all are cut from the same prints. In true inlay the pieces to be inserted are cut out of wood $\frac{1}{8}$ to $\frac{1}{4}$ in. thick. The surface into which these separate designs are to be set is carved out the required depth with wood-carver's tools, and the pieces making the design are driven in.

In marquetry two panels are sometimes made of the reverse colourings by sawing through the ground and the veneer at the same time. At one time it was quite a common occurrence to produce two pieces of furniture in which one was brass inlaid in the black, and in the other case the pattern was black inlaid in the brass, thus utilizing what would otherwise have been very costly waste material. Although this method of cutting through two or more pieces of wood clamped together, and simply dropping one piece into the opening made by the other, is not generally considered as fine work, many excellent inlayers like Boulle in the time of Louis XIV., did their inlay work, or marquetry, in just that way. When all the parts have been cut and fitted together face downwards, paper is glued over them to keep them in place, and the ground and the veneer are carefully levelled. The ground is then wetted with glue at a high temperature and the surfaces squeezed between the frames called *"cauls"* until the glue is hard.

History and Development.—Probably the earliest examples of inlay were found in the Venetian work of the 14th century, when wood was inlaid on ivory boxes. Other materials were used at an early date. One of the most beautiful forms of inlay executed by the Italians was with ivory upon walnut wood or black wood. In the 16th century the Italians made inlays of marble in various colours, and in the 17th century a combination of tortoise-shell and metal was not uncommon.

Most of the examples found in England are importations, either from Holland or France. The reputation of the Dutch *marqueteurs* was so great that Colbert engaged two, Pierre Gale and Vordt, for the Gobelins at the beginning of the 17th century. Jean Macé of Blois, the first Frenchman known to have practised the art, who was at work in Paris from 1644 (when he was lodged in the Louvre) or earlier, till 1672, as a sculptor and painter, learned marquetry in the Netherlands. His daughter married Pierre Boulle, and the greatest of the family, André Charles Boulle, succeeded to his lodging in the Louvre on his death in 1672. The members of this family are perhaps the best known of the French *marqueteurs.* Their greatest triumphs were gained in the marquetry of metal and tortoise-shell combined with beautifully chiselled ormolu mountings. It is thought by many that Boulle carried the work of inlaying too far. The 18th century commode of late Louis XIV. period, of tortoise-shell, mother-of-pearl and coloured ivories inlaid in brass, an example of which may be seen at South Kensington, is characteristic.

The Stuart period produced a good deal of marquetry in England, often pieces of real excellence. Long-case clocks, cabinets, chests of drawers and various other pieces of furniture were subjected to this kind of decoration. A shallower form of marquetry and some solid inlay work were also extensively used in the latter part of the 18th century. With the increase in luxury and display in the 17th and 18th centuries in France and Germany, cabinets and desks became objects upon which extraordinary talent and expenditure were lavished. Perhaps the most beautiful examples of the art in Italy are the panels of choir stalls or sacristy cupboards, though marriage coffers were also often sumptuously decorated in this manner. (F. L. D.)

INMAN, HENRY (1801–1846), American painter, was born in Utica (N.Y.), on Oct. 20, 1801. Apprenticed to the painter John W. Jarvis at the age of 14, he left him after seven years and set up for himself, painting protraits, genre and landscape. He was one of the organizers of the National Academy of Design in New York and its first vice-president (from 1826–32). As a portrait painter he was highly successful both in New York

and Philadelphia, and going to England in 1844, he had for sitters the lord chancellor (Cottenham), the poet Wordsworth, Doctor Chalmers, Lord Macaulay and others. His American sitters included President Van Buren and Chief Justice Marshall. He died in New York city on Jan. 17, 1846.

INN, a right bank tributary of the Danube. It rises in a small lake under Piz Longhino, in the Swiss canton of the Grisons. After flowing for 55 m. through the Engadine, it enters Austria at Martinsbruck, and continues as a swift mountain stream along the Inn Thal as far as Innsbruck where it enters the broader Unter Inn Thal. At Rosenheim it leaves the limestone zone of north Tirol and enters the plateau of Upper Bavaria, across which it flows to join the Danube at Passau. Its chief tributary is the Salzach on which stands the town of Salzburg. (*See* DANUBE.)

INNATE IDEAS, ideas or intellectual functions which are supposed to be inborn in, or native to, the human mind, as distinguished from those which are "acquired" in the course of experience, or are constructed by the mind on the analogy of experienced objects. The existence of innate ideas formed the subject of acute controversy in the 17th century. Herbert of Cherbury maintained the innate character of certain "common notions," such as substance, equality, etc., and axioms or "eternal truths" like "things equal to the same thing are equal to one another." Descartes likewise upheld the innate status of such ideas as those of God, substance, unity, equality, etc., and of various axioms of geometry, etc. Locke, on the other hand, denies the existence of innate ideas, and expressed his adhesion to the Aristotelian principle that all ideas are derived, directly or indirectly, from sense-experience—*nihil est in intellectu quod non prius fuerit in sensu.* He tried to refute Descartes by contending, as he well might, that there is no evidence for the existence of any full-fledged ideas in the minds of new-born infants, and that even savages are deficient in many of the ideas which Descartes considered to be innate in the human mind. Locke, however, had really misunderstood Descartes, who did not maintain that innate ideas are explicit in the human mind from birth, but only that there are in man certain *tendencies* to construct and apply certain ideas when occasion arises.

Man, as Leibnitz urged against Locke, is after all endowed from birth with an intellect so constituted as to function in certain ways in due course—*nihil est in intellectu . . . excipe nisi ipse intellectus.* Nobody now shares Locke's view that the human mind at birth is a *tabula rasa,* a blank tablet waiting passively to receive the impressions of the senses. All admit nowadays, indeed emphasize, the existence of certain native tendencies and endowments in the individual mind from birth or even sooner. But the views about their nature or previous history are various. Confining ourselves to such fundamental ideas as the so-called categories (substance, attribute, cause, effect, etc.) there is, on the one hand, the *a priori* view usually associated with the name of Kant (really much older), namely, that they are functionally inherent in the very structure of the mind, and are not derived from experience, because experience itself would be impossible without them. On the other hand, there is the empirical, evolutionary view put forward by H. Spencer, that although such ideas could not have evolved in the limited life-time of an individual, but are hereditary and so native in a sense, yet they may have been acquired from experience in the course of the vast period of the evolution of the human race. (*See* CATEGORIES, DESCARTES, KANT, LEIBNITZ.) (A. Wo.)

INNERLEITHEN, a police burgh, parish and health resort of Peeblesshire, Scotland, on Leithen Water, near its junction with the Tweed, 6½ m. S.E. of Peebles by the L.N.E. railway. Pop. (1921) 2,403. It seems once to have been known as Hornehuntersland, and to have been mentioned as early as 1159. Its chief industry is the manufacture of tweeds and other woollen goods, which, together with the fame of its medicinal springs, brought the burgh into prominence towards the end of the 18th century. The spa, alleged to be the St. Ronan's well of Scott's novel of that name, has a pump-room, well-house, etc. The town is flanked on the west by the hill fort of Caerlee and on the east by that of the Pirn. Farther east, close to the village of Walkerburn, are Purvis hill terraces, a remarkable series of earthen banks, the origin and purpose of which are unknown. Traquair house, or palace, on the right bank of the Tweed, is one of the oldest inhabited houses in Scotland, the most ancient portion dating from the 10th century, and including a remnant of the castle.

INNES, JAMES DICKSON (1887–1914), English landscape painter was born at Llanelly (Carmarthen), on Feb. 27, 1887. His mother was of Catalonian descent. He studied art at the Slade school (1905–08) and exhibited for the first time at the New English Art club in 1907. He travelled in France and Spain and exhibited his work at the Chenil gallery in 1910. He then worked with his friend, Augustus John, in Wales. In 1913 he went to Morocco. He died at Swanley on Aug. 22, 1914. His early work was influenced by W. Sickert and Wilson Steer. Later he became a follower of the post-Impressionists, while his last water-colours are in the spirit of J. S. Cotman. The Tate gallery has a number of his water-colours.

INNESS, GEORGE (1825–1894), American landscape painter, was born near Newburgh (N.Y.), on May 1, 1825. Before he was five years of age his parents had moved to New York and afterwards to Newark (N.J.), in which city his boyhood was passed. He would not "take education" at the town academy, nor was he a success as a greengrocer's boy. He had a strong bent towards art, and his parents finally placed him with a drawing-master named Barker. At 16 he went to New York to study engraving, but soon returned to Newark, where he continued sketching and painting after his own initiative. In 1843 he was again in New York, and is said to have passed a month in Gignoux's studio. But he was too impetuous, too independent in thought, to accept teaching; and, besides, the knowledge of his teachers must have been limited. Practically he was self taught, and always remained a student. In 1851 he went to Europe, and in Italy got his first glimpse of real art. He was there two years, and imbibed some traditions of the classic landscape. In 1854 he went to France, and there studied the Barbizon painters, whom he greatly admired, especially Daubigny and Rousseau. After his return to America he opened a studio in New York, then went to Medfield (Mass.), where he resided for five years. A pastoral landscape near this town inspired the characteristic painting "The Medfield Meadows." Again he went abroad and spent six years in Europe. He came back to New York in 1876, and lived there, or near there, until the year of his death, which took place at Bridge of Allan on Aug. 3, 1894, while he was travelling in Scotland. He was a National Academician, a member of the Society of American Artists, and had received many honours at home and abroad. He was married twice, his son, George Inness (b. 1854), being also a painter. Inness was emphatically a man of temperament, of moods, enthusiasms, convictions. He was fond of speculation and experiment in metaphysics and religion, as in poetry and art. Swedenborgianism, symbolism, Socialism, appealed to him as they might to a mystic or an idealist. He aspired to the perfect unities, and was impatient of structural foundations. This was his attitude towards painting. He sought the sentiment, the light, air, and colour of nature, but was put out by nature's forms. How to subordinate form without causing weakness was his problem, as it was Corot's. His early education gave him no great technical facility, so that he never was satisfied with his achievement. His was an original—a distinctly American—mind in art. Most of his American subjects were taken from New York state, New Jersey and New England. His point of view was his own. At his best he was often excellent in poetic sentiment, and superb in light, air and colour. He had several styles: at first he was somewhat grandiloquent in Roman scenes, but sombre in colour; then under French influence his brush grew looser, as in the "Grey Lowering Day"; finally he broke out in full colour and light, as in the "Niagara" and the last "Delaware Water-Gap." Some of his pictures are in American museums, but most of them are in private hands. (J. C. VAN D.)

INNOCENT (INNOCENTIUS), the name of 13 popes and one anti-pope.

INNOCENT I., pope from 402 to 417, was the son of Pope Anastasius I. During his papacy the siege of Rome by Alaric

(408) took place; the pope was, however, absent from Rome on a mission to Honorius at Ravenna at the time of the sack in 410. He maintained and extended the authority of the Roman see as the ultimate resort for the settlement of all disputes; his still extant communications to Victricius of Rouen, Exuperius of Toulouse, Alexander of Antioch and others, as well as his action on the appeal made to him by Chrysostom against Theophilus of Alexandria, are examples of his intervention. He took a decided view on the Pelagian controversy, confirming the decisions of the synod of the province of pro-consular Africa held in Carthage in 416, which had been sent to him. He wrote in the same year in a similar sense to the fathers of the Numidian synod of Mileve who, Augustine being one of their number, had addressed him. He died on March 12, 417, and in the Roman Church is commemorated as a confessor with Saints Nazarius, Celsus and Victor, martyrs, on July 28. His successor was Zosimus.

INNOCENT II. (Gregorio Paparesci dei Guidoni), pope from 1130 to 1143, was originally a Benedictine monk. His ability, pure life and political connections raised him rapidly to power. Made cardinal deacon of Sant Angelo in Pescheria by Paschal II. he was employed in various diplomatic missions. Calixtus II. appointed him one of the ambassadors who made peace with the empire and drew up the Concordat of Worms (1122), and in 1123, with his later enemy Cardinal Peter Pierleoni, he was papal legate in France. On Feb. 13, 1130, Honorius II. died, and on that night a minority of the Sacred College elected Paparesci, who took the name of Innocent II. After a hasty consecration he took refuge with a friendly noble from the supporters of Pierleoni, who was elected pope under the name of Anacletus II. by a majority of the cardinals. Innocent refused to recognize the choice; by June, however, he was obliged to flee to France. Here his title was recognized by a synod called by Bernard of Clairvaux at Étampes.

Similar action was taken in Germany by the synod of Würzburg. In Jan. 1131 Innocent met King Henry I. of England at Chartres, and in March, at Liége, the German King Lothair, whom he induced to undertake a campaign against Anacletus. The German army invaded Italy in Aug. 1132, and occupied all Rome except St. Peter's church and the castle of St. Angelo. Lothair was crowned emperor at the Lateran in June 1133, and Innocent gave him the territories of the Countess Mathilda as a fief, but refused to surrender the right of investiture. Left to himself Innocent again had to flee, this time to Pisa. Here he called a council which condemned Anacletus. A second expedition of Lothair expelled Roger of Sicily (to whom Anacletus had given the title of king in return for his support) from southern Italy, but a quarrel with Innocent prevented the emperor attacking Rome. At this crisis, in Jan. 1138, Anacletus died, and a successor elected by his faction, as Victor IV., resigned after two months. The Lateran council of 1139 restored peace to the church, excommunicating Roger of Sicily, against whom Innocent undertook an unsuccessful expedition. The pope supported Bernard of Clairvaux in his prosecution of Abelard and Arnold of Brescia, whom he condemned as heretics. The remaining years of Innocent's life were taken up by a quarrel with the Roman commune, which had set up an independent senate, and one with King Louis VII. of France, about an appointment. France was threatened with the interdict, but before matters came to a head Innocent died on Sept. 22, 1143, and was succeeded by Celestinus II.

See Herzog-Hauck, *Realencyklopädie*, "Innocenz II.," with full references. Gregorovius, *History of Rome in the Middle Ages*, trans. by Hamilton (1896), vol. iv. part ii. pp. 420–453.

INNOCENT III. (Lando da Sezza), anti-pope (1179–80), sprang from a noble Lombard family. Opponents of Alexander III. tried to make him pope in Sept. 1179. Alexander, however, bribed his partisans to give him up, and imprisoned him in the cloister of La Cava in Jan. 1180.

INNOCENT III. (Lotario de' Conti di Segni), pope from 1198 to 1216, son of Trasimondo, count of Segni, and of Claricia, a Roman lady of the noble family of Scotti, was born at Anagni about 1160. At the University of Paris he laid the foundations of his profound knowledge of the scholastic philosophy; at Bologna he studied canon and civil law. On his return to Rome he became a canon of St. Peter's; he was made subdeacon of the Roman Church by Gregory VIII.; and in 1190 his uncle, Pope Clement III., created him cardinal-deacon of Santi Sergio e Baccho. The election of Celestine III. in the following year withdrew Lotario for a while from the active work of the Curia, the new pope belonging to the family of the Orsini, who were at feud with the Scotti. Lotario, however, employed his leisure in writing several works: *Mysteriorum evengelicae legis ac sacramenti eucharistiae libri VI., De contemtu mundi, sive de miseria humanae conditions,* and *De quadrapartita specie nuptiarum.* Of these only the two first are extant; they show a profound erudition. Yet Lotario was destined to be above all things a man of action, and Innocent III. is remembered, not as a great theologian, but as a great ruler and man of affairs.

On Jan. 8, 1198, Celestine III. died, and on the same day Lotario, though not even a priest, was unanimously elected pope by the assembled cardinals. He took the name of Innocent III. On Feb. 21 he was ordained priest, and next day was consecrated bishop. His first acts were to restore the prestige of the Holy See in Italy, where it had been overshadowed by the power of the emperor Henry VI. The early death of Henry VI. (Sept. 1197) had left Germany divided between rival candidates for the crown, Sicily torn by warring factions of native and German barons. It was, then, easy for Innocent to depose the imperial prefect in Rome itself and to oust the German feudatories who held the great Italian fiefs for the empire. Spoleto fell; Perugia surrendered; Tuscany acknowledged the leadership of the pope; papal *rectores* once more governed the patrimony of St. Peter. Finally, Henry's widow, Constance, in despair, acknowledged the pope as overlord of the two Sicilies, and on her death (Nov. 27, 1198) appointed him guardian of her infant son Frederick. Thus in the first year of his pontificate Innocent had consolidated in the peninsula a secure basis on which to build up his world-power.

The effective assertion of this world-power is the characteristic feature of Innocent's pontificate. Other popes before him—from Gregory VII. onwards—had upheld the theory of the supremacy of the spiritual over the temporal authority; it was reserved for Innocent to make it a reality. In Germany his support of Otto IV. against Philip of Swabia, then of Philip against Otto and finally, after Philip's murder (June 21, 1208), of the young Frederick II. against Otto, effectually prevented the imperial power, during his pontificate, from again becoming a danger to that of the papacy in Italy. Concessions at the cost of the empire in Italy were in every case the price of his support. (*See* GERMANY: *History.*)

In his relations with the German emperors Innocent acted partly as pope, partly as an Italian prince; his victories over other potentates he won wholly in his spiritual capacity. He forced Philip Augustus of France to put away Agnes of Meran and take back his Danish wife Ingeborg, whom he had wrongfully divorced; compelled Peter of Aragon to forgo his intended marriage with Bianca of Navarre and ultimately (1204) to receive back his kingdom as a fief of the Holy See, and caused Alphonso IX. of Leon to put away his wife Berengaria of Castile, who was related to him within the prohibited degrees, though he pronounced their children legitimate. Sancho of Portugal was compelled to pay the tribute promised by his father to Rome, and Ladislaus of Poland to cease from infringing the rights of the church. The archbishop of Trondhjem was called to order for removing the ban of excommunication from the repentant King Haakon IV., as an infringement of the exclusive right of the pope to impose or remove the ban of the church in the case of sovereigns. Kaloyan, prince of Bulgaria, submitted to Rome, and, in Nov. 1204 received the insignia of royalty from the hands of the papal legates as the vassal of the Holy See.

Meanwhile Innocent promoted the crusade which ultimately, under the Doge Dandolo, led to the Latin occupation of Constantinople. (*See* CRUSADES.) This diversion from its original object was at first severely censured by Innocent; but an event which seemed to put an end to the schism of East and West came to

wear a different aspect; he was the first pope to nominate a patriarch of Constantinople, and he expressed the hope that henceforth the church would be "one fold under one shepherd." By a bull of Oct. 12, 1204, moreover, Innocent proclaimed the same indulgences for a crusade to Livonia as the Holy Land. The result was the "conversion" of the Livonians (1206) and the Letts (1208) by the crusaders headed by the knights of the Teutonic Order. The organization of the new provinces thus won for the church Innocent kept in his own hands, instituting the new archbishopric of Riga and defining the respective jurisdictions of the archbishops and the Teutonic Knights. Another crusade was that proclaimed by Innocent in 1207 against the Albigenses. All that can be said in his favour is that he acted from supreme conviction; and that he did not use force until for ten years he had tried all the arts of persuasion in vain. (*See* ALBIGENSES.)

Of all Innocent's triumphs the greatest was his victory over King John of England. The quarrel arose out of a dispute as to the election to the vacant see of Canterbury, which Innocent had settled by nominating Stephen Langton (*q.v.*) over the heads of both candidates. John refusing to submit, Innocent imposed an interdict on the kingdom and threatened him with a crusade; and John was compelled to recognize Langton and to hold England and Ireland as fiefs of the Holy See, subject to an annual tribute (May 1213). For years the pope virtually ruled England through his legates. (*See* ENGLISH HISTORY and JOHN, king of England.) So great had the secular power of the papacy become that a Byzantine visitor to Rome declared Innocent to be "the successor not of Peter but of Constantine."

Innocent's authority within the church itself exceeded that of his predecessors. The centralization of the ecclesiastical administration at Rome received a great impulse, and the independent jurisdiction of metropolitans and bishops was curtailed. He introduced a system of provisions and reservations, by which he brought the patronage of sees and benefices into his own hands—a system which led later to intolerable abuses. The 12th ecumenical council assembled at the Lateran under his presidency in 1215. It was attended by the plenipotentiaries of the emperor, of kings and of princes, and by some 1,500 archbishops, bishops, abbots and other dignitaries. The business before it, the disciplining of heretics and Jews, and the proclamation of a new crusade, etc., vitally concerned the States represented; yet the function of the great assembly was little more than to listen to and endorse the decretals read by the pope. (*See* LATERAN COUNCILS.) The great pope died on July 16, 1216, at Perugia, and was succeeded by Honorius III.

Whatever judgment posterity may have passed on Innocent's aims, opinion is united as to the purity of the motives that inspired them and the tireless self-devotion with which they were pursued. "I have no leisure," Innocent once sighed, "to meditate on supermundane things; scarce I can breathe. Yea, so much must I live for others, that almost I am a stranger to myself." His views on the papal supremacy are best explained in his own words. Writing to the patriarch of Constantinople (*Inn. III., lib.* ii. *ep.* 200) he says: "The Lord left to Peter the governance not of the church only but of the whole world"; and again in his letter to King John of England (*lib.* xvi. *ep.* 131): "The King of Kings . . . so established the kingship and the priesthood in the church, that the kingship should be priestly, and the priesthood royal (*ut sacerdotale sit regnum et sacerdotium sit regale*), as is evident from the epistle of Peter and the law of Moses, setting one over all, whom he appointed his vicar on earth." In his answer to the ambassadors of Philip Augustus he states the premises from which this stupendous claim is logically developed:—

> To princes power is given on earth, but to priests it is attributed also in heaven; to the former only over bodies, to the latter also over souls. Whence it follows that by so much as the soul is superior to the body, the priesthood is superior to the kingship. . . . Single rulers have single provinces, and single kings single kingdoms; but Peter, as in the plenitude, so in the extent of his power is pre-eminent over all, since he is the Vicar of Him whose is the earth and the fullness thereof, the whole wide world and all that dwell therein.

To the emperor of Constantinople, who quoted 1 Peter ii. 13, 14, to the contrary, he replied in perfect good faith that the apostle's admonition to obey "the king as supreme was addressed to lay folk and not to the clergy." The more intelligent laymen of the time were not convinced even when coerced. Even so pious a Catholic as the minnesinger Walther von der Vogelweide, giving voice to the indignation of German laymen, ascribed Innocent's claims, not to soundness of his scholastic logic, but to the fact that he was "too young" (*owê der babest ist ze junc*).

The literature on Innocent III. is very extensive; a carefully analysed bibliography will be found in Herzog-Hauck, *Realencyklopädie* (3rd ed., 1901) *s.* "Innocenz III." In A. Potthast, *Bibliotheca hist. med. aevi* (2nd ed., Berlin, 1896), p. 650, is a bibliography of the literature on Innocent's writings. In the *Corpus iuris canonici*, ed. Aemilius Friedberg (Leipzig, 1881), vol. ii., pp. xiv.–xvii., are lists of the official documents of Innocent III. excerpted in the *Decretales Gregorii IX.* The most important later works on Innocent III. are Achille Luchaire's *Innocent III., Rome et l'Italie* (1904), *Innocent III., la croisade des Albigeois* (*ib.* 1905), *Innocent III., la papauté et l'empire* (*ib.* 1906), *Innocent III., la question d'orient* (*ib.* 1906); *Innocent III., les royautés vassales du Saint-Siège* (*ib.* 1908); and *Innocent III., le concile de latran et la réforme de l'église* (1908); Baethgen, *Die Regenschaft Papst Innozenz III. im Königreich Sizilien* (1914); E. W. Meyer, *Staatstheorien Papst Innozenz III.* (1919). *Innocent the Great*, by C. H. C. Pirie-Gordon (1907), contains some useful documents. *See* also H. H. Milman, *History of Latin Christianity* (1855, etc.), vol. v.; F. Gregorovius, *Rome in the Middle Ages*, translated by A. Hamilton (1896), vol. v. pp. 5–110; J. C. L. Gieseler, *Ecclesiastical Hist.*, trans. by J. W. Hull, vol. iii. (1853), which contains numerous excerpts from his letters, etc. Innocent's works are found in Migne, *Patrologiae Cursus Completus, Series Latina*, vols. ccxiv.–ccxvii. For a translation of Innocent's answer to King John on the interdict, and John's surrender of England and Ireland to Innocent, *see* Gee and Hardy, *Documents illustrative of Church History* (1896), pp. 73 *et seq.*

INNOCENT IV. (Sinibaldo Fiesco), pope 1243–54, belonged to the noble Genoese family of the counts of Lavagna. Born at Genoa, he was educated under the care of his uncle Opizo, bishop of Parma. After taking orders at Parma, when he was made canon of the cathedral, he studied jurisprudence at Bologna. His first recorded appearance in political affairs was in 1218–19, when he was associated with Cardinal Hugolinus (afterwards Gregory IX.) in negotiating a peace between Genoa and Pisa. In 1223 Pope Honorius III. gave him a benefice in Parma, and in 1226 he was established at the curia as *auditor contradictarum literarum* of the pope, a post he held also under Gregory IX., until promoted (1227) to be vice-chancellor of the Roman Church. In September of the same year he was created cardinal priest of San Lorenzo in Lucina. He was papal *rector* (governor) of the March of Ancona from 1235 to 1240. On June 25, 1243, he was elected pope by the cardinals assembled at Anagni.

When Innocent was raised to the Holy See the emperor Frederick II. lay under excommunication. Frederick hoped great things from the elevation of a member of an imperialist family; but it was soon clear that Innocent intended to pursue the traditions of his predecessors. Embassies and courtesies were, indeed, interchanged, and on March 31, 1244, a treaty was signed at Rome, whereby the emperor undertook to satisfy the pope's claims in return for his own absolution from the ban. Neither side, however, was prepared to begin to carry out the agreement, and Innocent began to feel unsafe in Rome, where the imperial partisans had the ascendancy. He left Rome, ostensibly to meet the emperor, and from Sutri fled by night on horseback, pursued by the emperor's cavalry, to Civitavecchia, whence he took ship for Genoa and proceeded to Lyons, at that time a merely nominal dependence of the empire. Thence he wrote to Louis IX., asking for an asylum in France; but this Louis cautiously refused. From Lyons Innocent issued a summons to a general council, before which he cited Frederick to appear in person, or by deputy. The council, which met on June 5, 1245, was attended only by partisans of the pope; and though Frederick condescended to be represented by his justiciar, Thaddeus of Suessa, the judgment was a foregone conclusion.

On July 17, Innocent formally renewed the sentence of excommunication on the emperor, and declared him deposed from the imperial throne and that of Naples. Frederick retorted by announcing his intention of reducing "the clergy, especially the highest, to a state of apostolic poverty," and by ordaining punish-

ments for those priests who should obey the papal sentence. Innocent proclaimed a crusade against the emperor and armed his agents, the Franciscan and Dominican friars, with special indulgences for those who should take up the cross against the imperial heretic. At the same time he sought to undermine Frederick's authority in Germany and Italy. In Naples he fomented a conspiracy among the feudal lords; in Germany, at his instigation, the archbishops with a few of the secular nobles in 1246 elected Henry Raspe, landgrave of Thuringia, German king; but the "priests' king" died in the following year, William II., count of Holland, being after some delay, elected by the papal party in his stead.

Innocent's relentless war against Frederick was not supported by the lay opinion of his time. It wrought havoc and misery in Germany, where it increased the already bitter resentment against the priests. The pope's legate was driven from England by threats of personal violence and not even the saintly King Louis IX. of France, though he made several vain attempts to mediate, approved the pope's attitude. The failure of the crusade which, in 1248, he led against the Muslims in Egypt, was ascribed to the deflection of money and arms from this purpose to the war against the emperor. Even the clergy were by no means altogether on Innocent's side; the council of Lyons was attended by but 150 bishops, mainly French and Spanish, and the deputation from England, headed by Robert Grossetête of Lincoln and Roger Bigod, came mainly in order to obtain the canonization of Edmund of Canterbury and to protest against papal exactions. Yet Innocent triumphed. His financial position was from the outset strong, for not only had he the revenue from the accustomed papal dues but he received large sums from the powerful religious orders. At first the war went in Frederick's favour; but the capture of Parma by papal partisans (June 16, 1247) turned the scale. Frederick's camp before Parma (the temporary town of Vittoria) was taken and sacked, the imperial insignia being captured. From this blow the emperor never recovered; he died on Dec. 13, 1250.

Innocent left Lyons for Italy in April 1251. He continued the struggle with Frederick's son and successor, Conrad IV., who in 1252 descended into Italy, reduced the rebellious cities and claimed the imperial crown. Innocent now offered the crown of Sicily in turn to Richard of Cornwall, Charles of Anjou, and Henry III. of England, the last of whom accepted the doubtful gift for his son Edmund. After Conrad's capture of Naples Innocent feared that Rome itself might fall into the hands of the German king. But Conrad died on May 20, 1254, leaving his infant son Conradin under the pope's guardianship. Innocent posed as the champion of the infant king. He held, indeed, to his bargain with Henry III. and exercised his rights over the Sicilian kingdom by nominating his own relations to its most important offices. Finally, when Manfred, who by Frederick's will had been charged with the government of the two Sicilies, felt obliged to acknowledge the pope's suzerainty, Innocent threw off the mask, ignored Conradin's claims, and on Oct. 24 formally asserted his own claims to Calabria and Sicily. He entered Naples on the 27th; but meanwhile Manfred had fled and had raised a considerable force; the news of his initial successes reached Innocent as he lay sick, and hastened his end. He died on Dec. 7, 1254, and was succeeded by Alexander IV.

Innocent IV. is comparable to his greater predecessor Innocent III. mainly in the extreme assertion of the papal claims. In some respects he carried on the high traditions of his great predecessors. He admonished Sancho II. of Portugal to turn from his evil courses and, when the king disobeyed, absolved the Portuguese from their allegiance, bestowing the crown on his brother Alphonso. He established an ecclesiastical organization in the newly converted provinces of Prussia, which he divided into four dioceses; but his attempt to govern the Baltic countries through a legate broke on the opposition of the Teutonic Order, whose rights in Prussia he had confirmed.

It was Innocent IV. who, at the council of Lyons, first bestowed the red hat on the Roman cardinals, as a symbol of their readiness to shed their blood in the cause of the church.

Innocent was a canon lawyer of some eminence. His small work *De exceptionibus* was probably written before he became pope; but the *Apparatus in quinque libros decretalium,* which displays practical sense and a mastery of the materials, was written at Lyons immediately after the council. His *Apologeticus,* a defence of the papal claims against the empire, has been lost. Innocent was also a notable patron of learning; he encouraged Alexander of Hales to write his *Summa universae theologiae,* did much for the universities, notably the Sorbonne, and founded law schools at Rome and Piacenza.

Innocent's letters, the chief source for his life, are collected by E. Berger in *Les Registres d'Innocent IV.* (3 vols., 1884–87). For English readers the account in Milman's *Latin Christianity*, vol. vi. (3rd ed., 1864) is still useful. Full references will be found in Herzog-Hauck, *Realencyklopädie,* vol. ix. (1901).

INNOCENT V. (Pierre de Champagni or de Tarentaise), pope from Jan. 21 to June 22, 1276, was born about 1225 in Savoy and entered the Dominican order at an early age. He studied theology under Thomas Aquinas, Albertus Magnus and Bonaventura, and in 1262 was elected provincial of his order in France. He was made archbishop of Lyons in 1271; cardinal-bishop of Ostia and Velletri, and grand penitentiary in 1275; and, partly through the influence of Charles of Anjou, was elected to succeed Gregory X. As pope he established peace between the republics of Lucca and Pisa, and confirmed Charles of Anjou in his office of imperial vicar of Tuscany. He was seeking to carry out the Lyons agreement with the Eastern Church when he died. His successor was Adrian V. Innocent V., before he became pope, prepared, in conjunction with Albertus Magnus and Thomas Aquinas, a rule of studies for his order, which was accepted in June 1259, and was the author of several works in philosophy, theology and canon law. He is sometimes referred to as *famosissimus doctor.*

See F. Gregorovius, *Rome in the Middle Ages,* vol. 5, trans. by Mrs. G. W. Hamilton (1900–02); A. Potthast, *Regesta pontif. Roman.* vol. ii. (Berlin, 1875); E. Bourgeois *de Bienheur eux Innocent* V. (1899); J. E. Borel, *Notice biogr. sur Pierre de Tarentaise* (Chambéry, 1890); P. J. Béthaz, *Pierre des Cours de la Salle, pape sous le nom Innocent V.* (Augustae, 1891); L. Carboni, *De Innocentio V. Romano pontifice* (1894).

INNOCENT VI. (Etienne Aubert), pope from Dec. 18, 1352, to Sept. 12, 1362, was born at Mons in Limousin. He became professor of civil law at Toulouse and subsequently chief judge of the city. Having taken orders, he was raised to the see of Noyon and translated in 1340 to Clermont. In 1342 he was made cardinal-priest of Sti Giovanni e Paolo, and ten years later cardinal-bishop of Ostia and Velletri, grand penitentiary, and administrator of the bishopric of Avignon. Innocent revoked the reservations and commendations of his predecessor and prohibited pluralities; urged upon the higher clergy the duty of residence in their sees, and diminished the luxury of the papal court. Largely through the influence of Petrarch, whom he called to Avignon, he released Cola di Rienzo, who had been sent a prisoner in Aug. 1352 from Prague to Avignon, and used the latter to assist Cardinal Albornoz, vicar-general of the States of the Church, in tranquillizing Italy and restoring the papal power at Rome.

Innocent caused Charles IV. to be crowned emperor at Rome in 1355, but protested against the "Golden Bull" of the following year, which prohibited papal interference in German royal elections. He renewed the ban against Peter the Cruel of Castile, and interfered in vain against Peter IV. of Aragon. He made peace between Venice and Genoa, and in 1360 arranged the treaty of Bretigny between France and England. In the last years of his pontificate he was busied with preparations for a crusade and for the reunion of Christendom, and sent to Constantinople the celebrated Carmelite monk, Peter Thomas, to negotiate with the claimants to the Greek throne. He instituted in 1354 the festival of the Holy Lance. He was succeeded by Urban V.

The chief sources for the life of Innocent VI. are in Baluzius, *Vitae Pap. Avenion.* vol. i. (Paris, 1693) · *Magnum bullarium Romanum,* vol. iv. (Turin, 1859); E. Werunsky, *Excerpta ex registris Clementis VI. et Innocentii VI.* (Innsbruck, 1885). *See* also L. Pastor, *History of the Popes,* vol. i., trans. by F. I. Antrobus (1899); F. Gregorovius, *Rome in the Middle Ages,* vol. 6, trans. by Mrs. G. W. Hamilton (1900–02); D. Cerri, *Innocenzo Papa VI.* (Turin, 1873); J. B. Christophe, *Histoire de la papauté pendant le XIVe siècle,* vol. 2 (1853); M. Souchon, *Die Papstwahlen* (Brunswick, 1888); G. Daumet, *Innocent VI. et Blanche*

de Bourbon (1899); E. Werunsky, *Gesch. Kaiser Karls IV.* (Innsbruck, 1892). There is an excellent article by M. Naumann in Hauck's *Realencyklopädie*, 3rd ed.

INNOCENT VII. (Cosimo dei Migliorati), pope from Oct. 17, 1404, to Nov. 6, 1406, was born at Sulmona in the Abruzzi in 1339. He was made papal vice-chamberlain and archbishop of Ravenna by Urban VI., and appointed by Boniface IX. cardinal priest of Sta. Croce in Gerusalemme, bishop of Bologna, and papal legate to England. He was unanimously chosen to succeed Boniface. The election was opposed at Rome by a considerable party, but peace was maintained by the aid of Ladislaus of Naples, in return for which Innocent agreed not to come to terms with the anti-pope Benedict XIII., except on condition that he should recognize the claims of Ladislaus to Naples. Innocent issued at the close of 1404 a summons for a general council to heal the schism, but the council never assembled, for the Romans rose in arms to secure an extension of their liberties, and finally maddened by the murder of some of their leaders by the pope's nephew, Ludovico dei Migliorati, they compelled Innocent to take refuge at Viterbo (Aug. 6, 1405). The Romans, recognizing later the pope's innocence of the outrage, made their submission to him in Jan. 1406. He returned to Rome in March, and, by bull of Sept. 1, restored the city's decayed university. He died on Nov. 6, 1406, and was succeeded by Gregory XII.

See L. Pastor, *History of the Popes*, vol. i., trans. by F. I. Antrobus (1899); M. Creighton, *History of the Papacy*, vol. i. (1899); N. Valois, *La France et le grand schisme d'occident* (1896–1902); Louis Gayet, *Le Grand Schisme d'occident* (1898); J. Loserth, *Geschichte des späteren Mittelalters* (1903); Theodorici de Nyem, *De schismate libri tres*, ed. by G. Erler (Leipzig, 1890); K. J. von Hefele, *Conciliengeschichte* (1855–74), Bd. 6, 2nd ed.; J. von Haller, *Papsttum u. Kirchenreform* (1903).

INNOCENT VIII. (Giovanni Battista Cibo), pope from Aug. 29, 1484, to July 25, 1492, successor of Sixtus IV., was born at Genoa (1432), the son of Arano Cibo, who under Calixtus III. had been a senator of Rome. Through the favour of Cardinal Calandrini, half-brother of Nicholas V., he obtained from Paul II. the bishopric of Savona. Sixtus IV. translated him to the see of Molfetta, and in 1473 created him cardinal-priest of Sta. Balbina, subsequently of Sta. Cecilia. As pope he addressed a fruitless summons to Christendom to unite in a crusade against the infidels, and concluded in 1489 a treaty with Bayezid II., agreeing in consideration of an annual payment of 40,000 ducats and the gift of the Holy Lance to detain the sultan's fugitive brother Jem in close confinement in the Vatican. Innocent excommunicated and deposed Ferdinand, king of Naples, by bull of Sept. 11, 1489, for refusal to pay the papal dues, and gave his kingdom to Charles VIII. of France, but in 1492 restored Ferdinand to favour. In the bull *Summis desiderantes* (Dec. 5, 1484) he instigated very severe measures against magicians and witches in Germany; he prohibited (1486) on pain of excommunication the reading of the propositions of Pico della Mirandola; he appointed (1487) T. Torquemada to be grand inquisitor of Spain; and he offered plenary indulgence to all who would engage in a crusade against the Waldenses. He sent missionaries under Portuguese auspices to the Congo. An important event of his pontificate was the capture of Granada (Jan. 2, 1492), for which Innocent gave to Ferdinand of Aragon the title of "Catholic Majesty." Innocent died on July 25, 1492, and was succeeded by Alexander VI.

The sources for the life of Innocent VIII. are to be found in L. Muratori, *Rerum Italicarum Scriptores* (1723–51), vol. 3, and in Raynaldus, *a.* 1484–92. *See* also L. Pastor, *History of the Popes*, vol. 5, trans. by F. I. Antrobus (1898); M. Creighton, *History of the Papacy*, vol. 4 (1901); F. Gregorovius, *Rome in the Middle Ages*, vol. 7, trans. by Mrs. G. W. Hamilton (1900–02); T. Hagen, *Die Papstwahlen von 1484 u. 1492* (Brizen, 1885); S. Riezler, *Die Hexenprozesse* (1896); G. Viani, *Memorie della famiglia Cybo* (Pisa, 1808); F. Serdonati, *Vita e fatti d'Innocenzo VIII.* (Milan, 1829).

INNOCENT IX. (Giovanni Antonio Fachinetti) was born in 1519. He filled the offices of apostolic vicar of Avignon, legate at the council of Trent, nuncio to Venice, and president of the Inquisition. He became cardinal in 1583; and under the invalid Gregory XIV. assumed almost the entire conduct of affairs. His election to the papacy, on Oct. 29, 1591, was brought about by Philip II. Innocent died on Dec. 30, 1591, and was succeeded by Clement VIII.

See Ciaconius, *Vitae et res gestae summorum Pontiff. Rom.* (1601–02); Cicarella, continuator of Platina, *De Vitis Pontiff. Rom.* (both contemporaries of Innocent); Ranke, *Popes* (Eng. trans., Austin, 1840, etc.), ii. 233 *seq.* (all brief accounts). (T. F. C.)

INNOCENT X. (Giovanni Battista Pamfili) was born in Rome on May 6, 1574, served successively as auditor of the Rota, nuncio to Naples, legate apostolic to Spain, was made cardinal in 1627, and succeeded Urban VIII. as pope on Sept. 15, 1644. Throughout his pontificate Innocent was completely dominated by his sister-in-law, Donna Olimpia Maidalchini, who made herself thoroughly detested for her inordinate ambition and rapacity. Urban VIII. had been French in his sympathies; but the papacy now shifted to the side of the Habsburgs, and there remained for nearly 50 years. Evidences of the change were numerous: Innocent promoted pro-Spanish cardinals; attacked the Barberini, protégés of Mazarin, and sequestered their possessions; aided in quieting an insurrection in Naples, fomented by the duke of Guise; and refused to recognize the independence of Portugal, then at war with Spain. As a reward he obtained from Spain and Naples the recognition of ecclesiastical immunity. In 1649 Castro, which Urban VIII. had failed to take, was wrested from the Farnese and annexed to the Papal States. The most worthy efforts of Innocent were directed to the reform of monastic discipline (1652). His condemnation of Jansenism (1653) was met with the denial of papal infallibility in matters of *fact*, and the controversy entered upon a new phase. (*See* JANSENISM.) Innocent died on Jan. 7, 1655, and was succeeded by Alexander VII.

For contemporary lives of Innocent *see* Oldoin, continuator of Ciaconius, *Vitae et res gestae summorum Pontiff. Rom.*; and Palazzi, *Gesta Pontiff. Rom.* (Venice, 1687–88) iv. 570 *sqq.*; Ciampi's *Innoc. X. Pamfili, et la sua Corte* (1878) gives a very full account of the period. Gualdus' (pseud. of Gregorio Leti) *Vita de Donna Olimpia Maidalchina* (1666) is gossipy and untrustworthy; Capranica's *Donna Olympia Pamfili* (Milan, 1875, 3rd ed.) is fanciful and historically of no value. *See* also Ranke, *Popes* (Eng. trans., Austin, 1840, etc.), iii. 40 *sqq.*; v. Reumont, *Gesch. der Stadt Rom.* (1867–70), iii. 2, p. 623 *sqq.*; Brosch, *Gesch. des Kirchenstaates* (1880) i. 409 *sqq.*; and the extended bibliography in Herzog-Hauck, *Realencyklopädie*, *s.v.* "Innocenz X."

INNOCENT XI. (Benedetto Odescalchi), pope from 1676 to 1689, was born at Como on May 16, 1611. He studied law in Rome and Naples, entered the Curia under Urban VIII., and became successively protonotary, president of the Apostolic Chamber, governor of Macerate and commissary of Ancona. Innocent X. made him a cardinal (1647), legate to Ferrara, and, in 1650, bishop of Novara. He was chosen to succeed Clement X. on Sept. 21, 1676. He at once applied himself with great thoroughness to moral and administrative reform. The moral teaching of the Jesuits incurred his condemnation (1679) (*see* LIGUORI), an act which the society never forgave, and which it partially revenged by forcing, through the Inquisition, the condemnation of the quietistic doctrines of Molinos (1687), for which Innocent entertained some sympathy. (*See* MOLINOS.)

Innocent's protest against Louis XIV.'s extended claim to regalian rights called forth the famous Declaration of Gallican Liberties by a subservient French synod under the lead of Bossuet (1682), which the pope met by refusing to confirm Louis' clerical appointments. His determination to restrict the ambassadorial right of asylum, which had been grossly abused, was resented by Louis, who defied him in his own capital, seized the papal territory of Avignon, and talked loudly of a schism, without, however, shaking the pope in his resolution. Innocent opposed Louis' candidate for the electorate of Cologne (1688), approved the League of Augsburg, acquiesced in the designs of the Protestant William of Orange, even in his supplanting James II., whom, although a Roman Catholic, he distrusted as a tool of Louis. The great object of Innocent's desire was the repulse of the Turks, and his efforts to that end entitled him to share in the glory of relieving Vienna (1683). Innocent died on Aug. 12, 1689, and was succeeded by Alexander VIII.

The Life of Innocent has been frequently written. *See* Guarnacci, *Vitae et res gestae Pontiff. Rom.* (1751), i. 105 *sqq.*; Palazzi, *Gesta Pontiff. Rom.* (Venice, 1690); also the lives by Albrizzi (1695), Buona-

mici (1776), and Immich (1900). Particular phases of Innocent's activity have been treated by Michaud, *Louis XIV. et Innoc. XI.* (1882 *sqq.*, 4 vols.); Dubruel, *La Correspond. . . . du Card. Carlo Pio*, etc. (see *Rev. des quest. hist.* lxxv. [1904] 602 *sqq.*); and Gerin, in *Rev. des quest. hist.*, 1876, 1878, 1886. For correspondence of Innocent *see* Colombo, *Notizie biogr. e lettere di P. Innoc. XI.* (Turin, 1878); and Berthier, *Innoc. PP. XI. Epp. ad Principes* (1890 *sqq.*). An extended bibliography may be found in Herzog-Hauck, *Realencyklopädie*, *s.v.* "Innocenz XI."

INNOCENT XII. (Antonio Pignatelli), pope from 1691 to 1700 in succession to Alexander VIII., was born in Naples on March 13, 1615, was educated at the Jesuit college in Rome, entered upon his official career at the age of 20, and became vice-legate of Urbino, governor of Perugia, and nuncio to Tuscany, to Poland and to Austria. He was made cardinal and archbishop of Naples by Innocent XI., whose pontificate he took as a model for his own, which began on July 12, 1691. His reforms were many and salutary. Among other things he struck at the root of nepotism in a bull of 1692 ordaining that thenceforth no pope should grant estates, offices or revenues to any relative. Innocent put an end to the strained relations that had existed between France and the Holy See for nearly 50 years. He obtained from the French bishops the virtual repudiation of the Declaration of Gallican Liberties. He confirmed the bull of Alexander VIII. against Jansenism (1696); and, in 1699, under pressure from Louis XIV., condemned certain of Fénelon's doctrines which Bossuet had denounced as quietistic. (*See* FÉNELON.) Innocent died June 27, 1700, and was succeeded by Clement XI.

See Guarnacci, *Vitae et res gestae Pontiff. Rom.* (1751), i. 389 *sqq.*; Ranke, *Popes* (Eng. trans., Austin, 1840, etc.), iii. 186 *sqq.*; v. Reumont, *Gesch. der Stadt Rom.* (1867–70), iii. 2, p. 640 *sqq.*, and the *Bullarium Innoc. XII.* (1697).

INNOCENT XIII. (Michele Angelo Conti), pope from 1721 to 1724, the son of the duke of Poli, and a member of a family that had produced several popes, among them Innocent III., was born in Rome on May 13, 1655, served as nuncio in Switzerland and Portugal, was made cardinal and bishop of Osimo and Viterbo by Clement XI., whom he succeeded on May 8, 1721. One of his first acts was to invest the emperor Charles VI. with Naples (1722); he protested in vain against the imperial investiture of Don Carlos with Parma and Piacenza. He recognized the Pretender, "James III.," and promised him subsidies conditional upon the re-establishment of Roman Catholicism in England. Moved by deep-seated distrust of the Jesuits and by their continued practice of "Accommodation," despite express papal prohibition (*see* CLEMENT XI.), Innocent forbade the Order to receive new members in China, and was said to have meditated its suppression. This encouraged the French Jansenist bishops to press for the revocation of the bull *Unigenitus;* but the pope commanded its unreserved acceptance. Innocent died on March 7, 1724, and was succeeded by Benedict XIII.

See Guarnacci, *Vitae et res gestae Pontiff. Rom.* (1751), ii. 137 *sqq.*, 381 *sqq.*; Sandini, *Vitae Pontiff. Rom.* (Padua, 1739); M. v. Mayer, *Die Papstwahl Innocenz' XIII.* (1874); Michaud, "La Fin du Clement XI. et le commencement du pontificat d'Innocent XIII." in the *Internat. Theol. Zeitschr.* v. 42 *sqq.*, 304 *sqq.*

INNOCENTS' DAY or CHILDERMAS, a festival celebrated in the Latin church on the 28th of December, and in the Greek church on the 29th (O.S.) in memory of the massacre of the children by Herod. The Church early regarded these little ones as the first martyrs. It is uncertain when the day was first kept as a saint's day. At first it seems to have been absorbed into the celebration of the Epiphany, but by the 5th century it was kept as a separate festival. In Rome it was a day of fasting and mourning. The boy-bishop (*q.v.*), whose tenure of office lasted till Childermas, had his last exercise of authority then, the day being one of the series of days which were known as the Feast of Fools. Parents temporarily abdicated authority, and in nunneries and monasteries the youngest nun and monk were for the twenty-four hours allowed to masquerade as abbess and abbot. These mockeries of religion were condemned by the Council of Basel (1431). The day is still observed as a feast day and merrymaking for children in Catholic countries. Innocent's Day was ever accounted unlucky, and Louis XI. used to prohibit any State business.

INNS AND INNKEEPERS. An inn is a hostelry, hotel or public house kept for reward, for the lodging and entertainment of travellers or of any who need temporary accommodation. The name is also given, in a specialized sense, to the institutions set apart for the study and practice of the law. (*See* INNS OF COURT.)

Inn signs are thought by Sir Thomas Browne to be of pagan origin, the sun and moon so frequently represented showing a dedication to Apollo or Diana. Later on hagiology superseded the pantheon and the saints in the calendar swung on sign-boards, interspersed with the arms of various noble personages, who having been well treated as they passed that way, allowed the innkeeper to display their escutcheons over his portal. The hanging of an ivy bush above the inn door is of immemorial antiquity and has not entirely fallen into disuse at the present day. The chequers so frequently displayed as an ale house sign was common among the Romans and is depicted in a Pompeian street view presented by Sir William Hamilton to the Society of Antiquaries. As to this sign, a writer in the *Gentleman's Magazine* for 1794 (p. 797) states: "The great Earl Warrenne . . . had an exclusive power of granting licenses to sell beer. That his agent might collect the tax more readily, the door posts were painted in checquers, such being the arms of Warren."

Law Relating to Innkeepers.—The term inn includes both as regards privileges and liabilities any house of public entertainment where beds, food, etc., are furnished to all persons paying for the same, although it may be called a hotel, tavern, public house, temperance hotel or coffee house. Apparently, however, a lodging or boarding house is not an inn. An innkeeper "being in some sort a public servant" has no right to select his guests, or insist on knowing the traveller's name and address, or refuse shelter at any hour of the day or night, provided he has vacant accommodation and the traveller is not obviously objectionable. But an innkeeper is not bound permanently to entertain a guest. By the common law of England an innkeeper is responsible for the personal property of a traveller so long as the relationship of landlord and guest continues between the parties, unless the goods are destroyed by the act of God or the king's enemies, which latter term does not include damage by riot or rebellion. No special contract or agreement is necessary in order to raise this obligation, and the loss of the goods is *prima facie* evidence of the innkeeper's negligence. This liability is possibly a survival of a very necessary precaution in the days when it was no uncommon thing for highwaymen and innkeepers to be in league together. But contributory negligence on the part of the guest may relieve the landlord from his legal liability in case of loss.

This common law liability of an innkeeper (except as regards horses, harness and carriages which term includes motor cars) for the safe custody of the goods of a guest is, however, limited by the Innkeepers Liability Act, 1863, which provides that an innkeeper shall not be liable to a greater amount than £30 for loss of goods, unless the loss is caused by the default or neglect of himself or his servants. But this limitation of liability is conterminous only with an exhibit of the first section of the act in a prominent position in the hall or entrance to the inn; and if the innkeeper refuse to receive for safe custody any goods of his guest, he is liable for the loss as at common law. But an innkeeper is not an insurer of the persons or wearing apparel of his guests—when the clothing is in actual use—although he must take reasonable precautions for the safety of travellers using his house. In return for these liabilities the law gives him a lien over his guest's goods for the amount of his bill. This is a particular and not a general lien, and attaches only to the actual goods brought by the guest to the inn and housed by the innkeeper with him. When several guests of one party leave together, the lien extends to the goods of all. The innkeeper is only bound to take ordinary care of goods thus held, but he cannot use them or charge for their storage. By the Innkeepers Act, 1878, if goods have been kept for six weeks they may, after advertisement in one London and one local newspaper, be sold on expiry of one month from the date of such advertisement. Apparently this act applies to Scotland in spite of the provision for advertisement in a London paper (Green's *Encyclopaedia of Scots Law*, 2nd ed. vi. p. 571)

In Scotland the law is in all material particulars the same as in England except that accidental fire is considered *damnum fatale* for which the innkeeper is not liable. He is moreover bound to receive and house the goods of a traveller, other than personal effects, provided they are not very exceptional or dangerous.

In the United States the common law follows that of England, and laws of the various States of the Union have diminished the liability of the innkeeper in much the same manner as in England.

(F. Wt.; W. W. P.)

INNSBRUCK, the capital of the Austrian province of Tirol, is a beautiful town situated at a height of 1,880 ft. in a wide plain formed by the Inn and its right bank tributary the Sill and mainly on the peninsula between these streams. Surrounded by lofty mountains that seem to overhang the town it occupies a site both strategically and commercially important at the junction of the highway from Germany to Italy over the Brenner pass with the great thoroughfare from western Europe to Vienna and the east over the Arlberg pass. As the name implies, this is a famous crossing place of the Inn guarded in Roman time by the station of Veldidena, which was succeeded by the Premonstratensian abbey of Wilten. The town is first recorded by its present name in 1187 and in 1233–1235 it was fortified. About 1420 the Archduke Frederick IV. built a new castle here and the town replaced Meran as the capital of Tirol. Its history has been generally uneventful and it always manifested a strong loyalty to the ruling house of Austria, particularly during the revolution of 1848.

Within the town there is a striking contrast between old and new. The narrow arcaded streets of the old town, with fine old frescoed houses of the 17th and 18th centuries, give place to the regularly built blocks and open spaces of the more modern accretions, yet without disturbing the sense of unity. One of the finest of the older buildings is the Franciscan or Court church (1553–1563), mainly in Italian Renaissance style. Within is the remarkable cenotaph of the emperor Maximilian I. (d. 1519), count of the Tirol from 1490 onwards, a gigantic marble sarcophagus with 28 bronze statues of his ancestors and favourite heroes and 24 marble reliefs depicting scenes from his life. The church contains also a number of other tombs of notable historic figures.

The university of Innsbruck, formally founded in 1677, suspended during 1782–1792 and 1810–1826, was refounded in 1826 and makes the town a centre of intellectual life. Well-staffed and equipped with fine buildings and a library of nearly 400,000 volumes, the university influence spreads far beyond the borders of Tirol and Austria. More than 1,500 students attend its courses, 39% coming from the Tirol, 27% from other parts of Austria and 34% from foreign countries including 2% from the United States of America. There is also a well-stocked museum, the Ferdinandeum, with rich collections, some illustrative of the Tirolean life.

Other interesting and historic buildings and monuments combine with the surrounding scenic and climatic attractions to make Innsbruck a centre for tourists, whereby its functions as the regional capital and market are strengthened. Practically two hundred thousand visitors are catered for annually and their needs form the basis of a large trade in foodstuffs and other necessities of daily life. Improved facilities for travel have swelled this tourist traffic in the 20th century, a fact that is reflected in the growth of the town since 1900 when its population numbered 26,866. By the census of March, 1923, it showed 56,365 and is estimated in 1928 as approaching 70,000, mainly German-speaking and Romanists.

See also under *Tirol* and H. Bobek, *Innsbruck, Eine Gebirgsstadt, ihr Lebensraum und ihre Erscheinung* (Stuttgart, 1928).

INNS OF COURT AND CHANCERY. The inns of court seated in London, Lincoln's inn, Gray's inn, the Inner and Middle Temple, are voluntary societies, unchartered, unincorporated and unendowed. Their early history is very obscure and the date of their respective foundations cannot be precisely determined. It is quite clear, however, that they were the successors, if not the direct descendants of the early law schools which flourished in the city in the 12th and 13th centuries. There was according to tradition a legal institution in Newgate, called Johnstone's inn; another in Pewter lane and a third in Paternoster row. There was the cathedral school of St. Paul's and St. George's inn in Seacole lane, near the Old Bailey, and there was in all probability a school of some sort attached to the church of St. Mary-le-Bow in Cheapside. Throughout the 12th century men learned in the civil and canon law—mostly churchmen—swarmed across the channel for the express purpose of teaching and practising the law. In the reign of Stephen we hear of Roger of Bec lecturing on the sister laws in the city, a proceeding which the citizens induced the king to prohibit. This is the first hint we get of the struggle between the common lawyers and the church. The civilian lawyers had speedily made themselves masters of the common law, as witness the display of knowledge of English law by Lanfranc in his suit with Odo of Bayeux heard before the Conqueror. Henry II.'s judges, although churchmen, were faithful to the common law in his struggle with the church, and those practising before them were also churchmen, many of whom, says Coke, "that I may use the words of the record, kept schools of law in the city of London and taught such as resorted to them the laws of the realm, taking their foundation of *Magna Carta* and *Carta de Foresta*." In 1164, however, the clergy were forbidden to lecture on natural philosophy and municipal law outside their monasteries, and in 1217 clerks and priests were enjoined not to appear as advocates in the secular courts. In 1234 Henry III. by his writ addressed to the mayor and sheriffs of the city ordered "the suppression of the schools of the laws in the city." What "the laws" were we do not know. The term *leges* was used to mean the civil and canon law, and also the laws of the realm. It was probably used here to mean the latter, since as part of the policy of the church to attract all judicial business into the ecclesiastical courts, the clergy were, by a bull of Innocent IV. in 1254, prohibited from teaching the common law at all. What immediate effect Henry's order had we do not know, but we do know that from 1234 to the accession of his son, the profession of the law was thrown into confusion. Unqualified and unsuitable persons were practising the law, with the result that even the judges became tainted. These judicial scandals culminated in a commission of inquiry instituted in 1289 by Edward I. on his return from the Holy Land, and the punishment of many of the judges and officials of the courts. This was followed up by a second commission empowered to reform the legal profession, which directed that students "apt and eager" should be brought up from the provinces and placed in proximity to the courts of law situate at Westminster. And by the statute *De Attornatis et Apprenticiis* the chief justice of the common pleas and his fellow judges were directed to provide a certain number of serjeants and barristers (to use the modern equivalents) who should attend the courts wherever they might be and have exclusive audience therein. We may confidently assume from a case in the Year Book of 1292 that prior to 1289 there existed in the city some society charged with the duty of educating students for the legal profession and granting degrees which entitled them to plead in the courts. We may also assume that this society or some similiar body existed even a century earlier, since in the reign of Henry II. we hear of lawyers styled 'masters,' a title which survives in the masters of the bench of an inn of court. This society then, or perhaps group of societies, was the law faculty, and the practising lawyers were the masters of the faculty, just as in any other mediaeval gild. For the inns of court and chancery, like the colleges and halls of Oxford and Cambridge, are children of the gild. Under this system no one could become a master unless he had sat at the feet of some duly qualified master and until by actual performance of the duties of his profession he had proved to the satisfaction of the masters of the faculty assembled in public his right to be included among them. Thus, just as in the universities students would flock round a well-known professor in some faculty and form part of his household, so in London law students became apprentices of a master of the law faculty—a judge, a serjeant-at-law, or it may be only an apprentice-at-law—and live in his private house or inn, together with his officials and clerks. When

the exodus of the lawyers from the city took place we do not know, but we do know that Henry de Lacy, earl of Lincoln, one of Edward's most trusted ministers, purchased a house in Shoe lane from the Black Friars in 1286. He sat as a royal justice for the trials of the judges and other officials in 1289–92, and apart from these duties transacted a vast amount of other legal business, which, after his death in 1311, continued to be conducted in this house by his son-in-law, the earl of Lancaster. The latter died on the scaffold in 1322 and upon the marriage of his widow with Lestrange, the property passed to her husband's family.

Lincoln's Inn.—According to Dugdale there was a tradition current amongst the ancient of Lincoln's inn that the earl of Lincoln, "about the beginning of Edward II.'s reign, being a person well affected to the knowledge of the law, first brought in the professors of that honourable and necessary study to settle in this place," *i.e.*, in the present Lincoln's inn. This, however, was at that time the town house of the bishop of Chichester, and continued to be occupied by the bishops of that see until 1442. Williams thinks that the earl's house in Shoe lane constituted the original Lincoln's inn, whilst Baildon maintains that de Lacy brought his company of lawyers to settle in Thavie's inn on the opposite side of the lane, west of St. Andrew's church. This house became the property of John Davy, a chancery clerk, a man of some prominence in Holborn from 1350 till his death in 1387. It is this property which became an inn of chancery and was purchased by Lincoln's inn in 1550. This house has been confused with one adjoining, belonging to another John Davy, an armourer, upon whose death it was sold in 1350 to Sir John de Houton, a baron of the Exchequer, and again in 1366 to two clerks in the chancery, which suggests that this house also became a legal hostel. Whether any or which of these houses was the original Lincoln's inn it is impossible to say, but it has been established by G. T. Turner and Williams that the second Lincoln's inn was situated east of Chancery lane. Between the years 1331 and 1334, Thomas de Lincoln, the king's serjeant, son of Thomas de Lincoln, acquired there properties lying between Staple inn and the Rolls, which after passing through other hands—evidently acting as trustees—became the property of the abbot and convent of Malmesbury. In letters patent dated Oct. 6, 1380, it is described as *totum hospicium vocatum Lyncolns Ynne*, and in 1399 the convent was receiving £8 a year rent which, early in the 15th century, was reduced to 40s. on account of the ruinous condition of the premises. This accounts for the removal of the society after the death of Bishop Read in 1415 to his mansion on the other side of the lane.

The earliest records of Lincoln's inn, the *Black Books*, commence in 1422. The item under date 1437–38 of 40s. for the rent of "Lyncollysyn" is obviously for the old premises of Thomas de Lincoln. The rent of the new premises to the bishop of Chichester at this period was ten marks, which sum continued to be paid until the freehold was conveyed to Richard Kingsmill and his fellow benchers by Edward Suliard in 1580 for the sum of £520. By this time the title of "hospicium" had been dropped and the title was now once more "the society of Lincoln inn." All were "fellows" (*socii*) of the "fellowship" (*societas*), although the term "company" was also used to describe the whole body. The control of the society was vested in the council, which consisted of the masters of the bench. Next in rank came the utter-barristers, those who had been called to the bar, and the inner-barristers or students, so called because at the moots held in the hall of the inn the former sat on the outermost part of the form which represented the bar of the court, and the latter sat inside and between them. Formerly attorneys and solicitors also might be members of the inn. The chief officials were the four governors, who ceased to be elected in 1574 and whose place was taken by the treasurer. The other officers were the autumn and Lent readers, the dean of the chapel, the keeper of the *Black Books*, the marshal, the pensioner, originally the chief official, the butler for Christmas, the steward for Christmas, the master of the revels, the chief butler, the escheator, the chaplain and the servants, the chief of whom was the manciple, mentioned in the city archives of 1417. It is interesting to note that Sir Thomas More's grandfather was chief butler prior to his call in 1470. He became autumn reader in 1489. The chief butler at this period acted rather as clerk to the council than as butler in the modern sense. He was clearly an educated man. The bishop of Chichester's palace and the chapels of Our Lady and of St. Richard sufficed for the needs of the society for nearly a century. The Bishop's Hall was pulled down in 1491 and the present Old Hall erected in its place in 1506. This has recently been restored to its former state. When this proved insufficient for the growing membership the present New Hall was built in 1843. The present chapel, constructed by Inigo Jones, was completed in 1623. Thavie's inn was sold by the benchers in 1769 and thus erased as a legal institution. The other inn of chancery attached to Lincoln's inn, Furnival's inn, dates from about 1406. In 1817, with the exception of the hall, it was rebuilt. This building, abutting upon Holborn, has since been pulled down, and upon its site arose the present office of the Prudential Insurance Society, the ancient hall being again preserved. Here Charles Dickens was living when the *Pickwick Papers* were published.

Gray's Inn.—The site of Gray's inn formed part of the manor of Portpoole, which became the property of Richard de Chygwell in 1280. This site passed in 1294 to the dean and chapter of St. Paul's, who let it to Reginald de Grey, chief justice of Chester and first Lord Grey of Wilton. There is little doubt that the judge lived here with his clerks and other officers of his court and law students. The Greys had for a century been connected as officials with both the court of exchequer and the chancery. Gray's inn continued in the de Grey family till the conveyance of the manor of Portpoole by Lord Grey of Wilton to Hugh Denys and Mary his wife and other feoffees, who in 1503 sold the manor to the prior and convent of the charter house at Sheen, from whom the benchers held the inn until the dissolution of the monasteries in 1539 when the rent became due to the Crown. In 1733 the benchers acquired the freehold. The existing records of the inn only commence with the year 1569, but from other evidence there is every reason to believe that so far from Gray's inn being the youngest member of the four inns of court, it is at least of equal antiquity to that of any other inn. In 1370 it was described as *hospicium*, from which we are justified in assuming that prior to this date it was in the occupation of a legal society. We have a list of readers commencing with John Markham 1391 and, out of chronological order, William Skipwith 1355, who was already a serjeant. From a Year Book of Edward III. we learn that "Ingleby having taken an exception at bar, Willby and Skipwith answered that that was never an exception taken in that place, though they had often heard it *entre les apprentices en hostelles*." This would mean that Gray's inn was in existence as a legal society at least as early as 1330 and it is highly probable that the description in the Harleian ms. of Ralph Andrew as a bencher of "Grayes Inne" in 1311 is correct. The constitution and officers of the inn are similar to those of the other inns. When the records open governors had ceased to be elected. The control of the inn was vested in the masters of the bench. The office of pensioner was abolished in 1630, but the name survives in the *Pension Book of Gray's Inn* and in the old and new pension chambers, where the masters of the bench meet for the discussion and transaction of the business of the society and for relaxation. Of the servants of the inn the chief were, in 1570, the steward, the master butler, the priest and the master cook. After the Reformation, the priest gave way to the chaplain, and in 1631 the order of precedence was "the preacher, the chaplain, the steward, the master butler, the master cook, to be allowed such commons as gentlemen: the second butler, the third butler, the fourth butler, the second cooke, the preacher's man, the steward's man, one washpot, two turne broches to be allowed such commons as yeomen are." In addition were the chapel clerk, the laundress, the gardener and the cleaners of the sewers and courts. Whether any of the old hall of the de Greys remains cannot be determined. We know that it was rebuilt or re-edifyed under the supervision of Nicholas Bacon and Gilbert Gerard in 1556. Restored in recent years to its original state it is a particularly fine specimen of Tudor architecture and may be compared with the Middle Temple hall, which it much resembles, although on a smaller scale. The oak screen is said

to have been presented by Elizabeth. The chapel was certainly in existence prior to 1315, when John de Grey made provision for a chaplain. It was reconstructed or re-edifyed in 1615 and finally restored in 1893. We hear first of the library in 1555. It was housed in a chamber on the first floor of No. 1 Gray's inn square, over which Francis Bacon, afterwards lord chancellor, was allowed to extend his adjoining chambers. In 1788 the library was moved to the old duchy office, east of the hall, and in 1884 No. 8 South square, where Macaulay once had chambers, was swept away for an extension. To make room for a further extension No. 7 has now disappeared also. The oldest chambers in the inn are those erected in Gray's inn place in 1696.

The inns of chancery affiliated to Gray's inn were Staple inn and Barnard's inn. The former was an inn of chancery in the reign of Henry V., and is probably of far earlier date, since here was held the court of the Staple, where the judges sat on woolsacks. The inn is now the property of the Actuaries Society. Barnard's inn, named after Lionel Barnard who leased it from the dean of Lincoln, became an inn of chancery at least before 1451, when we are told by Stow that as a result of "a tumult to-night the gentlemen of the inns of court and chancery and the citizens . . . the principals of Clifford's inn, Furnival's inn and Barnard's inn were sent prisoners to Hartford castle." Its hall was already in existence at this date. The inn is now the property of the Mercer's company and used as a school.

The Inner and Middle Temples, so far as their history can be traced, have always been separate societies. The first mention of the Middle Temple as a distinct society occurs in a will dated 1404, and of the Temple as an inn of court in the *Paston Letters,* where, under date Nov. 1440, the Inner Temple is spoken of as a college, as is also subsequently the Middle Temple. The Temple had been the seat in England of the Knights Templars, on whose suppression in 1312 it passed with other of their possessions to the Crown, and after an interval of some years to the Knights Hospitallers of St. John of Jerusalem. It now appears that 13 houses built by Roger Blom, formerly *nuncius* of the Templars, in the churchyard, north of the church, were let to certain professors of the common law not later than 1326. Notwithstanding the destruction of the muniments of the Temple by fire or by popular commotion, sufficient testimony is attainable to show that in the reigns of Edward III. and Richard II. the Temple had become the residence of the legal communities which have since maintained there a permanent footing. The two societies continued as tenants to the Knights Hospitallers of St. John until the dissolution of the order in 1539; they then became the lessees of the Crown, and so remained until 1609, when James I. made a grant by letters patent of the premises in perpetuity to the benchers of the respective societies on a yearly payment by each of £10, a payment bought up in the reign of Charles II. In this grant the two inns are described as "the Inner and the Middle Temple or New Temple," and as "being two out of those four colleges the most famous of all Europe" for the study of the law. Excepting the church and the priests' hall at the west end of the hall, nothing remains of the edifices belonging to the Knights Templars, the present buildings having been almost wholly erected since the reign of Queen Elizabeth or since the Great Fire, in which the major part of the Inner Temple perished. The church has been in the joint occupation of the Inner and Middle Temple from time immemorial—the former taking the southern and the latter the northern half. The round portion of the church was consecrated in 1185, the nave or choir in 1240. It is the largest and most complete of the four remaining round churches in England, and is built on the plan of the church of the Holy Sepulchre at Jerusalem. Narrowly escaping the ravages of the fire of 1666, this beautiful building is one of the most perfect specimens of early Gothic architecture in England. In former times the lawyers awaited their clients for consultation in the round church, as similarly the serjeants-at-law were accustomed to resort to St. Paul's cathedral, where each serjeant had a pillar assigned him. The constitution of both societies is similar to those of the other inns, but the meetings of the benchers are in both styled a "parliament," which is further evidence of their antiquity.

The *Inner Temple*, comprehending a hall, parliament chamber, library and other buildings, occupies the site of the ancient mansion of the Knights Templars, which has from time to time been more or less rebuilt and extended, the present handsome range of buildings, including a new dining hall, being completed in 1870. The library owes its existence to William Petyt, keeper of the Tower Records in the time of Queen Anne, who was also a benefactor to the library of the Middle Temple. The greatest addition by gift was made by the Baron F. Maseres in 1825. Of the inns of chancery belonging to the Inner Temple *Clifford's inn* was anciently the town residence of the Barons Clifford, and was demised in 1345 to a body of students of the law. It was the most important of the inns of chancery, and numbered among its members Coke and Selden. At its dinners a table was specially set aside for the "Kentish Mess," though it is not clear what connection there was between the inn and the county of Kent. It was governed by a principal and 12 rulers. *Clement's inn* was an inn of chancery before the reign of Edward IV., taking its name from the parish church of St. Clement Danes, to which it had formerly belonged. Clement's inn was the inn of Shakespeare's Master Shallow, and was the Shepherd's inn of Thackeray's *Pendennis*. The buildings of Clifford's inn survive (1928), but of Clement's inn there are left but a few fragments.

The *Middle Temple* possesses in its hall one of the most stately of existing Elizabethan buildings. Commenced in 1562, under the auspices of Edmund Plowden, then treasurer, it was not completed until 1572, the richly carved screen at the east end in the style of the Renaissance being erected in 1575. The hall, which has been preserved unaltered, has been the scene of numerous historic incidents, notably the entertainments given within its walls to regal and other personages from Queen Elizabeth downwards. The library, which contains about 28,000 volumes, dates from 1641, when Robert Ashley, a member of the society, bequeathed his collection of books in all classes of literature to the inn, together with a large sum of money; other benefactors were Ashmole (the antiquary), William Petyt (a benefactor of the Inner Temple) and Lord Stowell. From 1711 to 1826 the library was greatly neglected; and many of the most scarce and valuable books were lost. The present handsome library building, which stands apart from the hall, was completed in 1861, the prince of Wales (afterwards Edward VII.) attending the inauguration ceremony on Oct. 31 of that year, and becoming a member and bencher of the society on the occasion. He afterwards held the office of treasurer (1882). The mss. in the collection are few and of no special value. In civil, canon and international law, as also in divinity and ecclesiastical history, the library is very rich; it contains also some curious works on witchcraft and demonology. There was but one inn of chancery connected with the Middle Temple, that of *New inn*, which, according to Dugdale, was formed by a society of students previously settled at St. George's inn, situated near St. Sepulchre's church without Newgate; but the date of this transfer is not known. The buildings have now been pulled down.

The King's Inns, Dublin, the legal school in Ireland, corresponds closely to the English inns of court, and is in many respects in unison with them in its regulations with regard to the admission of students into the society, and to the degree of barrister-at-law, as also in the scope of the examinations enforced. Formerly it was necessary to keep a number of terms at one of the inns in London—the stipulation dating as far back as 1542 (33 Henry VIII. c. 3). Down to 1866 the course of education pursued at the King's inns differed from the English inns of court in that candidates for admission to the legal profession as attorneys and solicitors carried on their studies with those studying for the higher grade of the bar in the same building under a professor specially appointed for this purpose—herein following the usage anciently prevailing in the inns of chancery in London. This arrangement was put an end to by the Attorneys and Solicitors Act (Ireland) 1866. The origin of the King's inns may be traced to the reign of Edward I., when a legal society designated Collett's inn was established without the walls of the city; it was destroyed by an insurrectionary band. In the reign of Edward III. Sir Robert Preston, chief baron of the Exchequer, gave up his residence within the city

to the legal body, which then took the name of Preston's inn. In 1542 the land and buildings known as Preston's inn were restored to the family of the original donor, and in the same year Henry VIII. granted the monastery of Friars Preachers for the use of the professors of the law in Ireland. The legal body removed to the new site, and thenceforward were known by the name of the King's inns. Possession of this property having been resumed by the Government in 1742, and the present Four Courts erected thereon, a plot of ground at the top of Henrietta street was purchased by the society, and the existing hall built in the year 1800. The library, numbering over 50,000 volumes, with a few mss., is housed in buildings specially provided in the year 1831, and is open, not only to the members of the society, but also to strangers. The collection comprises all kinds of literature. It is based principally upon a purchase made in 1787 of the large and valuable library of Justice Robinson, and is maintained chiefly by an annual payment made from the Central Fund of the Irish Free State in substitution for the annual payment formerly made from the Consolidated Fund to the society in lieu of the right to receive copyright works which was conferred by an Act of 1801, but abrogated in 1836.

In discipline and professional etiquette the members of the bar in Ireland differ little from their English brethren. The same style of costume is enforced, the same gradations of rank—attorney-general, solicitor-general, king's counsel and ordinary barristers—being found. There are also serjeants-at-law limited, however, to three in number, and designated 1st, 2nd and 3rd serjeant. The King's inns do not provide chambers for business purposes; there is consequently no aggregation of counsel in certain localities, as is the case in London in the inns of court and their immediate vicinity.

The corporation known as the *Faculty of Advocates* in Edinburgh corresponds with the inns of court in London and the King's inns in Dublin (*see* ADVOCATES, FACULTY OF).

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INNUENDO: *see* LIBEL AND SLANDER.

INOUYE, KAORU, MARQUESS (1835–1915), Japanese statesman, was born in 1835, a *samurai* of the Chōshū fief. He was a friend of his fellow-clansman Prince Ito, and they visited England together in 1863, serving as common sailors during the voyage. At that time all travel abroad was forbidden on pain of death, but the veto did not prove deterrent in the face of a rapidly growing conviction that, as a matter of self-protection, Japan must assimilate the essentials of Western civilization. Shortly after the departure of Inouye and Ito, the Chōshū fief, having fired upon foreign vessels passing the strait of Shimonoseki, was menaced by war with the Yedo government or with the insulted powers, and Inouye and Ito, on receipt of this news, hastened home hoping to avert the catastrophe. They repaired to the British legation in Yedo and begged that the allied squadron, then about to sail for Shimonoseki to call Chōshū to account, should be delayed that they might have an opportunity of advising the fief to make timely submission. Not only was this request complied with, but a British frigate was detailed to carry the two men to Shimonoseki, and, pending her departure, the British legation assisted them to lie *perdu*. Their mission proved futile, however, and Inouye was subsequently waylaid by a party of conservative *samurai*, who left him covered with wounds. This experience did not modify his liberal views, and, by the time of the Restoration in 1867, he had earned a high reputation as a leader of progress and an able statesman.

As foreign minister Inouye had the conduct of the long and abortive negotiations for treaty revision between 1883 and 1886, and in 1885 he was raised to the peerage with the title of count, being one of the first group of *Meiji* statesmen whose services were thus rewarded. Prior to his permanent retirement from office in 1898, he held the portfolios of foreign affairs, finance, home affairs and agriculture and commerce, and throughout the war with Russia he attended all important state councils, by order of the emperor, being also specially designated adviser to the minister of finance. In 1907 he was raised to the rank of marquess. His name will go down in his country's history as one of the five *Meiji* statesmen, namely, Princes Ito and Yamagata, Marquesses Inouye and Matsukata and Count Okuma. He died on Sept. 1, 1915.

INOWRACLAW (Hohensalza), town of Poland, 21 m. S.W. of Thorn. Pop. (1921) 24,277. It is situated on rising ground above a fertile district and has an agricultural trade. Iron-founding and the manufacture of machinery and chemicals are important. In the vicinity are important salt works and a sulphur mine. Inowraclaw is mentioned as early as 1185, and in 1772 it passed to Prussia. It passed to Poland after the war of 1914–18.

INQUEST: *see* CORONER.

INQUISITION, THE. The name given to the ecclesiastical jurisdiction dealing both in the middle ages and in later times with the detection and punishment of heretics and all persons guilty of any offence against Catholic orthodoxy. (Lat. *inquisitio*, an inquiry.) It is incorrect to say that the Inquisition made its appearance in the 13th century complete in all its principles and organs. It was the result of, or rather one step in, a process of evolution, the beginnings of which are to be traced back to the fourth century at least.

Opinions of the Fathers.—During the first three centuries of the Church there is no trace of any official persecution, and the earlier Fathers, especially Origen and Lactantius, reject the idea of it. Constantine, by the edict of Milan (313), inaugurated an era of official tolerance, but from the time of Valentinian I. and Theodosius I. onwards, laws against heretics began to appear, and increased with astonishing regularity and rapidity. Heretics are subjected to exile or confiscation, disqualified from inheriting property, and even, in the case of a few groups of Manichaeans and Donatists, condemned to death; but it should be noticed that these penalties apply only to the outward manifestations of heresy, and not, as in the middle ages, to crimes of conscience. Within the Church, St. Optatus alone (*De schismate Donatistarum*, lib. iii. cap. iii.) approved of this violent repression of the Donatist heresy; St. Augustine only admitted a *temperata severitas*, such as scourging, fines or exile, and at the end of the 4th century the condemnation of the Spanish heretic Priscillian, who was put to death in 385 by order of the emperor Maximus, gave rise to a keen controversy. St. Martin of Tours, St. Ambrose and St. Leo vigorously attacked the Spanish bishops who had obtained the condemnation of Priscillian. St. John Chrysostom considered that a heretic should be deprived of the liberty of speech and that assemblies organized by heretics should be dissolved, but declared that "to put a heretic to death would be to introduce upon earth an inexpiable crime."

The Middle Ages.—From the 6th to the 9th century the heterodox, with the exception of the Manichaean sects in certain places, were hardly subjected to persecution. They were, moreover, rare and generally isolated, for groups of sectaries only began to appear to any extent at the time of the earliest appearances of Catharism. But from the latter part of the 10th century until the beginnings of the 12th there were numerous executions of heretics, either by burning or strangling, in France, Italy,

the Empire and England; and during this period it is not easy to determine what part was taken by the Church and its bishops and doctors in this series of executions. In many cases the people, supported by the crown, were responsible for the death of the heretics; the historians give only the faintest indications of any direct intervention of the clergy, except perhaps for the examination of doctrine. The theory in these matters was at first as uncertain as the practice; in the 11th century one bishop only, Theodwin of Liége (d. 1075), affirms the necessity for the punishment of heretics by the secular arm (1050). His predecessor, Wazo, bishop of Liége (1041–44), had expressly condemned any capital punishment and advised the bishop of Chalons to resort to peaceful conversion. In the 12th century Peter the Cantor[1] protested against the death penalty, admitting at the most imprisonment; and in dealing with the heretics of Cologne, St. Bernard, who cannot be accused of leniency where heterodoxy was concerned, recommended pacific refutation, followed by excommunication or prison, but never the death penalty (*see* BERNARD, ST., OF CLAIRVAUX).

But it must be noticed that from the opening years of the 12th century date the beginnings of a decided evolution in the canon law, continuing up to the time of Innocent III., which substituted for arbitrary decisions according to circumstances an organized and particularized legislation, in which judgment was given *secundum canonicas et legitimas sanctiones,* Anselm of Lucca and the *Panormia* attributed to Ivo of Chartres reproduced word for word under the rubric *De edicto imperatorum in damnationem hoereticorum,* law 5 of the title *De hereticis* of Justinian's code, which pronounces the sentence of death against the Manichaeans; and we should remember that the Cathari, and in general all heretics in the West in the 11th and 12th centuries were considered by contemporary theologians as Manichaeans. Gratian in the *Decretum* proclaims the views of St. Augustine (exile and fines). From the beginning of the 12th century the death penalty for impenitent heretics was frequently demanded in influential quarters. In 1184 Pope Lucius III. and the emperor Frederick Barbarossa agreed on the penalties of exile, confiscation, demolition of their houses, *infamia,* and loss of civil rights. The usage, then, was already quite clear; but the death penalty had not as yet been inflicted. It was probably Peter II. of Aragon who was the first to decree, in 1197, the punishment of death by burning against the heretics who should not have left his kingdom within a given time. But it was Innocent III. who gave the most powerful impetus to the anti-heretical movement in the secular world by his frequent exhortations (beginning in 1198) to the secular princes (letters of March 25, 1199, and Sept. 22, 1207).

Beginnings of the Inquisition.—From the foregoing it is clear that the Inquisition did not arise out of, and at the time of, the crusade against the Albigenses. These executions *en masse* certainly created a definitive precedent for violent repression, but there was still no regular organization: the council of Toulouse, held in Nov. 1229 by the Roman legate after the treaty of peace, attempted to organize one, and constituted itself the tribunal. But the procedure was still uncertain. The emperor Frederick II. defined his jurisprudence more clearly: from 1220 to 1239, supported by Pope Honorius III., and above all by Gregory IX., he established against the heretics of the Empire in general a legislation in which the penalties of death, banishment and confiscation of property were formulated so clearly as to be henceforth incontestable. Gregory IX. felt his influence, and also that of the Dominican Guala, bishop of Brescia, who had subjected his episcopal town to the full rigour of the imperial laws. The pope no longer hesitated as to the principle or the degree of repression; but introduced new methods of inquiry and judgment: he created out of the material furnished by the mendicant orders, and especially the Dominicans, the monastic inquisition, which was more elastic, more constant in its activities and more numerous than the inquisition by legate, and better disciplined than the episcopal inquisition. In Nov. 1232 the Dominican Alberic went round Lombardy with the title of *Inquisitor haereticae pravitatis.* In 1231 a similar commission was given to the Dominicans of Friesach and to the terrible Conrad of Marburg, whose zeal in Germany even exceeded the pope's wishes. In 1233 Gregory IX. addressed a letter to the bishops in the south of France, in which he announced his intention of employing the preaching friars for the discovery and repression of heresy. The inquisition was now regularly instituted, but its jurisprudence was elaborated by successive additions or limitations by the force of custom and the detailed prescriptions added by the papal constitutions. The pope's commissioners "in the matter of heresy" at first travelled from place to place. On arriving in a district they addressed its inhabitants, called upon them to confess, if they were heretics, or to denounce those whom they knew to be heretics: a "time of grace" was opened, during which those who freely confessed were dispensed from all penalties, or only given a light penance; while those whose heresy had been openly manifested were exempted from the penalties of death and perpetual imprisonment. But this time could not exceed one month. After that began the inquisition. As soon as their mission was at an end, and heresy was considered to be stamped out, the inquisitors left the country. Later, inquisitorial districts were formed. The seat of the Inquisition in each district was the monastery of the order (Dominican or Franciscan) to which the inquisitors for that part belonged. There was never any special court or prison: the *murus* (prison) was lent to the Inquisition by the ecclesiastical or secular authorities. The maintenance of the prisoners and the duty of providing the prison fell in principle upon the bishops (council of Toulouse, 1229), but they tried to evade it. The kings of France, and in particular Louis VIII., granted subsidies to the inquisitors. For each district the inquisitors were chosen by the provincials of their order, approved or rejected by the pope, and removable by him only. Their discretionary powers were absolute. They conducted their interrogations before two persons (laymen or ecclesiastics) and only pronounced their sentence after consultation with leading men in the district. This was the only protection for the accused. It was in vain that the civil lawyers tried to prove that the secular authorities had a right to see the documents bearing on the case; the Inquisition always succeeded in setting aside these claims. The share taken in the proceedings by the bishops, the accused or their representatives, though admitted in principle, was as a rule merely illusory.

Procedure of the Inquisition.—Bernard Guy (Bernardus Guidonis), Dominican, 1261–1331, one of the earliest and most complete exponents of the theory of the Inquisition, admits distinctly that in its procedure *multa sunt specialia.* The procedure was secret and in the highest degree arbitrary, proceeding *sine strepitu et figura judicii,* its object being to ascertain not so much particular offences as tendencies: the murderers of the inquisitor Peter Martyr (Dominican, d. 1252) were tried, not as assassins, but as guilty of heresy and adversaries of the Inquisition; and on the other hand, external acts of piety and verbal professions of faith were held of no value. Moreover, the Inquisition was not bound by the ordinary rules of procedure in its inquiries: the accused was surprised by a sudden summons, and as a rule imprisoned on suspicion. All the accused were presumed to be guilty, the judge being at the same time the accuser. Absence was naturally considered as contumacy, and only increased the presumption of guilt by seeming to admit it. The accused had the right to demand a written account of the offences attributed to him, but the names of the witnesses were withheld from him (Innocent IV.; bulls *Cum negocium* and *Licet sicut accepimus*), he did not know who had denounced him, nor what weight was attached by the judges to the denunciations against him. The utmost that was allowed him was the unsatisfactory privilege of the *recusationes divinatrices, i.e.,* at his first examination he was asked for the names of any enemies of whom he knew, and the causes of their enmity. Heretics or persons deprived of civil rights (*infames*) were admitted as witnesses in cases of heresy. Women, children or slaves could be witnesses for the prosecution, but not for the defence, and cases are even

[1] Pierre de Beauvoisis (?), choir-master (*grand-chantre*) of the university of Paris (1184), bishop of Tournai (1191), of Paris (1196); died as a Cistercian in 1197. He was beatified.

to be found in which the witnesses were only ten years of age. Langhino Ugolini states that a witness who should retract his hostile evidence should be punished for false witness, but that his evidence should be retained, and have its full effect on the sentence. No witness might refuse to give evidence, under pain of being considered guilty of heresy. The prosecution went on in the utmost secrecy. The accused swore that he would tell the whole truth, and was bound to denounce all those who were partners of his heresy, or whom he knew or suspected to be heretics. If he confessed, and denounced his accomplices, relatives or friends, he was "reconciled" with the Church, and had to suffer only the humiliating penalties prescribed by the canon law. If further examination proved necessary, it was continued by various methods. Bernardus Guidonis enumerates many ways of obtaining confessions, sometimes by means of moral subterfuges, but sometimes by a process of weakening the physical strength. And as a last expedient torture was resorted to. The Church was originally opposed to torture, and the canon law did not admit confessions extorted by that means; but by the bull *Ad extirpanda* (1252) Innocent IV. approved its use for the discovery of heresy, and Urban IV. confirmed this usage, which had its origin in secular legislation (*cf.* the Veronese Code of 1228, and Sicilian Constitution of Frederick II. in 1231). In 1312 excessive cruelty had to be suppressed by the council of Vienna. The next step was the torture of witnesses, a practice which was left to the discretion of the inquisitors. Moreover, all confessions or depositions extorted in the torture-chamber had subsequently to be "freely" confirmed.

The procedure was of course not litigious; any lawyer defending the accused would have been held guilty of heresy. The inquiry might last a long time, for it was interrupted or resumed according to the discretion of the judges, who disposed matters so as to obtain as many confessions or denunciations as possible. After the different phases of the examination, the accused were divided into two categories: (1) those who had confessed and abjured, (2) those who had not confessed and were convicted of heresy. There was a third class, by no means the least numerous, namely, those who having previously confessed and abjured had relapsed into error. Next came the moment of the sentence: "there was never any case of an acquittal pure and simple" (H. C. Lea). The formula for full and complete acquittal given by Bernardus Guidonis in his *Practica,* should, he says, never or very rarely be employed. The sentences were solemnly pronounced on a Sunday, in a church or public place, in the presence of the inquisitors, their auxiliaries, the bishops, the secular magistrates and the people. This was the *sermo generalis.* The accused who had confessed were reconciled, and the penalties were then pronounced; these were, in order of severity, penances, fasting, prayers, pilgrimages, public scourging, the compulsory wearing on the breast or back of crosses of yellow felt sewn on to the clothes or sometimes of tongues of red, letters, etc. The inquisitors eventually acquired the right of inflicting fines at discretion. In 1244 and 1251 Innocent IV. reproved them for their exactions. All these minor penalties could be commuted for payments in money in the same way as absolution from the crusader's vow, and the council of Vienna tried to put an end to these extortions. Beyond these minor penalties came the severer ones of imprisonment for a period of time, perpetual imprisonment and imprisonment of various degrees of severity (*murus largus, murus strictus vel strictissimus*). The *murus strictus* consisted in the deepest dungeon, with single or double fetters, and "the bread and water of affliction"; but the severity of the prison régime varied very much. The *murus largus,* especially for a rich prisoner, amounted to a fairly mild imprisonment, but the mortality among those confined in the *murus strictus* became so high that Clement V. ordered an inquiry to be made into the prison régime in Languedoc, in spite of Bernard Guy's protest against the investigation as likely to diminish the prestige of the inquisitors. After the sentences had been pronounced, the obstinate heretics and renegades were for the last time called upon to submit and to confess and abjure. If they consented, they were received as penitents, and condemned on the spot to perpetual imprisonment; if they did not consent, they were handed over to the secular arm. When the heretic was handed over to the secular arm the agents of the secular power were recommended to punish him *debita animadversione,* and the form of recommending him to mercy was gone through. In effect, handing over to the secular arm was equivalent to a sentence of death, and of death by fire. Jacob Sprenger, Dominican provincial in Germany (1494) and inquisitor, does not hesitate to speak of the victims *quas incinerari fecimus* ("whom we [the inquisitors] caused to be burnt to ashes"). But we must accept the conclusions of H. C. Lea and Vacandard that comparatively few people suffered at the stake in the mediaeval Inquisition. Between 1308 and 1323, Bernard Guy, who cannot be accused of inactivity, only handed over to the secular arm 42 persons, out of 930 who were convicted of heresy.

Punishment by Confiscation of Goods.—From the point of view of jurisprudence of the Inquisition, the confiscation of the condemned man's property by the ecclesiastical and secular powers is only the accompaniment to the more severe penalties of perpetual imprisonment or death; but from the point of view of its economic history the importance of the confiscation is supreme. The practice originated in the Roman law, and all secular princes had already, in their own interest, recognized it as lawful (Frederick Barbarossa, Decree of Verona; Louis VIII., ordinances of 1226, 1229; Louis IX., ordinance of 1234; Raymond VII. of Toulouse, etc.). In the kingdom of France there was a special official, the *procureur des encours* (confiscation in the matter of heresy), whose duty it was to collect the personal property of the heretics, and to incorporate their landed estates in the royal domain; in Languedoc crying abuses arose, especially under Alphonse of Poitiers. Soon the papacy managed to gain a share of the spoils, even outside the states of the Church, as is shown by the bulls *ad extirpanda* of Innocent IV. and Alexander IV., and henceforward the inquisitors had, in varying proportions, a direct interest in these spoliations. In Spain this division only applied to the property of the clergy and vassals of the Church, but in France, Italy and Germany, the property of all heretics was shared between the lay and ecclesiastical authorities. Venice alone decided that all the receipts of the Holy Office should be handed over in full to the state. Clement V., in his attempted reform and regularization of inquisitorial procedure, endeavoured to reduce the confiscations to a fairly reasonable minimum, and in 1337–38 a series of papal inquiries was held into this financial aspect of the matter. The Assize of Clarendon, the Constitutions of Frederick II. (1232) and of Count Raymond of Toulouse (1234) had also come to a joint decision with the councils on this question. Charles V. of France prevailed upon the papacy to abolish this regulation (1378). Confiscation was, indeed, most profitable to the secular princes, and there is no doubt that the hope of considerable gain was what induced many princes to uphold the inquisitorial administration, especially in the days of the decay of faith. The resistance of the south of France to the Capetian monarchs was to a large extent broken owing to the decimation of the bourgeoisie by the Inquisition and their impoverishment by the extortions of the *encours.* The same was the case in certain of the Italian republics; while in districts such as the north of France, where heretics were both poor and few, the Inquisition did not easily take root, nor did it prove very profitable. These confiscations, the importance of which in the political and economic history of the middle ages was first shown fully by H. C. Lea, were a constant source of uncertainty in transactions of all kinds; there was, for instance, always a risk in entering into a contract in a place where the existence of heretics was suspected, since any contract entered into with a heretic was void. Nor was there any more security in the transmission of inheritances for posthumous trials were frequent; the *Liber sententiarum inquisitionis* of Bernardus Guidonis (1307–23) records sentences pronounced after death against 89 persons during a period of 15 years. But not only was their property confiscated and their heirs disinherited; they were subject to still further penalties. Frederick II. extended to heresy the application of the Roman law disqualifying from holding office, and even included under its operation the children and

grandchildren of the guilty man. Alexander IV. and Boniface VIII. lightened the severity of this law, and removed certain disqualifications, notably in the case of ecclesiastical offices and property.

The sphere of action of the Inquisition was gradually extended by the theologians and casuists until sorcery and magic ranked with doctrinal heresy (*see* Hansen, *Inquisition, Hexenwahn, u. Hexenverfolgung*, 1900). With regard to Jews, they might profess their religion and observe its rites without being in a state of heresy: they were only heretic when they attacked the Christian faith or community, made proselytes, or returned to Judaism after being converted. But those who practised usury were "suspected of not holding orthodox doctrine as to theft" (Vacandard), and on this account the Inquisition gained a hold on them (the special case of Spain is described on page 381).

TREATMENT OF HERESY

England.—The Inquisition was primarily the instrument for the repression of all kinds of breaches of orthodoxy. Its work in this capacity we will now outline for each of the great countries of mediaeval Christendom. England, whether before or after the establishment of the Inquisition, had few trials for heresy and, particularist in this as in all her religious activity, judged them according to her own discipline, without asking Rome for laws or special judges. But orthodoxy remained almost unimpaired until the time of Wycliffe. Apparently neither the Catharist, Waldensian nor pantheistic heresies gained any footing in Great Britain. The affair of the Templars in France, which was quite political, was repeated in England: Clement V. having ordered their arrest, Edward II., after much hesitation, gave orders to the sheriffs to execute it and then decided that the *ecclesiastical law* should be applied. The papal inquisitors sent to England met with a bad reception, and the pope was obliged to forbid them to use torture, which was contrary to the laws of the kingdom. It was found impossible to establish the Templars' guilt and only canonical penalties were inflicted on them. The rising of the Lollards having alarmed both the church and the state, the article *De haeretico comburendo* was established by statute in 1401, and gained a melancholy notoriety during the religious struggles of the 16th century; it seems to have been not so much a measure for the safeguarding of dogma as a violent assertion of the secular absolutism. It was not till 1676 that Charles II. caused it to be abrogated, and obtained a decision that in cases of atheism, blasphemy, heresy, schism and other religious offences, the ecclesiastical courts should be confined to the penalties of excommunication, removal from office, degradation and other ecclesiastical means of censure, to the exclusion of the death penalty. Scotland was much later than England in giving up persecution and bloodshed; and so late as 1696 a student of medicine aged eighteen named Aikenhead was accused of heresy and hanged in Edinburgh.

France.—The activities of the monastic Inquisition in France lay chiefly in the south. The repression of the Albigensian heresy went on even when its importance had disappeared. The chronicle of the inquisitor Guilhem Pelhisso (d. 1268) shows us the most tragic episodes of the reign of terror which wasted Languedoc for a century. Guillaume Arnaud, Peter Cella, Bernard of Caux, Jean de St. Pierre, Nicholas of Abbeville, Foulques de St. Georges, were the chief of the inquisitors who played the part of absolute dictators, burning at the stake, attacking both the living and the dead, confiscating their property and land, and enclosing the inhabitants both of the towns and the country in a network of suspicion and denunciation. The secular authorities were of the utmost assistance to them in this task; owing to the confiscations, the crown had too direct an interest in the success of the inquisitorial trials not to connive at all their abuses. There were frequent attempts at retaliation, directed for the most part against the inquisitors, and isolated attacks were made on Dominicans; but the work of repression culminated under Bernard Guy, and completed the destruction of Catharism, the appearances of which after the middle of the 14th century are rare. Afterwards the efforts of the Inquisition were directed against the Spirituals, who were a branch of the Franciscans, and were remote disciples of Joachim, abbot of Floris (*q.v.*), and whom their rigid rule of absolute poverty led, by a reaction against the cupidity of the ordinary ecclesiastics, to repudiate the papal hierarchy. On Feb. 17, 1317 John XXII. condemned all these irregular followers of St. Francis, and the Inquisition of Languedoc was at once set against them. Four *spirituales* were burnt at Marseilles in 1318, and soon the persecution was extended to the Franciscan *beguins* or *tertiarii*, many being burnt about 1320. The Waldenses (*q.v.*) were more difficult to destroy: originally less dangerous to the church than the Cathari, they resisted longer, and their dispersal in scattered communities aided their long resistance.

In the north of France the workings of the Inquisition were very intermittent; for there were fewer heretics there than in the south, and as they were poorer, there was less zeal on the part of the secular arm to persecute them. At its outset, however, the Inquisition in the north of France was marked by a series of melancholy events: the inquisitor Robert le Bougre, formerly a Catharist, spent six years (1233–39) in going through the Nivernais, Burgundy, Flanders and Champagne, burning at the stake in every place unfortunates whom he condemned without a judgment, supported as he was by the ecclesiastical authorities and by princes such as Theobald of Champagne. The pope was forced to put a check on his zeal, and, after an inquiry, condemned him to imprisonment for life. We know that there were inquisitors settled in Île de France, Orléanais, Touraine, Lorraine and Burgundy during the 12th century, but we know next to nothing of what they did. In the 14th century, the Flemish and German heresies of the Free Spirit made their appearance in France, and some executions resulted. But in the 15th century, with the exception of a few condemnations aimed against the Hussites, the Inquisition acted but feebly.

From the middle of the 14th century onward, the *parlement* had taken upon itself the right of hearing appeals from persons sentenced by the Inquisition. And the University again, by its faculty of theology, escaped the jurisdiction of the Inquisition. These two great bodies at the time of the Reformation took the place of the Inquisition in dealing with heresy.

Italy.—In Italy heresy not infrequently took on a social or political character; it was sometimes almost indistinguishable from the opposition of the Ghibellines or the communalist spirit of independence. Lombardy, besides a number of Cathari, contained a certain number of vaguely-defined sects against whom the efforts of the Apostolic Visitors sent by Innocent III. were not of much effect. From the very earliest days of the Inquisition, John of Vicenza, Roland of Cremona and Rassiero Sacchoni directed their persecutions against Lombardy, and especially against Milan. St. Peter Martyr, who was conspicuous for his violence, was assassinated in 1252. On March 20, 1256 Alexander IV. ordered the provincial of the friar preachers of Lombardy to increase the number of inquisitors in that province from four to eight. At Florence both heresy and Ghibellinism were alike crushed by the severities of Fra Ruggieri, and indulgences were promised to all who should aid in the extinction of heresy in Tuscany. Certain districts revolted against this violence, which threatened to devastate Italy as it had devastated Provence; in 1277 Fra Corrado Pagano was killed on an expedition against the heretics of the Vattelline, and two years after the people of Parma rose against the inquisitors. Besides, this reign of terror only raised to a furious pitch the passionate and independent piety of the Italian peoples. The Inquisition had a hard struggle against the successes of Gerard Legarelli, and especially Dolcino (*see* APOSTOLICI), which only came to an end after a long and difficult trial of the adepts of the Messianist sect of Guglielma, some of whom belonged to the noble families of Lombardy. Up till the beginning of the 14th century, however, the power of the Inquisition steadily increased, and at this period Zanghino Ugolini appeared as the most skilful exponent of its theory and procedure. About the same time Charles of Anjou introduced the Inquisition into the Two Sicilies, but it could rarely effect anything there; the religious cohesion of the country was weak, and refugees were sure of safe hiding, both Waldenses and Fraticelli being frequently

harboured there.

Venice always preserved its autonomy as regards the repression of heresy; she was perfectly orthodox, but remained independent of Rome; Innocent IV. sent inquisitors there, but the heretics continued actually to be subject to the secular tribunals. In 1288 a compromise was arrived at, and the papal Inquisition was admitted into the republic, but only on condition that it should remain under the secular power; thus there was established a mixed régime which survived till the last days of the Venetian state. In Savoy the Inquisition constantly carried on severe measures against the Waldenses of the Alps. During the 14th and 15th centuries there was an uninterrupted succession of trials.

As regards the papal states, "it was in the nature of things that, by a confusion of the two personages, the pope should consider all opposition to him *qua* Italian prince as resistance offered to the head of the church, *i.e.*, to the church" (Langlois). The Colonna had a personal animosity against the Gaetani; therefore Boniface VIII., a Gaetano, declared the Colonna to be heretics. Rienzi was accused of heresy for having questioned the temporal sovereignty of the pope at Rome. The Venetians, who in 1309 opposed the annexation of Ferrara by Clement V. to the detriment of the house of Este, were proclaimed heretics and placed under the ban of Christendom. Savonarola was attacked because he interfered with the policy of Alexander VI. at Florence. It was this same desire for the hegemony of Italy which inspired the attitude of the popes throughout the middle ages, causing them to excommunicate, apparently without reason so far as doctrine was concerned, the Visconti of Milan, the Della Scala of Verona, the Maffredi of Faenza, etc., and prompting them to lay under an interdict or preach a crusade against certain rebellious great towns (Clement V. against Venice, John XXII. against Milan).

Germany.—In Germany heresies, especially of a mystical character, were numerous; some of them affected the people, and led to religious and social movements of no little importance. The repression of heresy went on by fits and starts, and the Inquisition was never exercised so regularly in the Germanic as in certain of the Latin countries. At the outset of the 13th century persecutions of the Waldenses and Ortlibarii (followers of Ortlieb of Strassburg, *c.* 1200) took place at Strasbourg; measures were taken locally, until, in 1231, Gregory IX. issued definite instructions to the German prelates with a view to a regular repression of heresy, and gave to Conrad of Marburg full powers to execute them. In Feb. 1234 the Diet of Frankfort decided, in spite of the pope's injunctions, that the destruction of heresy should be entrusted to the ordinary magistrates. Moreover, owing to the struggle between the Empire and the papacy, the German prelates always limited the prerogatives of the papal Inquisition. Marsilius of Padua, the theoretical exponent of the imperial rights, attributes to the secular judge the right and obligation to punish heresy, the priest's rôle being merely advisory. In 1353 Innocent VI. tried to implant the papal Inquisition in Germany once for all; its success was but short, and Urban V.'s attempt in 1362 succeeded little better, in spite of the fact that Charles IV. (edicts of Lucca, June 1369) gave him the support of the secular power. Towards 1372, however, Gregory XI. succeeded in regularizing the exercise of the powers of the papal inquisitors on German soil; and the latter, notably Kerlinger, Hetstede, etc., set to work to destroy the communities of the Beghards (who had developed with extraordinary rapidity), to burn their books, to close those *beguinages* which were under suspicion, and to check mystical epidemics such as those of the "flagellants," "dancers," etc. But these measures provoked protests from the people, the secular magistrates and even the bishops, so that Gregory XI., perceiving that he was face to face with the popular party, invited the bishops to control the inquiries of his own envoys. At the end of the 15th century the two inquisitions were acting concurrently.

Bohemia.—In Bohemia and the provinces subject to it the Waldenses had found their chosen country, and by the middle of the 13th century their propaganda was very flourishing. In 1245 Innocent IV. ordered the bishops to prosecute them with the aid of the secular arm, and in 1257, at the request of King Premysl Ottokar II., Alexander IV. introduced the Inquisition into Bohemia. But from this date till 1335 inquisitorial missions succeeded one another without effecting any sensible diminution in the material and moral strength of the heresy. The Waldenses had been joined by other sectaries, the Luciferani, and especially the Brethren of the Free Spirit. It was in vain that the bishops of Bohemia and Silesia carried on during the second half of the 14th century an active campaign against heresy; the spirit of criticism which had arisen with regard to the morals, and even to the dogmas of the Church, was already preparing the way for Hussitism.

The Balkan States.—In the regions east of the Adriatic, Catharism, the first communities of which had very probably settled here, was supreme in the time of Innocent III. and Honorius III. The first Dominicans who established themselves in these parts had much to suffer from the aggression of those very heretics whom they had come to convert. Gregory XI., implacable in his persecution of Catharism, preached a crusade against them in 1234, and Bosnia was laid waste by fire and sword. But in spite of these violent measures Catharism only gained strength in the churches of Bulgaria, Rumania, Slavonia and Dalmatia. In 1298 Boniface VIII. tried to organize the Inquisition there, but the project remained fruitless. The attempt was revived in 1323 by John XXII. with doubtful success. The persecutions undertaken in the 14th and 15th centuries merely resulted in binding the Cathari to the invading Turks, with whom they found more tolerance than with the Slav princes converted to Roman orthodoxy.

Spain.—In Spain the papal Inquisition only very slowly gained a footing. Spain had been, in turn or simultaneously, Arian under the Visigoths, Catholic under the Hispano-Romans, Mohammedan by conquest, and under a régime of religious peace Judaism had developed there. After the reconquest its heresies had been of minor importance. At the end of the 12th century Alphonso II. and Peter II. had on principle promulgated cruel edicts against heresy, but the persecution seemed to be dormant. By the bull *Declinante* of May 26, 1232 inquisitors were sent to Aragon by Gregory IX. on the request of Raymond of Penaforte, and by 1237–38 the Inquisition was practically founded. But as early as 1233 King James I. had promulgated an edict against the heretics which quite openly put the Inquisition in a subaltern position, and secularized a great part of its activities. The people, moreover, showed great hostility towards it. In Castile Alphonso the Wise had, by establishing in his *Fuero Real* and his *Siete Partidas* an entirely independent secular legislation with regard to heretics (1255), removed his kingdom from all papal interference. At the opening of the 14th century Castile and Portugal had still no Inquisition. It was not against heresy that the church had to direct its vigilance. A mutual tolerance between the different religions had in fact sprung up, even after the conquest; and for a long time past both the decisions of councils and papal briefs had proclaimed their surprise and indignation at this ominous indifference. Sporadic cases of violent measures against Jews and Mohammedans occurred during the 13th century and increased in frequency and severity during the 14th and 15th centuries. Massacres *en masse* and forced baptisms were carried out, instigated by the clergy. A class of "converted" Mohammedans and Jews arose, and increased after the conquest of the kingdom of Granada and the completion of the conquest by Ferdinand and Isabella, and after the pacification of the kingdoms of Aragon and Valencia by Charles V. The Mahommedans and Jews in these parts were given the choice between conversion and exile. Being of an active nature, and desiring some immediate powers as a recompense for their moral sufferings, the Jewish or Mohammedan *Conversos* soon became rich and powerful. In addition to the hatred of the church, hatred and jealousy arose also among laymen and especially in the rich and noble classes. *Limpieza, i.e.*, purity of blood, and the fact of being an "old Christian" were made the conditions of holding offices. And a combination of secular jealousy, national pride, and religious bigotry led to the foundation of an essentially national Inquisition, directed against local heretics, and founded without the help of the papacy. It was created in 1480 by Ferdinand and Isabella.

Sixtus IV. had wished the papal Inquisition to be established after the form of the middle ages; but Ferdinand, in his desire for centralization wished to establish an inquisition which should be entirely Spanish, and entirely royal. Rome resisted, but at last gave way. Sixtus IV., Alexander VI., Innocent VIII., Julius II. and after them all the popes of the 16th century, saw in this secular attempt a great power in favour of orthodoxy, and approved it when established. The Inquisition took advantage of this to claim an almost complete autonomy. The decisions of the Roman Congregation of the Index were only valid for Spain if the Holy Office of Madrid thought good to countersign them; consequently there were some books approved at Rome and proscribed in the peninsula, and some which were forbidden at Rome and approved in the peninsula. The Spanish Holy Office perceived long before Rome the dangers of mysticism, and already persecuted the mystics, especially the *Alumbrados* and afterwards the Molinists, while Rome still favoured them. There was even a financial dispute between the Inquisition and the papacy. The Roman Penitentiary sold exemptions from penalties (involving loss of civil rights), such as prison, the galleys and wearing the *sanbenito,* and dispensations from the crime of *Marrania* (secret Judaism). The inquisitors tried to gain control of this sale, and at a much higher price, and were seconded in this by the kings of Spain, who saw that it was to their own interest. The struggle continued throughout the first half of the 16th century, the Curia finally triumphing, thanks to the energy of Paul III. Since, however, the Inquisition continued to threaten the holders of papal dispensations, most of them found it prudent to demand a definite rehabilitation, in return for payments both to the king and the Inquisition. As a national institution the Inquisition had first of all the advantage of a very strong centralization and very rapid procedure, consisting as it did of an organization of local tribunals (established in all parts of the country) with a supreme council at Madrid, the *Suprema.* The grand inquisitor was *ex officio* president for life of the royal council of the Inquisition.

From the very beginning the papacy strengthened the organization by depriving the Spanish metropolitans, by the bull of Sept. 25, 1487, of the right of receiving appeals from the decisions given jointly by the bishops of the various dioceses, their suffragans and the apostolic inquisitors and by investing the inquisitor-general with this right. And, more than this, Torquemada actually took proceedings against bishops; for example, the accusation of heresy against Don Pedro Aranda, bishop of Calahorra (1498); while the inquisitor Lucero prosecuted the first archbishop of Granada, Don Ferdinando de Talavera. Further, when once the Inquisition was closely allied to the crown, no Spaniard, whether clerk or layman, could escape its power. Even the Jesuits, though not till after 1660, were put under the authority of the Suprema. But the descendants of Moors and Jews, though they were good Christians, or even nobles, were most held in suspicion. A family into which a forced conversion or a mixed marriage had introduced Moorish or Jewish blood was almost entirely deprived of any chance of public office, and was bound, in order to disarm suspicion to furnish agents or spies to the Holy Office.

The Spaniards were very quick to accept the Inquisition to such an extent as to look upon heresy as a national scourge to be destroyed at all costs, and they consequently considered it as a powerful and indispensable agent of public protection. As had happened among the Albigenses, commerce and industry were rapidly paralysed in Spain by this odious régime of suspicion, especially as the *Conversos,* who inherited the industrial and commercial capacity of the Moors and Jews, represented one of the most active elements of the population. Besides, this system of wholesale confiscations might reduce a family to beggary in a single day, so that all transactions were liable to extraordinary risks. It was in vain that the counsellors of Charles V., and on several occasions the Cortes, demanded that the inquisitors and their countless agents should be appointed on a fixed system by the state; the state, and above all the Inquisition, refused to make any such change. The Inquisition preferred to draw its revenues from heresy, and this is not surprising if we think of the economic aspect of the Albigensian Inquisition.

The political aspect of the work and character of the Inquisition had been very diversely estimated; it is a serious error to attribute to it, as has too often been done, extreme ideas of equality, or even to represent it as having favoured centralization and a royal absolutism to the same extent as the Inquisition of the 13th and 14th centuries in Languedoc. "It was a mere coincidence," says H. C. Lea, "that the Inquisition and absolutism developed side by side in Spain." The Suprema did not attack all nobles as nobles; it attacked certain of them as *Conversos,* and the Spanish feudal nobles were sure enough of their *limpieza* to have nothing to fear from it. But it is undeniable that it frequently tended to constitute a state within the state. At the time of their greatest power, the inquisitors paid no taxes, and gave no account of the confiscations effected; they claimed for themselves and their agents the right of bearing arms, and it is well known that their declared adversaries, or even those who blamed them in some respects, were without fail prosecuted for heresy. It was, however, only the Bourbons, who had imbibed Gallican ideas, who by dint of perseverance managed to make the Inquisition subservient to the Crown, and Charles III., "the philosopher king," openly set limits to the privileges of the inquisitors. Napoleon, on his entry into Madrid (Dec. 1808), at once suppressed the Inquisition, and the extraordinary general Cortes on Feb. 12, 1813 declared it to be incompatible with the constitution, in spite of the protests of Rome. Ferdinand VII. restored it (July 21, 1814) on his return from exile, but it was impoverished and almost powerless. It was again abolished as a result of the Liberal revolution of 1820, was restored temporarily in 1823 after the French military intervention under the duc d'Angoulême, and finally disappeared on July 15, 1834, when Queen Christina allied herself with the Liberals. It was not, however, till May 8, 1869 that the principle of religious liberty was proclaimed in the peninsula; and even since then it has been limited by the constitution of 1876, which forbids the public celebration of dissident religions (S. Reinach). In 1816 the pope abolished torture in all the tribunals of the Inquisition. It is a too frequent practice to represent as peculiar to the Spanish Inquisition modes of procedure in use for a long time in the inquisitorial tribunals of the rest of Europe. There are no special manuals, or *practica,* for the inquisitorial procedure in Spain; but the few distinctive characteristics of this procedure may be mentioned. The Suprema allowed the accused an advocate chosen from among the members or familiars of the Holy Office; this privilege was obviously illusory, for the advocate was chosen and paid by the tribunal, and could only interview the accused in presence of an inquisitor and a secretary. The theological examination was a minute proceeding; the "qualificators of the Holy Office," special functionaries, whose equivalent can, however, easily be found in the mediaeval Inquisition, charged those books or speeches which had incurred "theological censures," with "slight, severe or violent" suspicion. There was no challenging of witnesses. The torture, to the practice of which the Spanish Inquisition certainly added new refinements, was originally very much objected to by the Spaniards, and Alphonso X. prohibited it in Aragon; later, especially in the 15th, 16th and 17th centuries it was applied quite shamelessly. But by the end of the 18th century, according to Llorente, it had not been employed for a long time; the *fiscal,* however, habitually demanded it, and the accused always went in dread of it. The punishment of death by burning was much more often employed by the Spanish than by the mediaeval Inquisition.

With the extension of the Spanish colonial empire the Inquisition spread throughout it almost contemporaneously with the Catholic faith. Ferdinand IV. decreed the establishment of the Inquisition in America, and Jimenes in 1516 appointed Juan Quevedo, bishop of Cuba, inquisitor-general delegate with discretionary powers. Excesses having been committed by the agents of the Holy Office, Charles V. decreed (Oct. 15, 1538) that only the European colonists should be subject to the jurisdiction of the Inquisition; but Philip II. increased the powers of the inquisitors' delegate and, in 1541 established on a permanent basis three new provinces of the Inquisition at Lima, Mexico and Cartagena. The first *auto-da-fé* took place at Mexico in 1574, the year in which Hernando Cortez died. The Inquisition of Portugal was no less

careful to ensure the orthodoxy of the Portuguese colonies. An Inquisition of the East Indies was established at Goa, with jurisdiction over all the dominions of the king of Portugal beyond the Cape of Good Hope. Finally Philip II. even wished to establish an itinerant Inquisition, and at his request the pope created, by a brief of July 21, 1571, the "Inquisition of the galleys," or "of fleets and armies."

During the 16th and 17th centuries the Inquisition in Spain was directed again Protestantism. The inquisitor-general, Fernando de Valdés, archbishop of Seville, asked the pope to condemn the Lutherans to be burnt even if they were not backsliders, or wished to be reconciled, while in 1560 three foreign Protestants, two Englishmen and a Frenchman were burnt in defiance of international law. But the Reformation never had enough supporters in Spain to occupy the attention of the Inquisition for long. After the *Marranes* the mystics of all kinds furnished the greatest number of victims. Here again we should not lose sight of the tradition of the mediaeval Inquisition; the mysticism of the Beghards, the Brethren of the Free Spirit and the innumerable pantheist sects had been pitilessly persecuted by the inquisitors of Germany and France during the 14th and 15th centuries. The Illuminati (*alumbrados*), who were very much akin to the mediaeval sectaries, and the mystics of Castile and Aragon were ruthlessly examined, judged and executed. Not even the most famous persons could escape the suspicious zeal of the inquisitors Valdés and Melchior Cano. St. Ignatius de Loyola was twice imprisoned at the beginning of his career; St. Theresa was accused of misconduct, and several times denounced; one of her works, *Conceptos del amor divino,* was prohibited by the Inquisition, and she was only saved by the influence of Philip II. Countless numbers of obscure visionaries were accused of Illuminism and perished. From its earliest appearance Molinism was persecuted with almost equal rigour. Molinos himself was arrested and condemned to perpetual imprisonment (1685–87), and during the 18th century, till 1781, several Molinists were burnt. The Inquisition also attacked Jansenism, freemasonry (from 1738 onwards; *cf.* the bull *In eminenti*) and "philosophism," the learned naturalist José Clavigo y Faxarcho (1730–1806), the mathematician Benito Bails (1730–97), the poet Tomas de Iriarte, the ministers Clavigo Ricla, Aranda and others being prosecuted as "philosophers." Subject also to the tribunal of the Holy Office were bigamists, blasphemers, usurers, sodomites, priests who had married or broken the secrecy of the confessional, laymen who assumed ecclesiastical costume, etc.

Two features of the Spanish Inquisition are especially noteworthy: the prosecutions for "speeches suspected of heresy" and the censure of books. The great scholar Pedro de Lerma, who after fifty years at Paris (where he was dean of the faculty of theology) had returned to Spain as abbot of Compluto, was called upon in 1537 to abjure eleven "Erasmian" propositions, and was forced to return to Paris to die. Juan de Vergara and his brother were summoned before the Inquisition for favouring Erasmus and his writings, and detained several years before they were acquitted. Fray Alonso de Virues, chaplain to Charles V., was imprisoned on an absurd charge of depreciating the monastic state, and was only released by the pope at the instance of the emperor. Mateo Pascual, professor of theology at Alcala, who had in a public lecture expressed a doubt as to purgatory, suffered imprisonment and the confiscation of his goods. The censure of books was established in 1502 by Ferdinand and Isabella as a state institution. All books had to pass through the hands of the bishops; in 1521 the Inquisition took upon itself the examination of books suspected of Lutheran heresy. In 1554 Charles V. divided the responsibility for the censorship between the Royal Council, whose duty it was to grant or refuse the *imprimatur* to manuscripts and the Inquisition, which retained the right of prohibiting books which it judged to be pernicious; but after 1527 it also gave the licence to print. In 1547 the Suprema produced an Index of prohibited books, drawn up in 1546 by the university of Louvain; it was completed especially as regards Spanish books, in 1551, and several later editions were published. Moreover, the *revisores de libros* might present themselves in the name of the Holy Office in any private library or bookshop and confiscate prohibited books. In 1558 the penalty of death and confiscation of property was decreed against any bookseller or individual who should keep in his possession condemned books. The censure of books was abolished in 1812.

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(P. AL.; X.)

INSANITY. This term ordinarily connotes more or less severe unsoundness of mind. Though its loose usage is almost synonymous with mental disease, scientifically the term should only be applied to the mental condition of an individual who, through socially inefficient conduct, has to be placed under supervision and control. The mind is the mechanism by means of which we adapt adequately to our environment and when, through its derangement, conduct is exhibited which the community looks upon as evidence of disease and as implying irresponsibility, the individual concerned is said to be insane and the law steps in to certify him as such. Strictly speaking, then, insanity is really a social and legal term and not medical. Mental illness is a broad concept which may include very efficient members of society. No satisfactory definition can therefore be arrived at, since it would be necessary to define what we mean by sanity, which would involve us in equal difficulties.

It is unnecessary to dwell upon the mystical conceptions of insanity which were held in the middle ages, and it will be sufficient to note that it was only towards the close of the 18th century that this sphere of mental disorder was scientifically studied. This was a period in which materialism flourished and research devoted to the anatomy and physiology of the brain gave the workers reason to believe that the nature and causes of insanity would before long be discovered, since the advance of knowledge in the structure and functioning of the central nervous system was progressing at a rapid rate. A school of thought therefore held sway which founded insanity upon a physiological basis and endeavoured to base all pathology in terms of organic change in the brain. Although the great value of this method cannot be gainsaid, there is ample evidence that other aspects of approaching the problem of insanity are essentially necessary. Of late years another school has advanced the belief that the majority of cases of insanity are psychogenic in origin and that even where gross physical disease has been the exciting factor, that the symptoms can only be adequately understood at the psychological level. Others, again, prefer to take a wider view-point still and regard insanity in the light of biological or psycho-biological reactions. Modern psychological knowledge would lead us to believe that the understanding of much of the subject is made clearer when we regard it in the light of instinctive forces conflicting with environment and resulting in a failure of adjustment. The mental symptoms cannot be rightly spoken of as a disease but as types of reaction through the effort on the part of the individual to meet conditions. For the detailed theories of such a conception, the writings of Freud, Jung, Adler and Adolf Meyer should be consulted. The researches of Freud in this direction are of paramount importance and have largely revolutionized many of our ideas on psycho-pathology. The materialistic school would hold that though in many states of insanity no observable structural changes are found, they exist all the same, only they are such that our im-

perfect methods cannot detect them, and in time they will be discovered. At present we have insane conditions divided into those that are regarded as functional and those that are organic. In the former we have mania, melancholia and paranoia, and some would include dementia praecox. The psychogenic school would argue that though mental disease may arise secondarily to physical disorder, the symptoms are psychological reverberations of that disorder and the body of an individual must be regarded as environmental to the ego. In an integrated organism, though the basis of the wrong functioning lies in the physical sphere, some of the effects are manifested at the psychological level. The symptoms, then, are expressions of the personality, and however much we may stress the bodily aspect, that can in no way explain the content of a delusion or an hallucination. The fact that some individuals may take alcohol to the extent of producing severe physical disease without affecting the mind, and others will fall victims to insanity through its use, proves that psychic factors cannot be left out of calculation. The many structural changes which are found in certain forms of insanity should be reviewed as probably secondary to a perverted mentality. The bodily effects of emotion are well known and it can easily be surmised that long continued emotional stress should in time be followed by organic change. During the World War we had ample evidence of this. Mental reactions must be looked upon as reactions of the whole integrated organism which cannot be the expression of any one part of it. As McDougall says, mind has a nature and a structure and functions of its own which cannot be fully and adequately described in terms of structure of the brain and its processes. If this be true, as he thinks, it does not seem logically impossible that the nature of the mind itself may be disordered or impaired or defective. It seems, then, that we must steer clear of belonging to one or other of the extreme camps when we view the nature of insanity, but take a very wide vista which will embrace the study of the individual, his personal and racial history, his environment, and his physical and mental structure.

The causes of insanity will be predisposing and exciting. The former will be those conditions resident within the individual which will render him liable to suffer thus when certain factors are super-added, and the latter are those circumstances which precipitate the mental disturbance.

Predisposing Causes.—(1). *Heredity.* It has to be admitted that few scientific data are before us to establish on any firm basis our knowledge of the inheritance of mental instability. Though there is no doubt as to the enormous importance of this factor, it is certain that in the past the use of this influence has often been a cloak for ignorance and that the effects of early environment and faulty education of the instincts and emotions have not been adequately valuated. Most of the statistical work on the subject is of little worth. Human families do not easily lend themselves to genetic study and much is founded on hearsay. Fallacies have arisen because no differentiation has been made between the different varieties of insanity, and the results have been taken as absolute, and are not compared with similar investigations with the family history of normal people. The chief investigations in which these fallacies have been avoided would bring us to the following conclusions: A hereditary taint is present in the relatives of 70% of mentally sound people; of 77% of insane. Of these it affects the distant relatives of the former more than of the latter, but the parents of the latter more than those of the former. Insanity is present in the parent once out of every 30 healthy people, once out of every five insane. Senile dementia, apoplexy, drug habits are all rarer in the parents of insane persons than in those of healthy, while dipsomania and character anomalies are twice as common in the parents of the former. So that hereditary taint is far commoner in normal people than is usually supposed, and an insanity taint is of importance only when present in the parents. It seems that the absence of an hereditary taint makes the occurrence of insanity much less probable than the presence of it makes the occurrence probable. In some cases of insanity heredity is of special importance, *e.g.*, paranoia, manic-depressive insanity, while in others it is of little or no importance, *e.g.*, general paresis, toxic insanities, etc. Direct heredity is usually pure, that is an epileptic parent tends to have an epileptic child. Transformation is relatively rare. It is not thought that consanguinity or inbreeding has any ill-effects unless the stock is already tainted; then, of course, the chances of transmission are correspondingly increased. Studies on heredity on Mendelian lines (*see* MENDELISM) are inconclusive, but there is some amount of evidence of interest concerning feeblemindedness, epilepsy, manic-depressive insanity and dementia praecox. In all such studies there is lacking some method of determining what are the fundamental units that can be transmitted by heredity. It is probable that these will be found to be not actual diseases, or even definite predispositions to such, but factors that can develop into either insanity or other conditions (character anomalies, criminality, genius, etc.) according to the interaction of environmental influences.

(2). *Civilization.* It is amongst the most highly civilized that insanity is most prevalent. In the process of evolution, life in general becomes more complex, adaptation more difficult, mental conflict more in evidence. The insane, too, are found with greater frequency in the congested centres of population where the struggle for existence is at its greatest height. The percentage of insanity is greater among the unmarried than the married.

(3). *Sex and Age.* The total incidence of insanity differs but slightly in the two sexes. In the male the effects of alcohol, and syphilis, and general stress tend to balance the special strains of pregnancy, and the change of life in women. The greatest liability to such mental disorder exists between the ages of 30 and 40, but it must be realized that there are more people living in the general community of this age. Considering the number of insane in each decade compared to the total population of the same age, it will be found that the liability practically progressively increases from 20 to 80 years of age.

(4). *Climate.* The only effect of climate is mainly that of supplying conditions which make exhaustion and infection more liable. Malaria, enteric fever and dysentery are responsible for most of the insanity attributed to climatic conditions.

(5). *Physiological Epochs.* At the periods of puberty, adolescence, child-bearing, the climacteric in women and the senium in man, there are special chemical, bodily and mental changes which render the individual more prone.

Exciting Causes.—(1). *Toxic Poisons—Exogenous or introduced from without.* Alcohol in the past has been said to be responsible for much insanity, but recent and more careful investigation would tend to show that this causation has been grossly exaggerated and that really only a small proportion are due directly to this agent. The taking of this drug is very often more a symptom of mental disease than its cause, and, if in any way causative, it is often only so in a contributory way. Alcohol is a narcotic, and by lessening inhibition over the higher centres of judgment and control, any psychopathic tendency is released and appears on the surface. It is, therefore, this tendency to be psychopathic which is the important factor in determining whether or not a person will become insane, and not especially the amount of alcoholism. That the mental factor underlying alcoholism is of great significance has been shown by Bevan Levis, who found that the least intemperate communities had the highest rate of pauperism and insanity, while the most intemperate communities had the lowest rate. That is, when prosperity was greatest and funds for intemperance were available, poverty and mental stress were least and insanity was less prevalent. F. Mott pointed out that insanity does not keep pace with the incidence of alcohol, and in his large experience he found cirrhosis of the liver very rare in asylums; so that we may infer that most individuals will tolerate any amount of alcohol up to extensive physical disease, without becoming insane and that this only occurs where there are other important factors present.

Other exogenous chemical poisons which may be productive of insanity are opium (morphine), cocaine, and metallic salts of mercury, lead and arsenic. Much more important are those *toxins due to bacterial infection. Syphilis* stands out in this respect prominently. When inherited, its effects may severely retard men-

tal development, and when acquired, it may bring about general paralysis, which constitutes 5% to 15% of the total admissions to our mental hospitals. Indirectly, too, it may contribute to the inception of other forms of insanity. Almost any infection may produce insanity in a predisposed individual. The mental reactions occurring in the acute stage of infection are most commonly of a delirious nature, but the subsequent form of insanity will vary according to the personality. Tuberculosis, enteric fever, malaria, and influenza are frequently responsible. Of late years some investigators have laid great stress on infected foci somewhere in the body being causative of different insane states. With this idea in their mind, careful search for such are made in the teeth, tonsils, nasal sinuses, stomach, bowel, genito-urinary passages; and in women, the womb with its appendages. The teeth and tonsils are said to be the commonest sites, and in the hands of the more enthusiastic advocates of this conception, wonderful recovery results are claimed when these infective foci are eliminated. Research of others has not confirmed these findings, and there is grave reason for doubting that any such one factor, and that a physical one, can be alone responsible for such a complex mental state as that of insanity. The great importance, however, of removing possible sources of general infection is always to be borne in mind. *Endogenous chemical poisons* or auto-intoxication have also been presumed to be causative factors, and those of most consequence were thought to originate from the gastro-intestinal tract and as a result of chronic kidney disease. Though in some cases such agents may contribute a causative share, there is no reason for thinking they have any specific value.

(2). *Injuries.* Direct injuries to the head may cause structural lesions of the brain and be the immediate cause of some form of insanity, while more indirect injuries, such as concussion from falls, may also be the starting point of a mental disorder.

(3). *Bodily diseases* may play a part in the production of insanity through the interference they bring about in nutrition, circulation and fatigue.

(4). *Exhaustion* or overwork has been commonly supposed to be a cause, and during the World War a certain type of insanity developed by soldiers on active service was officially designated as "exhaustion psychosis." Though prolonged mental or physical strain often seems to be the precursor of a severe mental breakdown, it is probable that exhaustion *per se* without other and more important adjuvant factors will seldom originate an insane state. The excessive fatigue is frequently a symptom, and if in any way contributory, it must be regarded as one link in a series.

(5). *Mental.* Any severe mental stress may excite insanity when the predisposition exists. Commonly, the mental factor involves some situation which the individual cannot face, and it may be said that in this difficulty he takes refuge in a world of unreality. Domestic trouble, financial worries, deaths of those who are near and dear, sexual problems, are the usual sources of stress met with. Sudden and horrible shocks may act similarly. This psychogenic aspect of insanity has been much studied of late years, and holds a wide field to-day which strenuously opposes the views of the materialistic school.

Classification of Insanity.—Though it is true that different symptoms of insanity tend to arrange themselves into groups, we must bear in mind that the clinical pictures described under their special headings are not by any means clear-cut entities; they are not diseases in the strict sense of the term, but types of reaction. Yet, for descriptive purposes, some classification is needed, and though no classification is entirely satisfactory, the following will best meet our requirements:

(1) Manic-depressive insanity (2) Dementia praecox (Schizophrenia) (3) Paranoia group	Characterized by psychical symptoms. No constant changes in brain yet established. Best understood by employment of psychological conception
(4) Imbecility and idiocy (5) Senile dementia	Characterized by qualitative defect of mental functions. Generally accompanied by observable defect or changes in the brain
(6) Toxic insanity (7) General paralysis of the insane (8) Organic brain disease (9) Epileptic insanity	Diseases of the brain invariably or mostly accompanied by mental symptoms.

(Since we are dealing only with insane states and not mental disorder the neuroses and psycho-neuroses such as neurasthenia [*q.v.*], anxiety and compulsion neuroses and hysteria are not included.)

General Symptoms of Insanity.—It must be borne in mind that any of the symptoms enumerated, taken by themselves, are not necessarily evidence of an insane condition, but that they only have such an indication when taken in conjunction with each other, when studied in their individual setting and in comparison with the previous expressions of the personality. Again, it must be stressed that though they may indicate mental disorder, it is the factor of conduct that renders the case insane or not. Certain symptoms are more or less particularly associated with special forms of insanity.

General Behaviour.—Some change in this direction is usually the earliest indication noted by friends and relations. This may relate predominantly to the habits, moods, activities or content of speech. The capacity to work, the ability to adapt to circumstances, and the usual respect for the conventions of society, may likely be affected. Alcohol may be unduly indulged in, personal cleanliness and general care of the self neglected, while the character as a whole may undergo transformation. We may have a general over-activity, which commonly is not directed consistently towards a definite goal, and when severe may lead to violence and destructiveness. This is a prominent symptom of mania. On the other hand there may be great difficulty and slowness of voluntary movement, which is specially evinced in melancholia. Movements may be stereotyped and oft-repeated, automatic, just opposite to what we should expect, or impulsive. Curious postures may be taken up, and bizarre mannerisms shown. The stream of speech may be affected similarly. This may be greatly voluble, slow and difficult, or there may be mutism, irrelevance, incoherence.

Disorder of the emotions will be mainly evidenced by an exaggerated sense of well-being, elation or exaltation on the one hand or the reverse picture of gloom and severe depression. The morbidity of these states will accrue from the fact that they are not warranted by the condition of the individual or his surroundings. These extreme emotions are mostly noted in one or other of the phases of manic-depressive insanity. Emotional deterioration, or apathy, is particularly seen in dementia praecox. Anxiety, morbid anger, suspicion, and general instability of the emotions are other frequent abnormalities in this sphere.

Disorders of the content of thought are usually prominent, and a *delusion* is regarded as specially important by the law and laity as evidence of insanity. Such false beliefs may be sane or insane. We may regard them as insane when three characteristics concerning them are found. First, they are evidently untrue, highly improbable, or manifestly impossible. Second, they cannot be corrected by any appeal to reason. Thirdly, they are out of harmony with the individual's education and environment. Nevertheless, sometimes a false belief may be an insane delusion without showing any of these characteristics. Delusions may be very varied, but those of persecution and grandeur are perhaps the most frequent. They may be fixed or changeable; they may or may not affect conduct.

The *process of thinking* itself may be greatly modified. There is difficulty in thinking; much pre-occupation with one idea; thoughts seem stolen; they are obsessive; or everything in the environment is taken personally (ideas of reference).

Disorders of perception may affect any sense. They may be in the form of illusions which are inaccurate perceptions of something really and actually perceived, or hallucinations which have no sensory foundation in the environment, and are created by perverted functioning of the mind. On rare occasions hallucinations occur in normal people. Many can be explained on a purely mental basis, while others have an organic interpretation and are based on physiological disturbances such as toxic states. Auditory hallucinations are the most common, and usually are of the nature of voices. Their content is of great importance in the study of the

patient, and generally are in consonance with the delusions entertained. Most frequently the voices are derogatory and accusatory. Visual hallucinations are mostly noted in toxic forms of insanity. Those affecting smell, taste and touch are of much less frequent occurrence. Psychic or pseudo-hallucinations seem to occupy a position midway between imagination and the fully developed form of hallucination. There is not the same conviction of their external reality, and yet it is believed by the patient that they are brought about by some external agency. Hypnagogic hallucinations are those which occur in the state between sleeping and waking, and these have not the same morbid value. The sensations from the muscles, joints and internal organs may be affected and give rise to curious delusional ideas.

Disorders of orientation imply a lack of appreciation of three aspects of the environment, either simply or together—that of time, space and personal relations. These are not infrequent in severe forms of insanity, and are commonly noted in the confusional conditions of delirium and toxic states.

Disorders of memory will either be complete or partial absence of memory (amnesia) which may only concern past events or be progressive and continuous; false recollections (paramnesia), when the insane patient relates with conviction and detail events which never took place; and excessive retention of memories (hyperamnesia), which occurs in certain insane states.

Disorders of attention may involve the inability to fix the attention for any length of time in one direction (distractability), as seen typically in mania. Where this is in excess there is liable to arise an insufficiency of perception so that orientation is rendered defective. Enfeeblement of the power of voluntary attention is one of the most characteristic signs of dementia (a gradual weakening of the intellectual faculties). In other insane states there may be complete absorption of attention on one or more groups of ideas, which render the individual so self-absorbed that the surroundings are not attended to, and often not seen at all.

Various *disturbances of consciousness* may be manifested. Sleep may be abolished, lessened or increased. The last named is uncommon and is usually associated with brain disease or some general toxaemia. In certain insane patients such as maniacs there exists a marvellous capacity to withstand more or less prolonged sleep deprivation. Trance-like sleep may be noted in other types. In stupor the patient makes little or no response to any stimulus, and such a condition may, when severe, last for lengthy periods. Lastly, we may have symptoms pointing to definite *disorders of the personality*. There may be *depersonalization* when the individual feels that he is no longer himself, or that he no longer exists, or there is the last uncommon condition in which a patient believes himself to be some other person and may act on that belief. In certain severe insane states there may be a gradual disintegration of the personality, which leaves the victim without any of the acquired cultural traits, and only possessing his primitive functions. We can now give some description of the various types of insane conditions met with according to the classification already set forth.

Manic-depressive Insanity.—These disorders which were previously known as mania and melancholia were embraced by Kraepelin under this one heading, as he believed that they were both symptomatic of one morbid process. There is always the liability to the recurrence of attacks, and in these either the manic or the melancholic phase may manifest itself. Kretschmer, of late, in his study of morphological types has concluded that his "pyknic" type, which is characterized by middle height, rounded figure, a short, broad face on a short, massive neck, and a fat paunch protruding from a deep vaulted chest, is the type of individual who would tend to develop this particular form of insanity, if any. Certainly there is a type of personal disposition which is more apt to be thus attacked than others, and one refers to the person who is inordinately optimistic and bright, or, on the other hand, is gloomy and worries over trivialities. Manic-depressive insanity is, therefore, constitutional, and can best be understood from a psycho-pathological standpoint. The deep-seated constitutional origin is marked by its hereditary taint, and by the fact that the attacks are frequently noted for their apparent lack of cause. Usually, however, some difficulty in the individual's life is found as a precipitating factor.

The manic-phase manifests itself by three main symptoms—elation, flight of ideas and general hyperactivity of mind and body. In the mildest type (hypomania) we note these symptoms in slight degree, but the efficiency of the individual is greatly reduced and alcoholic indulgence and delinquent conduct is often seen. In acute mania the symptoms are severe, speech may be so flighty as to be incoherent, and some disorientation is likely to be present. Delusions often occur, but are changeable and ridiculous in character. In the main they will be grandiose in type, but false ideas of persecution may be evinced. Activity of mind and body is constant, little if any sleep is indulged in, food not attended to, so that signs of exhaustion and loss of flesh become marked. Such a patient may be boisterous, destructive and violent. The feeling of exaltation is extreme, and irritation and anger are easily aroused when thwarted. Simple and evanescent hallucinations are often noted. In its most extreme degree this manic phase may be delirious in its severity, and complicated by a septic blood state, brought about by physical injuries.

In the *depressive phase* we note exactly the opposite symptoms of great depression, difficulty in thinking and under-activity of mind and body. Here again we may speak of three grades of severity. In the mildest the individual often realizes his invalidism. He moves and speaks slowly, seems incapable of effort, and sees everything as through a glass darkly. In *acute melancholia* the symptoms are much more pronounced. The depression is profound and delusions of self-accusation referring to sin, poverty and being "lost" are in evidence. Hypochondriacal ideas, such as their bowels being stopped up or their brains decayed, are frequent. The personality may seem to the patient to be transformed, and hallucinations consonant with their delusions also occur. In the severest type there is stupor, and the patient lies in bed inert, with much clouding of consciousness, the victim of horrible delusions and hallucinations.

Manic-depressive insanity may last a variable period, but, though recovery is usually the rule, a recurrence of attacks is highly likely. The interval between such attacks may progressively lessen. Certain cases may remain chronic. Any patient with any state of melancholia much be regarded as a potential suicide, and cared for accordingly.

There is a form of insanity termed *involutional melancholia* which is closely related to manic-depressive insanity, but which occurs at the period of involution, *i.e.*, about 50 years of age. The symptoms are mainly similar to those in the depressive phase of manic-depressive insanity, but there is a greater tendency for the delusions to be hypochondriacal, and there is usually more or less restlessness and anxiety. Hence the old term "agitated melancholia." Fifty per cent make a satisfactory recovery.

Dementia-praecox.—This (more lately termed schizophrenia) is a form of insanity which most usually appears about puberty and adolescence in which heredity seems to play a marked rôle. Recent studies would tend to show that a type of personality, the "shut-in" character (shy and seclusive), is more liable than others to develop this mental disorder. Kretschmer isolates special physical types which he regards as predisposed in this direction. The cause of the condition is highly debatable. It is thought by some to have its root in auto-intoxication, and Mott related it to endocrine disorder especially affecting the sex glands. Focal sepsis is regarded as the most important factor by Cotton of America. Other psychiatrists view the origin from a purely psychological or biological point of view. Bleuler looks upon the disease as a splitting of the personality, while Adolf Meyer believes that it is not a disease but forms of reaction which are the outcome of progressive mal-adaptations of the individual to his environment. Jung draws attention to buried complexes. Whichever view is taken, there seems to be a mental or physical lack of potentiality for development, and the individual is "stranded on the rock of puberty." An exciting factor is often apparently absent, or physical or mental worries or shocks may be a precipitating cause. Though the onset may be acute, in the majority of instances it develops insidiously over a long period of months or

even years. Peculiarities of thought and action finally blossom into insanity. The symptoms seem highly unnatural, and an observer feels quite out of touch with a dementia praecox patient. The most prominent symptom is that of apathy and indifference, and there is a great lack of co-ordination between feeling and intellect which indicates a deep-seated mental change. The patient is fully oriented, his memory is good, but there is a dreamy attitude, with lack of attention and interest. Sudden silly, and seeming causeless outbursts of laughter are frequent. The personality changes so that the habits get slovenly, untidy and dirty. Ideas of reference, illusions, delusions and hallucinations are always present. All sorts of oddities of manner, attitude and speech may be noted, while the judgment becomes so deteriorated that there is no conception by the patient of the seriousness of his disorder or position. Four forms of dementia praecox are ordinarily described; simple dementia, hebephrenia, catatonia and a paranoid form.

In the *simple type* the development is insidious for years. Early on we note dreaminess, or falling off of interest, and an impoverishment of the personality. The individual becomes moody, unsocial, irritable and less and less able to undertake any responsibility or apply himself to anything but a simple task. Many tramps and ne'er-do-wells come into this category.

In *hebephrenia* after a period of ill-health there is often an abrupt onset of confusion and depression, with disagreeable delusions of persecution and hallucinations. With the subsidence of the acute symptoms the fundamental defect becomes apparent with the symptoms mentioned above—the most prominent being bizarre conduct, incoherent thought and vivid auditory hallucinations.

Catatonia tends, after a depressive phase, to manifest itself by a state of stupor or excitement, which irregularly alternate. In the former we see constrained, fixed attitudes with much muscular tension, and any attempt to move the patient is met with marked resistance (negativism). A state like that of catalepsy is often maintained with curious grimaces and mutism. There may be shown the opposite condition of negativism, *i.e.*, a great suggestibility in which all commands are mechanically obeyed. In the excited phase there is a manic-like condition, with much talking, shouting and general physical activity. The actions are, however, absurd, stereotyped and tend to be oft repeated. Violent impulses are given way to, and much violence is frequently manifested, which may involve homicide and suicide. Delusions and hallucinations are in evidence, and the excited period may quickly abate.

The *paranoid form* often appears somewhat later in life than the others, and is specially differentiated by the presence of somewhat systematized delusions of persecution and grandeur, which are usually absurd and fantastic, with hallucinations of hearing.

In the large majority of cases dementia praecox is a serious, chronic condition, which leads to a progressive dementia. Yet it must not be considered hopeless, for some sufferers seem to recover entirely and others may reach a stage of betterment which permits of some adjustment to life outside a mental hospital. To prognosticate the future in any individual is a very difficult problem. The paranoid form has the worst outlook.

Paranoia.—In its true form this is uncommon, and has been regarded as, perhaps, more a morbid unfolding of a peculiar personality than an actual disease. Exaggerated suspicion and conceit seem to be its emotional groundwork. According to Kraepelin it is characterized by "the furtive development, resulting from inner causes, of a lasting, immovable, delusional system that is accompanied by the complete retention of clearness and order in thinking, willing and acting." It is because of this seeming intellectual soundness that the condition may escape recognition, and few such cases find their way into mental hospitals. Early in life a paranoiac character may evince itself and the individual tends to be quiet, reserved, self-conscious and lacking in confidence, though at the same time ambitious, selfish, proud, with unusual intelligence. There is an increasing tendency to find fault with the environment, and irritability and aggressiveness show themselves. Later disappointments lead to suspicion and blame on others being engendered until definite delusions of a persecuting nature appear. Such delusions become systematized until the person is convinced that certain people or bodies of people are plotting his downfall. The delusions, however, appear to be logical to a large extent, and not contradictory, though in time a normal person will recognize the weakness of their premises and the exaggerated absurdity of the inferred deductions. Apart from the delusions the paranoiac is apparently sound in his train of ideas, hence the old term "monomania." According to the form of the delusion paranoiacs are commonly described in four types. The persecutory is the commonest; the grandiose have delusions of self-importance and may regard themselves of royal lineage; the erotic, who believe they are beloved and desired in marriage by some unattainable individual; and the querulous, who think themselves delusionally the victims of injustice, and who consequently are appealing to law tribunals for redress of their wrongs. True paranoia is looked upon as incurable.

Paranoid symptoms and paranoid states, akin in some respects to paranoia, may be met with as part of the clinical picture in many types of insanity, such as dementia praecox, general paresis, toxic insanities and manic-depressive insanity.

Imbecility and Idiocy.—These are the severer forms of feeble-mindedness which arise from some developmental defect before birth as a result of injury, or after birth through injury or disease. The feeble-minded are defined as "persons in whose case there exists before birth, or from an early age, mental defectiveness not amounting to imbecility, yet so pronounced that they require care, supervision and control for their own protection or for the protection of others." Their mental defect is slight, and capable of much improvement by educational methods. Ultimately they may be able to take a place in the world, and under favourable circumstances be self-supporting. An *imbecile* can be materially improved by training, but not sufficiently to take a place in the world. The intelligence does not exceed that of a normal child of about seven years.

Idiocy is a state of profound mental defectiveness. The lower grades are unteachable, while the higher may be educated slightly in such ways as attending to the calls of nature. The mental development does not exceed that of a normal child of two years. Physical deformities of various kinds are common, the minor defects being usually referred to as "the stigmata of degeneration." The causes of their failure in development are varied. Heredity has an influence, while accidents and injuries connected with pregnancy and child-birth are common causes. Acute infection and especially syphilis involving the brain, often contribute. General diseases of the mother and her pelvic organs may, under certain conditions, bring about brain malformation. There are several well recognized types:

1. *Amaurotic family idiocy* occurs mainly, if not entirely, in the Jewish race. There is blindness, from atrophy of the optic nerve, and the idiocy is accompanied by paralysis of all four limbs. The child invariably dies before the age of two years.

2. *Cretinism,* due to an inborn deficiency in secretion from the thyroid gland. The effect of treatment with thyroid gland produces marvellous results.

3. *Mongolism,* so called because of the resemblance of the physical characteristics to those belonging to the Mongolian race. Certain features connected with the skull, tongue and eyes are diagnostic.

4. *Hydrocephalus,* commonly known as "water on the brain." The brain is unduly pressed upon and impaired by the excessive quantity of cerebro-spinal fluid which accumulates within the ventricles.

5. *Microcephaly.* The skull is abnormally small, being less than 17in. in circumference.

6. *Sensory-deprivation Types.* Here there is no structural defect of the brain, but owing to the child being deprived of two or more of the principal senses, such as sight and hearing, upon which mental development depends, a state of severe mental defect is established. Special training, however, and the utilization of other sensory organs, may have excellent results.

7. Other types are known as inflammatory (due to brain in-

flammation); paralytic (associated with paralysis); epileptic (associated with epilepsy). (*See* FEEBLE-MINDEDNESS.)

Senile Forms of Insanity.—These may appear after 60 years of age. Accompanying physical decay there may only be a general mental deterioration or dementia, which is characterized by general reduction in intellectual capacities, memory defect, involving recent events, a narrowing of interests, more or less irritability, suspiciousness and restlessness, especially at night. Upon this background of senile dementia various insane symptoms may be ingrafted. There may be a certain amount of confusion, which may be very marked, and memory defects may be associated with all sorts of fabrications (presbyophrenia). Specially depressed or agitated types may be in evidence, and a paranoid condition with delusions of persecution and hallucinations of hearing are at times met with. The abnormal state may be complicated by physical symptoms due to senile morbid brain changes. The course of senile dementia is progressive until death. Such patients finally become completely demented in every respect. After death the brain shows signs of atrophy and there are definite organic changes in its substance, membranes and blood vessels.

Toxic Insanity.—A type due to poisonous substances formed within the body or introduced from without. The former are known as endogenous and the latter exogenous. Many of these are short-lived and therefore do not necessitate commitment to a mental hospital. The amount of a toxin which can be tolerated without inducing insanity is an index of the nervous and mental stability of an individual. The endogenous mainly arise from such infective conditions as influenza, pneumonia, malaria, smallpox, rheumatic or typhoid fever. Though the toxic substances differ in nature, they may result in exactly similar symptoms or, on the other hand, the same poison may excite an outbreak of different forms of insanity depending upon the special morbid potentialities of the personality attacked. Mental symptoms are mainly noted during the febrile period, and a delirious state is the commonest condition. There is first confusion, and this is followed by disorientation for time and place, with restlessness, anxiety and hallucinations of sight and hearing. Excitement may be intense and resemble mania. Speech tends to become incoherent, and drowsiness may give way later to a stuporose state. When the fever is over there is frequently a severe depression, in which suicide has to be thought of. It is at this period, too, that symptoms of manic-depressive insanity or dementia praecox may supervene in an individual so predisposed. The great majority of toxic cases completely recover but a certain number may suffer a lasting mental impairment. A similar state of insanity may be brought about, though rarely, by exhaustion, occurring from haemorrhage, starvation, or excessive physical or mental overwork. In some cases the factors of exhaustion and infection are causative together.

The commonest exogenous toxin productive of insanity is alcohol. As was indicated when the general causes of insanity were being considered, the relation of alcohol to insanity has hitherto been viewed in a much too superficial light. Alcohol, patently, can bring about acute and chronic insanity through its toxic effect, but there are several forms which the more modern psychiatrists look upon as other forms of mental disease, merely coloured by the added factor of alcoholism, or which may be viewed as psychopathic reactions which alcohol has allowed to come to the surface. Though these types of so-called alcoholic insanity will be mentioned here, under their several headings, it will be pointed out that, strictly speaking, they should come under a different classification. Alcohol is, undoubtedly, in its effects an indication of the nervous and mental stability of an individual. *In vino veritas* is a very true maxim, for it is when the influence of wine is at work that the true personality is manifested. The veneer of conscious control is removed, and those who, through head injury or disease, have already a diminution of cerebral control, will the more easily react to its effects. The defect in inhibitions which are so liable to accompany the incidence of certain forms of insanity may easily lead to alcoholic habits, these then being mistaken as causative of the disorder.

Ordinary *drunkenness* may be pathological, and render unstable people temporarily insane. Under the influence of variable quantities of alcohol an individual may evince maniacal frenzy, delusions and hallucinations, and may indulge in such anti-social conduct that the law has to step in to restrain him. Subsequent to such attacks there is usually a complete blank in the memory of such episodes. The only true toxic types of alcoholic insanity are delirium tremens, alcoholic dementia and a peculiar form known as Korsakow's psychosis.

Delirium Tremens. This condition of temporary insanity is too short-lived to be seen within the walls of mental hospitals, though abnormal states may follow which necessitate supervision and control. It usually originates in a chronic alcoholic, after a severe drunken bout, but may also occur in an alcoholic who is the victim of acute disease or some gross injury. That sudden abstinence is provocative, as has been thought, is exceedingly doubtful. Most commonly, before the special symptoms manifest themselves, there is a period of a few days in which the sufferer is nervous, sleepless, restless, shaky and has no appetite. The delirium more or less suddenly appears. The patient is quite confused as to time and place and has the most vivid hallucinations, which are predominantly visual. These characteristically take on the form of small animals, such as rats, snakes and insects, but they may be of larger type in all kinds of fantastic shapes. Auditory hallucinations causing apprehension are sometimes present, and all sorts of delusional experiences may be passed through. The emotion is that of great fear of meeting some awful fate and conduct is not only extremely restless, but is apt to show impulsive offence and defence. The delirium may be occupational in character, and the patient is constantly busy carrying out his usual duties in a make-believe world. Speech is incoherent, and mostly in touch with his hallucinatory experiences. Tremor is well-marked, and is mostly noted in the small muscles of the hand, tongue and face. The condition lasts only a few days and terminates in a long sleep. Some, however, die from exhaustion.

Alcoholic dementia is liable to result from the chronic toxic effect of long years of excessive alcoholic indulgence. Insidiously there is a progressive enfeeblement of the intellect, a blunting of judgment, memory, control and morality. Untruthfulness is prominent, and attitudes of jealousy and a feeling of persecution, which are common, are apt to develop into definite delusions. Finally the mental deterioration is extreme, and attended by organic disorders resulting from alcohol. In some cases both the mental and physical signs resemble those seen in general paralysis of the insane.

The third form of a true alcoholic insanity is called after the psychiatrist who first described the condition, and known as *Korsakow's* psychosis. Though the commonest causative toxin is alcohol, other poisons are sometimes responsible. It is comparatively rarely seen before the age of 50, and is noted more in the female sex. It may result immediately from an attack of delirium tremens and has been looked upon as a chronic alcoholic delirium. The characteristic symptom is a peculiar falsification of memory. There is a marked defect in the recording of the events of the present and past for a variable period, but long distant experiences are well recollected. The memory gaps are unconsciously compensated for by being filled by all sorts of fabrications, which are recounted in great detail and have every appearance of truth. The converse seems clear and intelligent, though it is highly confused as to time and place. Hallucinations both of sight and hearing are usually present. The mood is mostly happy and the patient has no insight into his condition. In the physical sphere there is neuritis of many of the peripheral nerves, with perhaps some local paralysis. Besides, various other structures of the nervous system may be involved. As a rule the outlook is not good, and even where much betterment ensues, the memory is left defective.

There are two other forms of insanity which are usually classed as alcoholic in origin, but since the symptoms are not really due to its toxic effect, but to the fact that the alcohol has released morbid potentialities, they should not scientifically be brought under such a heading. There are so-called alcoholic hallucinosis and alcoholic paranoia.

In *alcoholic hallucinosis* the symptoms mainly in evidence are

auditory hallucinations of an unpleasant nature, with delusions of persecution, in which the sexual element tends to be predominant. The patient hears voices accusing him of all sorts of immoral practices, and concerning these he is gibed at and threatened. He is naturally anxious, depressed and apprehensive of harm. The fact that he may identify those around him as his persecutors is liable to render him dangerous and homicidal. On the other hand, suicide as a refuge may be attempted. As a rule, recovery to sanity comes about, but the condition may become chronic.

In *alcoholic paranoia* there is a paranoid state in which hallucinations, if present, are of secondary importance, the characteristic symptom being delusions of jealousy and marital infidelity. These alcoholic delusions of jealousy tend to fluctuate with the amount of alcohol drunk, and commonly disappear quickly when abstinence is enforced in an institution. Very rarely the insanity becomes chronic. Other toxic agents such as opium, cocaine and miscellaneous intoxicants may cause insanity, but are too uncommon and unimportant to need mention.

General Paralysis of the Insane (general paresis, dementia paralytica). This type may be grouped under forms of insanity due to infection, or to those associated with organic brain disease. For simplicity's sake it is spoken of separately. It is due essentially to syphilitic infection of the grey matter of the brain, and the syphilitic virus (treponema pallidum) can be microscopically seen there. It is characterized by a progressive and rapid mental deterioration. Five to 15% of the admissions to mental hospitals are of this disease, which affects males much more than females. It develops between the ages of 30 and 50, but there is a juvenile form which may attack the young who are the victims of congenital syphilis. The disorder has a long incubation period and does not show itself usually until 10 or 15 years after infection. The onset is commonly insidious, and manifests itself in a change of character. Former ideals and standards of living are replaced by recklessness, neglect of appearance, gross indulgence, bad moral habits, loss of sense of obligation to family and others. There is a general dulling of comprehension, deficiency of memory, judgment and self-control. There is no insight into these factors, which are often accompanied by a special sense of well-being and ideas of great wealth and power. Sometimes a convulsive attack ushers in the disease. The patient gradually deteriorates mentally and physically and there is an increasing inability to adapt to life. Very bizarre, grandiose delusions are constantly noted but on the other hand there may be depression, with grotesquely absurd delusions consonant with this mood. In the course of time the downhill mental involvement is so profound that the patient may be said to live a purely vegetative existence, and become as helpless as a new-born babe. Atypical cases of course are often met with. Since this form of insanity is due to organic brain disease we must expect definite physical signs to be present, and it is upon these that the diagnosis must be founded. Appearing at some stage of the disease we shall note inequality of the pupils, which react to accommodation but not to light (Argyll-Robertson pupil), changes in tendon reflexes, muscular weakness, tremor, especially of the hands, tongue and face muscles, slurring of speech, and perhaps apoplectic or epileptiform seizures. The blood, when tested, will demonstrate the syphilitic infection (Wasserman reaction) and the cerebrospinal fluid, both chemically and microscopically, will show definite changes. After death the post-mortem findings in the brain are very typical. The outlook is very bad, since a fatal ending as a rule comes about in two to five years. Curious remissions may occur in which for some time the disease process is seemingly stayed or bettered for a varying period, but subsequent to which the patients rapidly go down-hill. Of late years new methods of treatment have raised hopes that a cure might be realized, but so far with only indefinite results. The latest consists of the artificial induction of malaria, which in many cases has temporarily brought great improvement. Time will show whether these efforts, combined with anti-syphilitic treatment, brings success. Other forms of insanity may be associated with cerebral syphilis, which are much more amenable to treatment, and consequently have a better prognosis.

Organic Brain Diseases.—Among the organic brain diseases in which insanity not infrequently manifests itself, *arteriosclerosis* is a common condition, and may be intimately connected with senile dementia. Here the changes in the arteries and consequent interference with the cerebral circulation, with some softening of the brain, are productive of the morbid mental symptoms. The patient gradually shows defects in efficiency and memory, with emotional instability and irritability. The mind is apt to get confused at times and delusions of a hypochondriacal, persecutory or jealous nature may appear. The personality is often well-preserved for a prolonged period and insight is good at first, but in time there is a progressive mental deterioration and more or less complete disorganization of the mind ensues. Physically, there will likely be organic nervous signs, with perhaps local paralysis and epileptiform fits. Other organic brain diseases which may be complicated with symptoms of insanity are disseminated sclerosis, locomotor ataxy and epidemic encephalitis.

Epileptic Insanity.—In a certain proportion of cases, if epilepsy begins in early life. it may lead to condition of feeblemindedness, imbecility or idiocy. In relation with epileptic seizures, or in place of them, various abnormal mental states are liable to arise in some victims, which necessitate their commitment to a mental hospital. In these conditions there may be severe depression, excitement, state of ecstasy or confusion. Epileptic insane patients are apt to be morose, irritable, suspicious and querulous. Any chronic state of insanity will probably be paranoid in nature, with delusions and hallucinations. As a class they are dangerous.

According to the report of the United States Department of Commerce, the number of insane persons in 161 of the 165 State and Federal hospitals for mental disease on Jan. 1, 1927 (exclusive of the State psychopathic hospitals, and the Federal hospitals operated by the Veterans' Bureau, the Public Health Service, the Army and the Navy), was 250,890, as compared with a total of 229,664 in 1923. In the country as a whole the number of mental patients under institutional care shows a steady increase.

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(C. S. R.)

HOSPITAL TREATMENT OF INSANITY

The era of real hospitals for the insane may be said to have begun in the 19th century, although there had been established here and there in different parts of the world certain asylums or places of restraint before this period. The prevailing idea of the pathology of insanity in Europe during the middle ages was that of demoniacal possession. The insane were not sick, but possessed of devils, and these devils were only to be exorcised by moral and spiritual agencies. Mediaeval therapeutics in insanity adapted itself to the etiology indicated. Torture and the cruellest forms of punishment were employed. The insane were regarded with abhorrence, and were frequently cast into chains and dungeons.

Until as late as the middle of the 18th century, mildly insane persons were cared for at shrines, or wandered homeless about the country. Such as were deemed a menace to the community were sent to ordinary prisons or chained in dungeons. Thus large numbers of lunatics accumulated in the prisons, and slowly there grew up a sort of distinction between them and criminals, which at length resulted in a separation of the two classes. In time many of the insane were sent to cloisters and monasteries, especially after these began to be abandoned by their former occupants. Thus "Bedlam" (Bethlehem Royal hospital) was originally founded in 1247 as a priory for the brethren and sisters of the Order of the Star of Bethlehem, and was rebuilt as an asylum for the insane in 1676.

Pinel, in 1792, struck the chains from the lunatics huddled in

the Salpétrière and Bicêtre of Paris, and called upon the world to realize the horrible injustice done to this wretched and suffering class of humanity; but 25 years later, the insane, everywhere in Europe, were still treated brutally, and it was not until 1838 that in France they were all transferred from small houses of detention, workhouses and prisons, to asylums specially constructed for this purpose.

No great advance in the humane and scientific care of the insane was made till towards the middle of the 19th century. Only then did the actual metamorphosis of asylums for detention into hospitals for treatment begin to take place. Hand in hand with this progress there has grown, and still is growing, a tendency to subdivision and specialization of hospitals for this purpose. There are now hospitals for the acutely insane, others for the chronic insane, asylums for the criminal insane, institutions for the feeble-minded and idiots, and colonies for epileptics. There are public institutions for the poor, and well-appointed private retreats and homes for the rich. All these are presided over by properly qualified medical authorities, supervised by unsalaried boards of trustees or managers, and inspected by Government lunacy commissioners, or boards of charities.

It may be said indeed that the modern hospital for the insane does credit to latter-day civilization. Physical restraint is no longer practised. The day of chains—even of wristlets, covered cribs and strait-jackets—is past. Neat dormitories, cosy single rooms, and sitting- and dining-rooms please the eye, and improved methods of treatment are adopted in the way of sleep-producing and alleviating drugs, dietetics, physical culture, hydrotherapy and the like. There are few asylums now without pathological and clinical laboratories.

Germany approaches nearest to an ideal standard of provision for the insane. The highest and best idea which has yet been attained is that of small hospitals for the acutely insane in all cities of more than 50,000 inhabitants, and of colonies for the chronic insane in the rural districts adjacent to centres of population. The best of these colonies are constructed on the principle of a farming hamlet, without barracks, corridored buildings, or pavilions, being similar in most respects to any agricultural community. At the same time all the inhabitants are under medical supervision, and a laboratory for scientific researches forms a highly important part of the equipment. Such a colony is not looked upon indeed as a refuge for the incurable; it is rather a hospital for the sick where treatment is carried on under the most humane and most suitable conditions, and wherein the percentage of recoveries will certainly be larger than in asylums and hospitals as now conducted.

But that the tendency in the direction of the more humane and scientific treatment of the insane is a general and a growing one is manifested in all countries by the steadily increasing abandonment of the former huge cloister-like abodes for the detention of such sufferers.

During the World War the British public insisted that no soldier should be sent to an asylum unless proved to be suffering from an incurable mental disease, or until, after a probation of 12 months, the disease was regarded as incurable; and the success of this method of dealing with mental disease in the army led the board of control to reconsider the question of the early treatment of insanity.

Through the munificence of Dr. Henry Maudsley, the London County Council has built the Maudsley hospital for the study and treatment of mental diseases in the early and curable stage; and here a real effort has been made to deal with insanity on modern rational lines.

It has an out-patients' department, and 150 beds for males and females, together with a qualified staff of medical officers. The Maudsley hospital is a recognized school of the London University, and a course of lectures, together with practical instruction, is given to medical men who are desirous of qualifying for the diploma of psychological medicine. The London County Council give study leave to their medical officers of asylums, and now require officers who apply for senior appointments to possess a university diploma of psychological medicine or a diploma of the conjoint board of the Royal College of Physicians and Surgeons. Opportunities for research in the pathological laboratory are afforded to suitable applicants by the committee.

The Maudsley hospital, being a rate-aided hospital, is primarily intended for those who have a London settlement, and the charge made varies according to the means of the patient. All inmates of the hospital are voluntary and uncertified. This allays the fear of the patients that they may be made permanent inmates, and inspires them with confidence in their treatment. Out-patients are thereby encouraged to attend the hospital, and in this way a more favourable prognosis is secured, for mental disorders and diseases are thus observed and treated in their incipient stages.

In most London general hospitals special out-patient departments exist for mental diseases, and there is an attempt being made to link up the general hospitals and mental institutions. A few actually admit in-patients with mental illnesses of a type considered suitable to be treated in such an environment.

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The United States.—Most of the intensive work in treating insanity is naturally done in special hospitals, but more and more is being done in schools and even in the pre-school period, in habit and child guidance clinics, in outpatient departments, in mental hygiene organizations, in private practice, in general hospitals, in nursing homes and sanatoria. There is much demand for a greater variety of provisions in harmony with the needs of a great variety of patients. The theory and practice of psychiatry (*q.v.*) to-day include all conditions in the treatment of which familiarity with personality development and personality problems and with disorders and diseases of personality is required.

For the treatment of mental disorders the United States show a wide range of unusually inadequate and many unusually modern provisions. In some regions the gaol is still an intermediary station between home and State hospital (some State laws making the sheriff and juries and the gaol the agency for first aid). In only a few States, as in New York, the health officer has to provide intermediate help pending admission to the State institution. As intermediate stations, there are creditable reception hospitals in a number of cities.

As the ideal for treatment there should be reception and treatment hospitals not too far from the homes, either detached or as special divisions in general community hospitals, with country annexes and colonies for cases that would do better outside of cities, and various types of colony provisions for protracted care. A most important task will always be the service in the community, outside of institutions—the "extra-mural psychiatry."

Unfortunately, to maintain adequate hospitals and hospital organization in small as well as in large communities appears to call for too great an expenditure for disorders which the general medical profession and the public—up to but a few decades ago and in many places up to the present—have largely left to charity and moral advice and exhortation and to the "asylums" now called hospitals.

The first really reasonably well supported hospitals in the United States for mental cases were a few private institutions (New York hospital, Massachusetts General, Pennsylvania and similar hospitals) or special foundations (the Hartford Retreat, Butler hospital, Sheppard and Enoch Pratt hospital). For the rank and file, increasingly well-conducted State institutions and State care acts have helped to replace the makeshifts provided by the counties and certain townships, by no means wholly supplanted. Much care should be taken lest the dependence on private philanthropy might have a retarding effect on the education of the tax-paying public.

Psychiatric institutes, clinics and training schools, research centres and especially the National Committee for Mental Hygiene, are doing valiant work for progress. Better training of the

average physician, education of the public by child guidance clinics and community service and examples of organization of local and State work are marking the present trend in many States and in Canada. (AD. M.)

See H. M. Hurd, ed. *Institutional Care of the Insane in the United States and Canada* (4 vol., 1916–17); H. M. Pollock and E. M. Furbush, *Comparative Statistics of State Hospitals for mental diseases* (1922); J. A. Goldberg, *Social Aspects of the Treatment of the Insane* (1921); J. V. May, *Mental Diseases, a public health problem* (1922), and reports of the various State departments which have the State institutions under their care.

INSANITY IN LAW. It would be difficult to find a more satisfactory term for unsoundness of mind than the old phrase hallowed by usage *non compos mentis* and it is interesting to note in the legislation of Saskatchewan the phrases *mentally incompetent person* and *mentally incompetent* for *lunatic* and *insane* (No. 65 of 1921). Serving a less useful purpose perhaps are various euphemisms whereby *lunacy, insanity, lunatic* and *lunatic asylum* are called *mental disorder* or *defect, patient* and *mental hospital* respectively (South Africa, no. 38 of 1916). It is to be noted that even countries under the civil law (*i.e.*, countries whose law is rather code law than case law) shrink from definitions of insanity and prefer as we have done to judge of the alleged unsoundness of mind with regard to the circumstances of any particular case. One distinction, however, is practically universal, viz., between *idiot* and *lunatic;* idiocy is considered to be natural and lunacy acquired. The Idiots Act of 1886 has, however, been repealed by the Mental Deficiency Acts of 1913 and 1927 and certain definitions attempted. The latter acts introduce the new terms *mental defective* and *defective*. For all legal purposes these can be dealt with under the act of 1890 as persons of unsound mind. The Mental Deficiency Acts provide for the segregation of persons if *defective,* with a separate code for their benefit. (*See* MENTAL DEFICIENCY.)

When a man becomes unable to manage himself or his affairs, society, to protect herself and the lunatic, changes his status by taking the management of his person or of his property, or of both, out of his hands. But, since rights and obligations are co-relative, the civil incapacity resulting from the changed status carries with it a certain freedom from responsibility which forms the subject matter of the substantive law of lunacy. Of these the most dramatic is the criminal irresponsibility of the insane. Other examples of irresponsibility are the avoiding of certain contracts, including, under certain circumstances, marriage and the setting aside of wills.

No person of unsound mind can, in this country, be detained, nor can the management of his property pass into the hands of another, except by due process of law, and we shall consider how this is done and what safeguards besides the writ of habeas corpus (*q.v.*) there are against improper detention.

The adjective law of insanity is codified in the Lunacy Acts, 1890–1922. In the middle ages the wardship of idiots and lunatics was in the king, who under the Statute De Prerogativa Regis enjoyed an idiot's property, subject to the obligation to provide him with necessaries, but was a strict trustee for a lunatic. Idiots and lunatics were so found on inquisitions under the writs *De Idiota Inquirendo* and *De Lunatico Inquirendo;* but as juries avoided finding a verdict of idiocy the former writ fell into desuetude. The latter, however, exists to this day and is described in part 3 of the Lunacy Act of 1890. Certain important legal distinctions exist between the status of a "lunatic so found" (*i.e.*, under the inquisition) and a "lunatic not so found"; the latter term meaning a person whose unsoundness of mind has been legally established by another procedure than inquisition as, *e.g.*, by certification.

On an inquisition the issue is whether the person is of unsound mind so as to be incapable of managing himself or his affairs. (1) A lunatic so found is looked after by a committee. The committee of the person and the committee of the property are not necessarily one and the same person (L.A. 1890, pt. 4). In some cases a lunatic so found is allowed his liberty but not the management of his property (L.A. 1890, s. 98 [2]). The contracts entered into by a lunatic so found are void *ab initio* as also is marriage even during a lucid interval. He may, however, make a valid will during a lucid interval, and even at other times his will is valid if it appears that he was of a "disposing mind." (2) The person and property of lunatics not so found are governed by other rules. The property of the average lunatic is so soon swallowed up in the arrangements for his care that it is not his property that interests the State, but the absence of it. (*See* POOR LAW.) A lunatic may be detained in any one of seven ways: (1) On an urgency order signed by a relative or other interested person and accompanied by one medical certificate. The judicial authority does not intervene in this order, which lasts only seven days. (2) On a petition by relatives; two medical certificates (L.A. 1890, s. 4); the usual procedure. (3) On the information of a constable, etc., that a lunatic, not a pauper, is not under proper care and control or is cruelly treated or neglected by any relative, etc.; two medical certificates (s. 13). (4) On the information of a constable, etc., that any person, whether pauper or not, is "wandering at large" and deemed to be a lunatic; one medical certificate. (5) Under s. 23 two commissioners in lunacy may, with one medical certificate, send a pauper lunatic or alleged lunatic to an asylum. (6) On the information of a parish officer, with one medical certificate, pauper lunatics may be dealt with (ss. 14). Methods 2 and 3 require the intervention of the judicial authority defined in ss. 9 and 10. The judicial authority may act in cases 4 and 6, but a justice of the peace will suffice. The committee of the person or a master in lunacy may, of course, without medical certificates, sign a reception order after a lunatic has been formally so found and a committee of the person may sign in case 1.

Elaborate safeguards against improper detention are provided by the Lunacy Act, 1890. The powers and duties of the commissioners in lunacy are transferred by the latter act to a board of control (s. 65, 1). Two or more commissioners, one of whom must be a doctor and one a barrister, must visit every asylum at least once a year (s. 187). In addition, two members at least of the visiting committee appointed by the local authority (s. 188) must inspect every two months every part of an asylum and see every patient therein, so that they may have an opportunity of making complaints. There are also provisions for visiting hospitals, licensed houses and single patients (ss. 191–200). Lunatics so found are visited by "chancery visitors" (ss. 163–68).

The Royal Commission on Lunacy, 1926, was unable to find (p. 39) that any of the alleged cases of improper detention could be supported on the evidence. This royal commission was appointed in 1924 to enquire, as regards England and Wales, into the law and procedure relating to the certification, detention and care of persons of unsound mind; and to consider to what extent provision should be made for the treatment of such persons without certification.

The report considers that "insanity is after all only a disease like other diseases" and complains that "the keynote in the past has been detention; the keynote in the future ought to be treatment and prevention." Whatever may be thought of the first proposition, it may be pointed out with regard to the second that the idea of treatment of insanity is no new one, and it is certainly not the fault of the law if there have been shortcomings in this respect. A medical certificate under the Lunacy Acts contains the phrase "and is a proper person to be taken charge of and detained under care and treatment." This conception is 100 years old and dates back to an act of 1828 to regulate the care and treatment of insane persons in England, repealing various acts for regulating madhouses. (Nor is the idea of treatment a new one on the Continent, *see* the French Lunacy Act of 1838—*Loi sur les Alienes*—Art. 1.)

The royal commission recommended the removal of the "stigma of pauperization" by "divorcing lunacy law and administration from the poor law" and the avoidance of the "stigma of certification" by the putting of certain cases under care and treatment without full certification. This would seem to throw more responsibility on the medical man, who already, if he attempts to treat a borderline case himself, may be prosecuted under s. 28 (4) of the act for receiving an alleged lunatic without an order; or

if he certifies such a case he may later be sued by a patient who considers himself to have been wrongfully certified. An excellent summary and criticism of the present state of the law as to the responsibility of medical men is to be found in Justice McCardie's judgment in the case of *de Freville* v. *Dill* (1927).

In actions at common law the issue is: Was the alleged lunatic at the date in question capable of understanding the nature of the act he was performing. The contract of a lunatic not so found is voidable but not void *ab initio* (contrast case of a lunatic so found) and it must be shown that the other was aware of the lunatic's condition. A lunatic not so found may therefore make a valid contract in a lucid interval, nor need he have fully recovered (*ex parte* Hoyland [1805] 11 Ves. 10).

Marriage (*q.v.*) is more than a contract involving, as it does, a change of status. By the Marriage of Lunatics Act, 1811, the "marriage" of a lunatic so found, even during a lucid interval, is void. The marriage of a lunatic not so found is voidable if insanity of a pronounced type can be shown to have existed at the time of the ceremony.

In probate actions (actions on wills) the issue is: was the testator of a sound and disposing mind. In particular he must be able to recall the several persons who may be fitting objects of his bounty and understand the relation of the various beneficiaries to himself and their respective claims upon his bounty. A medical man who attests a will *ipso facto* certifies that, in his opinion, the testator is of a sound disposing mind as regards that particular will.

In the criminal law the question for the jury, if insanity is pleaded, is: Was the person at the time of committing the act labouring from such a defect of reason, from disease of the mind, as not to know the quality of the act he was doing; or, if he did know it, did he know that what he was doing was wrong. This issue is a summary of the famous McNaughten rules. In 1843 one McNaughten, under the delusion that he was being persecuted by Sir Robert Peel, killed that statesman's secretary. Insanity was pleaded on the ground that the delusion deprived prisoner of any control over acts connected with the delusion, and the prisoner was found not guilty on the ground of insanity. The case gave rise to a good deal of discussion and led to the unusual step of putting a hypothetical case to the law lords; unusual, because in English law judges give judgment after hearing the argument in an actual case. The answers of the judges on this occasion are called the McNaughten rules. Not having been decided in an actual trial, they are technically not authority, but in practice their authority is great. They have found their way for example into *The Law Relating to Lunacy*. Theobald says (A. 1924 at p. 242) "The more recent charges given by the judges in trials for murder shows that, though the rules in McNaughten's case are relied on, yet being abstract and general in their terms the judges are careful to adapt and apply them to the circumstances of each case."

In July 1922 the then lord chancellor (Lord Birkenhead) appointed a committee to consider what changes, if any, were desirable in the existing law practice and procedure relating to criminal trials in which the plea of insanity as a defence is raised, and whether any, and if so what, changes shall be made in the existing law and practice in respect of cases falling within the provisions of s. 2(4) of the Criminal Lunatics Act, 1884. The committee's recommendation (1. 11. 1923), among others, that a modified recognition should be given to the doctrine of irresistible impulse was referred to 12 high court judges in 1924; ten advised against it.

Insanity is seldom pleaded except in murder trials, but it must be remembered (as pointed out by Lord Birkenhead, Times, 26. v. 1924) that any alteration in the law will be far-reaching and affect crimes great and small. All that we can say about an irresistible impulse is that in fact it has not been resisted.

BIBLIOGRAPHY.—*See* N. A. Heywood and A. S. Massey, *Lunacy Practice* (1st ed., 1900, 5th ed., 1920); C. A. Mercier, *A Text-book of Insanity* (1902; 2nd ed. rewritten, 1914); H. S. Theobald, *The Law relating to Lunacy* (1924). (F. T. G.)

United States.—In America the law does not follow either medicine or metaphysics in its conception or definition of insanity. The whole American system of criminal law postulates moral responsibility, and persistently refuses to accept any other standard. Hence, the law will not entangle itself in the ancient controversy between metaphysicians as to the freedom of the will. For the purpose of accountability for crime, it holds that the deliberate acts of sound minds involve discrimination and are not necessitated. So, likewise, it holds that such accountability is not nullified by mere mental or psychiatric derangement, however extreme in itself. Hence, while medical knowledge may be necessary rightly to apply the law's definition of insanity, the prevailing legal definition has an ethical and not a medical or psychological content.

This prevailing definition, though variously worded by different courts and legislatures, is, in essence, that given in Sect. 1,120 of the Penal Law of the State of New York, to wit that:—

> A person is not excused from criminal liability as an idiot, imbecile, lunatic, or insane person, except upon proof that, at the time of committing the alleged criminal act, he was laboring under such a defect of reason as not to know the nature and quality of the act he was doing, or not to know that the act was wrong.

This statutory definition is taken, almost verbatim, from the answer of the 15 judges of England to the questions propounded to them by the House of Lords in 1843 in M'Naughten's case (10 Cl. and F. 200). It draws no distinction, in point of criminal responsibility, between insanity or idiocy or imbecility; and it measures such responsibility by the depravation of understanding as to the particular act rather than in general. Under this definition, knowledge of the nature and quality of the act has reference to its physical nature and quality, and knowledge that the act is wrong refers to its moral, rather than its legal side, although knowledge of its illegality may *imply* knowledge of its immorality, since obedience to the law is a moral duty. Hence, where an insane delusion produces a conflict between moral duty and a known man-made law, the defence of insanity is still available. (*People* v. *Schmidt*, 216 N. Y. 324, 338.)

Implicit in this definition of legal insanity, is the subsidiary principle declared by many American courts that a sufferer from insane delusions must be judged as to his knowledge of the nature, quality and morality of his act by the supposed facts presented by the delusion.

In a few States the legal definition of insanity has been so enlarged as to include irresistible impulse. This test assumes that, even though there may be full realization of the nature, quality and immorality of the act, nevertheless, through mental or psychic disease the defendant may have lost all power to refrain, and hence can be held to no legal responsibility. But this additional definition is rejected in most States as involving the law too deeply in metaphysics and as not affording a safe basis of legal adjudication. Hence, capacity to distinguish between right and wrong, without power of choosing between them, is not recognized, except in the law of a very few States. According to the great weight of authority, where the accused relies on insanity, he has the burden of proof upon that issue. A person while insane cannot be required to plead or to undergo trial or sentence. The manner of determining insanity at the time of the offence or at the time of trial or sentence is usually regulated by statutes which differ widely as between the various States.

Throughout the United States there is a growing tendency to test the issue of insanity in advance of trial and by more scientific means than a battle of hired experts. There is also a growing appreciation of the fact that habitual criminality may in itself be a symptom of mental derangement. Both these new trends of thought manifested themselves in a statute (ch. 415) passed by the State of Massachusetts in 1921 which provided that an indicted person, accused of or known to have been previously convicted of a felony or previously indicted more than once, shall be examined by the State department of mental diseases as to any mental condition or defect which would affect his criminal responsibility. The official report is accessible to the court and to both sides, and is admissible as evidence, although not conclusive. If the prisoner is found insane he is committed immediately to a State hospital. This law has almost completely

eliminated in Massachusetts the trial of a plea of insanity and the familiar duel of hired experts. Under it, accused persons mentally irresponsible are speedily placed in hospitals and treated medically rather than punitively.

In civil matters, the law is relieved of the question of guilty responsibility, and hence adopts various definitions of insanity, depending upon the nature of the acts involved. A person medically insane may, nevertheless, legally make a contract, or appoint an agent, or convey property, if he is able to comprehend, in a reasonable manner, the nature and effect of his act. He may make a will if he has sufficient mind and memory reasonably to understand the nature of the business in which he is engaged, to comprehend the character and extent of his estate, and to recollect the natural objects of his bounty. An insane person is liable for his tortious acts or negligence, except where actual intent is an essential element of the wrong, as, for example, in the case of such defamation as is actionable only when uttered with conscious malice. (C. H. TUT.)

See A. M. Hamilton, *A System of Legal Medicine* (2nd ed., 2 vol., 1900); S. S. Glueck, *Mental Disorder and the Criminal Law* (with appendix of state legislation and interpretative decisions, 1925); J. Koren, *Summaries of Laws Relating to the Commitment and Care of the Insane in the United States* (1912).

INSCRIPTIONS, documents incised on some hard or permanent material in the form of letters or other conventional signs, for the purpose of conveying some information or preserving a record. They are, therefore, to be distinguished on the one hand from manuscripts, or documents written on papyrus, parchment, paper or other more or less smooth surfaces, by means of a brush, reed or pen and some coloured fluid (*see* PALAEOGRAPHY and PAPYROLOGY); and on the other hand from pictures or reliefs intended to convey information or to record events (*see* PICTOGRAPHY), though inscriptions were often combined with such pictures or reliefs, especially in primitive times. There are also some classes of documents which are intermediate between inscriptions and manuscripts, such as writing incised with a stylus or sharp pointed instrument upon tablets covered with a thin coating of wax, or scratched upon pottery or other hard materials (*ostraka*). But as the forms of the letters and the character of the writing in both these cases approximate to what is found in manuscripts, they are usually considered to belong to that class of document; but *graffiti,* or casual scratching on walls, rocks or fragments of pottery, are sometimes included in the study of inscriptions, because they often fill gaps in our knowledge, and, in early times at least, do not differ in form or character from ordinary inscriptions. A good example is offered by the names and other records scratched by Greek mercenaries at the time of Psammetichus on the legs of the colossal statues at Abu Simbel in Egypt. As one of the earliest examples of the use of the Greek alphabet, these find their place in the history of inscriptions. Where, on the other hand, we find casual notes, as well as receipts, accounts, etc., scratched upon potsherds or *ostraka,* we realize that these are merely a cheap substitute for more expensive material such as papyrus, and that the study of such *ostraka* cannot be separated from that of manuscripts on papyrus, and really forms a branch of palaeography rather than of epigraphy.

A. FORM

1. **Materials and Technique.**—*Materials.* Inscriptions were commonly incised on stone or marble, on metal, or on wood (though this last material has hardly ever survived, except in Egypt), or on terra-cotta. In Egypt and Mesopotamia hard stones were frequently used for the purpose, and the inscriptions are therefore well preserved and easy to read. In Greece the favourite material, especially in Athens, was white marble, which takes an admirably clear lettering, but is liable to weathering of the surface if exposed, and to wear if rebuilt into pavements or similar structures. Many other kinds of stone, both hard and soft, were often used, especially crystalline limestones, which do not easily take a smooth surface, and which, therefore, are often difficult to decipher, owing to accidental marks or roughness of the material.

The metal most commonly used for inscriptions was bronze; flat tablets of this were often made for affixing to the walls of temples and other buildings. Occasionally such tablets were made of silver or gold; and inscriptions were often incised on vessels made of any of these metals. Inscriptions on metal were nearly always incised, not cast. An important class of inscriptions are the legends on coins; these were struck from the die. (*See* NUMISMATICS.) Clay was very extensively used for inscriptions in Mesopotamia and in Crete. In this case the symbols were incised or impressed on specially prepared tablets when the clay was soft, and it was subsequently hardened by fire. In Greece, many inscriptions on vases were painted before firing, in that case often having reference to the scenes represented, or incised after firing; potsherds (*ostraka*) were often used as a cheap writing material. Inscriptions were also often impressed from a mould upon wet clay before firing, in the case of tiles, amphora handles, etc., and in these cases often supply valuable information as to the buildings to which they belong or the place from which they took their origin.

The *tools* used for making inscriptions varied with the material; most of them were some kind of chisel, usually with a square blade; early inscriptions were sometimes made on hard rock by successive blows with a punch or pointed hammer. Sometimes a circular punch was used for *O* or a letter of which *O* formed a part.

Styles of Cutting. Early inscriptions, which are often amateur work, are frequently very irregular in their cutting. But in almost all examples of later work, the inscriptions are evidently cut by professionals, and there are definite styles and methods belonging to various places and periods. In Egypt, for instance, the hieroglyphs (*q.v.*) are carefully and delicately cut in early times, and in later periods become more careless and conventional. In Greece, the best work was done in the 5th and 4th centuries B.C. in Athens; the letters were all exact and regular in shape, with no adventitious ornaments, and were, especially in the 5th century, usually exactly aligned with the letters above and below, as well as those on each side. The result is a beauty and simplicity of effect that has never been surpassed. At that time all the strokes were made of equal thickness, but in the 4th century B.C. and later there came in the custom of holding the chisel obliquely to the surface, thus producing a wedge-shaped stroke. A similar custom in Mesopotamia gave rise to the so-called *cuneiform* system (*q.v.*). On metal inscriptions in Greece this same effect appears earlier than on stone or marble. In the 3rd century and later it becomes common to introduce *apices* or ornamental ends to the strokes, a custom which prevails to the present day in our ordinary capital letters. The custom of making different strokes and different parts of curves of varying thickness became common in Roman inscriptions, which developed a monumental style of their own, varying from period to period. Inscriptions can often be approximately dated by the style of the cutting as well as by the shapes of the letters; skill in doing this can only be acquired by a careful and minute study of originals and facsimiles.

Inscriptions vary greatly in size according to the position where they were intended to be read, their purpose, and the skill of the cutter. Some inscriptions are of great length, the longest, a statement of accounts of the temple at Delos, under Athenian administration, being nearly half as long as a book of Thucydides; and many other inscriptions approach this in length.

2. **Symbols and Forms of Writing.**—The origin of *writing* and the evolution of the *alphabet* are discussed in the special articles upon those subjects. For the present purpose it is sufficient to note that most of the forms of writing known to us originated in some system of picture-writing, which developed into a hieroglyphic system. Such systems appear to have originated independently in different parts of the world—in Egypt, Mesopotamia, Crete, among the Hittites and in China and America. The evidence for all of these is mainly to be found in inscriptions. The development from Ideographs (or direct representation of an object or idea) to symbols of phonetic value, and so to syllabaries or alphabets, took place in many different systems to various degrees. But the first people to invent a completely alphabetic system of writing were the Phoenicians, from whom the Greeks bor-

rowed it with certain modifications and improvements. From the Greek was derived the Latin, and from the two all the alphabets of European peoples. It is still a matter of dispute whether the Phoenician was derived from the Egyptian.

The hieroglyphic symbols naturally tended to be conventionalized and simplified for convenience of cutting, in accordance with the materials and tools employed. In many cases they developed from a pictorial to a linear form. It is possible that some of these linear forms may not be derived from hieroglyphs, but from purely conventional geometrical forms, such as were widely used at all periods and places as owners' or masons' marks. The tendency of linear forms to become wedge-shaped is most conspicuous in cuneiform, but as has been noticed, the same tendency occurs in Greek inscriptions of the 3rd and 2nd centuries B.C. and earlier in inscriptions incised on bronze.

In the north of Europe the Ogham (*q.v.*) inscriptions are alphabetic, and are apparently an independent invention on arbitrary lines, like the Morse code; but Runes, which were extensively used in the same region, are derived from the Greek or the Latin alphabets.

In most alphabetic systems there are also found in inscriptions certain symbols which are not strictly alphabetic or phonetic in character. The commonest of these are the various systems of numerals that are used in different times and places. It is impossible here to give any full description of these different systems; but a brief account may be given of the principles underlying them. Most of them are based upon a decimal system, doubtless owing to the habit of counting on the fingers. In some cases the symbols are simple and obvious, as in the Cretan script, where circles (or *rhombi*), dots and lines are used for hundreds, tens and units, each being repeated as often as necessary; and a similar system for the lower denominations is used at Epidaurus in the 4th century B.C. In Athens the usual system was to indicate each denomination by its initial, M for Μύριοι (10,000), X for χίλιοι (1,000), H for Ηεκατόν (100), Δ for δέκα (10) π for πεντε (5) and I for units. The other Greek system followed that derived from the Phoenicians, using the letters of the alphabet in their conventional order from one to nine, 10 to 90 and 100 to 900; in this arrangement obsolete letters were retained in their original places so as to give the requisite number of 27 symbols. The Roman system of numerals—M, D, C, L, X, V, I (for 1,000, 500, 100, 50, 10, 5 and 1) is generally supposed to have arisen from the adaptation of those symbols in the Greek alphabet which the Romans did not want; an alternative theory is that it is simplified from a series of ideographs representing the spread hand, the fingers and so on.

Apart from numerals, the use of initials in the place of complete words was not common in early times. It became, however, very frequent in Roman inscriptions, which sometimes are made up almost entirely of such abbreviations and can only be understood by those familiar with the formulae. A list of the commonest of these will be found under ABBREVIATION. Compendia or monograms also occur in later Greek and Roman times, and become very common and very difficult to interpret in early Christian and Byzantine inscriptions.

Some kind of punctuation is often found in inscriptions of all kinds. In Greek inscriptions a vertical line or a dot, or dots, sometimes indicates the separation between sentences or words, but words are seldom separated by spaces as in modern printing, so that the text is continuous and no division of words exists. This is particularly the case with Greek inscriptions of the best period. In Roman inscriptions it was usual to separate the words by dots. In certain inscriptions a cross (+) was used to indicate the beginning of an inscription, especially when its direction was erratic. Christian inscriptions sometimes begin with a cross, which doubtless had a symbolic meaning; and a leaf or other device was often placed at the end.

The direction of the writing varies greatly in different places and times. The letters or symbols may be arranged vertically below one another, and read from top to bottom, or horizontally, either from right to left or left to right; they may also be arranged in a kind of pattern—in which case their order may be indeterminate, or in a wandering or curved line, or left to right and right to left alternately (*boustrophedon,* or as an ox in ploughing) Most Semitic alphabets, including Phoenician, read from right to left; and the earliest Greek inscriptions follow the same direction. But the direction from left to right became regular in Greece after the 6th century B.C., and consequently is adopted by the Romans and in all European systems. The individual letters or symbols usually face in the same direction as the writing, as a whole.

3. **The Position or Place** of inscriptions depends greatly upon their purpose or intention. When they have a direct relation to the sculptures, reliefs or paintings with which they are associated, they often form a kind of pattern to fill the background or vacant spaces between the figures; but sometimes, especially in Mesopotamian statues or reliefs, they are cut right across the figures without any regard to the artistic effect. In late Greek or Roman work it is usual to cut any inscription relative to a statue or relief upon the basis on which this is mounted; but short inscriptions such as dedications or artists' signatures are often placed in some inconspicuous position upon the work itself. In the case of painted vases, the inscriptions relative to the subject represented are usually painted; but dedications and other inscriptions are often incised after the vase has been fired.

In Egypt, inscriptions were often inscribed or painted upon the inner walls of tombs, whether they referred to religious belief or ritual, or to the honours and possessions of the deceased; they were intended for his benefit and convenience rather than for the information of others, so as to perpetuate his familiar surroundings, not to make him live in the memory of his successors. The information which we derive from such inscriptions is invaluable to us; but such was not the intention with which they were made. On the other hand, inscriptions which were intended to be seen by the public and to perpetuate a record of events, or to supply useful information, were usually placed in places of common resort, above all in temples and sacred precincts. Sometimes they were cut on convenient rock faces, sometimes upon the walls of temples or other buildings. Most frequently the slabs of marble (*stelae*), stone, metal or other material upon which the inscriptions were incised were set up in convenient positions to be read, in any places of public resort. This was the method of publication of all laws, decrees and official notices, of treaties and contracts, of honours to officials or private citizens, of religious dedications and prescriptions of ritual. Inscribed tombstones were set up over graves, which were usually placed along the chief roads leading out of a town, the most familiar example being the sacred way from Athens to Eleusis. Inscriptions commemorative of victories or other great events were only in exceptional cases erected upon the spot; more often such memorials were set up in some great religious centre such as Delphi or Olympia. But boundary stones were necessarily placed on the line which they defined.

Chief Periods and Nationalities.—The study of inscriptions supplies an important contribution to the history of many lands and peoples. In some cases, as in Egypt and Mesopotamia, it forms almost the only source of information in the absence of literary records; in others, as in Greece and Rome, it offers a most valuable supplement and comment to what is otherwise recorded.

Both Egyptian and Mesopotamian inscriptions go back to an extremely early date; it is at present uncertain which is the earlier, but both show, before 3500 B.C. and possibly much earlier, a complete, organized system of writing which implies many centuries of development behind it. The Egyptian hieroglyphic system, as used in inscriptions, continued without any essential change of character until Roman times, though various systems of hieratic modification were used at different times. On the famous Rosetta stone, in the British Museum, which first gave the clue to the interpretation of Egyptian writing, hieroglyphic, hieratic and Greek versions of the same decree are given side by side. Its date is 195 B.C. The Mesopotamian linear symbols developed mainly for technical reasons, into a wedge-shaped or cuneiform system, which was adopted in modified forms and applied to different languages through some thousands of years, Sumerian,

Babylonian, Assyrian and Persian, until it was superseded, after the conquests of Alexander, by Greek. An independent hieroglyphic system, which also developed into various linear scripts, existed in Crete during the Middle and Late Minoan periods, from about 3000, probably, to the fall of Cnossus, about 1500 B.C. The Hittite hieroglyphs correspond to the period of the Hittite empire in North Syria and Asia Minor from about 2000 to 800 B.C.; from it, according to one theory, arose the Cypriote syllabary, which continued in use until the 4th century B.C. or later.

The earliest Phoenician inscriptions known date from about the 10th century B.C., and the alphabet remained in use down to the 3rd century B.C. It was modified and adopted by the Greeks at an uncertain date; the earliest Greek inscriptions are generally dated in the 7th century B.C.

In early times each Greek State had its own alphabet; but in the year 403 B.C. (the archonship of Eucleides) the Ionian alphabet, which is the one used now for Greek capital letters, was officially adopted by Athens, and soon became universal in Greece. From the various Greek alphabets the different local Italian alphabets, including the Etruscan, were derived with various modifications. The Roman alphabet was among these, being based on the alphabet of Caere, a Chalcidian colony. There are a few very early Roman inscriptions; but they do not become common until the 3rd century B.C.; from that time the letters took much the same forms as they preserve to the present day.

The custom of putting inscriptions in Greek and in Latin on buildings and other monuments continued through mediaeval times, and is still customary, classical forms being frequently imitated. The latest dated inscription in the Greek Corpus records the building of a bridge in Sicily in A.D. 1121. The series of Byzantine inscriptions continues practically without interruption to the present day; and Latin retains its use as a universal language in religious, public and private inscriptions.

Methods of Dating.—It is often possible to date an inscription approximately by the style of the lettering, or even by the alphabet used. Thus at Athens the Ionic alphabet was adopted in place of the early Attic alphabet in the archonship of Eucleides, 403 B.C., according to a decree proposed by Archinus. But the change was already in process in private inscriptions, and even in official documents Ionic forms are sometimes found earlier. Inscriptions are dated in various ways, mostly by giving the name of a king, magistrate or priest. In the case of kings, they only give an approximate date, unless the year of his reign is given also. But in the case of most independent cities, the date is given by the name of an annual magistrate, and thus the year is precisely indicated. At Athens, the name used was that of the Eponymous Archon, and as an almost complete list of these has been drawn up from inscriptions and other sources, this means of dating is quite satisfactory. The custom of dating by Olympiads, which is familiar to us from later Greek and Roman writers, was rarely used in early Greece, except in connection with athletic victories. Many inscriptions are dated from various local eras, often based upon historical events, such as the foundation of a town or festival, the organization of a province, or even the visit of an emperor. The number of these eras in later times, especially in Asia Minor, becomes very bewildering. In Attic decrees, and some others, it was also usual to give the day of the month.

In Greek inscriptions of the Roman period the year of the emperor is defined by the number of his consulate, or other indications or titles, as in the corresponding Latin inscriptions. In later times, the dating is commonly by "Indiction"; but as this only gives the number of the year within the 15-year period, but leaves that period undefined, such dating is very inconvenient except for merely temporary use. In the Eastern empire the date from the creation of the world (5509 B.C.) is sometimes given; but the date of the Christian era is hardly ever used.

B. CONTENT

Purpose of Inscriptions.—Inscriptions, as above defined, may be roughly divided into two main classes: those in which the inscription was subservient to the use or purpose of the object on which it was inscribed, or at any rate had a direct relation to that object—for example, the name of the owner or the record of dedication to a god—and those in which the inscription existed independently for its own sake, or for the sake of the information which it recorded, and the object on which it was inscribed was either made for the purpose, as a slab of marble or plate of bronze, or was made use of, as in the case of a convenient wall or the surface of a rock, or even a potsherd. The walls of buildings are often covered with such inscriptions, especially if they are in a conspicuous or convenient position, and so offer an obvious means of publicity.

For us, accustomed as we are to a vast mass of books, newspapers and other printed documents, it is difficult to realize the extensive use and great convenience assigned to inscriptions in ancient times. Not only were public announcements of all sorts, such as we should make known by advertisements or posters, thus placed before the public, but all kinds of records and enactments—codes of law and political decrees; regulations for all matters, civil and religious; accounts and contracts, public and private; treaties between states; records of public and private benefactions and dedications, and all matters of administration; honours to the living and to the memory of the dead. Many of these were intended to preserve for all time the records which they contained; but others must have been of only temporary interest. It seems, therefore, the more remarkable that they should have been incised on permanent material such as bronze, marble or stone—and incised in the first instance, with a care and perfection of technique which have led to their survival to the present day, so as to preserve for us invaluable evidence as to the life and institutions of the people who made them. Temporary and permanent value are thus often combined in the same inscription. For instance, an Athenian citizen, visiting the Acropolis or the Market Place, could satisfy himself at first hand as to treaties or decrees of the people, public accounts or state income and expenditure. And at the same time these documents preserved for all time much history, both social and political.

Relative Inscriptions.—Inscriptions having a direct relation to the object, or representation, on which they are inscribed, vary greatly in their contents. Those relating to picture or relief chronicles of the victories or exploits of kings, as in Egypt and Mesopotamia, serve as a record of the events, and help to interpret the scenes. Such inscriptions are not common in Greek or Roman work; but frequently, especially in early Greek times, and on vases, the names of persons and even of objects are written beside them for the purpose of identification, and sometimes a speech issues from the mouth of a figure. On the carved wooden chest of Cypselus, of about 600 B.C. hexameter verses were written, curving about among the figures, and giving a description of each scene. The bases of statues and reliefs often had inscriptions cut upon them for identification and record. This was particularly the case with honorary statues and tombstones. In other cases, where there is an evident relation between the artistic representation and the inscription, the figures are subordinate and seem merely to illustrate the text, as when a treaty between Athens and Samos has a relief at its head representing the goddesses Athena and Hera clasping hands, as representatives of their respective cities. In other cases, the arms or device of a city is carved on an inscription, almost like a seal on a document. In all these cases the figures and the inscription are part of a common design, whether carried out by the same hand or not. But in the case of owners' marks or names cut on vases or other objects, or of the dedication of such objects, the inscription is not necessarily contemporary; it may indeed be misleading, as in the case, mentioned with disapproval by Cicero, of using again old Greek statues and placing new dedicatory inscriptions on them in Roman times; for instance, one of the statues of Athenian knights of the 5th century B.C. placed at the entrance of the Acropolis, had a later inscription cut on its base to make it serve as an equestrian statue of Germanicus, probably in 18 A.D. when he visited Athens. In Egypt and Mesopotamia also it is not unusual to find the name of a later king or official cut upon an earlier work.

Independent Inscriptions.—The majority of inscriptions are of independent value and interest, the object on which they are cut being either provided for the purpose or utilized as convenient and suitable. Such inscriptions may be classified as (*a*) *Religious* and (*b*) *Political and Social.* The distinction between the two is not always easy to draw; for in almost all ancient civilizations religion was a part of the established service of the State, and was under public control, or at least was closely bound up with political administration. It follows that many inscriptions relating to religious matters take the form of political decrees or state documents, and therefore might, especially as far as form is concerned, be included in either category; but it is usually possible to classify them according to their contents and intention.

GREEK INSCRIPTIONS

(*a*) **Religious.**—1. *Temples, Their Foundation and Administration.*—A temple was often a kind of religious corporation under the control of the State; and its accounts and details of administration were made public at frequent intervals, usually annually, by means of inscriptions, exhibited to public view in its precinct. Many such inscriptions have been found, and supply a great deal of information that can be obtained from no other source. Some great temples, such as that of Apollo on the island of Delos, held great amounts of property, both real and portable, the latter taking the form either of more or less precious offerings dedicated in the temple and its surrounding buildings, or of coined money. The inscriptions accordingly record gifts and acquisitions of landed property, leases and assignments, payments of rent and fines for default, loans and interest and many other business transactions suitable to a great landed proprietor or to a bank. They therefore throw much light upon the social and economic conditions of ancient life, such as are nowhere else recorded. Again, the lists of offerings dedicated in the temple and other buildings enable us to realize almost visually the appearance of their contents. These are described as being on the floor, on the walls, on shelves or in cases; they consisted of vases and other objects suitable for use in the temple service; ornaments and jewels; statuettes, mostly in gold and silver; weapons and tools; coined money; and bullion, mostly melted down from old offerings. The detailed care that was taken in this last case, to ensure that the full weight of these objects was preserved, whether made into a new vessel or not, is recorded in other inscriptions. These elaborate inventories were checked and revised by each successive board of administrators, and gave the best possible security against any robbery or peculation. In addition to such general lists, there are also innumerable records of various gifts and acquisitions, whether of land and houses, or of movable property of all sorts. Buildings and repairs are also recorded, sometimes by the State, sometimes by individuals, whose piety and generosity are suitably honoured. In form, these are often hardly to be distinguished from public works of a secular character, which must be mentioned later.

The inscriptions on or belonging to special dedications are often of great historical interest—there need only be quoted the inscription on the famous snake column, once at Delphi and now in the Hippodrome at Constantinople, with the list of the Greek States which took part in the Persian war; and that relating to the Roman arms dedicated by Pyrrhus of Epirus at Dodona after his victories. Most of the great temples being of immemorial sanctity, it is hardly to be expected that any records of their foundation should be found in inscriptions. But on the other hand we have many accounts of the dedication of new temples, either by states or communities or by private individuals. In almost all such cases it was necessary to obtain sanction for the foundation from the State; thus the inscription often takes the form of a decree of the people authorizing the foundation of the temple, and often giving some privileges to the founder or founders.

2. *Priests and Other Officials.*—Inscriptions give much information as to priests and other religious officials. There are in the first place lists of priests, some of them covering long periods and even going back to mythical times; there are also lists of the treasurers and administrators, who were usually lay officials appointed for the purpose, either by election or by lot. The duties and privileges of priests are recorded in many inscriptions, and vary considerably from place to place. It is recorded, for instance, what portions of a victim at any sacrifice were to be received by the priest. In any important temple this must evidently have been far more than the priest or his family could consume, and accordingly it must have been sold, and so constituted a considerable source of income. Consequently a priesthood was an office well paid and much sought after; and we actually find in later Greek times, especially in Asia Minor, that priesthoods were frequently sold, under proper guarantees and with due sureties as to the duties being carried out. Sometimes a fee to the priest had to be paid in cash; in some cases a priest or priestess was allowed to take up a collection on certain days. On the other hand, the duties of a priest are often recorded; he had to see to the cleaning and care of the temple and its contents, to provide flowers and garlands for decorations and to supply the regular daily service. Sacrifices on great occasions were usually provided by the State, as also were important repairs; but in some cases a priest undertook these on his own account, and was honoured accordingly—for instance, by being allowed to inscribe his name in the restored temple.

Besides priests, we find many other officials of various ranks attached to temples and recorded in inscriptions. Some of these, especially those who were concerned with buildings or constructions, or with the inventories of temple treasures and the accounts of administration, were lay officials appointed by the State, as in the case of political officers. But many others had specialized sacerdotal functions; for instance, in many places there were *manteis* or prophets, often of special families with hereditary skill in divination; at Eleusis we find records of the hierophant, the torch-bearer, and others who took part in the celebration of the mysteries. At Olympia, in later Greek times, we find a remarkable list of officials, viz.: three priests, three libation pourers, two prophets, three custodians (of keys), a flute-player, an interpreter, a priest for the daily sacrifice, a secretary, a wine-pourer, three dancers at libations, a woodman (to supply wood for the sacrifices), and a steward and cook—the last no sinecure, in view of the numerous sacrificial feasts.

There were also many more menial offices in the service of temples which were carried out by slaves. Such slaves were often presented to the temple or acquired in some other way. There is a whole class of inscriptions, found on many sites, in which the sale of slaves to a temple or to the god of a temple is recorded. It is often difficult to know whether such slaves were intended for the service of a temple, or, on the other hand, such service was either purely formal or was not required at all, the sale to the temple being intended as fictitious, so as to enable a slave to acquire his own freedom and at the same time to secure the protection of the god in his free status.

3. *Ritual.*—The ritual appropriate to different divinities and temples varied greatly from place to place; and it was, therefore, necessary or desirable to set up notices in all public places of worship for the information and guidance of worshippers. The commonest and most essential act of worship was sacrifice; an example of the simplest form of prescription is to be seen in the inscription on the relief from Thasos in the Louvre:—"To the Nymphs and to Apollo the leader of the Nymphs, the worshipper may, if he so choose, sacrifice a male and a female victim. It is not permissible to offer a sheep or a pig. No paean is sung. To the Graces it is not permissible to offer a goat or a pig."

It is to be noticed that this order of service contains a prohibition as well as a prescription. Such prohibitions are frequent, and often relate to the need of ceremonial purity in all worshippers entering a sacred precinct. They must for a certain time have abstained from certain prescribed means of pollution, varying from place to place. The officials are sometimes ordered to erect notices giving information on this point; for instance, at the precinct of Alectrona at Ialysus, it was prescribed that "no horse, ass, mule, nor any other animal with a bushy tail should enter, and that nobody should bring such animals in or wear

shoes or any article produced from pigs. There is also a fine for driving in sheep." Other precincts were protected in a more general manner from any invasion or violation. It was prohibited to cut wood or to remove earth and stones, or to drive any beasts into some precincts; the right of erecting booths was either restricted or denied altogether. Sometimes more detailed prescriptions are given for the whole organization of a festival; thus, at Andania, in Messenia, the arrangements for the celebration of the local Eleusinia, the dress of the participants, the officials and policing, are very fully described. Similarly, in the hall of the Iobacchi, at Athens, the order of proceedings, the officers and the characters in the sacred play, and various administrative details are ordered.

When there is any doubt about any ritual or procedure, divination is often resorted to, and the results of such divination are recorded in inscriptions as a guidance for the future; it was also a common practice to consult Delphi or some other oracle in doubtful or difficult cases; there the exact method of procedure is sometimes recorded, as well as the response of the oracle. Forms of worship are often prescribed or recorded, especially hymns, which are sometimes inscribed together with their musical notation. The performance of songs or hymns and dances are also matters of constant reference, especially in connection with lyrical or musical contests; the victorious band or performer often dedicated the prize in honour of the god. A special form of contest was that in dramatic performances, of which many records have survived, both from Athens and from many other parts of the Greek world. The regulation of athletic festivals, and the records of victors in their contests, also form a numerous class of inscriptions. As regards mysteries, though there are numerous regulations affecting the arrangement of celebrations and the conduct of those participating, there is, as was to be expected, very little concerning the actual performances.

Another interesting phase of Greek religion known to us mainly from inscriptions is offered by the shrines of healing. The most notable of these is the precinct of Asclepius at Epidaurus. Here have been found, on large slabs of inscription, compiled, in all probability, from earlier documents, lists of the cures effected by Apollo and Asclepius. The cures are of the most varied kinds, from painful diseases or surgical cases to a lost boy and a broken cup. The formula is in almost all cases the same: the consultant comes to Epidaurus, sleeps in the *abaton*, has dreams or sees visions, and comes out whole. In later times, when such faith-healing had probably become less efficacious, elaborate prescriptions of diet and hygiene are recorded.

A special form of prayer consists of curses, which were often buried in the ground, probably with the intent to reach the infernal gods. Such curses often give the reason for their being made, usually some injury done to the author of the curse; sometimes they devote the offender to the infernal gods.

4. *Private Associations for Religious Purposes.*—Another element in Greek religion which is known to us almost exclusively by means of inscriptions, is to be found in the religious associations that existed in many Greek cities, apart from the organization of state religion, though sometimes recognized by it. These associations had each its own regulations, which were duly recorded in inscriptions; they varied greatly both in purpose and in character. Many of them had a definitely religious purpose, in the worship of certain gods; sometimes an alien community was given special permission to worship its own god or gods in its own way. Other associations were more social in character and served as clubs, or as burial societies. A remarkable feature about such associations is that the lists of members of many of them include the names of women and of slaves, thus contrasting with the civic basis of established religion in Greece, and anticipating a religion in which "there is neither Jew nor Greek, there is neither bond nor free, there is neither male nor female."

(*b*) **Political and Social.**—1. *Codes of Law and Regulations.*—Ancient writers state that the earliest laws of Athens were inscribed upon tablets of wood, put together in a pyramidal shape. These, owing to their material, have perished; but we have some very early codes of law preserved on stone, notably at Gortyna in Crete. Here an inscription of great length is incised on the slabs of a theatre-shaped structure in 12 columns of 50 lines each; it is mainly concerned with the law of inheritance, adoption, etc. Doubtless similar inscriptions were set up in many places in Greece. An interesting series of inscriptions deals with the conditions under which colonists were sent out from various cities, and the measures that were taken to secure their rights as citizens. A bronze tablet records in some detail the arrangements of this sort made when the Locrians established a colony in Naupactus; another inscription relates to the Athenian colonization of Salamis, in the 6th century B.C.

2. *Decrees of People and Rulers, later of Kings and Emperors.*—A very large number of inscriptions are in the form of decrees of various cities and peoples, even when their subject matter suggests that they should be classified under other headings. Almost all legislative and many administrative measures take this form; often a decree prescribes how and where the inscription should be set up. The formulae and preambles of such decrees vary considerably from place to place, and from period to period. Those of Athens are by far the most exactly known, owing to the immense number that have been discovered; and they are so strictly stereotyped that they can be classified with the precision of algebraical formulae, and often dated to within a few years by this test alone. Very full lists for this purpose have been drawn up by Prof. W. Larfeld, in his work on the subject. It is usual to record the year (by the name of the eponymus archon), the day of the month and of the prytany (or presiding commission according to tribes), various secretaries, the presiding officials and the proposer of the decree. It is also stated whether the resolution is passed by the senate (Boule) or the assembly of the people (Ecclesia), or both. The circumstances or the reason of the resolution are then given, and finally the decision itself. Some other cities followed Athens in the form of their decrees, with such local variations as were required; others were more independent in their development, and different magistracies or forms of government had various results. In the Hellenistic age, and later, the forms of independent government were, to a great extent, kept up, though little real power remained with the people. On the other hand it is a common thing to find letters from kings, and later from Roman emperors, inscribed and set up in public places.

3. *Public Accounts, Treasure Lists, Building Inscriptions.*—It was customary to inscribe on stone all records of the receipt, custody and expenditure of public money or treasure, so that any citizen could verify for himself the safety and due control of the State in all financial matters. As in the case of temple accounts, it was usual for each temporary board of officials to render to their successors an account of their stewardship, and of the resources and treasures which they handed over. In all cases of public works, the expenditure was ordered by the State, and detailed reports were drawn up and inscribed on stone at intervals while the work was being carried out. In many cases there is a detailed specification of building work which makes it possible, not only to realize all the technical details and processes employed, but also the whole plan and structure of a building. A notable instance is the arsenal of Philon at the Peiraeeus which has been completely reconstructed on paper by architects from the building specification. In the case of the Erechtheum, we have not only a detailed report on the unfinished state of the building in 409 B.C., but also accounts of expenditure and payments to the workmen employed in finishing it. Similar accounts have been preserved of the building of the Parthenon, spread over 15 years; in the case of both the Parthenon and the Erechtheum, there are included the payments made to those who made the sculptures.

Naval and military expenditure is also very fully accounted for; among other information there are records of the galley-slips at the different harbours of the Peiraeeus, and of the ships of the Athenian navy, with their names and condition. In short, there is no department of state economy and financial administration that is not abundantly illustrated by the record of inscriptions.

Tribute Lists.—A set of records of high historical value are the

tribute lists, recording the quota paid to Athens by her subject allies during the 5th century B.C. These throw much light on her relations with them at various periods. (*See* DELIAN LEAGUE.)

4. *Ephebic Inscriptions.*—An institution as to which our knowledge is mainly derived from inscriptions is the ephebic system at Athens. There are not only records of lists of ephebi and of their guardians and instructors, but also decrees in honour of their services, especially in taking their due part in religious and other ceremonies, and resolutions of the ephebi themselves in honour of their officials. It is possible to trace in the inscriptions, which range over several centuries, how what was originally a system of physical and military training for Athenian youths from the age of 18 to 20, with outpost and police duties, was gradually transformed. In later times there were added to the instructors in military exercises others who gave lectures on what we should now call arts and science subjects; so that in the Hellenistic and Roman times, when youths from all parts of the civilized world flocked to Athens as an intellectual centre, the ephebic system became a kind of cosmopolitan university.

5. *Treaties and Political and Commercial Agreements; Arbitration, etc.*—In addition to inscriptions which are concerned with the internal affairs of various cities, there are many others recording treaties or other agreements of an international character between various cities and states. These were incised on bronze or stone, and set up in places of public resort in the cities concerned, or in common religious centres such as Olympia and Delphi. The simplest form of treaty is merely an alliance for a certain term of years, usually with some penalty for any breach of the conditions. Often an oath was prescribed, to be taken by representatives on each side; it was also not unusual to appeal to the god in whose temple the treaty was exhibited. In other cases a list of gods by whom the two parties must swear is prescribed. Commercial clauses were sometimes added to treaties of alliance, and commercial treaties are also found, agreeing as to the export and import of merchandise and other things. In later days, especially in the time of the Hellenistic kings, treaties tend to become more complicated and detailed in their provisions.

Another series of records of great historical interest is concerned with arbitration between various states on various questions, mainly concerned with frontiers. In cases of dispute it was not uncommon for the two disputants to appoint a third party as arbitrator. Sometimes this third party was another State, sometimes a specified number of individuals. Thus, in a frontier dispute between Corinth and Epidaurus, 151 citizens of Megara were appointed by name to arbitrate, and when the decision was disputed, 31 from among them revised or confirmed it. In all such cases it was the custom for a full record to be preserved on stone and set up in the places concerned. In this case the initiative in referring the matter to arbitration came from the Achaean League.

6. *Proxenia Decrees.*—A very large class of inscriptions deals with the institution of *proxenia*. According to this a citizen of any State might be appointed *proxenos* of another State; his duties would then be to offer help and hospitality to any citizen of that other State who might be visiting his city, and to assist him in any dispute or in securing his legal rights. The office has been compared to the modern appointment of consuls, with the essential difference that the *proxenos* is always a citizen of the state in which he resides, not of that whose citizens and interests he assists. The decrees upon this matter frequently record the appointment of a *proxenos*, and the conferring on him of certain benefits and privileges in return for his services; they also contain resolutions of thanks from the city served by the *proxenos*, and record honours consequently conferred upon him.

7. *Honours and Privileges Given to Individuals.*—This class of inscription is in form not unlike the last, except that the honours recorded are given for all sorts of services, private and public, to the State and to individuals. A frequent addition is an invitation to dine in the Prytaneum at Athens. Some are inscribed on the bases of statues set up to the recipient. In early times these inscriptions are usually brief and simple. The bust of Pericles on the Acropolis held nothing but the names of Pericles himself and of the sculptor Cresilas. Later it became usual to give, in some detail, the reasons for the honours awarded; and in Hellenistic and Roman times, these became more and more detailed and fulsome in laudatory detail.

8. *Signatures of Artists.*—These inscriptions are of special interest as throwing much light upon the history of art. The artist's name was usually, especially in earlier times, carved upon the base or pedestal of a statue, and consequently was easily separated from it if the statue was carried off or destroyed. A case where both statue and pedestal are preserved is offered by the Victory, signed on its pedestal by Paeonius at Olympia. Occasionally, and more frequently in later times, the artist's signature was carved upon some portion of the statue itself. But in later copies of well-known works, it has to be considered whether the name is that of the original artist or of the copyist who reproduced his work.

A special class of artists' signatures is offered by the names signed by Attic and other vase painters upon their vases. These have been made the basis of a minute historical and stylistic study of the work of these painters, and unsigned vases also have been grouped with the signed ones, so as to make an exact and detailed record of this branch of Greek artistic production.

9. *Historical Records.*—The great majority of these fall into one of the classes already referred to. But there are some instances in which an inscription is set up merely as a record. For instance, a victor in athletic or other contests may set up a list of his victories. The most famous historical record is the autobiographical account of the deeds and administration of Augustus, which was reproduced and set up in many places; it is generally known as the Monumentum Ancyranum, because the most complete copy of it was found at Ancyra. The Marmor Parium at Oxford, found in Paros, is a chronological record of Greek history, probably made for educational purposes, and valuable as giving the traditional dates of events from the earliest time down.

10. *Tombs and Epitaphs.*—This is by far the most numerous class of inscriptions, both Greek and Latin. In early times there is often no record beyond the name of the deceased in Athens, often with the name of his father and his deme. Sometimes a word or two of conventional praise is added, such as "a good and wise man." Occasionally the circumstances of death are alluded to, especially if it took place in battle or at sea. Such epitaphs were frequently in metrical form, usually either hexameters or elegiacs. Many of them have been collected, and they form an interesting addition to the Greek anthology. In later times it becomes usual to give more elaborate praise of the deceased; but this is hardly ever so detailed and fulsome as on more modern tombstones. The age and other facts about the deceased are occasionally given, but not nearly so often as on Latin tombstones, which offer valuable statistical information in this respect.

LATIN INSCRIPTIONS

Latin inscriptions may be classified on much the same lines as Greek; but certain broad distinctions may be drawn at the outset. They are generally more standardized as to form and as to content, not only in Rome and Italy, but also throughout the provinces of the Roman empire. One of the chief difficulties in deciphering Latin inscriptions lies in the very extensive use of initials and abbreviations. These are of great number and variety, and while some of them can be easily interpreted as belonging to well-known formulae, others offer considerable difficulty, especially to the inexperienced student. A mere list of such initials and abbreviations occupies 68 pages in R. Cagnat's *Cours d'Epigraphie Latine:* a selection is given in this work in the article ABBREVIATION. Often the same initial may have many different meanings according to the context. Some common formulae such as V.S.L.M. (*votum solvit libens merito*), or H.M.H.N.S. (*hoc monumentum heredem non sequetur*) offer little difficulty, but there are many which are not so obvious and leave room for conjecture. Often the only way to determine the meaning is to search through a list of initials, such as those given by Cagnat, until a formula is found which fits the context.

Most of what has been said about Greek inscriptions applies

to Roman also. The commonest materials in this case also are stone, marble and bronze; but a more extensive use is made of stamped bricks and tiles, which are often of historical value as identifying and dating a building or other construction. The same applies to leaden water pipes which frequently bear dates and names of officials. Terra-cotta lamps also frequently have their makers' names and other information stamped upon them. Arms, and especially shields, sometimes bear the name and corps of their owners. Leaden discs were also used, to serve the same purpose as modern identification discs. Inscriptions are also found on sling bullets—Roman as well as Greek; there are also numerous classes of *tesserae* or tickets of admission to theatres or other shows.

As regards the contents of inscriptions, there must evidently be a considerable difference between the records of a number of independent city states and an empire including almost all the civilized world; but municipalities maintained much of their independent traditions in Roman times, and consequently their inscriptions often follow the old formulae.

The classification of Roman inscriptions may, therefore, follow the same lines as the Greek, except that certain categories are absent, and that some others, not found in Greek, are of considerable importance.

(*a*) **Religious.**—1. *Dedications and Foundations of Temples, etc.*—These are very numerous; and the custom of placing the name of the dedicator in a conspicuous place on the building was prevalent, especially in the case of dedications by emperors or officials, or by public bodies. Restoration or repair was often recorded in the same manner. In the case of small objects the dedication is usually simple in form; it usually contains the name of the god or other recipient and of the donor, and a common formula is D.D. (*dedit, donavit*), often with additions such as L.M. (*libens merito*). Such dedications are often the result of a vow, and V.S. (*votum solvit*) is therefore often added. Bequests made under the wills of rich citizens are frequently recorded by inscriptions; these might either be for religious or for social purposes.

2. *Priests and Officials.*—A priesthood was frequently a political office, and consequently is mentioned along with political honours in the list of a man's distinctions. The priesthoods that a man had held are usually mentioned first in inscriptions, before his civil offices and distinctions. Religious offices, as well as civil, were restricted to certain classes, the highest to those of senatorial rank, the next to those of equestrian status; many minor offices, both in Rome and in the provinces, are enumerated in their due order.

3. *Regulations as to Religion and Cult.*—Among the most interesting of these is the ancient song and accompanying dance performed by the priests known as the Arval Brothers. This is, however, not in the form of a ritual prescription, but a detailed record of the due performance of the rite. An important class of documents is the series of calendars that have been found in Rome and in various Italian towns. These give notice of religious festivals and anniversaries, and also of the days available for various purposes.

4. *Colleges.*—The various colleges for religious purposes were very numerous. Many of them, both in Rome and Italy, and in provincial municipalities, were of the nature of priesthoods. Some were regarded as offices of high distinction, and were open only to men of senatorial rank; among these were the Augurs, the Fetiales, the Salii; also the Sodales Divorum Augustorum in imperial times. The records of these colleges sometimes give no information beyond the names of members, but these are often of considerable interest. Haruspices and Luperci were of equestrian rank.

(*b*) **Political and Social.**—1. *Codes of Law and Regulations.*—Our information as to these is not mainly drawn from inscriptions and, therefore, they need not here be considered. On the other hand the word *lex* (law) is usually applied to all decrees of the Senate or other bodies, whether of legislative or of administrative character. It is, therefore, best to consider all together under the heading of public decrees.

2. *Laws and Plebiscites, Senatus Consulta, Decrees of Magistrates or later of Emperors.*—A certain number of these dating from republican times, are of considerable interest. One of the earliest relates to the prohibition of Bacchanalian orgies in Italy; it takes the form of a message from the magistrates, stating the authority on which they acted. Laws all follow a fixed formula, according to the body which has passed them. First there is a statement that the legislative body was consulted by the appropriate magistrate in due form; then follows the text of the law; and finally the sanction, the statement that the law was passed. In decrees of the Senate the formula differed somewhat. They began with a preamble giving the names of the consulting magistrates, the place and conditions of the meeting; then came the subject submitted for decision, ending with the formula QDERFP (*quid de ea re fieri placeret*); then came the decision of the Senate, opening with DERIC (*de ea re ita censuerunt*). C. is added at the end, to indicate that the decree was passed. In imperial times, the emperor sometimes addressed a speech to the Senate, advising them to pass certain resolutions, or else, especially in later times, gave orders or instructions directly, either on his own initiative or in response to questions or references. The number and variety of such orders is such that no classification of them can be given here. One of the most famous is the edict of Diocletian, fixing the prices of all commodities. Copies of this in Greek as well as in Latin, have been found in various parts of the Roman empire.

3. *Records of Building, etc.*—A very large number of inscriptions record the building or repair of public buildings by private individuals, by magistrates, Roman or provincial, and by emperors. In addition to the dedication of temples, we find inscriptions recording the construction of aqueducts, roads, especially on milestones, baths, basilicas, porticos and many other works of public utility. In inscriptions of early period, often nothing is given but the name of the person who built or restored the edifice, and a statement that he had done so. But later it was usual to give more detail as to the motive of the building, the name of the emperor or a magistrate giving the date, the authority for the building, and the names and distinctions of the builders; then follows a description of the building, the source of the expenditure (*e.g.* S.P., *sua pecunia*), and finally the appropriate verb for the work done, whether building, restoring, enlarging or otherwise improving. Other details are sometimes added, such as the name of the man under whose direction the work was done.

4. *Military Documents.*—These vary greatly in content, and are among the most important documents concerning the administration of the Roman empire. "They are numerous and of all sorts—tombstones of every degree, lists of soldiers' burial clubs, certificates of discharge from service, schedules of time-expired men, dedications of altars, records of building or of engineering works accomplished. The facts directly commemorated are rarely important." But when the information from hundreds of such inscriptions is collected together, "you can trace the whole policy of the imperial Government in the matter of recruiting, to what extent and till what date legionaries were raised in Italy; what contingents for various branches of the service were drawn from the provinces, and which provinces provided most; how far provincials garrisoned their own countries, and which of them, like the British recruits, were sent as a measure of precaution to serve elsewhere; or, finally, at what epoch the empire grew weak enough to require the enlistment of barbarians from beyond its frontiers." (F. Haverfield, in *Authority and Archaeology*, p. 314.)

5. *Treaties and Agreements.*—There were many treaties between Rome and other states in republican times; but we do not, as a rule, owe our knowledge of these to inscriptions, which are very rare in this earlier period. In imperial times, to which most Latin inscriptions belong, international relations were subject to the universal domination of Rome, and consequently the documents relating to them are concerned with reference to the central authority, and often take the form of orders from the Emperor.

6. *The custom of proxeny* belonged to Greece. What most nearly corresponded to it in Roman times was the adoption of

some distinguished Roman as its *patron*, by a city or state. The relation was then recorded, usually on a bronze tablet placed in some conspicuous position in the town concerned. The patron probably also kept a copy in his house, or had a portable tablet which would ensure his recognition and reception.

7. *Honorary.*—Honorary inscriptions are extremely common in all parts of the Roman world. Sometimes they are placed on the bases of statues, sometimes in documents set up to record some particular benefaction or the construction of some public work. The offices held by the person commemorated, and the distinctions conferred upon him are enumerated in a regularly established order (*cursus honorum*), either beginning with the lower and proceeding step by step to the higher, or in reverse order with the highest first. Religious and priestly offices are usually mentioned before civil and political ones. These might be exercised either in Rome itself, or in the various municipalities of the empire. There was also a distinction drawn between offices that might be held only by persons of senatorial rank, those that were assigned to persons of equestrian rank, and those of a less distinguished kind. It follows that when only a portion of an inscription has been found, it is often possible to restore the whole in accordance with the accepted order.

8. *Signatures of Artists.*—When these are attached to statues, it is sometimes doubtful whether the name is that of the man who actually made the statue, or of the master whose work it reproduces. Thus there are two well-known copies of a statue of Hercules by Lysippus, of which one is said to be the work of Lysippus, and the other states that it was made by Glycon. Another kind of artist's or artificer's signature that is commoner in Roman times is to be found in the signatures of potters upon lamps and various kinds of vessels; they are usually impressed on the mould and stand out in relief on the terra-cotta or other material. These are of interest as giving much information as to the commercial spread of various kinds of handicrafts, and also as to the conditions under which they were manufactured.

9. *Historical Records.*—Many of these inscriptions might well be assigned to one of the categories already considered. But there are some which were expressly made to commemorate an important event, or to preserve a record. Among the most interesting is the inscription of the Columna Rostrata in Rome, which records the great naval victory of Duilius over the Carthaginians; this, however, is not the original, but a later and somewhat modified version. A document of high importance is a summary of the life and achievements of Augustus, already mentioned, and known as the Monumentum Ancyranum. The various sets of Fasti constituted a record of the names of consuls, and other magistrates or high officials, and also of the triumphs accorded to conquering generals.

10. *Inscriptions on Tombs.*—These are probably the most numerous of all classes of inscriptions; and though many of them are of no great individual interest, they convey, when taken collectively, much valuable information as to the distribution and transference of population, as to trades and professions, as to health and longevity, and as to many other conditions of ancient life. The most interesting early series is that on the tombs of the Scipios at Rome, recording, mostly in Saturnian metre, the exploits and distinctions of the various members of that family.

About the end of the republic and the beginning of the empire, it became customary to head a tombstone with the letters D.M. or D.M.S. (*Dis Manibus sacrum*), thus consecrating the tomb to the deceased as having become members of the body of ghosts or spirits of the dead. These are followed by the name of the deceased, usually with his father's name and his tribe, by his honours and distinctions, sometimes by a record of his age. The inscription often concludes with H.I. (*Hic iacet*), or some similar formula, and also, frequently, with a statement of boundaries and a prohibition of violation or further use—for instance, H.M.H.N.S. (*hoc monumentum heredem non sequetur*, this monument is not to pass to the heir). The person who has erected the monument and his relation to the deceased are often stated; or if a man has prepared the tomb in his lifetime, this also may be stated, V.S.F. (*vivus sibi fecit*). But it is obvious that there is an immense variety in the information that either a man himself or his friends may wish to record.

11. *Milestones and Boundaries.*—Milestones (*miliaria*) have already been referred to, and may be regarded as records of the building of roads. Boundary stones (*termini*) are frequently found, both of public and private property. A well-known instance is offered by those set up by the commissioners called III. viri A.I.A. (*agris iudicandis adsignandis*) in the time of the Gracchi.

THE STUDY OF INSCRIPTIONS

Inscriptions were studied and quoted by authors in ancient times, by orators and by historians—notably by Thucydides and Polybius—as records of political, economic and social interest; they also contributed to the history of art, and Polemon had the nick-name of *stelokopas* given him for his studies of such documents. His work is now lost. Some of the great scholars of the Renaissance were interested both in Greek and Roman inscriptions. But the gigantic task of collecting together all known Greek inscriptions was first attempted by A. Boeckh, in the *Corpus Inscriptionum Graecarum* (4 vols., 1825–40). This has been superseded by *Inscriptiones Graecae* (Berlin) in 14 volumes and many parts, arranged geographically. This great work is still in progress. Inscriptions prior to 403 B.C. are collected in Roehl, *Inscriptiones Graecae Antiquissimae*. Convenient selections are W. Dittenberger, *Sylloge Inscriptionum Graecarum* (4 vols. 3rd ed., 1924), and *Orientis Graeca Inscriptiones selectae* (2 vols. 1904–05); Michel, *Recueil d'Inscriptions Grecques* (1900); Hicks and Hill, *Greek Historical Inscriptions* (2nd ed. 1901); *Inscriptiones Graecae ad Res Romanas pertinentes* (Paris, Académie; 4 vols. 1891–1927); *Sammlung der Griechischen Dialekt-Inschriften* (Göttingen, 1884); Dureste and others, *Recueil des Inscriptions Juridiques Grecques* (1891); Kaibel, *Epigrammata Graeca et Lapidibus Collecta* (1878).

For formal introduction to the study, S. Reinach, *Traité d'Epigraphie Grecque* (1885; the introductory chapters translated from C. T. Newton, *Essays in Art and Archaeology*, 1880); E. S. Roberts, *Introduction to Greek Epigraphy* (vol. 1, 1887, vol. 2, with E. A. Gardner, *The Inscriptions of Attica*, 1905); W. Larfeld, *Griechische Epigraphie* (1892); *Handbuch der Griechischen Epigraphie* (1898); O. Kern, *Inscriptiones Graecae* (1913, photographic facsimiles).

In addition there are many publications of the inscriptions of special sites or localities, notably those from great excavations like those of Olympia and Delphi, or in museums, such as the British Museum Inscriptions.

For Latin inscriptions, the chief publication is the *Corpus Inscriptionum Latinarum* (Berlin—in progress); the volumes are arranged geographically; supplements are issued as *Ephemeris Epigraphica*. Convenient selections are those of Wilmanns, *Exempla Inscriptionum Latinarum* (1872), and of Dessau, *Inscriptiones Latinae* (3 vols. 1892–1916). An introduction to the study is R. Cagnat, *Cours d'Epigraphie Latine* (1890), having useful tables of initials, abbreviations and formulae. (E. GR.)

INSECT BITES AND STINGS. Insects may be the cause of disease or of morbid conditions in man in several different ways: (1) by living *on* his skin or hair, as in the case of three varieties of pediculi or lice (the head-louse, the body-louse, the crab-louse); or *in* his skin, as with the itch-insect (though this is strictly not an insect at all but a spider-like parasite), or with the tropical chigger, jigger or sand flea; (2) by depositing their eggs on the skin or mucous membrane, or on wounds, whence the larvae find their way below the surface, usually by boring or burrowing, as is the case with several tropical flies; (3) by being the instrument of transferring a bacterial infection to man from some other animal, as is the case with the rat flea in plague, or by taking part as host in the life-cycle of a spirochaete or a protozoon and passing the parasite on to man, as is done by certain mosquitoes in yellow fever or in malaria; (4) by the direct and immediate effects of their bite or sting. It is with this last method only that the present article is concerned.

In Great Britain and the United States, as in most other countries, such bites and stings are exceedingly common, the most frequent biting insects being the common flea, the bed-bug, gnats

and mosquitoes, and the most frequent stinging insects being the wasp, the bee, the hornet and the ant. It should be realized, too, that the effects of the louse are due not merely to its presence, as mentioned above, but to its actual bite.

The consequences of these bites and stings are well known, very few persons escaping some personal experience thereof, though susceptibility varies widely in different persons. Local irritation may be extreme, and the skin lesion produced may vary from a small reddened or erythematous patch or a tiny papule, to large urticarial or nettle-rash wheals, or even to a spreading cellulitis or inflammation of the tissues under the skin. These effects, usually pass off completely in a few hours or at most a day or two. Occasionally, however, dangerous developments occur.

The conditions most likely to lead to such developments are: (1) a very large number of stings, as when a swarm of angry bees settles on the body; (2) the lesion being on a mucous surface such as the tongue, the palate or the pharynx; (3) the supervention of some local complication such as erysipelatous or other streptococcal infection, or the direct transmission of some form of septic poisoning as by the bite of a fly which has been feeding on putrid material. In all such cases skilled surgical aid should at once be sought, as in extreme instances death has occasionally resulted and urgent measures may be necessary to deal with the situation.

Treatment.—The poison injected with an insect sting is, at least in many species, formed by a mixture of the secretions of two glands, one of which is acid (formic acid) and the other of which is alkaline. In most cases the acid predominates; hence weak alkaline solutions (soda or ammonia) are commonly effective in allaying the irritation. In some cases, however, especially, it is said, with the sting of some wasps, the alkaline element is predominant and in such instances a weak acid lotion (such as diluted vinegar) gives most relief.

The most convenient substance to use to relieve the irritation of mosquito bites is moist toilet soap. Late experience shows that the so-called "chigger bites" or the irritation caused by the entrance of any larval mites into the skin are best treated with a phenol-camphor mixture known in medicine as camphora carbolisata.

As preventive measures when insects are prevalent, camphor, menthol, lavender and oil of eucalyptus appear to have some virtue; and skilful and assiduous campaigns against flies, mosquitoes and wasps have of late added greatly to the amenities of a number of localities. A good preventive lotion against mosquitoes is composed of one part oil of citronella, one part spirits of camphor and one-half part oil of cedar. (*See* BACTERIOLOGY; KALA-AZAR; PARASITOLOGY.) (H. B. B.)

INSECTICIDES, chemicals used for destroying insect pests. When employed to protect plants they may be applied in the form of wet sprays or as dusts; those most commonly used for this purpose include various arsenicals, nicotine, oil emulsions, soaps, caustic alkalis, etc. When it is desired to kill insects that may be present in a room, fumigation (*q.v.*) or the filling of the room with poisonous gases or vapours is resorted to. This method may also be used for plants by enclosing them in tents. Hydrogen cyanide, carbon disulphide and carbon tetrachloride are some examples of the chemicals employed in fumigation. (*See* ENTOMOLOGY, ECONOMIC: *Control Measures; Physico-chemical Methods.*)

INSECTIVORA, an order of placental mammals of small size, with a dentition adapted to an insect-diet. Nearly all members of this order are nocturnal and terrestrial, many, however, are fossorial or arboreal, and a few are aquatic. There are generally five toes, each terminating in a claw; the first toe is never opposable to the others in either the fore or hind limb. A full series of teeth, including temporary, or deciduous milk-molars is developed, and the cheek-teeth are crowned with sharp cusps as a rule. The typical number of teeth is 44, arranged as shown in the formula i.$\frac{3}{3}$, c.$\frac{1}{1}$, p.$\frac{4}{4}$, m.$\frac{3}{3}$; occasionally there is a fourth pair of molars, while the incisors may be reduced to two pairs above and one pair below. The skull is of a primitive type, with a small brain-case, tympanic bone generally ring-like instead of forming a bulla and vacuities are frequently present in the palate. With the exception of the African *Potamogale,* collar-bones are always present, and a central bone is usually present in the carpus. The uterus is two-horned, the placenta, so far as is known, is deciduate and discoidal; the testes are abdominal or inguinal, and the teats usually numerous.

Representatives of this order are found throughout the temperate and tropical parts of both hemispheres, with the exception of South America (where only a few shrews have penetrated) and Australia.

The stomach is a simple, thin-walled sac; sometimes as in *Centetes,* the pyloric and oesophageal openings are close together. In the arboreal forms, which probably feed on vegetables as well as insects, most of the species possess a caecum.

Varieties of the Order.—All the members of the order appear to be highly prolific, the number of young varying from two to eight in the hedgehog, and from twelve to twenty-one in the Tenrec. Scent-glands exist in many species. In most shrews they occur on the sides of the body at a short distance behind the axilla, and their exudation is probably protective, as very few carnivorous animals will touch them. In both species of *Gymnura* and in *Potamogale* large pouches are situated on each side of the rectum, and discharge their secretions by ducts, opening in the first named genus in front of and in the latter within the margin of the vent. In the Tenrec similarly situated glands discharge by pores, opening at the bottom of deep pits.

If *Galeopithecus* and *Galeopterus* are accepted as members of the Insectivora then the order may be split into two suborders, the *Dermoptera* and the *Insectivora vera.* The former contains only the two genera *Galeopithecus* and *Galeopterus.* For further information on these two interesting genera *see* the articles GALEOPITHECUS and GALEOPTERUS.

Insectivora Vera.—The *Insectivora vera* may be divided into nine families, which fall into two groups. The first of these, containing the families *Tupaiidae* and *Macroscelididae,* is characterised by the full development of the union between the two halves of the pelvis. The orbit is either surrounded by bone (*Tupaiidae*) or is separated from the hinder part of the skull by a post-orbital process (*Macroscelididae*). Some authors regard the *Tupaiidae* as lowly organized members of the order Primates, but the present writer is quite unable to consider the genus *Tupaia* and its near relations *Anathana, Dendrogale, Urogale, Tana and Ptilocercus,* as representing anything more than a group of Insectivores. The *Tupaiidae,* which are confined to the Oriental region, are, however, in addition to the bony ring surrounding the orbit, distinguished by the large size of the brain. The dental formula is I.$\frac{2}{3}$, C.$\frac{1}{1}$, P.$\frac{3}{3}$, M.$\frac{3}{3}$. The Tupaias or Tree-Shrews are in many ways very like squirrels; they are, however, distinguished by their pointed insectivorous faces and light coloured shoulder stripes. The typical genus contains a great number of species and subspecies. *T. ferruginea,* from the Malay Peninsula and Islands, is bright chestnut-brown in colour with an olive-brown face and tail; the majority of the members of this genus do not exceed 350 mm. in total length. *T. pictus,* of Borneo, is a very handsomely coloured Tree-Shrew, chestnut and olive above, with buff shoulder stripes and a black dorsal stripe. From the Rhio Archipelago comes a deep chestnut coloured form known as *T. castanea. T. minor* is a very small species from Borneo, with a hind-foot of only 28 mm., and a total length of about 280 mm.

The closely allied genus, *Anathana,* is distinguished from *Tupaia* by the inner sides of the ears being more hairy, the larger size of the lower lobe of the ear, and the coarser nasal reticulations. The species come from India and Borneo. The genus *Urogale,* allied to *Tupaia* and *Anathana,* contains but a single species *U. cylindura* from the Philippine Islands, in general dimensions and appearance about as in the smaller *Tupaias,* the total length being 250 mm.

A number of handsomely coloured Tree-Shrews has recently been placed in the genus *Tana.* Included in this genus is a very brightly coloured species from Borneo and Sumatra, *T. tana. T. dorsalis,* from Borneo, is a smaller species, with a well-marked black dorsal stripe extending from the crown of the head to the base of the tail. The smallest members of this family are included in the genus *Dendrogale,* the total length not exceeding

235 mm. These pigmy Tree-Shrews come from Annam, Cochin China, Cambodia and Siam.

The asiatic Pentailed Tree-Shrew (*Ptilocercus lowi*) is usually included in this family, although it differs very markedly from all the other genera. The tail is very long, with the proximal two-thirds naked, and the remaining third furnished with a feather-like fringe. This species, the only representative of the genus, is found in Borneo, Sumatra and parts of the Malay Archipelago.

THE MACROSCELIDIDAE

In Africa the *Tupaias* are represented by the Jumping and Elephant Shrews constituting the family *Macroscelididae*, distinguished from the *Tupaiidae* by the absence of the bony rings around the orbits, the latter being separated from the hinder part of the skull merely by the post-orbital processes of the frontal bones. Further, the tarsus is markedly elongated and the lower ends of tibia and fibula are joined. Dental formula i.$\frac{3}{3}$, c.$\frac{1}{1}$, p.$\frac{4}{4}$, m.$\frac{2}{2 \text{ or } 3}$. The members of this family leap like gerbils or jerboas. The *Macroscelididae* may be considered to contain seven genera:—(1) *Macroscelides*, or Jumping Shrews, containing two South African species *M. proboscideus* from Cape Colony and the Orange Free State, and *M. melanotis* from Namaqualand; in this genus the lower molars are two in number and the auditory bullae much enlarged. (2) *Elephantulus* containing the Jumping Shrews of North, East and South Africa in which the lower molars are two in number, but the auditory bullae are normal, not enlarged. In size about equal to the foregoing genus. The various species extend from Morocco and Algeria (*E. rozeti*) southwards to Somaliland, East and South Africa. (3) *Nasilio*, or the Short-Nosed Jumping Shrews, with three lower molars and normal auditory bullae. Like the two allied genera, *Macroscelides* and *Elephantulus*, these Jumping Shrews are diurnal. The genus extends as far north as Angola in the west and Kenya Colony in the east. (4) *Petrodromus*, the 4-Toed Jumping Shrews, are distinguished from the foregoing genera in having only 4 instead of 5 toes to each front foot; the dimensions are considerably larger and the coat quite different in colour, being pale olive-green on the flanks and rufous on the back (*P. tetradactylus*, South Africa). The tail is long and clothed in short normal hairs. (5) *Mesoctenus*, closely allied to *Petrodromus*, but distinguished by the hairs on the underside of the tail being slightly bulbous at their ends; this genus includes two species *M. rovumae* (Rovuma) and *M. nigriseta* from East Africa. (6) *Cercoctenus*, in which the bulbous, or club-shaped hairs on the underside of the tail are still more developed, two species are recognized. *C. sultan* from Zanzibar, Tanganyika Territory, and Kenya Colony, and *C. schwanni* from Portuguese East Africa. (7) *Rhynchocyon*, the Long Nosed Elephant Shrews, in which the reduction in the number of toes is carried still further, there being only four toes to each foot. In this genus the snout is much longer, the size of the body considerably greater, and the tarsus still more elongated. The dental formula is i.$\frac{1 \text{ or } 0}{3}$, c.$\frac{1}{1}$, p.$\frac{4}{4}$, m.$\frac{3}{3}$. It has been proposed to divide the genus into two subgenera, the typical one containing the chess-board patterned species (*R. cirnei, reichardi, claudi* and *stulhmanni*) and *Rhinonax* including *R. chrysopygus* and *R. petersi* and its allies. Some of these Elephant Shrews are very handsomely coloured, *R. cirnei* from Nyasaland, has the posterior part of its back marked with rows of alternate dark and light blotches, giving a chess-board effect. The apical portion of the tail is always white. In the subgenus *Rhinonax* equally bright colouring occurs; *R.* (*R.*) *petersi* comes from East Africa and Zanzibar. *R.* (*R.*) *chrysopygus* (East Africa) has the body, flanks and limbs deep maroon, and the rump bright orange-yellow coloured.

SECOND GROUP OF FAMILIES

In the second group of families, which contains all the remaining Insectivora, the pelvic symphysis is either lacking or formed merely by the epiphyses of the pubes; and the orbit and temporal region of the skull are confluent. With the exception of the *Talpidae* (true Moles) and *Chrysochloridae* (golden Moles) the tympanum is ring-like. The first representatives of this group are the Moles, constituting the family *Talpidae*, in which the lower ends of the tibia and fibula are united, there is a descent of the testes, the tympanum forms a bladder-like bulla, the zygomatic or cheek-arch, although slender, is complete, there is no pelvic symphysis, the upper molars are five, and the first upper incisor is simple and the lower vertical. Most of the species are burrowing, but a few are aquatic; they have an exclusively animal diet. They are confined to temperate Europe, Asia and North America. Throughout the family the eyes are very small, and in some of the forms are covered with skin; the ears are short, and the fore-limbs are generally more or less modified for digging. The true Moles of the genus *Talpa* are the typical members of the first subfamily, the *Talpinae*, in which the clavicle and humerus are very short and broad, while there is an additional sickle-like bone on the inner side of the fore-foot which is very broad. The dental formula of the genus *Talpa* is i.$\frac{3}{3}$, c.$\frac{1}{1}$, p.$\frac{4}{4}$, m.$\frac{3}{3}$. *T. europea*, the Common European Mole, is widely distributed over Europe and western and central Asia; the eastern limits of its range are not known. *Parascaptor* is a closely related genus containing one species, *P. leucurus*, from Assam and the adjacent country; it is a small mole with a very short tail and long snout. The genus *Scaptochirus* is considered to contain three species from China; these moles possess very large fore-feet and short tails. Another closely allied genus is *Mogera*, which includes a few species of short-haired moles with short tails; dental formula i.$\frac{3}{3}$, c.$\frac{1}{0}$, p.$\frac{4}{4}$, m.$\frac{3}{3}$. These moles come from the Far East; *M. wogera*, from Japan, is a large, pale vandyke-brown coloured species.

There remain four North American genera of *Talpinae*:—(i.) *Scalops*, a genus with very large fore-feet and webbed toes; tail very short, slender and nearly naked, and ears and eyes quite small. *S. aquaticus*, the common mole of the eastern United States and of considerable importance as a fur-bearing animal, is found from Massachusetts to Minnesota and Colorado and southward to Florida and Texas. It is a pale sepia-coloured or slate-coloured mole, often tinged with brown, varying in length in the different sub-species, of which some 10 are recognized, from barely 5½ in. to 8 in. and in colour from light drab to dark sepia and brown, (ii.) *Scapanus*, a genus with very broad hands, but with toes lacking webs; the tail is rather longer, thick and scantily haired, and the general colour of the body is darker, varying in winter in some forms to black. There are several species, all natives of the Pacific slope where they take the place of the common mole (*Scalops*) of the eastern United States, which they strongly resemble in their habits. *S. townsendi*, the best known of the group, comes from northern California, Oregon and Washington, where it is common between the Cascades and the Coast ranges. It is a large mole, 9 in. long and blackish in colour, with a plump body and a tail 1½ in. long. *S. orarius*, about 7 in. long, with the body blackish or greyish in colour, occurs from northern California through Oregon and Washington to British Columbia. *S. latimanus*, similar or slightly larger in size but varying in colour from grey or drab to brown and black, is found from southern California to central Oregon; a larger grey form, var. *alpinus*, 7½ in. long, occurs at Crater Lake. (iii.) *Parascalops*, is a smaller genus, with one species. *P. breweri*, the Hairy-tailed Mole, found in dry sandy soil from New Brunswick to Georgia and westward to Ohio; the body is blackish, often with brownish gloss; the tail is short, thick, compressed at the base, and very hairy; the toes are not webbed. (iv.) *Condylura*, the Star-nosed Mole, which is distinguished by the possession of a fringe of fleshy appendages around the extremity of the snout, 11 appendages on each side. Its general bodily size is about that of the common European mole, but the tail is much longer. The star-nosed mole is blackish in colour and about 7½ in. long; the tail, which is about 2½ in. long, is covered with coarse hair; and the toes are not webbed. One species only is recognized, *C. cristata*, the type locality of which is Pennsylvania; it occurs, but rather infrequently, in wet meadows and marshes from southern Labrador to south-eastern Manitoba southward to Georgia and Indiana, often leaving its burrows and running about on the surface.

Second Subfamily.—The second subfamily is the *Desmaninae* including a series of animals rather intermediate between Moles and Shrews, known as the Mole-Shrews. A number of genera has been described, the most important of which are the following:—(i.) *Urotrichus,* small shrew-like animals with long snouts, and hairy, almost bushy tails; fore-feet not markedly enlarged, but more so than in the Shrews. *U. talpoides* comes from Japan, from where a number of races have been described (head and body 90 mm., tail 25 mm.). (ii.) *Neurotrichus* contains a small shrew-like species, *N. gibbsi,* with large hands and a short hairy tail (head and body 110 mm., tail 36 mm.). (iii.) *Scaptonyx,* allied to *Neurotrichus,* with a more hairy tail and smaller fore-feet; the genus is restricted to China. (iv.) *Dymecodon,* contains but a single species, *D. pilirostris* from Japan; it is smaller than *Urotrichus* and has a proportionally longer, but less hairy tail (head and body 78 mm.; tail 40 mm.). (v.) *Uropsilus* a long-nosed, long-tailed genus, with small hands and feet; the tail is short-haired; *U. soricipes* hails from China. (vi.) *Rhynchonax,* contains a single species from Sze-Chuan, China, smaller than *Uropsilas* and darker in colour. (vii.) *Galemys* contains the Water Mole or Western Desman, from south-western France and the Italian Peninsula. This and the following species show marked adaptation to an aquatic life the toes being webbed and the tail long and flattened laterally. The snout is of considerable length, as also is the soft body fur which is otter-brown above, and yellowish-grey below. Dimensions of the species (*G. pyrenaicus*):—head and body 131 mm., tail 145 mm., hind-foot 38. The last genus (9) *Desmana,* the Russian Desman (*D. moschata*) is very similar in form to *Galemys,* but much larger and more massive (total length 16 inches); it inhabits the streams and lakes of South-east Russia.

The Soricidae.—The next family, the *Soricidae* or Shrew-Mice, is closely related to the Moles, with which it is connected by some of the subfamily *Desmaninae.* The species are, however, distinguished by the ring-like tympanic, incompleteness of the zygomatic arch, and the forward direction of the first lower incisors. The majority are terrestrial, but a few are aquatic. There are no lower canines, and always six functional teeth on each side of the lower jaw; in some species an additional tooth occurs. In the typical genus *Sorex* the dental formula is as follows:—$i.\frac{3}{2}$, $c.\frac{1}{0}$, $p.\frac{3}{1}$, $m.\frac{3}{3}$; in this genus and its allies the teeth are tipped with brownish-red, in the *Croci-durine* section the teeth are wholly white. The members of the genus *Sorex* are widely spread over Europe, Asia (north of the Himalayas) and North America. The ears are well developed, the tail long and evenly haired, without the long hairs so characteristic of *Crocidura.* The typical species *S. araneus* is the Common Shrew-Mouse of Europe; it is distributed over the northern portions of Europe and Asia from England and Scotland eastward; southwards it reaches central Spain and Italy. As with so many British mammals it is absent from Ireland. (Head and body 65 to 80 mm.; tail 20–35 mm.; hind-foot 11–14·5 mm.). *S. minutus,* the Pygmy Shrew Mouse, is considerably smaller, measuring only about 52 mm. in length (head and body); found over the northern part of Eurasia from Ireland eastward and south as far as the Pyrenees and southern Italy. Over sixty species and subspecies of this genus have been described. In the genus *Soriculus* the openings of the male and female generative organs form with the anal orifice a shallow cloaca; in *Sorex* they are separate; dentition $i.\frac{4}{2}$, $c.\frac{1}{0}$, $p.\frac{1 \text{ or } 2}{1}$, $m.\frac{3}{3}$. The longest tailed *Soriculus* is *S. irene,* from Sze-Chuan, in which the tail measures 87 mm.; and the head and body 62 mm. in length. Closely allied to *Soriculus* is a group of small Chinese Shrews belonging to the genus *Chodsigoa,* some species having a long tail (63 mm.) while others (*C. lamula*) have a fairly short tail (head and body 67 mm.; tail 54 mm.). *Notiosorex* (dentition $i.\frac{3}{2}$, $c.\frac{1}{0}$, $p.\frac{1}{1}$, $m.\frac{3}{3}$) contains a small species, *N. crawfordi* from New Mexico (head and body 85 mm.; tail 26 mm.; hind-foot 12 mm.); and *Blarina* is another short-tailed genus of American Shrews, some members of which are found in South and Central America; in size they are about equal to the Common European Shrew, but have a much shorter tail (*B. brevicauda*:—tail 26 mm.; dentition $i.\frac{4 \text{ or } 3}{2}$, $c.\frac{1}{0}$, $p.\frac{2}{1}$, $m.\frac{3}{3}$). The genus *Blarinella,* from Western China, is closely allied to the American *Blarina;* the tail is not quite so short and the ear not so rudimentary as in the latter genus. The teeth are all heavily pigmented. *B. quadraticauda*:—head and body 69 mm.; tail 43 mm.; *B. griselda,* from Tao-chou, is smaller and has a shorter tail; dimensions:—head and body 68 mm.; tail 33 mm.; hind-foot 11 mm. *Neomys* is an aquatic genus of Shrews found over a large area of the Palaertic region north of the Mediterranean from Spain and England to the Caucasus and Asia Minor, northwards as far as Scandinavia. Dental formula, $i.\frac{3}{1}$, $c.\frac{1}{1}$, $p.\frac{2}{1}$ $m.\frac{3}{3}$. The fur is very soft and dark slatey-grey in colour; feet and tail fringed.

In the United States the *Soricidae* are represented by six genera. *Sorex,* with 20 species, includes *S. personatus,* the Common American Shrew, 4 in. long, found from New England to Tennessee and Alaska; *S. fumens,* the Smoky Shrew, of the north-eastern States, and *S. vagrans,* the Western Shrew, abundant from the Rocky Mountains westward. *Neosorex,* with 4 species, includes *N. albibarbis,* the Marsh Shrew, of eastern North America. *Microsorex,* with 2 species, includes *M. winnemana,* of Virginia, only 3 in. long, the smallest American mammal. *Blarina,* with 2 species, includes *B. brevicaudata,* the Mole-shrew, of the central and eastern states; *Crypotis* contains 2 species, natives to the southern states, and *Notiosorex,* a single species found in the south-west.

The Shrews with white teeth are found in Europe, Asia and Africa. The short-haired, long-tailed Shrews of Africa with four upper unicuspids are grouped together in the genus *Sylvisorex,* in some the tail is much longer than the body (head and body 60 mm.; tail 85); in others, as in *S. lunaris* from Ruwenzori, the tail is about equal in length to the head and body. In the allied genus *Myosorex,* also from Africa, the tail is long and the fur soft and thick; the openings of the generative organs and vent, although close together, are distinct. *Surdisorex* is another white-toothed genus containing one or two species; *S. norae* is distinguished by its very short tail (head and body 92 mm.; tail 20 mm.; hind-foot 15 mm.), very soft, deep chocolate-coloured coat, and large fore-feet. It inhabits Kenya Colony. The typical genus of this group, *Crocidura,* or Musk Shrews, is found over nearly the whole of Africa and the warmer parts of Europe and Asia; a species has recently been described from the Scilly Isles. Dentition $i.\frac{3}{2}$, $c.\frac{1}{0}$, $p.\frac{1}{1}$, $m.\frac{3}{3}$. The generative openings form a short cloaca with the anal orifice. Tail long, with a number of long, rather bristly hairs in addition to the shorter normal hairs. Some of the largest and smallest members of this genus are found in Africa; the smallest Musk Shrew, probably the smallest mammal, is *C. pasha,* from the Sudan. The Crocidurine Shrews with an extra premolar (dentition, $i.\frac{3}{1}$, $c.\frac{1}{1}$, $p.\frac{2}{1}$, $m.\frac{3}{3}$) are considered to represent a distinct genus, *Pachyura,* which is found over Africa, the warmer parts of Asia, and Mediterranean region. The members of this group all have the typical Crocidurine tails, with the long bristle-like hairs. *Praesorex goliath* is a giant shrew from the Cameroons (head and body 170 mm.; tail 102 mm.; hindfoot 25 mm.) related to the *Crocidura* but distinguished by its longer and harsher coat. In *Solisorex pearsoni,* another large form, the tail is shorter (66 mm.) and the fur softer and greyer. *Scutisorex* includes the "Tin-hatted Shrews" from Uganda and the Eastern Congo. The skull of this species has enormously developed lambdoid crests which extend backwards and are continuous with a posterior extension of the lateral temporal crests (head and body 143 mm.; tail 77 mm.; hind-foot 20 mm.).

Anourosorex.—*Anourosorex* is an allied genus containing but a single species, *A. squamipes,* a small mole-coloured shrew with a very short tail (head and body 83 mm.; tail 16 mm.; hind-foot 15 mm.). This genus, which inhabits Sze-chuan and Tibet, is distinguished from the closely related genus *Diplomesodon,* from the Kirghiz Steppes, by the soles of the hindfeet being scaly, not hairy. The latter genus, which also contains only one species, *D. pulchellus,* is further distinguished by its longer tail. Lastly there are two Asiatic mountain aquatic genera:—(i.) *Chimarrogale* from Kashmir, Sikkim, and country around Darjeeling,

distinguished by its long tail with an inferior fringe of elongated hairs; the generative organs open into the same integumentary ring as the anal orifice; the dental formula is i. $\frac{2}{2}$, c. $\frac{1}{0}$, p. $\frac{1}{1}$ m. $\frac{3}{3}$. (ii.) *Nectogale*, very similar in appearance to the foregoing genus, the "feathering" of the feet and tail being more developed; in colour about like a mole, whitish below.

Erinaceidae.—The Hedgehogs and Gymnuras, or Rat-Shrews, forming the family *Erinaceidae*, differ from the shrews in having a broader tympanic ring, a complete zygomatic arch, and the presence of a short public symphysis; the family is, at the present day, exclusively confined to the Old World. The typical subfamily, the *Erinaceinae*, or hedgehogs, is easily recognized by the spiny nature of the coat, the rudimentary tail, broad pelvis, and the presence of palatal vacuities; the members of this group are distributed over Europe, Africa and a large part of Asia. Dentition i. $\frac{3}{2}$, c. $\frac{1}{1}$, p. $\frac{3}{2}$, m. $\frac{3}{3}$. The Hedgehogs are divided into five genera:—(i.) *Erinaceus*, containing the common European species and about 12 other forms from Europe, Asia and the Canary Islands, ranging from Spain to China. In this genus the pterygoids and bullae are normal, the spines on the crown divided into two groups by a median parting which is narrow and inconspicuous, a hallux is present, and the third incisor normally one-rooted. (ii.) *Aethechinus*, found in Africa and Southern Europe, has the coronal parting broad and the third incisor two-rooted. Some of the forms (4 or 5 in number) are smaller and darker than in *Erinaceus*, *Aethechinus frontalis*, from South Africa, being dark blackish-brown above, and usually black below. (iii.) *Atelerix*, from Northern and East Africa, differs from the above mentioned genera in the hallux being absent; these hedgehogs are small in size and light buff or brownish in colour. *A. albiventris*, from the Sudan, is a very pale coloured species, while *A. spinifex*, from Nigeria, is a brown form. (iv.) *Hemiechinus*, a genus containing a number of forms from the Southern and Eastern Palaeartic Region; some species occur in Egypt and Northern India. In these hedgehogs there is a median parting on the crown. *H. collaris* is a black form from India; another Indian species is the Long-Eared Hedgehog, *H. megalotis*. Lastly, in (v.) *Paraechinus*, the pterygoids are inflated, and a coronal parting is present; found in South Eastern Europe, and from Egypt to India. *P. amir* is a large black coloured species (head and body 240 mm.), and *P. dorsalis* from Arabia has the prickles on the back bright buff coloured with a dark brown dorsal marking.

The Second Subfamily.—The second subfamily *Gymnurinae*, is distinguished by the absence of spines and palatal cavities, the long tail, and narrow pelvis. The species of the typical genus, *Gymnura*, inhabit Tenasserim, the Malay Peninsula, Sumatra, Borneo and a few adjacent islands. *G. gymnura* has the hinder part of the body and limbs black, and the head, shoulders and median part of the anterior back white. *G. rafflesii*, or *alba* is entirely white or pale buff. These Rat Shrews are of considerable size (head and body about 420 mm.). Dentition i. $\frac{3}{3}$, c. $\frac{1}{1}$, p. $\frac{4}{4}$, m. $\frac{3}{3}$. The Lesser Rat Shrews, of the genus *Hylomys*, are easily distinguished by their much smaller size, very short tail (head and body 140 mm.; tail 23 mm.), and dark vole-like coloration. Four races have been described from Borneo, Annam, Siam, Sumatra and Tonking. A closely allied genus is the Sze-Chuan and Yunnan *Neotetracus* in which the tail is of considerable length and the feet large (head and body 120 mm.; tail 63 mm.; hindfoot 26·5 mm.). In the Philippines the group is represented by *Podogymnura truei*, in which the hindfoot is greatly elongated.

The Potamogalidae.—The next family, the *Potamogalidae*, is represented by a single species, *Potamogale velox*, the Otter Shrew, an aquatic insectivore confined to the rivers of the Cameroons, Gaboon and Congo. In this genus the zygomatic arch is wanting; the animal measures about two feet in total length, the laterally compressed tail occupies about half this length. Dentition i. $\frac{3}{3}$, c. $\frac{1}{1}$, p. $\frac{3}{3}$, m. $\frac{3}{3}$.

Family *Centetidae* agrees with the *Potamogalidae* in the absence of zygomatic arch, but the upper molars have narrower crowns. Teats are present on both the breast and abdomen, and some forms are as spiny as hedgehogs; the group is confined to Madagascar. The subfamilies and genera are as follows:—*Centetinae* (i.) *Centetes*, the Tenrec, (*C. ecaudatus*), a large, tailless animal, with harsh, spiny hair; the young ones are striped. Dentition i. $\frac{2}{2}$, c. $\frac{1}{1}$, p. $\frac{3}{3}$, m. $\frac{3}{3}$. (ii.) *Hemicentetes*, the Lesser Tenrec, smaller than the Tenrec, and more spiny; striped throughout life. Dentition i. $\frac{3}{3}$, c. $\frac{1}{1}$, p. $\frac{3}{3}$, m. $\frac{3}{3}$. (iii.) *Ericulus*, the Hedgehog Tenrecs (*E. nigrescens* and *E. setosus*), Hedgehog-like animals having the whole dorsal surface covered with spines. Dentition i. $\frac{2}{2}$, c. $\frac{1}{1}$, p. $\frac{3}{3}$, m. $\frac{3}{3}$. *Oryzorictinae*. (i.) *Microgale*, small shrew-like species with long tails (head and body 60 mm.; tail 140 mm.). Dentition. i. $\frac{3}{3}$, c. $\frac{1}{1}$, p. $\frac{3}{3}$, m. $\frac{3}{3}$. (ii.) *Nesogale*, larger than *Microgale* but with a proportionately shorter tail. (iii.) *Oryzorictes*, distinguished by its shorter tail (47 mm.); the species are fossorial. (iv.) *Limnogale*, a large aquatic form (*L. mergulus*) with webbed toes and a long laterally compressed tail (head and body 150 mm., tail 140 mm., hind-foot 15 mm.).

Closely allied to the *Centetidae* is the family *Solenodontidae*, which contains but a single genus, *Solenodon*, and two species *S. paradoxus* and *S. cubanus*, the former from Hayti, and the latter from Cuba. The family is distinguished by the skull being constricted behind the orbits, the descent of the testes into the perineum, and in having the teats postinguinal. *Solenodons*, which look like huge rats, have the same dental formula as *Microgale*; they have long snouts and tails, and their bodies are clothed with long, coarse hair. The tail is naked, the whiskers very long, and the ears large.

The Chrysochloridae.—The last family of Insectivora is the *Chrysochloridae* or Golden Moles. The skull is conical and not constricted between the orbits; zygomatic arch and auditory bullae well developed, post orbital process absent. Upper molars tritubercular, with very tall crowns. The ears are small and the eyes concealed beneath the skin; the teats are both pectoral and inguinal. The forefeet are specialized for burrowing, the two middle claws of the manus being very powerful. All the species are fossorial and confined to south, east and central Africa. They are usually some shade of brown or grey with a brilliant metallic lustre, varying from peacock-green to golden bronze. Four genera are recognized:—(i.) *Bematiscus*, the Giant Golden Mole of Pondoland and the Transvaal. (ii.) *Chrysospalax*, the Natal Golden Moles, rather smaller than *Bematiscus*. (iii.) *Amblysomus*, the Golden Moles of South-east and Central Africa; smaller than the foregoing genera (head and body 115 mm.; tail 13 mm.), usually sepia brown or chocolate with bronze or pinkish metallic lustre. Teeth only 36 in number owing to the absence of the last pair of molars. (iv.) *Chrysochloris*, the typical genus, with 40 teeth, from South and Central Africa; about equal in size to *Amblysomus*; *C. asiatica*, from Cape Town, is a grey animal with a bluish sheen, while *C. congicus*, has a white face.

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INSECTIVOROUS PLANTS. Insectivorous or, as they are sometimes more correctly termed, carnivorous plants are, like the parasites, the climbers or the succulents, a physiological assemblage belonging to a number of distinct natural orders. They agree in the extraordinary habit of adding to the supplies of nitrogenous material, afforded them in common with other plants by the soil and atmosphere, by the capture and consumption of insects and other small animals. The curious and varied mechanical arrangements by which these supplies of animal food are obtained and utilized are described under the headings of the more important plants.

The best known and most important family of insectivorous plants—Droseraceae—includes six genera: *Byblis*, *Roridula*, *Drosera*, *Drosophyllum*, *Aldrovanda* and *Dionaea*, of which the last three are monotypic, *i.e.*, include only one species. The Sarraceniaceae contain the genera *Sarracenia*, *Darlingtonia*, *Heliamphora*, while the true pitcher plants or Nepenthaceae consist of the single large genus *Nepenthes*. These three families are closely allied and form the series Sarraceniales of the free-petalled

section (Choripetalae) of Dicotyledons. The curious pitcher-plant, *Cephalotus follicularis*, comprises a separate family, Cephalotaceae, closely allied to the Saxifragaceae. Finally the genera *Pinguicula, Utricularia, Genlisea* and *Polypompholix* belong to the gamopetalous family Lentibulariaceae.

While the large genus *Drosera* has an all but world-wide distribution, its congeners are restricted to well-defined and usually comparatively small areas. Thus *Drosophyllum* occurs only in Portugal and Morocco, *Byblis* in tropical Australia, and, although *Aldrovanda* is found in Queensland, in Bengal and in Europe, a wide distribution explained by its aquatic habit, *Dionaea* is restricted to a few localities in North and South Carolina. *Cephalotus* occurs only near Albany in Western Australia, *Heliamphora* on the Roraima Mountains in Venezuela, *Darlingtonia* on the Sierra Nevada of California, and these three genera too are as yet monotypic; of *Sarracenia*, however, there are seven known species scattered over eastern North America but mostly in the south-eastern United States. The 60 species of *Nepenthes* are mostly natives of the hotter parts of the Indian Archipelago, but a few range into Ceylon, Bengal, Cochin China, and some even occur in tropical Australia on the one hand, and in the Seychelles and Madagascar on the other. *Pinguicula* is abundant in the north temperate zone, and ranges down the Andes as far as Patagonia; the 210 species of *Utricularia* are mostly aquatic, and some are found in all save polar regions; their unimportant congeners, *Genlisea* and *Polypompholix*, occur in tropical America and south-western Australia respectively. It is remarkable that all the insectivorous plants agree in inhabiting damp heaths, bogs, marshes and similar situations where water is abundant, but where they are not brought into contact with the plenteous supply of inorganic food as are the roots of most terrestrial plants.

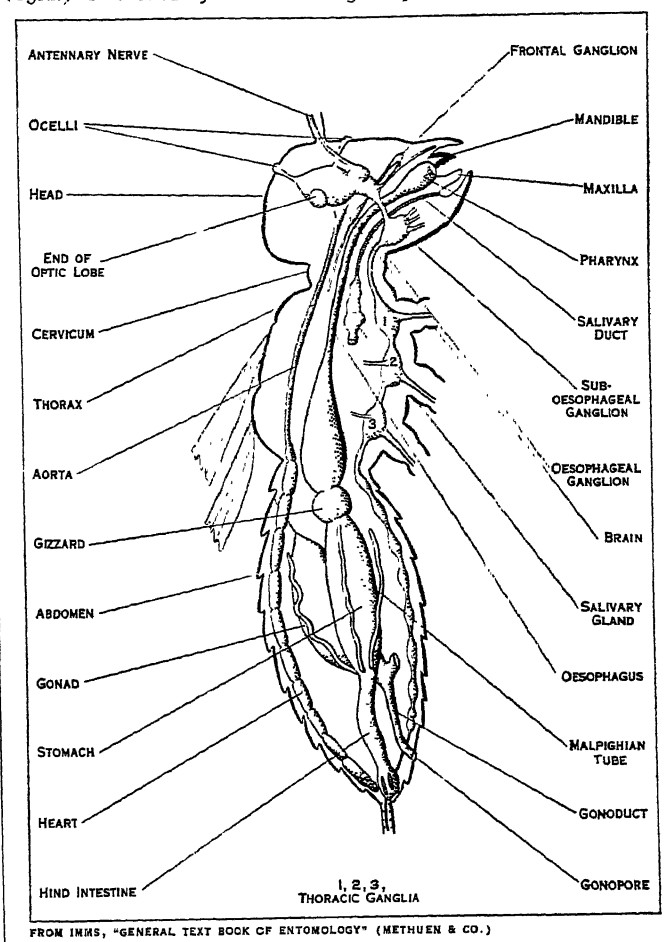
INSECT PESTS: *see* ENTOMOLOGY, *Economic*.

INSECTS, the ordinary name used for those animals placed by zoologists in the class Insecta (or Hexapoda) of the phylum ARTHROPODA (*q.v.*) and whose scientific study forms that branch of zoology termed ENTOMOLOGY (*q.v.*). In former times the word insect had a much wider and looser significance than to-day and the class Insecta of Linnaeus (1735) included those animals which form the whole of the Arthropoda of modern zoologists. Linnaeus's term Insecta was first used in a restricted sense by M. J. Brisson (1756), whose application of the word has since been generally adopted. In 1825 P. A. Latreille applied the term Hexapoda to the insects and, since it expresses a very characteristic feature of those animals, it is employed by some authorities.

A true insect has its body divided into three distinct regions—head, thorax and abdomen—each composed of a definite number of segments (fig. 1). The head bears a single pair of feelers or antennae, a pair of mandibles and two pairs of accessory jaws or maxillae. The thorax carries three pairs of legs (hence the term Hexapoda) and usually two pairs, more rarely one pair, of wings. The abdomen is devoid of walking limbs and the genital opening is situated near the anal extremity of the body. Respiration takes place by means of internal air-tubes or tracheae which communicate with the exterior by a variable number of paired openings or spiracles. After hatching from the egg the further development is rarely direct and a metamorphosis is usually undergone.

Insects probably outnumber in species all the rest of the animal kingdom, and their great numerical predominance is to be ascribed to their extraordinary adaptability to live under the most diverse conditions, and to the possession of wings. Insects represent the highest grade of evolution among invertebrate animals not only as regards complexity of structure, but also in psychic development as expressed in instinct. They have a world-wide range, species even occurring in the polar regions, on snow-clad mountains and glaciers, in all types of fresh water and in salt lakes; a few have invaded the sea while others have established themselves in hot springs, in deep wells and in caves where light never penetrates. It is, however, in the Tropics that insect life exhibits its greatest wealth of species and diversity of form and coloration.

In point of size insects present a wide range of differences: as J. W. Folsom has well expressed it, some insects are smaller than the largest Protozoa and others are larger than the smallest Vertebrata. If size be gauged by bulk combined with body-length, the beetle *Macrodontia cervicornis*, which ranges up to 150mm. (6in.) long, is to be regarded as one of the giants, while a length of 33cm. (13in.) is reached by some of the greatly attenuated stick-insects



FROM IMMS, "GENERAL TEXT BOOK OF ENTOMOLOGY" (METHUEN & CO.)

FIG. 1.—DIAGRAM SHOWING THE STRUCTURE OF A PRIMITIVE WINGED INSECT

(*q.v.*). In wing expanse alone the moth *Erebus agrippina* with a spread of 280mm. (11in.) is unsurpassed among living insects although certain fossil dragon-flies measure over 2ft. from wing to wing. At the other end of the scale there are beetles which do

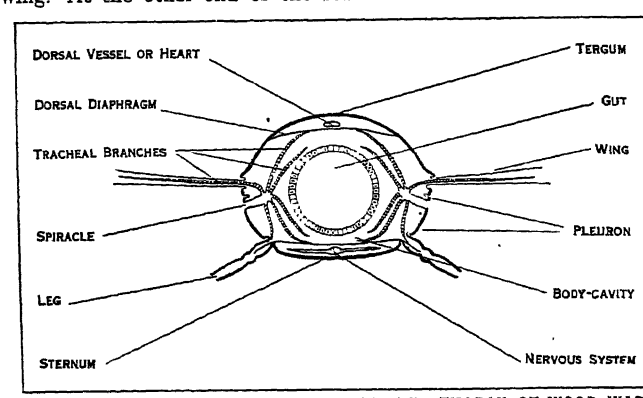


FIG. 2.—SCHEMATIC VIEW TAKEN ACROSS THE THORAX OF WOOD WASP

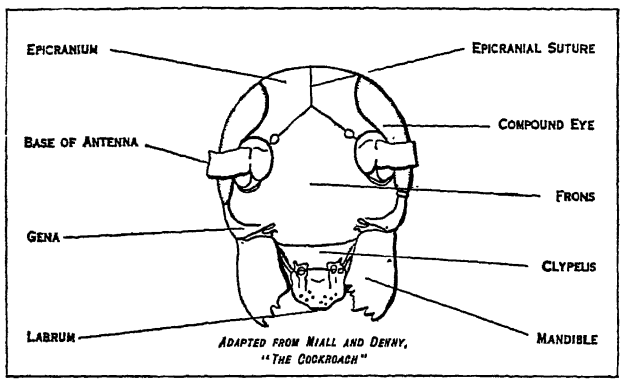
not exceed a length of ¼mm. and some minute wasp-like parasites are even smaller.

Apart from the interest that the structure habits and transformations of insects afford to the nature student the whole class is of very great importance in its relations to man. Many species are a direct menace to his food supply, some attack raw materials and others act as vectors of the pathogenic agents of disease both

in man and in domestic animals. (*See* ENTOMOLOGY: *Economic and Medical.*)

EXTERNAL ANATOMY

Skeleton and Segmentation.—The skeleton of an insect is the hard part which resists decay after death and forms the dried specimens kept in collections, and also those parts of insects found as fossils. The skeleton is mainly external and is the hard-



BY COURTESY OF DR. STEPHEN MIALL

FIG. 3.—FRONT VIEW OF HEAD OF COCKROACH

ened cuticle or outermost layer of the integument or body-wall. It is composed of a substance termed chitin and is produced by the hypodermis or cellular layer of the integument. The skeleton remains membranous and unchitinized at the joints or other places where movement occurs, but over the rest of the body it is composed of separate areas or sclerites which meet along definite lines or sutures: in cases where adjacent sclerites are fused the sutures are obliterated. Like other Arthropods, insects are seg-

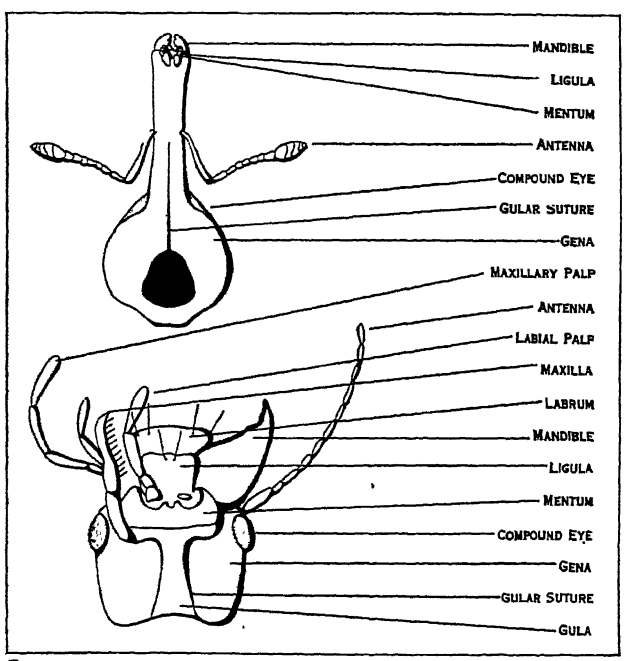


FIG. 4.—UNDER SURFACES OF HEADS OF TWO MEMBERS OF BEETLE FAMILY. ABOVE, WEEVIL; BELOW, GROUND BEETLE

mented animals and a segment consists normally of a dorsal region or tergum, a lateral region or pleuron on each side, and a ventral region or sternum—each region being composed of one or more sclerites. Typically, a segment bears a pair of jointed appendages or limbs attached on either side between the sternum and the pleuron (fig. 2); these appendages are modified according to the various functions they perform and are absent from most of the abdominal segments. In addition to forming the skeletal covering, the integument also produces the hairs, scales, spines and other external structures.

Coloration.—Many of the colours of insects are due to pigments which occur in the cuticle, or below the cuticle in the hypodermis, or in the blood. Pigmentary colours are mostly reds, yellows, browns and blacks, but very rarely blues, and are produced as the result of chemical changes that go on in the body of the insect. The experiments of F. Merrifield and others have shown that they are often greatly influenced by heat or cold and

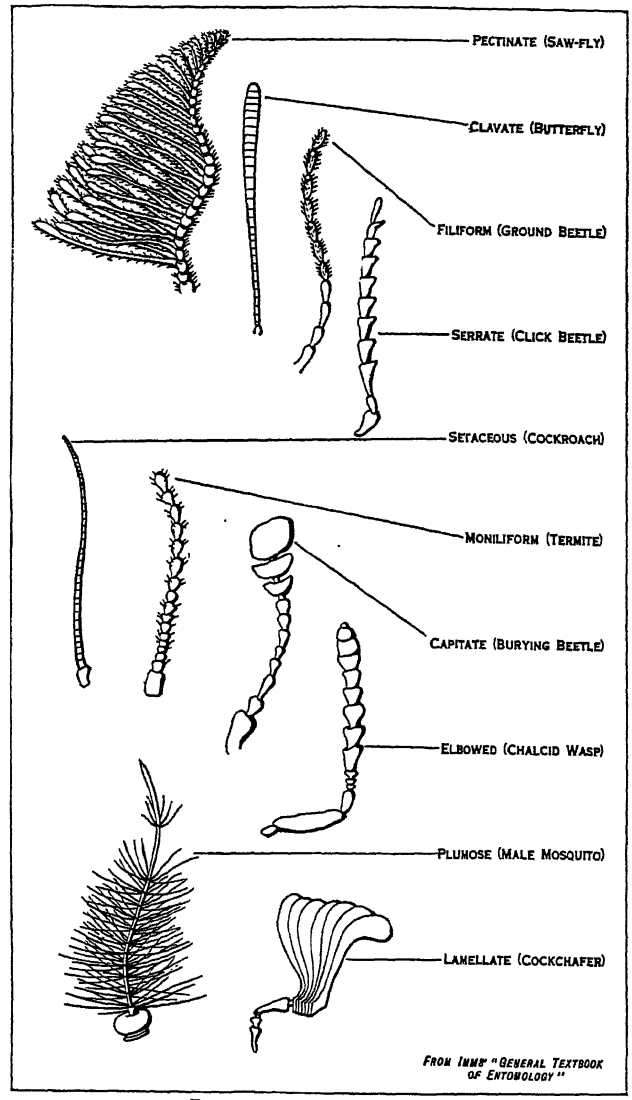


FIG. 5.—TYPES OF ANTENNAE

other means. Some pigments are excretory products and, in the cabbage white butterflies, the white scale colour is due to uric acid and certain yellows, reds and possibly greens, of other butterflies and moths and derivatives of this same substance. The yellows, greens and reds of many caterpillars are derived from the chlorophyll of the food, which enters the blood and the coloration is due to their visibility through the integument. Certain blacks and browns are of the nature of melanins and are induced by an oxidase. It is noteworthy that the pigments of many butterflies and moths are brilliantly fluorescent when subjected to ultra-violet light in a completely darkened room.

Other colours are the result of structural features that bring about interference; in a number of cases fine parallel ridges or striae on the scales produce iridescent colours. In some instances, as in Lycaenid or blue butterflies, little or no pigment may be present, while the metallic greens, blues and coppers of other insects are produced by scale-structure in combination with a backing of pigment. Very often this pigment is black, but the emerald green of an Ornithoptera butterfly has been shown to be due to scale structure combined with yellow pigment in the

walls of the scales. The golden iridescence of *Cassida* beetles is produced by a film of moisture beneath the surface cuticle and is quickly lost after death.

Head.—The head (figs. 3 and 4) is composed of six segments which are so intimately fused together that evidence of its segmental structure is chiefly derived from the presence of appendages. On the upper surface of the head of a cockroach or other generalized insect a Y-shaped *epicranial suture* is present, the sclerite between the arms of the Y being the *frons*, while behind the frons the rest of the head is termed the epicranium. Anterior to the frons is the *clypeus*, which is often fused with it, and in front of the clypeus is a movable upper lip or *labrum;* the inner sensory lining of the labrum is termed the *epipharynx*, which, along with the labrum, is often greatly developed in sucking insects. Paired compound eyes are almost always present on the epicranium and below the eyes are the *genae* or cheeks: three simple eyes or *ocelli* are also frequently evident. The head is attached to the thorax by a neck and the region of attachment is indicated by the large *occipital foramen:* on the floor of the head in front of this foramen there is sometimes present a median chin sclerite or *gula* (fig. 4). The head bears four pairs of appendages—antennae, mandibles, first maxillae and second maxillae. The *antennae* or feelers are composed of a variable number of joints or segments and are very diverse in form: they bear sense organs

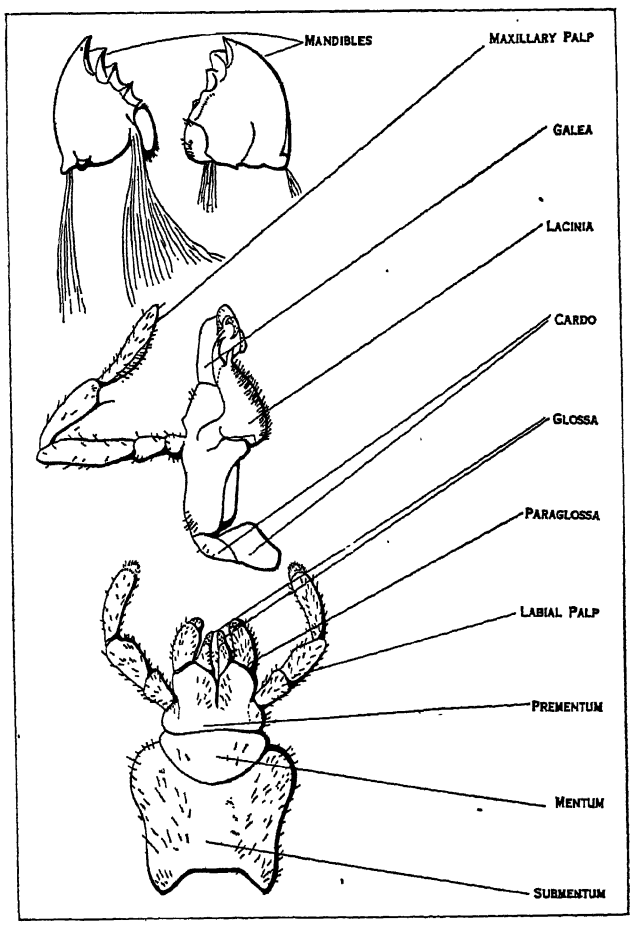
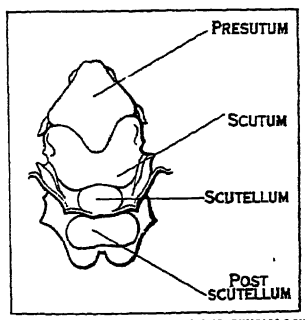


FIG. 6.—PRINCIPAL MOUTH PARTS OF A COCKROACH

of smell and touch and are often more conspicuously developed in the male than in the female (fig. 5). The *mandibles* (figs. 3 and 6) are the principal jaws and are used for seizing and crushing the food. The first maxillae are accessory jaws; each maxilla consists of two basal pieces, *cardo* and *stipes*, the latter bearing an outer lobe or *galea* and an inner toothed lobe or *lacinia*. Externally the maxilla carries a jointed *maxillary palp* which bears organs of special sense. The second maxillae form the lower lip or *labium* and are composed of a pair of partially fused appendages. Its large basal plate or *sub-mentum* is joined in front with the *mentum* and the latter carries the *pre-mentum* which shows indications of a paired structure. The pre-mentum when completely developed carries paired lobes on either side; these lobes are the *paraglossae* and *glossae* which are homologous with the galeae and laciniae of the first maxillae. Collectively they form the *ligula*, but often one or both pairs of these lobes are wanting or fused. Jointed *labial palpi* arise on either side from the outer border of the pre-mentum. On the floor of the mouth-cavity, above the base of the labium, is the tongue or hypopharynx, which receives the opening of the salivary duct; in the more primitive insects and some larvae, paired lobes—the *superlinguae* (*maxillulae*)—are present in relation with the hypopharynx.



FROM SNODGRASS, "ANATOMY AND PHYSIOLOGY OF THE HONEY BEE" (U.S. DEPT. OF AGRICULTURE)

FIG. 7.—TERGUM OF THE MESOTHORAX OF CRANE-FLY

The mouth parts of insects present many modifications of form in accordance with the uses to which they are subjected. Thus, in insects which feed by sucking, the galeae of the maxillae are prolonged into a proboscis, and in piercing insects the mandibles, maxillae and other organs are developed into needle-like stylets. These and other modifications are dealt with under the separate groups concerned.

Thorax.—Three segments make up the thorax which is the locomotory centre of the body: they are termed the *prothorax*, *mesothorax* and *metathorax*. The tergum of the prothorax is formed by the pronotum, and although large in cockroaches, plant bugs and beetles is usually reduced in other winged insects. In the mesothorax and metathorax the tergum is made up of a series of sclerites, one behind the other; viz., *prescutum*, *scutum*, *scutellum* and *post-scutellum* (fig. 7)—of these the scutellum of the mesothorax is often especially prominent. Laterally each pleuron is composed of an anterior sclerite or *episternum* and a posterior sclerite of *epimeron* (fig. 8). On the ventral side, each sternum is composed of variable numbers of sclerites in different groups.

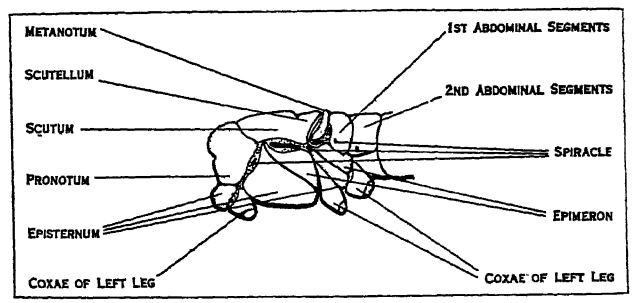


FIG. 8.—DIAGRAMMATIC VIEW OF THORAX OF WOOD WASP

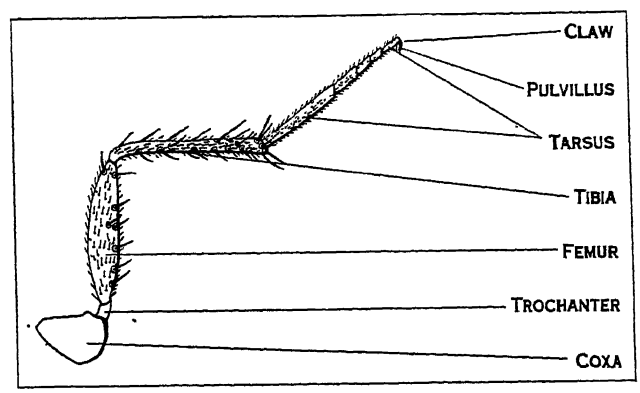


FIG. 9.—SIDE VIEW OF A TYPICAL LEG OF AN INSECT

Legs.—A pair of legs is borne on each thoracic segment. A leg is formed of five parts (fig. 9); viz., a broad subglobular *coxa*

which articulates with the thorax: a small *trochanter;* a stout elongate *femur;* a slender *tibia;* and a *tarsus* consisting typically of five segments or joints. The last tarsal segment bears a pair of claws, more rarely a single claw, and beneath the claws there is a pair of adhesive pads or *pulvilli* which aid in walking over steep or smooth surfaces. Legs vary greatly in form according to whether they are used for running, burrowing, grasping, etc.

Locomotion.—While walking an insect usually moves its legs in such a way that the fore and hind legs of one side, and the middle leg of the other side, progress forward almost at the same moment, the body being supported, as it were, on a tripod formed by the remaining three legs. The anterior leg pulls the body forward and the hind leg chiefly pushes in the same direction, while the middle leg steadies the body and helps to raise or lower it.

Wings.—Wings are lateral outgrowths of the integument of the tergum of the meso- and metathorax and commence to develop in the larva or nymph as the case may be. They exhibit great variety of form and structure in different groups of insects and may be wanting altogether: some insects, such as bristle-tails and spring-tails, have never acquired wings, while others such as lice, fleas, worker ants, etc., although wingless, are believed to have been derived from winged ancestors. A wing is composed of an upper and a lower membrane and between these two layers it is strengthened by a framework of chitinous tubes known as veins. The latter develop very largely in relation with the air-tubes or tracheae which enter the developing wing when it is little more than a bud-like outgrowth. The venation, or arrangement of the wing-veins, is of great importance in classification and the homologies of the veins are largely determined by studying the wings of fossil insects, and the pre-existing tracheae in the wing-buds of the nymphs and pupae of living insects; in the more primitive insects each principal vein is preceded by the trachea from which it takes its name.

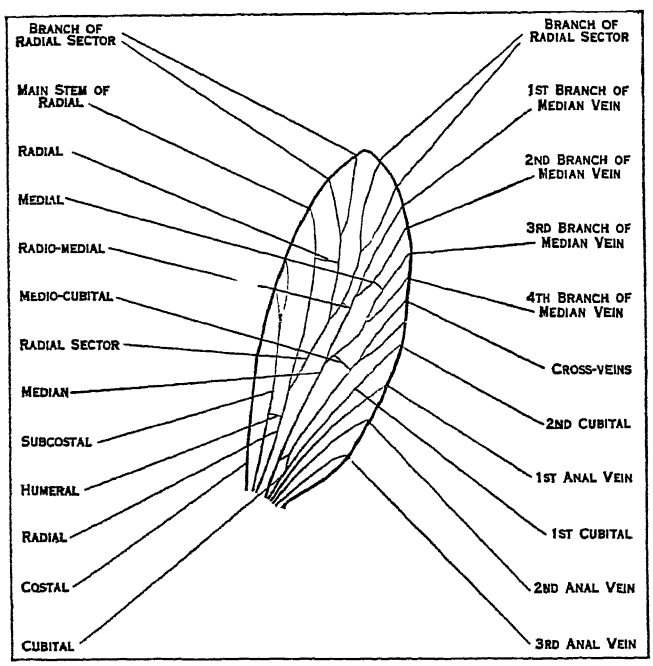


FIG. 10.—HYPOTHETICAL TYPE OF WING VENATION

The wing-vein nomenclature largely used to-day is known as the Comstock-Needham system. It is based upon the conclusion that all orders of winged insects have a venation derived from a common primitive type and that there are eight principal veins. These veins and their recognized symbols are shown in fig. 10. The actual venation, it must be understood, departs by a greater or lesser degree from this primitive plan and either reduction or multiplication of the veins and their branches is the rule. Between the veins are cross-veins which divide the wing into closed areas or cells, each cell taking its name from the vein which forms its anterior boundary.

Flight.—During flight the wings of an insect have an up-and-down motion combined with movement in the backward and forward directions. This results in the path or trajectory made by the apex of the wing taking the form of a continuous series of double loops resembling the figure 8. These movements are effected by two sets of muscles—indirect muscles and direct muscles (fig. 11). The indirect muscles are the largest in the body and are attached to the thorax and not to the wing-bases. They consist of two groups of muscles: (1) a pair of dorso-ventral muscles, by whose contraction the dorsal wall of the thorax is depressed, with the result that the wings are forced upward, owing to the peculiar nature of their articulation with the thorax; (2) a pair of longitudinal muscles, by whose contraction the dorsal wall of the thorax becomes arched upwards, and the wings consequently forced downwards. The rapid alternate contraction of these two groups of muscles, therefore, raises and lowers the wings by their action upon the dorsal wall of the thorax. The direct muscles arise in the thorax but are inserted on the bases of the wings: they are smaller and more numerous than the indirect muscles, and in the blow-fly they amount to ten pairs; they function in turning the wings backwards and forwards in a horizontal direction as well as aiding in steering. In most insects the important flight muscles are the indirect muscles, but in dragon-flies the chief muscles are inserted directly on to the bases of the wings.

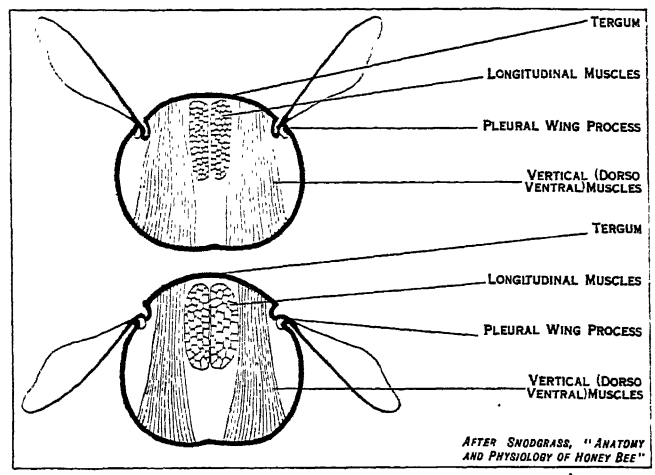


FIG. 11.—ACTION OF THE INDIRECT WING MUSCLES DURING FLIGHT

The wings are capable of very rapid motion: it has been found that the house-fly makes 330 strokes per second, a bee 190, a dragon-fly 28 and a butterfly nine strokes per second. This has been determined by using captive insects in such a manner that the tip of the wing comes in contact with a revolving drum covered with smoked paper. The least contact of the wing removes a minute area of the coating and exposes the white paper beneath. Comparison of such a record with one made in a similar manner by means of a tuning fork, of an ascertained frequency of vibration, enables the rapidity of wing movement to be accurately determined.

Abdomen.—The abdomen (fig. 12) is usually composed of ten segments, but since modification has taken place both anteriorly and posteriorly, it is often difficult to determine their limits in these two regions. Vestiges of an 11th segment are present in a few orders and in the Protura there are 12 segments: in all cases the anus is placed on the last segment. The latter region in generalized insects also frequently bears a pair of jointed tail-feelers or *cerci,* as in bristle-tails and may-flies, while the eighth and ninth segments carry ventral appendages known as *gonopophyses.* In the female they form two pairs of valves borne on the ninth

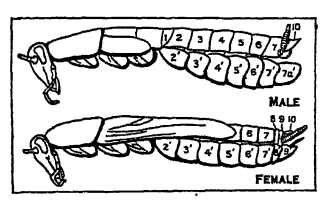


FIG. 12.—MALE AND A FEMALE COCKROACH

segment and enclosed in a pair of broader blades borne on the eighth segment, the whole forming an egg-laying organ or *ovipositor* (fig. 13). This structure is adapted to perform different uses in different groups of insects; in bees, wasps and many ants it is modified to form a sting: in saw-flies it is used for sawing niches in plant tissues for placing the eggs: in wood-wasps it drills holes for placing the eggs deep in wood, while in many ichneumon flies and their allies it is used for piercing other insects

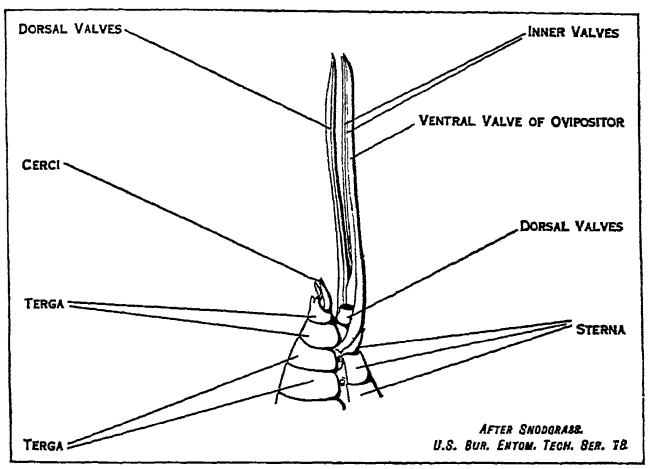


FIG. 13.—APEX OF ABDOMEN WITH OVIPOSITOR OF GRASSHOPPER

in whose bodies the eggs are laid. In some insects there is no ovipositor, while in many beetles and flies the terminal segments of the body are developed in a telescopic manner, thus functioning as an egg-laying organ. In male insects the gonopophyses function as external organs of reproduction: they comprise a pair of small valves or *parameres* associated with the intromittent organ, and a pair of large valves or claspers used for grasping the female—both pairs of organs belonging to the ninth segment.

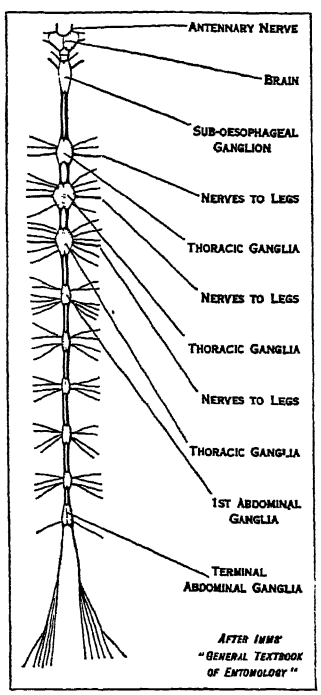


FIG. 14.—NERVOUS SYSTEM OF AN EARWIG

INTERNAL ANATOMY

The internal organs of an insect, like those of other Arthropods, lie in a common body-cavity or haemocoele which contains blood and is in free communication with and forms part of the general circulatory system.

Nervous System and Sense Organs.—The central nervous system consists typically of a ventral nerve cord with a pair of nerve centres or ganglia in each segment of the body: it is joined by a connective on either side of the gullet with the brain (fig. 14). The brain lies in the head just above the gullet and consists of three fused ganglia which innervate the antennae and visual organs. The first ganglion of the ventral cord is the suboesophageal ganglion which lies in the head just below the gullet and innervates the mouth-parts. The next three ganglia are situated one in each of the thoracic segments and innervate the wings and legs, while the remaining ganglia of the ventral cord belong to the abdomen. In the more specialized insects a variable number of the ganglia undergo fusion and as in the house-fly, all the thoracic and abdominal ganglia are merged into a common centre.

Connected with the nervous system are the organs of special sense. Visual organs consist of compound eyes and ocelli: typically both kinds of eyes occur in adult insects and often in nymphs, but in larvae lateral ocelli only are usually present. A compound eye consists of a large number of separate visual elements or ommatidia and is covered externally by a transparent cornea which is divided into hexagonal lenses or facets equal in number to the ommatidia beneath (fig. 15). In the ocelli the di-

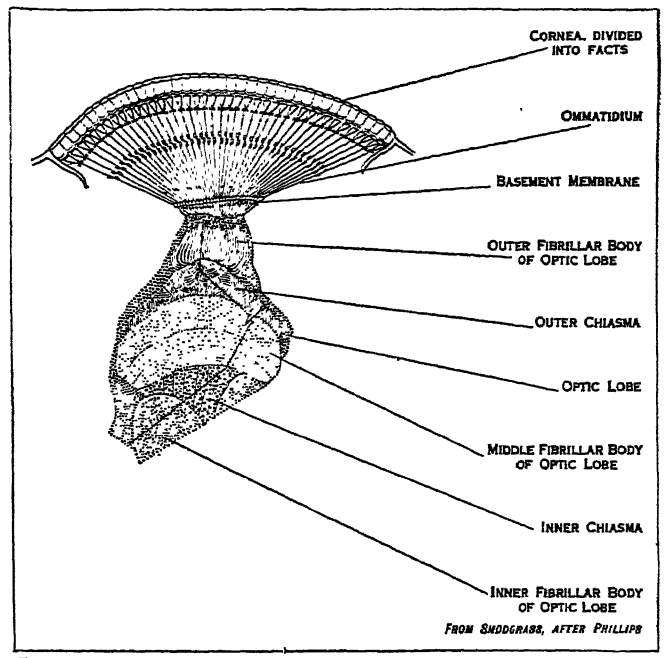


FIG. 15.—SECTION THROUGH THE EYE AND OPTIC LOBE OF BRAIN OF WORKER HIVE BEE

vided cornea is replaced by a single biconvex lens which overlies the visual elements (fig. 16). Vision by means of compound eyes is explained by the mosaic theory which maintains that only those rays of light entering a facet which are parallel with the long axes of the ommatidia, reach the retina where they register a minute part of the whole field of vision, oblique rays being absorbed by the surrounding pigment. The entire image will consequently be a mosaic made up of as many units as there are

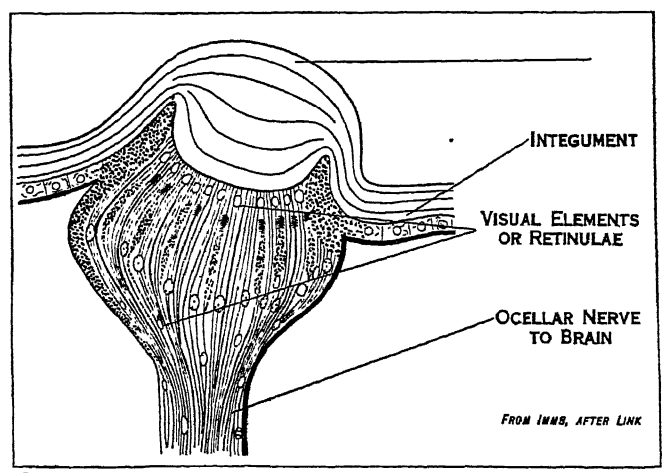
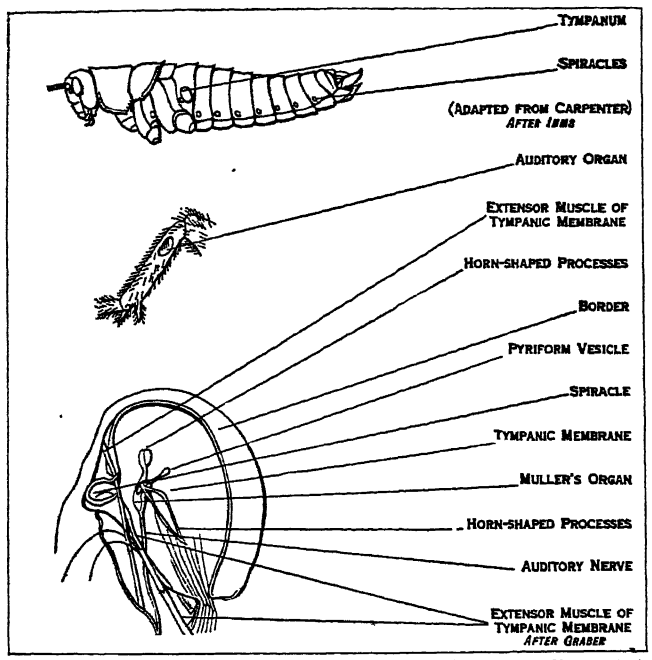


FIG. 16.—SECTION THROUGH AN OCELLUS OF A CUCKOO SPIT INSECT

facets to the cornea. The compound eye appears to be an organ especially adapted for perceiving moving objects quickly, while the ocelli distinguish very near objects and varying intensities of light. Auditory organs in their simplest form consist of fine rods suspended between two points of the integument and connected with nerve-fibres: in such a condition they are present in many insects and larvae. In other cases more elaborate organs are developed, and in grasshoppers (*Acridiidae*) there is a tympanic membrane on either side of the first abdominal segment which is in contact with a delicate sac containing fluid and receiving

nerve-endings (fig. 17). In long-horned grasshoppers and crickets a small swelling below the knee joint bears two narrow slits which lead into chambers whose delicate walls are in contact with air-tubes and bear nerve-endings. In both these examples sound waves impinge on an auditory membrane whose vibrations are transmitted by nerve fibres to the central nervous system. Sense perception of other kinds takes place by means of modified hairs



DENKSCHRIFTEN DER KAISERLICHEN AKADEMIE DER WISSENSCHAFT, BY PERMISSION OF THE AKADEMIE DER WISSENSCHAFTEN, VIENNA

FIG. 17.—LATERAL VIEW OF A LOCUST

covered by a very delicate cuticle and in direct connection with a nerve fibre. Included in this category are tactile organs which closely resemble ordinary hairs and are widely distributed over

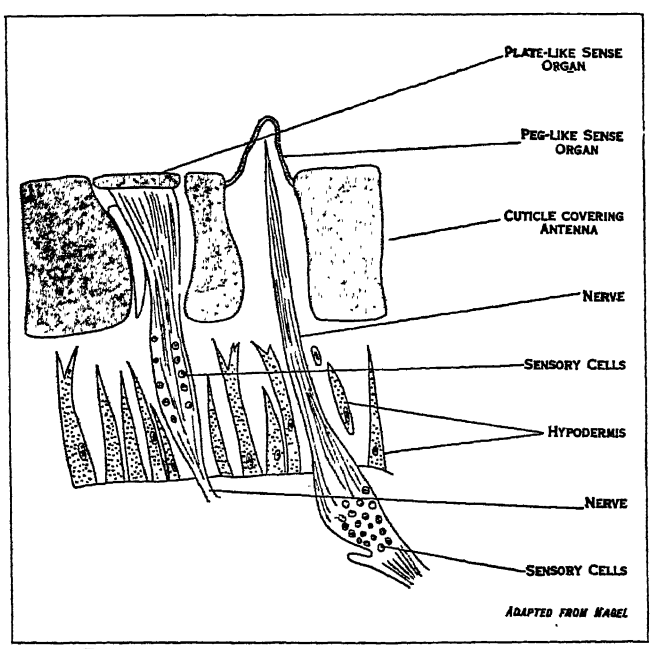
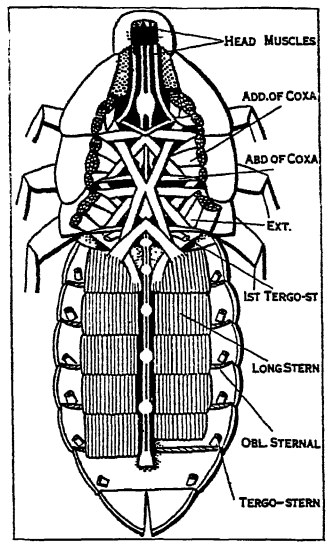


FIG. 18.—SENSE ORGANS FROM ANTENNA OF THE HORNET

the body and appendages: olfactory organs (fig. 18) which are more variable and modified in form and are present in large numbers on the antennae, especially of male insects: and gustatory organs whose taste function is presumed from their location on parts near or connected with the mouth-cavity.

Muscular System (fig. 19).—Unlike those of vertebrates the voluntary and involuntary muscles of insects are cross-striated. In the thorax and abdomen the muscles are arranged in (1) a longitudinal series, both tergal and sternal muscles being present, (2) a dorso-ventral series and (3) a pleural series. In the thorax there are also other special muscles connected with the movements of the legs and wings. The head contains numerous muscles which comprise the abductor and adductor muscles of the mouth-parts and cervical muscles controlling the movements of the head.



MIALL AND DENNY, "THE COCKROACH" (LOVELL REED & CO.)

FIG. 19.—VENTRAL MUSCLES AND NERVE CORD OF THE COCKROACH

Respiratory System.—The respiratory organs consist of a much branched system of air-tubes or *tracheae* (fig. 21), which are kept distended by spirally arranged thickenings of their chitinous lining (fig. 20). The small tracheae end in fine capillaries or *tracheoles* which pass to the various organs of the body. Air enters the tracheae through paired lateral openings or *spiracles:* each spiracle is surrounded by a chitinous rim and is generally provided with a closing apparatus and often special devices to exclude foreign matter. The typical number of spiracles is ten pairs—two pairs on the thorax and eight pairs on the abdomen, but this number is often reduced, especially in larvae. Respiratory movements on the part of the insect facilitate the entry of air into the tracheae whence it passes by diffusion into the tracheoles, where it finally gives up its oxygen to the tissues. Carbon dioxide is got rid of partly by diffusion through membranous areas of the integument and partly by passage through the tracheae, it being finally expelled through the spiracles by the contraction of the tergosternal muscles which compress the body. Many aquatic insects breathe by means of tracheal gills. In other insects, which have no tracheae, respiration is cutaneous.

Circulatory System.—The heart in an insect is represented by a tubular contractile dorsal vessel which is composed of successive chambers and runs along the middle line of the back, just below the integument (fig. 1). It lies in the pericardial sinus

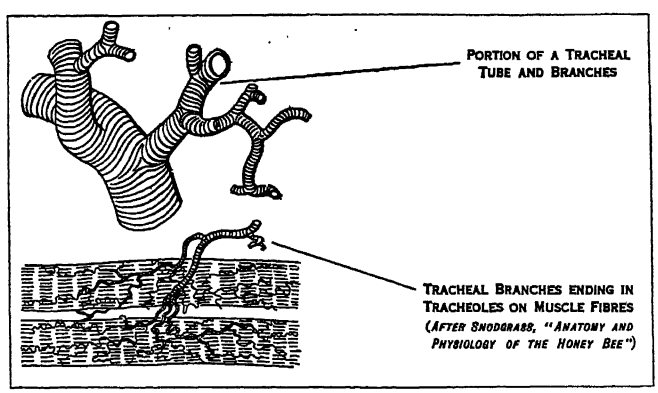
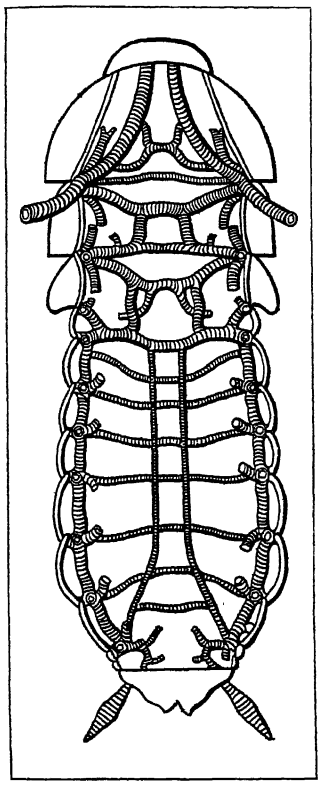


FIG. 20.—PORTION OF A TRACHEAL TUBE AND BRANCHES

whose floor is formed by the pericardial diaphragm, and there is usually a ventral diaphragm, enclosing a peri-neural sinus surrounding the nerve cord (fig. 8). The dorsal vessel pumps the blood forward, through its anterior prolongation or aorta, into the body-cavity: here it bathes the various organs and flows through the appendages. The pulsations of the two diaphragms keep the blood in circulation and it is eventually returned to the pericardial sinus through openings in the diaphragm. Here it makes its way back to the dorsal vessel, entering the latter organ through paired valvular inlets placed at the constrictions between

adjacent chambers. The blood is composed of a fluid or plasma containing amoeba-like corpuscles, somewhat resembling the leucocytes of mammalian blood. Although it plays a part in respiration, its chief function is the circulation of nutrient material among the various organs of the body.

Digestive System.—The digestive canal (fig. 22) is divided into fore-gut, mid-gut or stomach and hind-gut: the first and third regions are formed as tubular inpushings of the integument and are lined with thin cuticle, while the mid-gut is developed as a separate chamber. The fore-gut consists of a narrow gullet, a sac-like crop and often a gizzard: in Lepidoptera and many flies the crop is a separate food-reservoir connected by a canal with the gullet (fig. 23). On either side of the fore-gut are the salivary glands which open into the mouth-cavity. The mid-gut is short, and often provided with outgrowths or caeca, while the hind-gut consists of a tubular intestine and an end-chamber or rectum. Arising from the hind-gut, near its junction with the mid-gut is a variable number of slender Malpighian tubes. The food during mastication is mixed with saliva whose enzymes act upon the starchy matter. The secretions of the mid-gut deal chiefly with proteids and fats and resemble those of the pancreas of vertebrates. Digestion often takes place largely in the crop while the mid-gut is the seat of absorption and the hind-gut conducts waste products to the exterior.



MIALL AND DENNY, "THE COCKROACH" (LOVELL REED & CO.)

FIG. 21.—VENTRAL PORTION OF AIR TUBES IN A COCKROACH

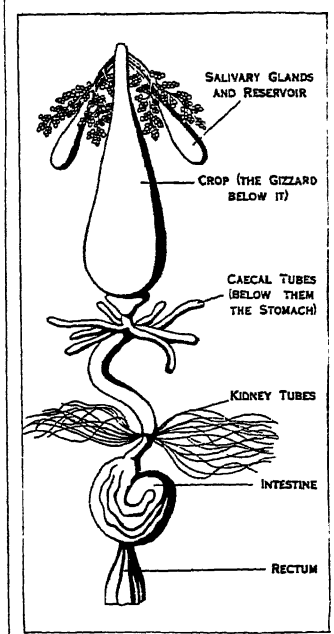
Excretory System.—The Malpighian tubes function as kidneys and eliminate urates and other waste products from the blood, discharging them into the hind intestine (figs. 22 and 23). In many insects the fat-body, or irregular tissue found in the body-cavity, also functions in an excretory capacity, but it mainly stores up nutrient reserves to be drawn upon during metamorphosis.

Reproductive System.—In the female (fig. 24) the ovaries are paired organs each formed of a variable number of egg-tubes or ovarioles which contain the developing ova. The latter as they ripen pass down the oviducts to enter a median passage or vagina and are discharged through the female genital pore which is usually placed between the sterna of the eighth and ninth abdominal segments. There are also generally a *spermatheca* for storing the sperms and paired accessory glands. In the male (fig. 24) the testes are likewise paired and are formed of seminal tubes which produce the sperms. The sperms are discharged into paired ducts or *vasa deferentia*, and finally into a median ejaculatory duct opening in the *aedeagus* or intromittent organ, which is placed between the ninth and tenth abdominal sterna. Sometimes the vasa deferentia are locally enlarged as seminal vesicles for storing the sperms and accessory glands may also be present. Fertilization of the ova depends upon the union of the sexes, which, in some insects, may occur several times in the life of the individual, either male or female.

EMBRYOLOGY

The Egg.—The eggs are usually rich in yolk for nourishing the growing embryos: many eggs are elongate-oval in shape, others are spherical, and some are flattened or flask-shaped: the outer coat (*chorion*) is often elaborately sculptured. Eggs may be laid singly or in groups: enclosed in capsules or *oothecae*, as in cockroaches, etc., or enveloped in a gelatinous mucilage as in some midges and caddis flies, which lay them in water.

Early Development.—After maturition and fertilization of the egg have taken place, development commences by the division of the segmentation nucleus which results in the formation of a number of cleavage nuclei. These pass to the periphery of the egg where they arrange themselves in a single layer or *blastoderm* (fig. 25) which encloses the yolk. In many insects a group of cells appears at the hind pole of the egg: these cells are derived from the segmentation nucleus but take no part in blastoderm formation, and are the primitive germ cells (figs. 25 and 26) which ultimately give rise to the future ova or spermatozoa as the case may be. At a later stage they become enclosed in the mesoderm which forms the sexual organs. Early in development the blastoderm becomes thickened on the future ventral surface forming the germ band or ventral plate (fig. 25). Along this band a pair of longitudinal folds arise which grow and meet, thus converting the one-layered rudiment into two layers—the outer layer being the ectoderm and the inner layer the mesoderm (fig. 26). This stage, known as the *gastrula*, which is an important phase in the development of all animals, is subject to several variations in insects.



MIALL AND DENNY, "THE COCKROACH" (LOVELL REED & CO.)

FIG. 22.—FOOD CANAL OF A COCKROACH

Formation of the Embryo (fig. 27).—Early on, the germ band becomes divided by transverse furrows into a series of segments of which six form the future head, three form the thorax and 11 or 12 form the abdomen: at this stage the germ band may be referred to as the embryo. On each segment, except the first and last, pairs of bud-like appendages appear. These, in all insects, form the future antennae, mouth-parts and legs, while the remain-

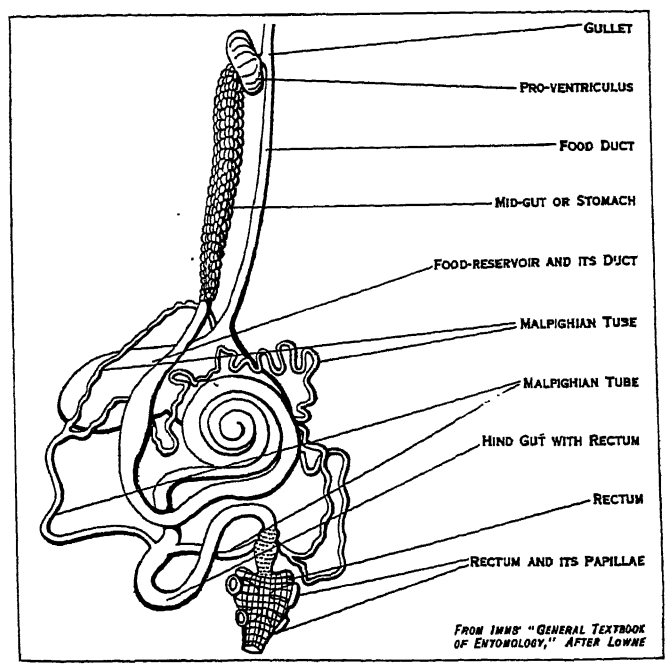


FIG. 23.—DIGESTIVE CANAL OF A MUSCID FLY

der, with certain exceptions, usually disappear before the embryo is fully developed. The transient appendages are the small second pair, behind the antennae, and those borne on the abdomen. Among Apterygota certain of the abdominal appendages form those of the adult and in caterpillars they develop into abdominal feet. In other insects cerci, when present, are formed from the last pair, but the rest of the abdominal appendages disappear: The

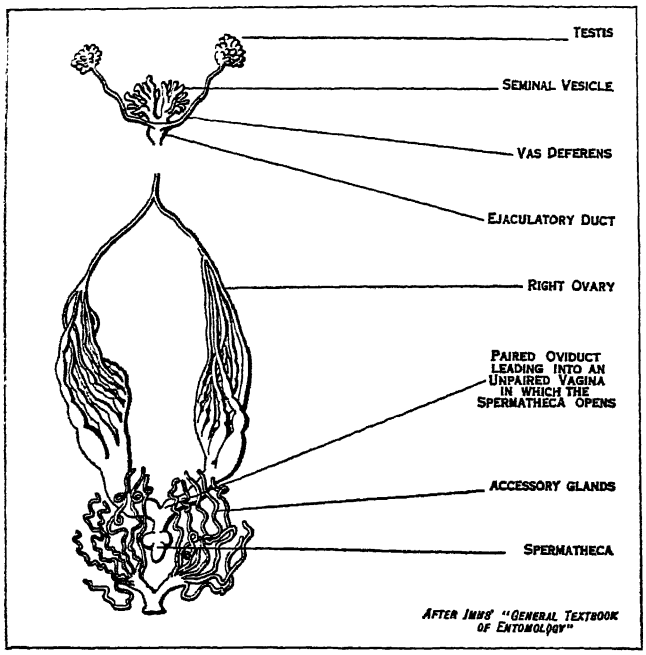


FIG. 24.—REPRODUCTIVE ORGANS OF WINGED TERMITE

gonapophyses are believed to be derived from abdominal appendages of the eighth and ninth segments, but direct proof is wanting. Along either side of the middle line of the ectoderm a pair of ridges develop which are the fundaments of the nervous system. They become segmented into paired swellings or *neuromeres,* one neuromere lying in each embryonic segment. The first three neuromeres give rise to the brain, the next three form the sub-oesophageal ganglion and the remainder form the ganglia of the thorax and abdomen. At a later stage pits appear on the outer side of the last two thoracic and the first eight or nine abdominal appendages, these being the rudiments of the spiracles.

Embryonic Membranes (fig. 28).—In some insects such as beetles the embryo remains at the surface of the yolk, but it subsequently becomes covered by folds which arise along its edges. These folds grow towards one another and fuse, and in this way enclose the embryo in an amniotic cavity which is covered by an outer membrane or *serosa* and an inner membrane or *amnion* (fig. 28). In some other insects such as butterflies and dragonflies the embryo becomes sunk into the yolk and a portion of the non-embryonic part of the blastoderm becomes necessarily carried in with it, forming the amnion. In a moth or butterfly the embryo sinks into the yolk without change of orientation, but in dragonflies it moves through an arc until its position is completely reversed on the dorsal side of the yolk. Here it rests for a while and again passes through the same arc to its original ventral position.

Digestive System (fig. 29).—In the positions of the future mouth and anus the ectoderm becomes inpushed to form the rudiments of the fore-gut and hind-gut respectively. The method of origin of the mid-gut is much disputed: by some embryologists it is believed to arise partly from the mesoderm and partly from cells budded off from the previously mentioned gut-rudiments—others claim its origin from the latter source only. The Malpighian tubes develop as outgrowths from the hind-gut when the latter is little more than a pit, and subsequently become carried inwards as the gut-rudiment deepens.

Dorsal Closure (fig. 30).—As development proceeds the embryo broadens out and gradually grows around the yolk until its sides finally meet and fuse along the dorsal region. In many insects either the amnion or serosa ruptures over the region of the embryo to allow of its growth, but in Lepidoptera these membranes remain intact, and the amniotic cavity follows the growth of the embryo around the yolk.

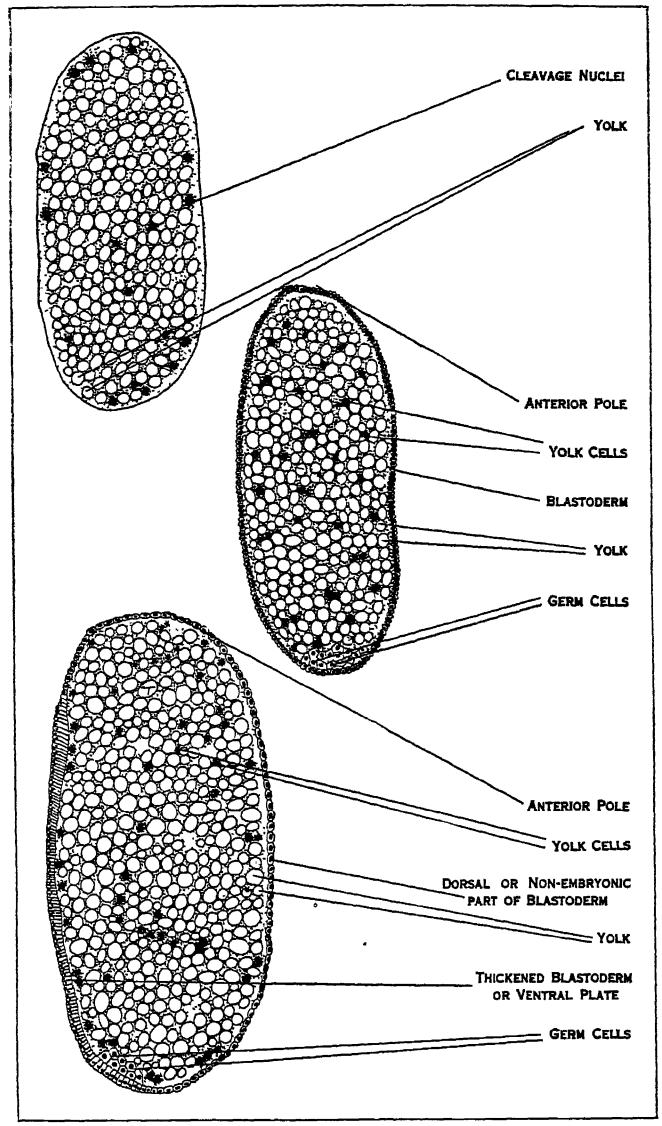


FIG. 25.—STAGES OF DEVELOPMENT IN THE EGGS OF A BEETLE, IN SECTION

Integument and Tracheal System.—When the dorsal closure is completed the embryo is surrounded by ectoderm which forms, in addition to the organs previously mentioned, the whole

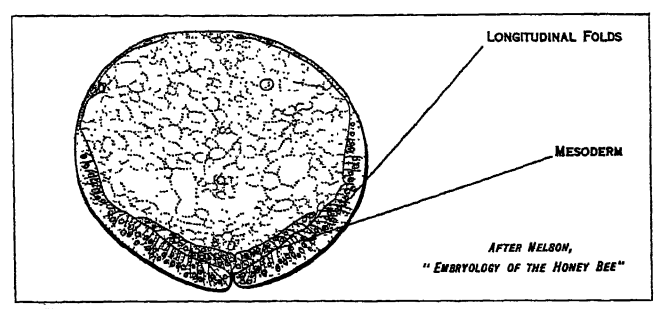


FIG. 26.—TRANSVERSE SECTION OF THE EGG OF THE HIVE BEE

integument of the body and its appendages together with the tracheal system and salivary glands. The tracheae arise from the original spiracular pits which deepen into tubes and become freely branched as development proceeds.

Mesoderm and Organs Derived from It (fig. 30).—The

mesoderm or inner layer of the germ band undergoes segmentation corresponding with that of the ectoderm. Coelomic cavities appear in these mesoderm segments, but they subsequently break down and take little part in the formation of the permanent body-cavity as happens in so many animals. The mesoderm gives rise to the dorsal vessel, fat-body, muscles and the sexual organs and their paired ducts, but the vagina and the ejaculatory duct respectively are derived as inpushings of the ectoderm. The body-cavity is chiefly formed from a space that is produced by the separation of the yolk from the mesoderm in the mid-ventral region: this space extends laterally with the upward growth of the embryo till the complete body-cavity is formed.

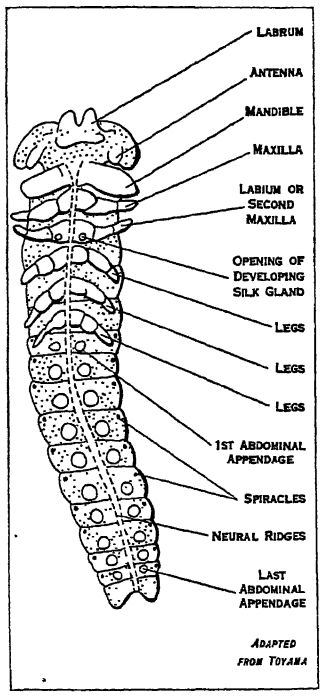


FIG. 27.—EMBRYO OF A SILKWORM

Later Development and Eclosion.—Once the fundaments of the various organs are laid down the final stages of development largely consist in their continued growth and structural differentiation. When fully developed the embryo becomes the young insect and its method of hatching or eclosion from the egg varies in different groups. Some insects (*e.g.*, caterpillars) simply eat their way out through the egg-shell, others rupture it by body movement, or there may be a lid or operculum which is pushed apart from the rest of the shell by the insect in its efforts to emerge. In some plant-bugs and other insects a hatching spine or egg-burster is present on the head and after eclosion is effected this structure is left behind.

REPRODUCTION

Insects exhibit a diversity of reproductive phenomena unparalleled in other animals. Nowhere else do we find parthenogenesis both sporadic and cyclic, viviparity, paedogenesis and polyembryony all within the limits of a single group of the animal kingdom. Normally reproduction is dependent upon the meeting of the sexes which leads to the fertilization of the ova preparatory to egg-laying.

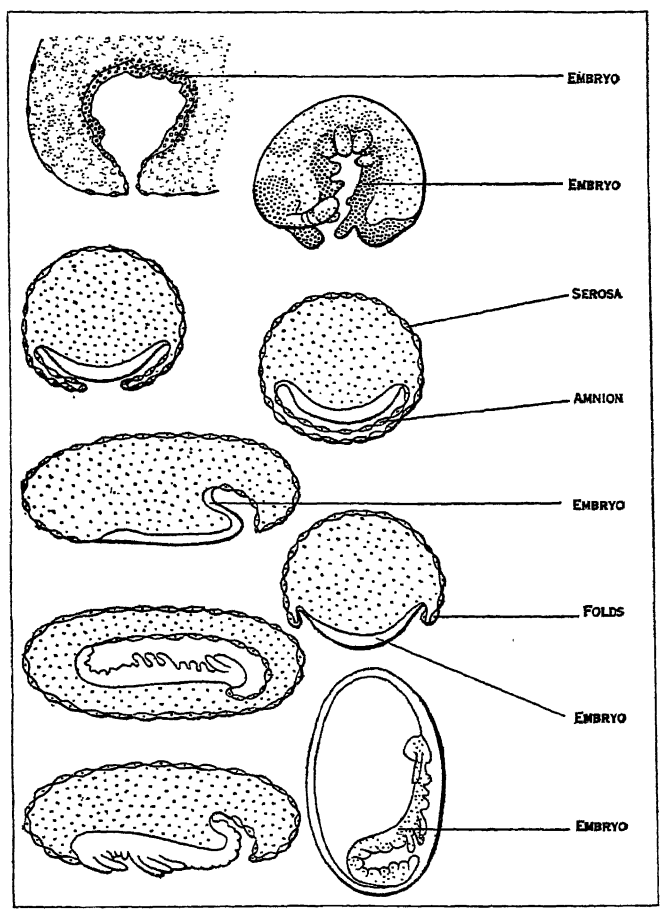
Mating.—In some insects mating takes place only once and death supervenes soon afterwards, as in may-flies. In the hive bee the queen has a life of several years, but a single act of mating is sufficient for fertilizing the eggs during that long period, and the male perishes soon after pairing. In other insects a male may pair freely with several females and in many beetles repeated mating takes place in the life of both sexes. Burgess found that in the ground beetle *Calosoma sycophanta* the female required several matings or a large proportion of the eggs would be infertile.

Oviposition and Fecundity.—Egg-laying or oviposition takes place in various ways as already mentioned and the eggs are deposited in situations expressly adapted for the immediate needs of the future offspring. In some cases the female simply drops the eggs at random while flying low, as happens in certain moths whose larvae feed on grasses or their roots. Very commonly the eggs are laid singly or in masses on the food-plant of the future larvae: or they may be inserted into plant tissues, as in some grasshoppers. When inserted more deeply excrescences or galls may arise as in saw-flies, gall-wasps and gall-midges. Other insects lay their eggs beneath the soil, while parasitic species lay them on or within the bodies of the hosts which support their future offspring.

The number of eggs laid by the female greatly varies among different species. In the Phylloxera of the vine and the woolly aphis, the winter females lay but a single large egg apiece; the mussel scale in England lays on an average less than 40 eggs; the moth *Hadena oleracea* lays over 800 eggs, and the house-fly may deposit over 2,000 eggs during its life. The maximum fecundity is reached among termites whose queens are often little more than huge inert egg-laying machines producing upwards of 4,000 eggs every 24 hours, and 1,000,000 eggs a year during a life of perhaps six to nine years.

Viviparity.—In some insects embryonic development takes place while the eggs are still within the body of the female and living young are consequently produced. This is a very general phenomenon throughout the summer in all true aphides. Viviparity is also not rare among certain flies and is occasionally found in some beetles. Among flies there are species which produce large numbers of eggs whose larvae are "born" as soon as they issue from the eggs, while there are others such as the tsetse flies and sheep ked, which produce a very small number of eggs and the larvae are retained in the body of the female and nourished till fully grown. They are then "born" and turn to pupae almost immediately afterwards.

Parthenogenesis.—Parthenogenesis, or reproduction without the act of fertilization, exhibits a multiplicity of phases among insects. In some species it is a rare, occasional phenomenon: in others it is the constant and normal method of reproduction, or

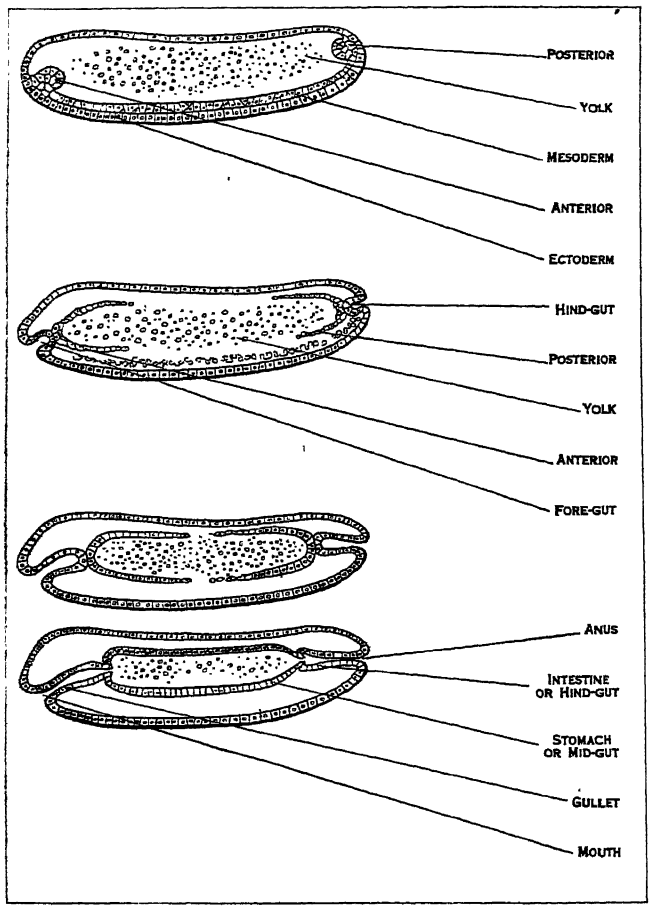


SNODGRASS, "SMITHSONIAN REPORT" (U.S. DEPT. OF AGRICULTURE)

FIG. 28.—PROTECTION OF THE INSECT EMBRYO WITHIN THE EGG

it may be cyclic—alternating with sexual reproduction. Parthenogenesis may, therefore, be classed under three headings: (1) *Sporadic,* which happens especially among moths and is more frequent in some species than in others: both males and females may be produced from the unfertilized eggs; (2) *Constant:* in social bees and wasps the males are regularly produced from the unfertilized eggs, and the same happens in many of the Chalcids. In some of the stick-insects females only are produced and the males are very rare: again, in certain gall-wasps and saw-flies males are unknown and sexual reproduction is consequently absent. (3) *Cyclic:* in

many gall-wasps and almost all aphides one or more parthenogenetic generations alternate with a sexual generation. In the gall-wasps the individuals of the two generations are often very different in form and produce dissimilar galls. The spring generation consists of females which give rise to a summer generation of both sexes which mate and produce the spring females of the next year. In aphides generation after generation of virgin females are



SNODGRASS, "SMITHSONIAN REPORT" (U.S. DEPT. OF AGRICULTURE)

FIG. 29.—STAGES IN THE DEVELOPMENT OF THE DIGESTIVE CANAL OF AN INSECT EGG

produced viviparously till finally they give rise to true sexual individuals which pair and lay normal eggs.

Paedogenesis.—In a few insects larvae or pupae are capable of parthenogenetic reproduction, and this process, which involves the production of offspring by the immature animal, is termed paedogenesis. Thus, the pupae of an aquatic fly (family *Chironomidae*) have been known to produce eggs which duly hatched into larvae. In the gall-midge *Miastor*, the larvae regularly produce daughter larvae which eat their way out of the body of the parent and reproduce in a similar manner on their own account. After several generations of this type, male and female flies are usually produced which pair and their progeny gives rise to the paedogenetic cycle over again.

Polyembryony.—This consists in the production of two or more embryos from a single egg by a process of budding (fig. 31). It is only found in certain of those Hymenoptera whose larvae live as parasites in the blood and tissues of other insects. The simplest case is found in a minute creature *Platygaster hiemalis* which is a parasite of the Hessian fly. Some of the eggs of this parasite develop normally into larvae, while others develop up to a point when the embryo divides so as to produce two larvae within the same egg-covering. In other species ten or 12 larvae may arise from a single egg, while in some chalcid wasps which parasitize caterpillars, 100 or more larvae may be produced from a single embryo. These develop in a continuous chain enveloped in a cellular covering and, when mature, they separate and become free in the body of their host. The resultant insects may be female or male, according to whether the original egg was fertilized or not. As many as 3,000 larvae are known to issue from a single caterpillar of the Silver Y moth in which several of these chains of embryos were present.

GROWTH AND METAMORPHOSIS

After hatching or birth, insects undergo a process of growth and change till they become adult. Every insect during its growth sheds its cuticle several times, this process being known as moulting or *ecdysis*, the cast skin being the *exuvia*. The form assumed

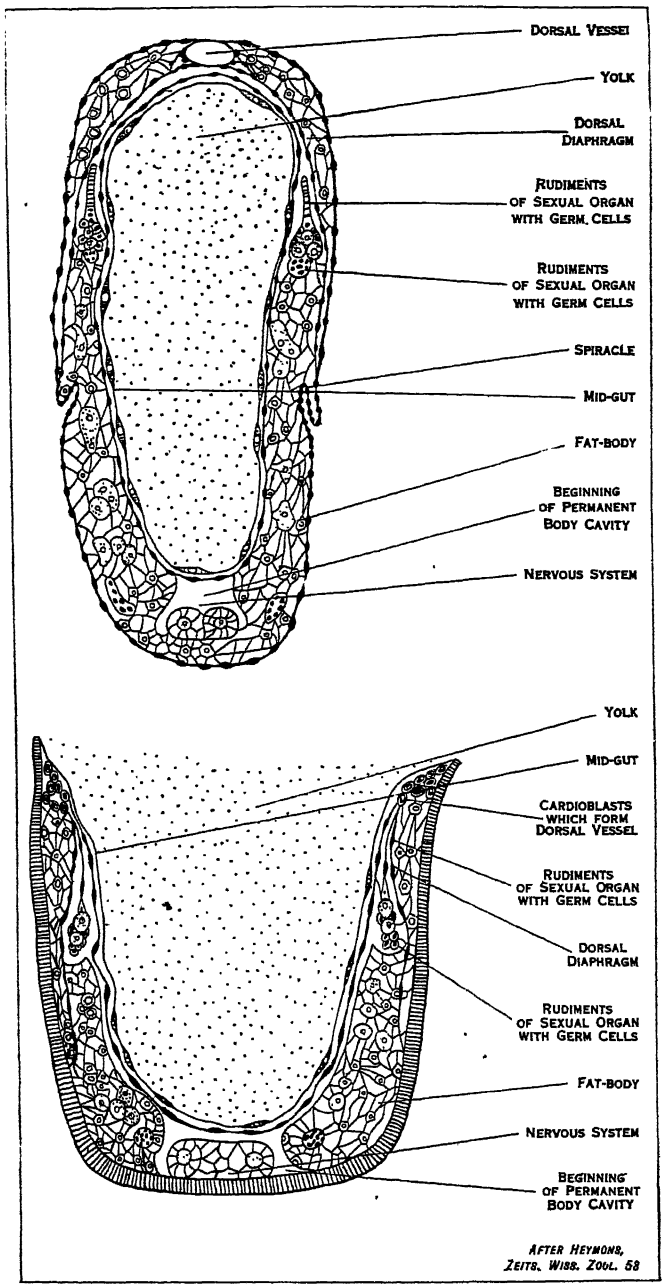


FIG. 30.—SECTIONS THROUGH THE ABDOMEN OF AN EMBRYO COCKROACH

by an insect between successive moults is termed an *instar:* thus, when it issues from the egg it is in its first instar and after the second ecdysis it is in its third instar, and so on. The final instar is the fully mature insect or *imago*.

Metamorphosis.—Most insects issue from the egg in a different form from that assumed in the imago and in order to reach the latter condition, they have to pass through changes that are collectively termed metamorphosis. A small number of insects emerge



DRAWN FOR THE ENCYCLOPÆDIA BRITANNICA BY HELEN DAMROSCH TEE-VAN FROM SPECIMENS IN THE AMERICAN MUSEUM OF NATURAL HISTORY

COMMON FORMS OF INSECT LIFE

1. Locust (*Cicada pruinosa latifasciata*). 2. Leaf Insect (*Phyllium siccifolium*). 3. Large Dragon Fly (*Anax junius*). 4. Walking Stick (*Diapheromera femorata*). 5. Ant Lion Fly (*Dendroleon obsoletus*). 6. Small Dragon Fly (*Calopteryx maculata*). 7. May Flies (*Hexagenia rigida*). 8. Lantern Fly (*Fulgora lanternaria*). 9 Weevil (*Cyphus placidus*). 10. Buprestid Beetle (*Chalcophora georgiana*). 11. Locust or long horned Grasshopper (*Neoconocephalus robustus*). 12. Palm Weevil (*Rhynchophorus palmi*). 13. Grasshopper (*Hippiscus phoenicopterus*). 14. Carabus Beetle (*Calosoma sycophanta*). 15. Cricket (*Gryllus pennsylvanicus*). 16. Mole Cricket (*Gryllotalpa hexadactyla*). 17. Copris Beetle (*Copris carolina*). 18. Rhinoceros Beetle (*Dynastes tityrus*)

from the egg in their completed form and therefore do not undergo metamorphosis. Such insects are often termed *Ametabola,* springtails and bristle-tails being familiar examples. Certain other insects, which have lost their wings in their remote ancestry, have their transformations so reduced that they no longer merit the term metamorphosis. Such examples are consequently secondarily ametabolous and they exhibit only trivial differences between the young and adults: examples of this kind are found among stick-insects, lice, worker termites and other insects. The majority of insects, however, pass through a metamorphosis and may be termed *Metabola.* In the strict zoological sense the young of all animals undergoing metamorphosis are called larvae. Among insects it is convenient and customary to distinguish two types of immature individuals, viz., *nymphs* and *larvae.*

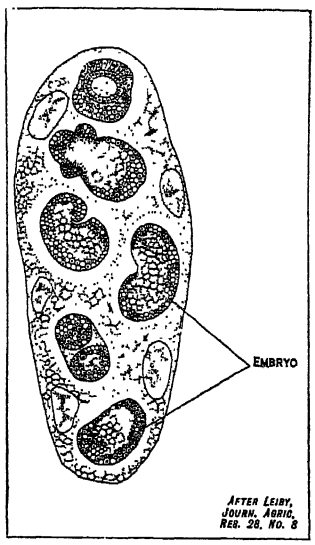


FIG. 31.—PLATYGASTER VERNALIS. SECTION THROUGH AN EGG OF PARASITIC HYMENOPTERON

A nymph (fig. 32) is an immature insect which quits the egg in a relatively advanced stage and mainly differs from the imago in that the wings and gonapophyses, when present, are in a relatively rudimentary condition. The mouth-parts resemble those of the adult and compound eyes are present. Growth from the nymph to the imago is gradual and unaccompanied by a pupal instar.

A larva (figs. 36 and 37) is an immature insect which leaves the egg in a form very different from that of the imago. It is structurally less advanced than a nymph, it never bears external rudiments of wings, and compound eyes are wanting.

Types of Metamorphosis.—From the foregoing remarks it will be noted that metamorphosis is of two types. In cases where the young insects are nymphs and there is no pupa, the change to the imago is direct and gradual, and metamorphosis is said to be incomplete (fig. 35). When the young insects are larvae which ultimately transform into pupae, metamorphosis is of an indirect and complex character and is said to be complete (fig. 33).

Types of Larvae.—Larvae issue from the egg in different stages of development which partly depend upon the amount of yolk that was available for their growth: generally, the less yolk there is the more immature are the larvae when they hatch. Larvae may be grouped under four types: (1) *Embryonic larvae:* these occur among some of the parasitic Hymenoptera whose eggs contain little or no yolk. They are so immature that they are little more than prematurely hatched embryos with an unsegmented abdomen and no appendages behind those of the thorax: the digestive and nervous systems are as yet rudimentary and the tracheal system is undeveloped. Such larvae live as parasites in the blood or other tissues of various insects and are thus surrounded by a highly nutritious food; (2) *Eruciform larvae:* these emerge from the egg at a much later stage when segmentation is complete and the internal organs are fully formed. Their special feature is the retention of a variable number of the embryonic abdominal appendages which are transformed into feet (fig. 33). Such larvae are known as caterpillars and are found in saw-flies, butterflies and moths; (3) *Campodeiform larvae* (fig. 34): larvae which bear this name are hatched in a form bearing a general resemblance to *Campodea* and other bristle-tails. They are carnivorous creatures that wander in search of their prey: the integument is well chitinized and the antennae, legs and cerci are prominently developed. In conformity with their active life, eyes and other sense organs are evident. Larvae of this type hatch late from the egg after the loss of the embryonic abdominal appendages. In many respects they resemble the nymphs of insects with incomplete metamorphosis, but are less advanced in their development. Campodeiform larvae are characteristic of ground beetles and Neuroptera; (4) *Vermiform larvae* (fig. 36): these are very

FROM HOWARD, "INSECT LIFE" (U.S. DEPT. OF AGRICULTURE)

FIG. 32.—NYMPH OF LOCUST SCHISTOCERA AMERICANA

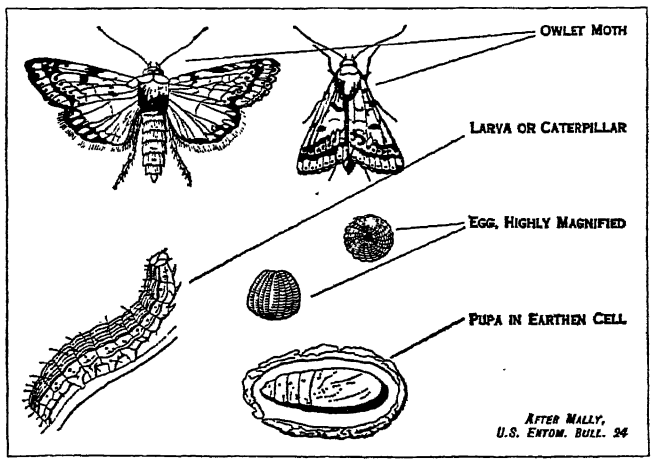
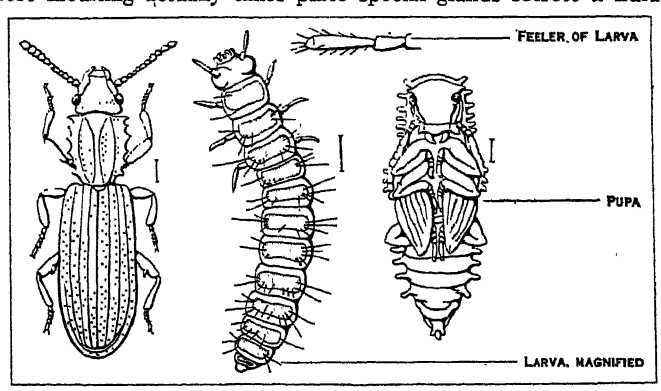


FIG. 33.—OWLET MOTH

varied in form and are worm-like or maggot-like with only vestiges of legs and antennae, or entirely legless. They are believed to be derived from the campodeiform type by degeneration induced by the presence of abundant food supply, which renders locomotory and sense organs of little value to the insect. Vermiform larvae occur in all flies, some beetles and in most Hymenoptera.

In addition to the foregoing there are many larvae that are of an intermediate character. Such larvae in general facies are campodeiform but in other characters incline towards the eruciform or, more usually, the vermiform type.

Ecdysis.—Since the cuticle is ill-adapted to accommodate itself to the increase in size of an insect consequent upon growth it is periodically shed. During each act of ecdysis not only the general cuticle covering the body and appendages is cast off, but also the cuticular lining of the tracheae, fore-gut and hind-gut. All these parts together with hairs, spines and similar structures are renewed by the activity of the hypodermal cells beneath them. Before moulting actually takes place special glands secrete a fluid



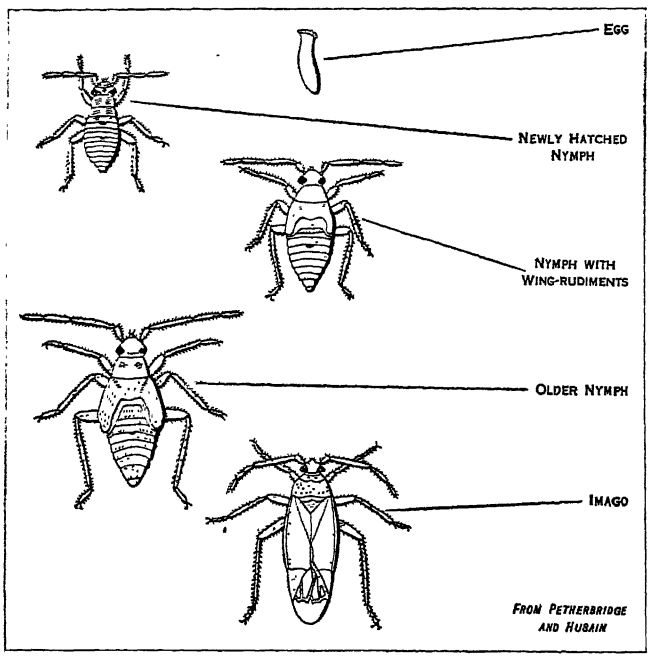
CHITTENDON, "BULLETIN OF ENTOMOLOGY" (U.S. DEPT OF AGRICULTURE)

FIG. 34.—SAW-TOOTHED GRAIN-BEETLE

which penetrates between the old and new layers of cuticle and facilitates the final separation and rupture of the old skin. Springtails are the only insects that regularly undergo ecdysis after becoming adult, while may-flies undergo a moult on attaining the winged state, but before they are fully mature. In all other insects moulting is confined to the larvae and nymphs. Among the larvae of many flies and Neuroptera two ecdyses are very constant: in caterpillars moulting is variable, some may have nine ecdyses while in others it may be as low as three. In the may-fly Chloeon

23 ecdyses have been observed.

Growth.—The larval and nymphal periods are pre-eminently ones of growth and the increase in weight that is undergone in a short interval of time is remarkable. Among the influences that affect growth most profoundly are nutrition and temperature. Insufficient food, or food of the wrong nutrient composition, retards growth and consequently delays metamorphosis, and much the same effect is observable if insects be subjected to too low a

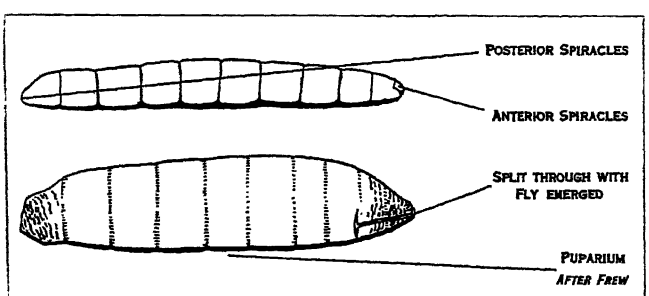


FROM PETHERBRIDGE AND HUSAIN, "ANNALS OF APPLIED BIOLOGY" (CAMBRIDGE UNIVERSITY PRESS)

FIG. 35.—METAMORPHOSES OF CAPSID BUG

temperature. Under normal conditions of food and temperature a silkworm weighs, when fully grown, up to 10,500 times its weight when just hatched, and the caterpillars of the goat moth during a life of three years are stated to increase 72,000 times in weight in that period.

Hypermetamorphosis.—When an insect passes through two or more markedly different larval instars it is said to undergo hypermetamorphosis. This phenomenon is accompanied by a marked change in the life of the larva concerned. In most cases where this happens, the first larval instar is active and campodeiform, and in this condition the insect seeks its food. Having dis-

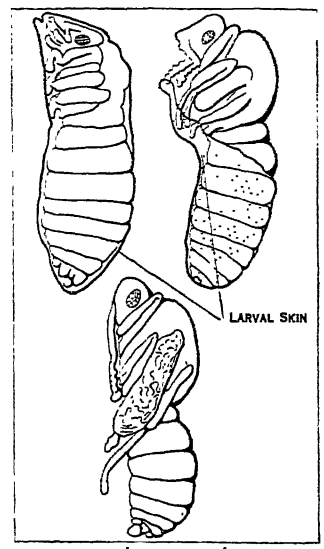


AFTER FREW

FIG. 36.—LARVA OF GOUT FLY

covered its pabulum it undergoes changes of form which adapt it to its subsequent mode of life. Hypermetamorphosis is evident in some beetles (*see* COLEOPTERA), in certain flies, in most of the groups of parasitic Hymenoptera (*q.v.*) and in some other insects.

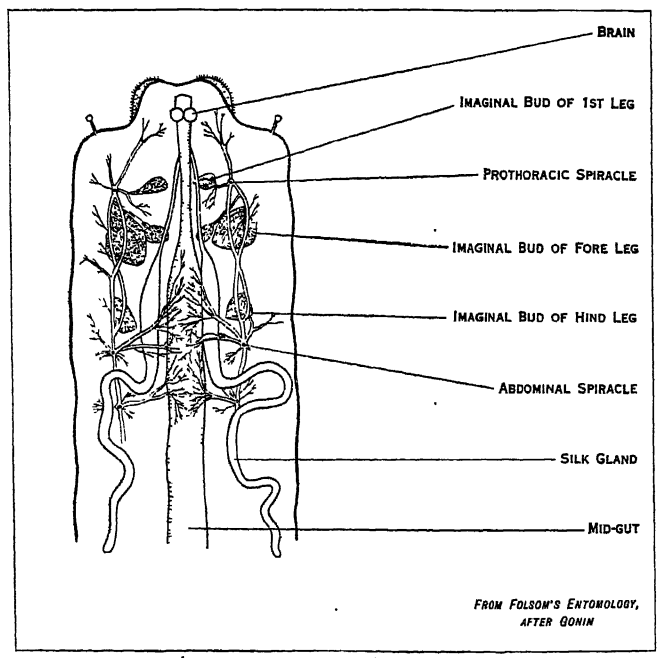
Pupa.—Near the end of the larval period the insect prepares itself for transformation into the pupa, usually constructing a cocoon or other type of protection. A preliminary period of quiescence then follows when the insect is in a condition termed the *pre-pupa* (fig. 37). In this stage the wings and appendages first become evident outside the body, and its general form foreshadows that of the imago. The pre-pupa is loosely enclosed in the old larval skin, and after the latter is moulted the true pupal condition is assumed. Since the pre-pupal and pupal instars are particularly vulnerable, either protection or concealment is necessary. It is only rarely that pupae are quite exposed as happens in those of many butterflies, but, in this case, protection is afforded by their colouration, which often closely assimilates with the natural surroundings. The larvae of many moths and beetles burrow in the ground when about to pupate, and then transform within earthen cells composed of soil particles, held together by an adhesive secretion. Numerous other insects construct cocoons of various extraneous materials woven together with a warp of silk, while in many moths the cocoons are formed entirely of silk: some of the most elaborate cocoons are those constructed by the great silkworm moths of the family Saturniidae. Among true flies there is seldom a cocoon and in those with a coarctate pupa, the latter is protected by being concealed below the soil, in refuse or other situations where the larval life was passed.



FROM PEREZ, "ÉTUDE DES MÉTAMORPHOSES" (PRESSE UNIVERSITAIRE DE FRANCE)

FIG. 37.—PRE-PUPAL STAGES

The term pupa is applied to the resting, passive stage in the life of insects with a complete metamorphosis, and during this instar it is incapable of feeding. The pupa is an acquired transitional phase during which the developing wings, legs and other append-



"RECHERCHES SUR LA MÉTAMORPHOSE DES LEPIDOPTÈRES"

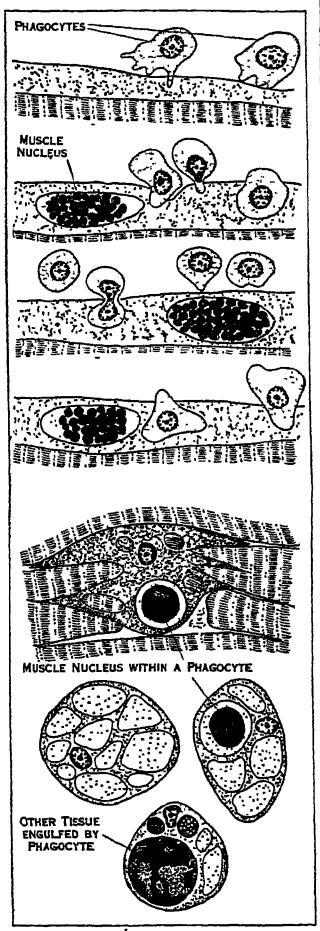
FIG. 38.—FULLY GROWN CATERPILLAR OF WHITE BUTTERFLY DISSECTED

ages of the future insect appear outside the body. Three types of pupae are generally recognized. In the *free pupa* (figs. 34 and 37) the wings and legs are free from any secondary attachment to the body, and such pupae have considerable capacity for movement. In mosquitoes and midges the pupae are aquatic, and are active swimmers: in certain other insects they are able to work their way above ground to facilitate the emergence of the perfect insects. The *obtected pupa* (fig. 33) has the wings and legs glued down to the body and there is but little freedom of movement: this type is characteristic of most moths. The *coarctate pupa*

(fig. 36) is found in all the higher groups of flies. In these insects the last larval skin is not cast off but remains outside the pupa as a hardened shell forming a capsule or puparium.

Emergence from the Pupa.—As the time approaches for the eclosion of the perfect insect the pupa noticeably darkens, and in many butterfly pupae, the colours of the contained insect are distinctly observable at this time. During the act of emergence the insect usually ruptures the pupal cuticle in a longitudinal fracture down the back of the thorax, and draws itself out. It then crawls up the nearest available support and rests with its miniature wings hanging downwards. By the influx of blood from the body the wings assume their full size and, after a period of rest when all the parts become hardened, the insect is able to make its first flight. When a cocoon is present the insect often has to bite its way through the walls by means of its jaws as in Coleoptera and Hymenoptera, but in caddis-flies and Neuroptera, the pupa bears mandibles for this purpose; various other methods of emergence from the cocoon are mentioned in the article LEPIDOPTERA.

Development of the Perfect Insect.—The culminating point of metamorphosis is the actual formation of the imago. In insects with incomplete metamorphosis this is accomplished by a gradual process of growth changes, both internal and external, during successive nymphal instars till the adult condition is attained. In insects with complete metamorphosis, it has been seen that a pupal stage has been intercalated in the life-cycle, and it is during this instar that profound change occurs. Outwardly inactive, the pupa is in reality the seat of intense activity within. The formation of the imago begins in the larva and is initiated by the development of new growths termed imaginal buds, which gradually build up all the parts that require reconstruction to serve the needs of the future insect, as well as forming all organs unrepresented in the larva. Imaginal buds which form the legs, wings, mouth-parts and other external organs, are derived from the hypodermis and some of them can be seen by careful dissection of a fully grown caterpillar (fig. 38). The buds which form the internal organs arise from nests of cells in special locations within the existing larval organs, and by their growth and extension build up the new parts necessary. In some insects such as beetles and Neuroptera the internal changes are often relatively simple, but in ants, bees and many flies they are extremely complex. It is during the pupa that the unwanted larval organs have to be broken down and replaced by new growths, and the amount of reconstruction required depends upon how far the structure and functions of the imago differ from those of the antecedent larva. In the blow-fly, for example, practically all the larval organs are broken down in the pupa, and their residue, as it were, serves as nutriment for developing new growths. The actual method of destruction of the larval organs has given rise to much discussion, but most authorities maintain that wandering blood cells, or phagocytes, play an active part, and in fig. 39 are seen certain of the phagocytes destroying a larval muscle. In other insects it is believed that phagocytes either perform a less important part in the process, or take no part at all, and that physiological changes induce the organs concerned to degenerate and break down.



FROM PEREZ, "MÉTAMORPHOSE DES MUSCIDES" (LIBRAIRIE H. DE SOUDIER)

FIG. 39.—DESTRUCTION OF LARVAL MUSCLE BY PHAGOCYTES IN PUPA OF BLOW FLY

CLASSIFICATION AND DISTRIBUTION

The number of described species of insects exceeds 450,000 and though several thousand new ones are discovered yearly, it is believed that the unknown species remain an enormous majority. The classification of this vast assemblage of forms has undergone many changes since Linnaeus' time, though five of his orders are recognized to-day. Most of the classificatory schemes that have been proposed are based primarily upon characters afforded by the mouth-parts, wings and metamorphosis. As many as 37 different orders are adopted by some authorities, but the most generally accepted systems are more conservative in this respect. The classification here adopted includes the following 23 orders (an asterisk indicates a separate article on the subject).

CLASS: INSECTA

Sub-class: APTERYGOTA*

Primitively wingless insects with no true metamorphosis. Abdominal appendages present other than gonopophyses and cerci.

Order I. Thysanura.—Small insects with long, many jointed antennae: abdomen of ten segments and bearing prominent cerci. Includes the bristle-tails.

Order II. Protura.—Very minute insects without antennae: abdomen of 12 segments, cerci wanting.

Order III. Collembola.—Very small insects with four-jointed antennae: abdomen of six segments, sometimes fused together, the first with a sucker-like ventral tube and the fourth usually with a forked springing organ. Includes the spring-tails.

Sub-class: PTERYGOTA

Winged insects (sometimes wingless through loss of flight organs): metamorphosis more or less evident. No abdominal appendages other than genitalia and cerci.

Division I.: EXOPTERYGOTA

Wings developed outside the body: metamorphosis incomplete or scarcely evident in the wingless species.

Order IV. Orthoptera*.—Fore-wings leathery, hind-wings membranous with posterior lobe folded up fan-wise. Prothorax large: mouth-parts for biting, with four-lobed ligula: cerci present. Includes cockroaches, grasshoppers, locusts, crickets, stick-insects and leaf-insects: some forms are wingless.

Order V. Dermaptera.—Fore-wings small leathery flaps, hind-wings large, membranous, complexly folded up. Mouth-parts for biting, with two-lobed ligula: tarsi three-jointed: the body terminated by forceps. Includes the earwigs (*q.v.*), many of which are wingless: also *Hemimerus* and *Arixenia* which are rare wingless forms, without forceps, living on mammals.

Order VI. Plecoptera* (Perlaria).—Soft-bodied insects with long thread-like antennae; wings membranous, folded flat over the back in repose; the hind pair usually largest and with a posterior lobe folded up fan-wise. Mouth-parts for biting, tarsi three-jointed: cerci often elongate. Nymphs aquatic, often with tufted gills. Includes the stone-flies.

Order VII. Ephemeroptera (Plectoptera).—Soft-bodied insects with atrophied mouth-parts and minute antennae. Wings membranous, net-veined, hind pair much the smaller: tarsi one- to five-jointed: cerci long, many-jointed and often accompanied by a median tail-filament. Nymphs aquatic with tracheal gills. Includes the may-flies (*q.v.*).

Order VIII. Odonata (Paraneuroptera).—Large insects with very elongate bodies, large eyes and minute antennae. Two pairs of equal, membranous, net-veined, glassy wings. Mouth-parts for biting: tarsi three-jointed: cerci small, one-jointed. Nymphs aquatic, labium modified into a hinged prehensile organ. Includes the dragon-flies (*q.v.*).

Order IX. Isoptera.—Social insects living in large nests: soft-bodied and generally pale coloured: either with two pairs

of elongate similar wings which are soon shed, or without wings. Mouth-parts for biting: tarsi almost always four-jointed: cerci very short. Wingless forms with rudimentary eyes or none at all and usually of two types: viz., soldiers with large heads and jaws or a pointed rostrum, and workers with normal heads and jaws. Includes the termites (*q.v.*) or white ants. (*See* also SOCIAL INSECTS.)

Order X. Embioptera.—Soft-bodied insects with two pairs of elongate, smoky wings of equal size and with degenerate veins. Mouth-parts for biting: tarsi three-jointed, first joint of fore-pair greatly swollen: cerci, short two-jointed. Females almost always wingless. A small group of insects often living gregariously in silken web-like tunnels and inhabiting warm countries. (*See* SOCIAL INSECTS.)

Order XI. Psocoptera (Corrodentia).—Very small soft-bodied insects, winged or wingless: wings membranous with few veins, anterior pair the larger with extensive stigma. Mouth-parts for biting: tarsi two- or three-jointed: cerci wanting. Includes the book-lice and their allies. The small recently discovered group Zoraptera are sometimes included here.

Order XII. Anoplura.—Very small tough-bodied, flattened, wingless insects living on mammals or birds, with short three- to five-jointed antennae: eyes reduced or wanting. Mouth-parts highly modified either for biting or piercing: tarsi one- or two-jointed: cerci wanting. Includes the true lice or Siphunculata and the bird-lice or Mallophaga. (*See* LOUSE.)

Order XIII. Thysanoptera*.—Minute and very slender insects with short six- to nine-jointed antennae and very narrow wings with long hair-fringes: mouth-parts stylet-like, for piercing: tarsi very short, one- or two-jointed, terminated by a small bladder-like organ: cerci wanting. Metamorphosis with a rudimentary pupal stage. Includes the thrips.

Order XIV. Hemiptera*.—Mouth-parts for piercing and sucking with mandibles and first maxillae stylet-like and lying in a jointed, grooved rostrum formed by the labium. Wings very variably developed, with but few veins, and often wanting. Prothorax large: tarsi with rarely more than three joints: cerci absent. An incipient pupal stage present in some cases. Includes the plant-bugs, cicadas (*q.v.*), leaf-hoppers, frog-hoppers, aphides (*q.v.*) and scale insects.

Division II.: ENDOPTERYGOTA

Wings developed inside the body until the pupal stage, metamorphosis complete.

Order XV. Neuroptera*.—Small to rather large soft-bodied insects with two pairs of usually sub-equal, membranous, net-veined wings which are closed roof-like over the body when at rest: hind-wings without a plicated posterior lobe. Mouth-parts for biting: tarsi five-jointed: cerci absent. Larvae campodeiform, terrestrial or aquatic: pupae free, usually in a silken cocoon. Includes the alder-flies (*q.v.*), ant-lion flies (*q.v.*), mantis flies, lace wings and mealy wings.

Order XVI. Coleoptera*.—Fore-wings modified into horny elytra which meet in a straight line down the back, the hind-wings (where present) membranous and folded beneath them. Prothorax large: mouth-parts for biting: cerci absent. Larvae of various types: pupae free, rarely in a cocoon. Includes the beetles.

Order XVII. Strepsiptera.—Minute insects: the males with branched antennae and degenerate biting mouth-parts. Fore-wings minute club-like scales: hind-wings very large, membranous and plicately folded. The females inert degenerate sac-like parasites living in the bodies of other insects includes the stylops (*q.v.*) and its allies.

Order XVIII. Mecoptera.—Soft-bodied insects with two pairs of similar membranous wings folded flat over the back in repose. Head generally prolonged into a beak: mouth-parts for biting: short cerci present. Larvae eruciform: pupae free, not in a cocoon. Includes the scorpion flies (*q.v.*) and their allies.

Order XIX. Trichoptera*.—Moth-like insects with two pairs of membranous hair-covered wings, with predominantly longitudinal venation: hind pair usually the larger with a plicate posterior lobe. Mouth-parts imperfect, mandibles wanting. Larvae aquatic, more or less eruciform, living in cases: pupae free, with strong mandibles. Includes the caddis flies (*q.v.*).

Order XX. Lepidoptera*.—Small to very large insects usually densely clothed with flat scales. Mouth-parts suctorial: first maxillae usually modified into a spirally coiled proboscis: mandibles almost always absent. Larvae terrestrial, eruciform, with several pairs of abdominal feet: pupae obtected or partially free, usually in a cocoon. Includes the butterflies and moths.

Order XXI. Diptera*.—Insects with a single pair of membranous wings: hind pair modified into minute knobbed organs or halteres: rarely wingless. Mouth-parts for sucking or for piercing also, and elongated to form a proboscis. Larvae vermiform: terrestrial, or parasitic or more rarely aquatic: pupae free or coarctate. Includes the true flies (*q.v.*).

Order XXII. Siphonaptera. (Aphaniptera).—Very small wingless insects, laterally flattened, with tough integument. Mouth-parts for piercing and sucking. Blood-sucking parasites living on warm-blooded animals. Larvae vermiform: pupae free, in a silken cocoon. Includes the fleas (*q.v.*).

Order XXIII. Hymenoptera*.—Wings tough and membranous: hind pair the smaller and connected with fore pair by a series of minute hooks. Mouth-parts for biting and licking: labium usually modified into a tongue of variable length. Prothorax small and ring-like: abdomen usually basally constricted to form a waist, its first segment fused with the thorax: a sawing or piercing ovipositor present. Larvae eruciform or vermiform but sometimes embryonic: pupae usually in a cocoon. Includes the saw-flies, ants, bees, wasps and ichneumon flies and their allies (*qq.v.*): *see* also SOCIAL INSECTS.

Geographical Distribution.—The class Insecta as a whole, is cosmopolitan as are almost all its individual orders. The range of any great group of animals is governed by many factors, whose individual effects are difficult to evaluate separately. In the case of insects the possession of wings is a feature of supreme importance, since it imparts to its possessors a capacity for dispersal lacking in other terrestrial animals not so endowed. The power to disperse freely allows a species to escape from intense competition, and the effects of rigid selection which results from overcrowding within limited areas. Habits and food-supply are clearly also highly important: aquatic insects cannot exist where there is no water and bark beetles are not to be found on steppes or plains devoid of all trees. Yet, on the other hand, many insects have a distribution much more restricted than their available food, climatic and other barriers precluding their spread. High mountain ranges may present insuperable obstacles by way of climate and changed vegetation, while deserts and oceans are even more powerful barriers to the dispersal of almost all insects. Many facts of distribution, however, cannot be interpreted under present conditions of the earth's topography and climates, and recourse has often to be made to a study of geological changes. The close similarity of the insects of Europe and North America, for example, is explained on the basis of a former more favourable climate in the Arctic region, when it did not interpose as a barrier to dispersal as happens under the frigid conditions of to-day. The presence of allied spring-tails in New Zealand and Chile suggests a former extension of the Antarctic continent between them, since such delicate insects can scarcely be credited to have attained their present distribution by other means. There are again insects which exhibit a wide but discontinuous distribution, such groups often appearing to be scattered remnants of forms which once enjoyed an extensive, continuous range, but now widely separated by climatic or topographic changes. Moths of the family *Uraniidae* and butterflies of the genus *Erebia* exhibit a distribution of this character.

Some individual insects are almost cosmopolitan and possess great capacity for migration and of adaptation to changed conditions. Examples of such species include the hawk-moth *Celerio lineata*, and the butterflies *Pyrameis cardui* and *Anosia plexippus*. The extensive distribution of the spring-tail *Hypogastrura armata* has been accounted for on the basis of former land-connections between certain of the great continents, as already alluded to. Other cosmopolitan insects such as the house-fly and many beetles

affecting grain and other stored products have attained their wide dispersal through human agencies.

The spring-tails have the widest range of any group of insects and have adapted themselves to the greatest diversity of surroundings, while ants approach them very closely in these two respects. Ants, as W. M. Wheeler remarks, are found "from the Arctic regions to the Tropics, from timber line on the loftiest mountains to the shifting sands of the dunes and sea-shores, and from the dampest forests to the driest deserts." More detailed facts relative to insect distribution are given in the separate articles devoted to the principal orders.

Geological Distribution.—Insects are relatively scarce as fossils and are only found in certain geological formations especially favourable for their preservation. Most of the specimens probably originally got drowned, and were quickly covered with silt or other deposits before they had time to decay; consequently the richest remains occur in vegetable deposits such as coal, lignite and peat, and in ancient fresh-water basins. A great many also occur in amber where they became entangled in the resin, which quickly enveloped them, thus securely sealing them up in a wonderful condition of preservation. Among the most famous localities for fossil insects are the Carboniferous rocks of Commentry, France, the Permian beds of Kansas and of New South Wales, the Triassic beds of Queensland, the lithographic limestones of Jurassic age in Bavaria, the Oligocene shales of Florissant in Colorado, the Miocene beds of Oeningen in Bavaria and Baltic amber of the same period.

The study of fossilized remains indicates that no undisputed insect has been found earlier than Upper Carboniferous times and even these very ancient insects were already highly evolved, affording little information as to the ancestry of the class as a whole. The oldest known insects are all Exopterygota and comprise totally extinct orders, some of which are allied to the existing Orthoptera and others (Palaeodictyoptera) exhibit the combined characters of several of the most generalized living orders; included among these fossils are also ancestral dragon-flies of gigantic size. The only still existing insects represented in Carboniferous times are the cockroaches, which have persisted with relatively little modification through the intervening ages to the present day. In Lower Permian times the first true dragon-flies appear, with Ephemeroptera, Hemiptera and some anomalous insects (Protohymenoptera), which are regarded as the far-off ancestors of the Hymenoptera. In rocks of this age there are also found the earliest remains of the Endopterygota which are represented by some small species of Mecoptera. In the Upper Permian are found the first recorded Coleoptera and Neuroptera together with some remarkable insects (Paramecoptera) which are held to be the ancestors of Lepidoptera, Trichoptera and Diptera. It is not until Jurassic times that true Diptera and Trichoptera appear, while Hymenoptera are first found in the Cretaceous and the oldest Lepidoptera are of Oligocene age. In rocks of later date the insect remains are very like those of living forms and those found in Baltic amber even belong to existing genera.

A survey of fossil insects shows that the Exopterygota appeared first and though no remains of the most primitive insects (Thysanura) have been found till Tertiary times, it is probable that their delicate organization has not favoured their preservation through the great periods of time when they presumably were existing. Although the Endopterygota are of great antiquity, those orders which are most specialized and exhibit the greatest differences between the larva and the imago were the last to appear. Further details respecting fossil insects will be found in separate articles dealing with the principal orders.

NATURAL HISTORY

The Life-cycle.—In temperate and cold regions the life-cycle of most insects involves a period of dormancy or hibernation during the winter months, whereas in the uniform hot and moist climate of the Tropics, hibernating does not exist and one generation succeeds the other without any such dormant period. Hibernation may take place in any stage in the life-cycle in different insects. Among British butterflies, for example, the Hairstreaks hibernate as eggs, the White Admiral, Fritillaries, etc., overwinter as larvae, the garden whites and others as pupae and the Brimstone, Peacock and Tortoiseshells pass the winter as perfect insects, sheltering in old buildings, hollow trees and other likely situations.

Some insects such as the Cotton Boll Weevil may pass through as many as eight generations in the year, while on the other hand, the click beetle (*Agriotes obscurus*) requires about five years to complete a single generation, most of that period being spent as a larva. The house-fly under favourable conditions of food, temperature and moisture can complete its life-cycle in ten days, but the shortest cycle is found in some minute Chalcid wasps whose larvae live as parasites in the eggs of other insects, and require only seven days from when their eggs are laid till the perfect insects appear.

Plant-relations.—A vast number of insects only exist in association with vegetation and every kind of phanerogamic plant, and every part of the plant may serve as food for one or other species of insect. Larvae of moths, saw-flies and many beetles feed openly and devour the foliage, and other larvae live concealed within the leaves, stems, roots or the solid wood. Thrips, aphides and other plant-bugs pierce the plant-tissues and extract the sap. There are also insects which confine themselves to devouring the flowers, seeds or even the pollen, while bees and many moths and flies imbibe nectar. There are again other insects which, instead of destroying plants, modify them in such a way as to produce abnormal growths, or galls, which serve as food and shelter for their larvae. Most galls are produced by gall-wasps (*Cynipidae*), gall-midges (*Cecidomyidae*) and certain saw-flies while a few are produced by beetles, aphides and other insects. The actual cause of gall-formation has been much discussed and these growths are due to the activity of the meristem under the influence of a definite stimulus. In some cases gall-formation follows immediately after the insect has laid its eggs in the plant-tissues and in these instances it is believed to be due to a secretion injected into the plant at the time of egg-laying, since the gall develops after the egg has been killed by puncturing with a needle. In other cases it is induced by the presence of the larva, the gall not developing till after the insect has issued from the egg.

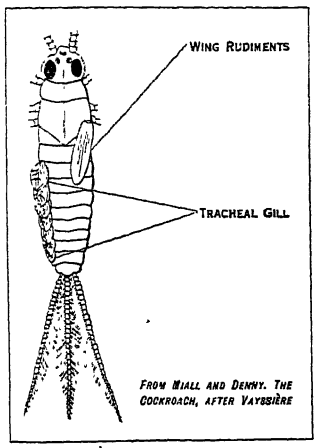
The relationship between insects and flowers is mutually beneficial: insects obtain nectar and pollen and in return ensure cross-pollination by transferring the pollen from the stamens of one flower to the stigma of another. Flower-haunting insects often exhibit special structural modifications enabling them to suck nectar from deeply seated nectaries, and bees are provided with organs for pollen-collecting. Flowers in their turn are coloured or otherwise ornamented to attract insect-visitors and their scents are believed to serve the same purpose. Most flowers are also so constructed that insects inevitably pollinate them, and many such as orchids, iris, yucca, etc., are formed so that pollination is effected in a particular manner.

Among the lower plants affected by insects, fungi of various kinds afford sustenance and shelter to many small beetles and their larvae, along with those of fungus-midges and other flies. Certain of the primitive fungi are pathogenic to insects, entering and spreading within their bodies and ultimately killing them. Mention needs also to be made of species of ants and termites which cultivate fungi within special recesses of their nests where they serve to feed the brood. Lichens are fed upon by various moth larvae, but liverworts, mosses and ferns support comparatively few insects.

Scavengers.—Not only living plants afford food and shelter for insects, but decaying vegetable matter is also resorted to by a vast number of beetles and flies, together with certain of the spring-tails. Dung affords sustenance for many insects as well as decomposing carcasses and animal remains of all kinds. In a large degree the activities of scavenger insects are beneficial in facilitating the rapid decomposition of all kinds of decaying material.

Aquatic Insects.—A considerable number of insects are aquatic and are found in fresh water, while a few occur in saline waters and in the sea. Among fresh-water insects some are aquatic

throughout their life, notably beetles of the family *Dytiscidae*, which live habitually submerged, and water-bugs or pond-skaters (*Hydrometridae*) which are surface dwellers. The Whirligig beetles (*Gyrinidae*) live submerged as larvae, but the adult beetles congregate in companies on the surface. A far greater number of insects are aquatic only in their immature stages, the adults being aerial: familiar examples are midges, mosquitoes, stone-flies, may-flies, caddis-flies and dragon-flies. All aquatic insects are believed to have been derived from terrestrial ancestors and have become adapted in diverse ways to their special mode of life: these adaptations mainly concern locomotion and respiration. Among beetles and water-bugs the swimming legs are flattened and oar-like, often fringed with closely set hairs, and form efficient paddles. Respiratory modifications are numerous and in pond-skaters the body is clothed with a dense velvety pile which renders them incapable of being wetted, and also serves to retain a coating of air around the insect when submerged: in this manner a supply of oxygen is provided for breathing and the insect can remain immersed till it is used up. Some beetles carry a supply of air beneath the elytra when submerged, while others descend with a bubble of air at the apex of the abdomen. Water-scorpions are provided with a kind of caudal respiratory tube and, when necessary, protrude the apex of this siphon through the surface film: air passes down this channel to enter a pair of spiracles situated at its base. Mosquito larvae breathe by means of a caudal siphon of a different character: it bears a pair of spiracles at its apex and air enters the tracheal system directly, when the siphon breaks the surface film. Many other insects breathe the oxygen dissolved in the water: such insects either possess gills or respire cutaneously. Gills are outgrowths of the integument containing tracheae or more rarely only blood. In may-fly nymphs (fig. 40) they are commonly in the form of lamellae attached to the sides of the abdomen, while in many dragon-fly nymphs they lie within the terminal chamber of the gut, water being inhaled and exhaled through the anus. The so-called bloodworms or larvae of certain midges (Chironomidae) are remarkable in that the blood contains haemoglobin and respiration takes place through the skin.



FROM VAYSSIÈRE, "ANNALES DES SCIENCES NATURELLES" (G. MASSON)

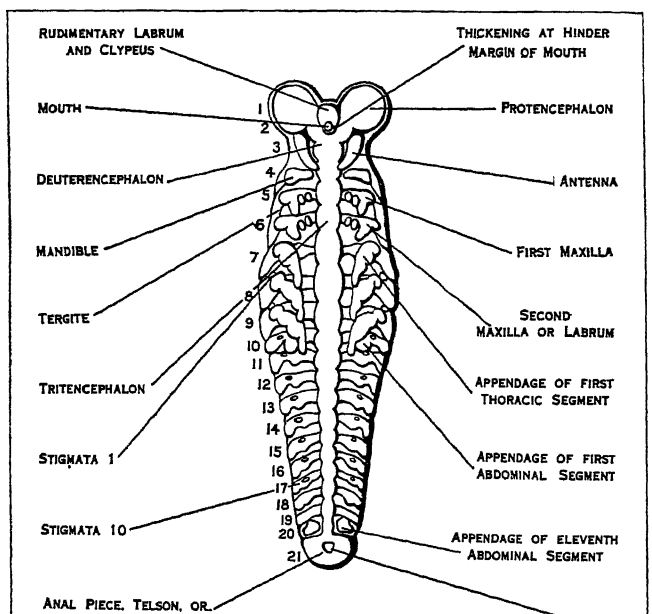
FIG. 40.—NYMPH OF MAY-FLY

The open sea is almost devoid of insect life excepting for a few midge larvae that have been dredged from tolerably deep water and the Hemipterous genus *Halobates* which frequents the surface of warm oceans often far from land. Between tide levels the shore is inhabited by the spring-tail *Anurida maritima*, a few beetles and their larvae and certain flies: These insects, or at least their larvae, are immersed during each tide when they retreat under stones or in the sand, while some midge larvae remain continuously submerged. Those of the European genus *Clunio* occur in rock pools along with the curious wingless females, while the males, which are winged, skim over the water surface. Loss of wings is a common feature of marine insects and it has been explained as an advantage which prevents such insects being blown out to sea.

Predators and Parasites.—There are diverse groups of insects that have adopted close relations with respect to food and shelter not only with other insects, but also with vertebrate animals. Many insects such as ground beetles and their larvae are predators which seek out and devour other insects as food: or the relations may be of a closer nature and the prey becomes the host, as happens in the case of parasites. Some parasitic insects live externally on their hosts and are termed *ectoparasites*, while others—*endoparasites*—live within the bodies of their hosts. Fleas and lice, for example, are ectoparasites of warm-blooded animals from whose bodies they extract blood as their food. The grubs of warble flies are endoparasites of mammals, while those of Ichneumon flies and Tachinid flies live within the bodies of other insects which they finally kill. Some very minute Hymenoptera are endoparasites of the eggs of various insects, finding therein sufficient nutriment to complete their transformations: other parasites attack only larvae or pupae and a few confine themselves to adult insects. A parasite may, in its turn, be parasitized by smaller insects of similar behaviour which are termed secondary parasites or *hyperparasites;* tertiary or even quaternary parasites are also known and provide the most complex examples of hyperparasitism.

Parasitic insects exhibit varying degrees of adaptation to their mode of life: some ectoparasites are very little modified except that their claws are specially developed for clinging to their hosts and wings are totally absent. Among endoparasites all traces of limbs and sense organs are wanting, these degenerative changes being adaptations to a life in which the necessity to seek out food is no longer present. The tracheal system is often totally absent but, on the other hand, the integument is unusually thin so as to allow of the passage of oxygen contained in the blood of the host, at whose expense such parasites feed and respire. During most of their life endoparasites avoid the vital organs of their hosts and feed largely upon the blood and fat-body, since their own death would speedily follow that of the insects they parasitize: for the same reason such parasites do not void the contents of the gut till the last moult. One of the most advanced types of parasitism is found in the stylops and its allies where the female, after issuing from the egg, spends its whole life as an endoparasite in the body of a bee or a leafhopper. The adult is a degenerate sac-like creature specially adapted for this mode of life. The male stylops is a parasite only as a larva and finally emerges as an active winged insect.

Inquilines.—Certain insects instead of devouring others feed at their expense and are termed inquilines. The latter are numerous in the nests of social insects and a well-known example is the wax-moth whose larvae live in bee-hives and destroy the comb.



FROM HEYMONS, "ZEITSCHRIFT FUR WISSENSCHAFTLICHE ZOOLOGIE" (AKADEMISCHE VERLAGSGESELLSCHAFT)

FIG. 41.—MORPHOLOGY OF AN INSECT

Larvae of the hover flies (*Volucella*) live in the nests of bumble-bees and wasps, where they feed on waste organic material. The curious bristle-tail *Atelura* occurs in ants' nests and is stated to live by imbibing the food which is being actually regurgitated from one ant to another. There are again other insects which benefit their hosts in return for their keep. Thus, certain beetles obtain food and shelter in ants' nests and provide the ants in return with cutaneous secretions that are much sought after by their hosts. In extreme cases the association is even more intimate, the guest beetles being actually fed by the ants in return for the secretions

provided, thus affording an example of symbiosis or mutual benefit. (*See* SOCIAL INSECTS.)

Gregariousness and Social Life.—Although the vast majority of insects are solitary in habit, individuals of certain species associate together collectively and are said to be gregarious. Whirligig beetles, for example, associate in companies on the surface of the water: locusts and some butterflies become gregarious when migrating and ladybirds at times congregate in masses. Some caterpillars are gregarious and members of a brood live in a common web spun over the food-plant: such companies usually disperse, as the food becomes used up, and its members live independently. There are again other insects such as the earwig and the mole cricket in which the female guards the eggs and the young brood. A solitary bee of the genus *Halictus* constructs its cells in a group around a common entrance tunnel in the ground: these cells are provisioned and guarded by the parent, who may even survive till the daughter bees emerge. Examples of this kind where the parent guards and tends the offspring, at least during their early life, foreshadow the beginnings of social life. The latter exhibits its own peculiar features in different groups of insects which have developed the social habit, but in all cases each society is a family consisting of two parent insects, or at least the fecundated female, and the offspring, and the members of the two generations live together in a common abode or nest in mutual co-operation. True social insects include several groups of wasps and bees, together with the ants and termites. In the highest grades of social life specialization of certain individuals to perform specific functions for the common good is attained and a system which exhibits striking parallels in behaviour with human society has been developed. (*See* SOCIAL INSECTS.)

PHYLOGENY

Ancestry of Insects.—It is conceded that the most primitive insects are the bristle-tails (*Thysanura*) and these lowly creatures betray certain characters which are to be regarded as inheritances from an ancestral stock. The embryonic development of insects also reveals primordial characters: the evanescent appendages just behind the antennae and those borne on the abdominal segments in generalized insect embryos, indicate that the ancestors of insects carried five pairs of head appendages and had a body of 15 segments, all of which except the last bore limbs. Those carried on the first three body segments (legs of insects) and on the 14th segment (cerci) were evidently more important than the intervening pairs, of which traces only remain in some larvae and in the Apterygota. It seems clear, therefore, that the ancestors of insects were many-legged animals and the nearest approach to such progenitors is to be found in certain small, white creatures living in moist earth and represented by *Scolopendrella* and its allies. They form the class Symphyla which is related to the Chilopoda (centipedes) and Diplopoda (millipedes). Structurally the Symphyla have so many features in common with such bristle-tails as *Campodea* and *Anajapyx* as to justify affinity between the two groups. Other Thysanura, such as *Machilis* and its allies, show features in common with the higher crustacea particularly with regard to the mouth-parts. It must also be remembered that the small evanescent appendages found behind the antennae in some insect embryos, are to be regarded as relics of the second pair of feelers only found in Crustacea. The foregoing remarks indicate very briefly that it is probable that the ancestors of insects had features in common with the Symphyla and through them with the Chilopoda and Diplopoda, but at the same time, these ancestors were derived from a stock from which the Crustacea also arose. The Arachnida, or spiders and scorpions, are only very remotely related to insects and evidently diverged very early in their evolution from the primordial arthropod stock. (*See* also ARTHROPODA.)

Origin of Wings.—The Thysanura are eminently terrestrial insects, devoid of wings, and undergo no metamorphosis. Since they are the most primitive known insects and the majority of that class are winged creatures, the derivation of the latter from the Thysanura is largely involved in the origin of wings. Many authorities believe that wings first arose as small lateral expansions of the tergal region of the thoracic segments. During their evolution these expansions became sufficiently large to function after the fashion of parachutes in insects which possessed a tendency to leap. At a later stage they acquired direct articulation with the thorax, became supplied with tracheae and developed the power of independent motion. By others it is contended that wings were derived from plate-like thoracic tracheal gills which had lost their original function and became adapted for purposes of flight. Such gills, it is maintained, resemble those found in many may-fly nymphs, and the theory implies that the ancestors of winged insects became temporarily aquatic and thus acquired gills, which developed into wings when their possessors resorted to the land for a second time.

Relationships of the Orders of Insects.—The most generalized orders of winged insects are all included in the division Exopterygota, but among this assemblage of forms several divergent lines of evolution are evident. The Orthoptera are the most primitive living winged insects and were probably more or less directly derived from Thysanuran ancestors. The Dermaptera, Isoptera and Embioptera are all more closely related to the Orthoptera than to any other order of insects. The Plecoptera exhibit many primitive features allying them with the Orthoptera, but their immature stages are aquatic as are those of the Odonata and Ephemeroptera. The two latter orders exhibit certain mutual relationships and are to be regarded as rather isolated developments from original Orthopteran ancestors. The Hemiptera and Thysanoptera have much in common: both orders are highly specialized with piercing mouth-parts and although originally descended from insects with jaws of the normal biting type, they have left little trace of their original lines of evolution. The Anoplura are degenerate parasites which are perhaps related through the Psocoptera with Orthopteroid ancestors. The Endopterygota are more closely related to each other than to any of the Exopterygota and no connecting links between the two divisions have so far been discovered. It is true that an incipient pupal stage is present among Termites and in some of the Hemiptera, and even among certain members of the latter order the wings develop internally, but these instances appear to be rather nature's experiments towards an endopterygote condition than evidence of lines of descent of any of the true endopterygote orders. The fossil order Paramecoptera appears to be the forerunner of almost all the higher orders of insects and the direct ancestors of the existing Mecoptera. The latter, along with the Neuroptera, Lepidoptera, Trichoptera and Diptera, form an interrelated complex, which attains its highest specialization in the last-mentioned order. The Hymenoptera lie outside this complex but there appears to be evidence that the fossil order Protohymenoptera is the far-off progenitor of the group, and possibly serves to connect them with a Paramecopteran stock. The Coleoptera and the related Strepsiptera exhibit little or no indications of their affinities: the campodeiform larvae of many beetles are primitive in type and not unlike those of Neuroptera and it is probable that the order arose as an early offshoot in the endopterygote series. The Siphonoptera or fleas likewise leave little trace of their descent, but in their metamorphoses they come nearer to the Diptera than to any other order and they are accorded a position next to the Diptera in the more generally accepted recent systems of classification.

See the articles COLEOPTERA; DIPTERA; HEMIPTERA; HYMENOPTERA; LEPIDOPTERA; NEUROPTERA; ORTHOPTERA; PLECOPTERA; THYSANURA; TRICHOPTERA.

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For luminous insects *see* E. N. Harvey, *The Nature of Animal Light* (Philadelphia, 1920), and for cave insects consult R. Jeannel, *Faune Cavernicole de la France* (1926).

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(A. D. I.)

INSEIN, a town and district of Lower Burma in the Pegu division, lying immediately to the north of Rangoon. Area 1904 sq.m.; pop. (1921) 293,083. The district includes a large tract of the Irrawaddy delta on either side of the Hlaing or Rangoon river and on the east of the Irrawaddy itself. In the west the district includes a portion of the southern end of the Pegu Yomas, there, clothed with dense evergreen forest which, in spite of its nearness to Rangoon, is still the haunt of wild elephants. The Rangoon-Prome line of the Burma railways runs through the district.



BY COURTESY OF THE NORTHERN BAPTIST CONVENTION

BURMA SCHOOL-GIRLS AT INSEIN ACADEMY, WEARING NATIVE DRESS

INSEIN, the chief town, lies 10 m. N.W. of Rangoon, of which it is now almost a suburb. It has a population (1921) of 14,308, has railway workshops, a Government engineering school and a large gaol.

INSOMNIA, or the inability to sleep adequately, is a common enough symptom in modern life and varies greatly in degree. Our understanding of its underlying causes is often rendered the more difficult because of our lack of knowledge concerning the exact physiology of normal sleep.

Three varieties of insomnia may be roughly distinguished: the inability to fall asleep at the onset for a variable period; the frequent awakening with incapacity to resume sleep for some time; the waking up at an unduly early hour with no subsequent sleep. Every individual case must be investigated carefully on its own merits, and the physician is frequently taxed to the utmost to combat the symptom on rational and not empirical lines. The responsible causes may have a bodily basis or must be sought in the mind. Among the former must be enumerated the evident factors of pain or discomfort from any cause: shortness of breath, cough, frequency of urination, itching, palpitation. Febrile conditions, high blood-pressure and other circulatory disturbances, toxic states and organic disease of the brain are also liable to be responsible.

In many forms of mental derangement insomnia is a frequent symptom and often heralds its inception. This is specially so in anxiety conditions, where unpleasant dreams may exaggerate the sleeplessness, and here the sufferer may fear to lose consciousness because of these experiences which he cannot control. In neurasthenia and many hysterical states insomnia is likely to be prominent. In such psychoses as manic-depressive insanity, dementia praecox, confusional insanity and general paresis, such a symptom is generally part of the clinical picture.

The advent of insomnia should never be regarded lightly but means should at once be taken to trace its root if possible. The appropriate treatment will depend upon the physical or mental origin. Attacking the symptom only is highly unscientific. Though indiscriminate sedative drugging must be deprecated, the possible harm from the medical administration of hypnotics is much exaggerated. Good sleep thus brought about may cut short a mental illness. In mild cases simple measures may do much while severe insomnia may be highly intractable. The use of suggestion or hypnosis is occasionally beneficial. (C. S. R.)

INSPIRATION is strictly the act of drawing physical breath into the lungs as opposed to "expiration." Metaphorically the term is used generally of analogous mental phenomena; thus we speak of a sudden spontaneous idea as an "inspiration." The term is specially used in theology for the condition of being directly under the divine influence, as the equivalent of the Greek *θεοπνευστία* (2 Timothy iii. 16). Similar in meaning is *ἐνθουσιασμός,* enthusiasm (from *ἐνθουσιάζω* from *ἔνθεος*). Possession by the divine spirit (*πνεῦμα*) was regarded as necessarily accompanied by intense stimulation of the emotions.

The Doctrine of Communion.—The possibility of a human being becoming the habitation and organ of a divinity is generally assumed in the lower religions. In the popular religion of China some of the priests, the *Wu,* claim to be able to take up into their body a god or a spirit, and thereby to give oracles. The Maoris at the initiation of the young men into the tribal mysteries sing a song, called "breath" to the mystic wind by which they believe their god makes his presence known. An Australian woman claimed to have heard the descent of the god as a rushing wind. In some savage tribes blood is drunk to induce the frenzy of inspiration; music and dancing are widely employed for the same purpose. Dionysus, the god of wine in Greece, was also the god of inspiration; and in their orgies the worshippers believed themselves to enter into real union with the deity. In Delphi the Pythia, the priestess who delivered the oracles, was intoxicated by the vapour which rose from a well, through a small hole in the ground. As the oracles were often enigmatic, they were interpreted by a prophet. In Rome the inspiration of Numa was derived from the nymph Egeria; and great value was attached to the books of the Cumaean Sibyl. In Arabia the *kahin* (priest) was recognised as the channel of divine communication. Inspiration may mean only possession by the deity, or it may mean further that the person so possessed becomes the channel through which the deity reveals his word and will. (*See* J. A. Macculloch's *Comparative Theology,* chap. xv., 1902.)

Prophecy in the Old Testament in its beginnings is similar to the phenomenon in other religions (1 Sam. ix. 8, x. 10–11). The prophesying in which Saul took part probably included violent

movements of the body, inarticulate cries, a state of ecstasy or even frenzy. The phrase "holy spirit" in Acts, as applied to the Apostolic Church, probably indicates a similar state of religious exaltation; it was accompanied by speaking with tongues, inarticulate utterances which needed interpretation (1 Cor. xiv. 27). In every religious revival, when the emotions are deeply stirred, similar phenomena are met with. Such a movement was Montanism in the 3rd century. At the Reformation, while Luther was at the Wartburg, fanaticism broke out, and spread from Wittenberg; prophets went about declaring the revelations which they had received. The Evangelical revival in the 18th century also had its abnormal religious features. The Revival in Scotland in 1860 was marked by one curious feature—the Gospel dance—when in their excitement men and women got up and spun round and round till they were exhausted. Spontaneous praise and prayer marked the revival in Wales in 1905–06.

Prophecy, as represented by the writings of the prophets, arose out of this state of religious exaltation, but left behind many of its features. The function of the prophets was to interpret the course of history as the divine providence for the chosen people Israel, so as to communicate God's Word and Will in judgment or in mercy. They were divinely endowed for this function by their inspiration. While these prophets seem to have continued in the exercise of all their normal faculties, which were stimulated and not suppressed, yet they do claim a distinctive divine activity in their consciousness, and distinguish with confidence their own thoughts from the revealed word. That abnormal psychic states, such as visions and voices, were sometimes experienced is not improbable (*see* Theodore H. Robinson, *Prophecy and the Prophets*), but the usual prophetic state seems to have been one of withdrawal of attention from the outer world, absorption of interest in the inner life, devout communion and intercession with God, and the divine response in a moral or a spiritual intuition rather than an intellectual ratiocination. Possession by the Spirit in its external manifestations is ascribed to Gideon, Jephthah, Samson, Saul, Elijah; but even when the same language is used of the later prophets, it is probably such an inward state as has just been described which is to be assumed.

A feature inseparable from this later phase of prophecy is *prediction.* For the warning or the encouragement of the people the prophet as Jehovah's messenger declares what He is about to do. Thus the fall of Samaria in 722 B.C., the deliverance of Jerusalem in 701, the overthrow of the kingdom of Judah in 586, the return from exile in 537 were all heralded by prophecy. This prediction was no shrewd political conjecture, but an application to existing conditions of the permanent laws of God's government. The abnormal phenomena of inspiration, the presence and operation of the Holy Spirit, in the Apostolic Church, have already been noticed.

The New Testament.—While Paul does not deny nor depreciate these charisms, as tongues, miracles, etc., he commends as the more excellent way the Christian life in faith, hope and love (1 Cor. xii. 31). The New Testament represents the Christian life as an inspired life. It is living communion with Christ, and therefore constant possession of the Holy Spirit. Every Christian, in the measure in which he has become a new creature in Christ, is a prophet, because he knows by the enlightening of God's Spirit "what is the good and acceptable and perfect will of God" (Romans xii. 2). An occasional state of divine possession in the other religions becomes in the prophets of Israel a permanent endowment for a few select agents of God's revelation; but when that revelation is consummated in Christ, inspiration becomes the universal privilege of all believers.

Apologetics.—While there is much superstition in the view of inspiration found in many religions, and much imposture in the claims to the possession of it, yet it would be illogical to conclude that this feature of religion is altogether human error and not at all divine truth. Man's knowledge of God is conditional, and therefore limited by his knowledge of the world and himself, and has accordingly the same imperfection. The reality of a divine communion and communication with man is not to be denied because its nature has been imperfectly apprehended. We must estimate the worth of inspiration by the higher and not the lower stages, by the vision of an Isaiah or the consecration of a Paul; but at the same time we must be prepared to recognise its lowly beginnings.

In dealing with the inspiration of the Bible, to which the use of the term has in the Christian Church been largely restricted, it is important to remember that inspiration is primarily personal; and that it assumes varied forms and allows varying degrees.

Other religions besides Christianity possess their sacred scriptures and the claim of inspiration is advanced for some of them, as by Hinduism for the *S'ruti* (hearing) writings as distinguished from the *Smriti* (recollection), Zoroastrianism for the Zend-Avesta, Islam for the Koran. But Buddhism advances no such claim for its *Tripitaka* (three baskets), nor Confucianism for its classics.

Exegesis.—The Pentateuch was accepted as authoritative law by the Jewish Church in 444 B.C. About two centuries later the Prophets (including the histories as well as the prophetic writings proper) were also acknowledged as sacred scriptures, although of inferior authority to the Law. In the century before the Christian era the Writings, including Psalms and Proverbs, were included in the Canon. Palestinian and Hellenistic Judaism disagreed about the recognition of the books now known as the Apocrypha. The writers of the New Testament use the Old Testament as holy scriptures, as an authoritative declaration of the mind and will of God; but the inaccuracy of many of the quotations, together with the use of the Greek translation as well as the original Hebrew, forbid our ascribing to them any theory of verbal inspiration. By the middle of the 2nd century the four Gospels were probably accepted as trustworthy records of the life of Jesus. The Epistles were accepted as authoritative in virtue of apostolic authorship. By the end of the 3rd century the use and approval of the churches had established the present canon.

The doctrine of the inspiration of these writings in the Jewish and Christian Church now claims attention. Inspiration is first of all ascribed to persons to account for abnormal states, or exceptional powers and gifts; in this doctrine it is transferred to writings, and its effects in securing for these inerrancy, authority, etc., are discussed with little regard for the psychic state of the writers.

The New Testament affirms the inspirations of the Old Testament (Matt. i. 22, xv. 4, Mark xii. 36, Acts i. 16, Romans iii. 2, ix. 25, Heb. i. 1, 1 Peter iv. 11). The term is used in regard to the Scriptures in 2 Timothy iii. 16. The Spirit of Christ is said to have been in the prophets (1 Peter i. 11); and it is affirmed that "no prophecy ever came by the will of man; but men spake from God, being moved by the Holy Spirit" (2 Peter i. 21). The constant use of the Old Testament in the New confirms this doctrine of inspiration.

Contemporary Jewish thought, as expressed by Philo, Josephus, and the Talmud according to Weber, was in agreement with this view of the Old Testament. But the nature of this inspiration must be more closely defined, and hence have arisen a number of theories of inspiration which can be only briefly mentioned. The theory of *verbal inspiration,* which was held by Plato, Philo, the Apologists, the Fathers, and the Protestant Scholastics, ignores the data which the Bible itself offers. The theory of *dynamic influence or degrees of inspiration* recognises that the human personality is not entirely suppressed by the direction and control of the Spirit; but it does not offer us any sure guidance in discriminating the human and the divine factor, and in estimating the value of the contents of the Bible. The theory of *essential inspiration* in claiming inspiration only in matters of doctrine and conduct (anticipated in Aquinas' distinction of *direct* and *indirect* inspiration, and favoured by Erasmus, Hugo Grotius, Baxter, Paley, etc.) betrays a too intellectualist standpoint in the emphasis it lays on correctness in theology and ethics, and ignores the progressive character of revelation.

Protestantism.—The theory of the Reformers (though not of their successors, the Protestant scholastics)—might be called that of *vital inspiration,* as its emphasis is on religious and moral life rather than on knowledge. While giving to the Scriptures supreme authority in all matters of faith and doctrine, the Reformers laid

stress on the use of the Bible for edification; it was for them primarily a means of grace for awakening and nourishing the new life in the hearts of God's people. By the enlightening work of the Spirit of God the Word of God is discovered in the Scriptures: it is the *testimonium Spiritus Sancti* in the soul of the Christian that makes the Bible the power and wisdom of God unto salvation. By thus laying stress on this redemptive purpose of the divine revelation, the Reformers were delivered from the bondage of the letter of Scripture, and could face questions of date and authorship of the writings frankly and boldly. Hence a pioneer of the higher criticism in Great Britain, W. Robertson Smith, was able to appeal to this Reformation doctrine (quoted in Denney's *Studies in Theology*, p. 205). The Reformers' application of this theory to the Bible was necessarily conditioned by the knowledge of their age; but it is a theory wide enough to leave room for our growing modern knowledge of the Bible.

Résumé.—Briefly stated, these are the conclusions which our modern knowledge allows. (1) Inspiration, or the presence and influence of the Divine Spirit in the soul of man, cannot be limited to the writers of the Scriptures; but, comparing the Bible with the other sacred literature of the world, its religious and moral superiority cannot be denied, and we may, therefore, claim for it as a whole a fuller inspiration. (2) As different writings in the Bible have more or less important functions in the progressive divine revelation, we may distinguish degrees of inspiration. (3) This inspiration is primarily personal, an inward enlightening and quickening, both religious and moral, of the writer, finding an expression conditioned by his individual characteristics in his writing. (4) The purpose of inspiration is practical; the inspired men are used of God to give guidance in belief and duty by declaring the word and will of God as bearing on human life. (5) As revelation is progressive, inspiration does not exclude defects in doctrine and practice in the earlier stages and their correction in the later stages of development. (6) As the progressive revelation culminates in Christ, so He possesses fullest inspiration; and it varies in others according to the closeness of their contact, and intimacy of their communion with Him. (7) As the primary function of Christ is redemptive, so the inspiration of the Bible is directed to make men "wise unto salvation." (8) It is the presence and influence in the souls of men of the same Spirit of God as inspired the Scriptures which makes the Bible effective as a means of grace; and only those who yield themselves to the Spirit of God have the witness in themselves that the Bible conveys to them the truth and the grace of God.

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INSTALLATION, the action of installing or formally placing some one in occupation of an office or place. The word is used of the ceremonial induction of an ecclesiastic, such as a canon or prebendary, to his stall in his cathedral choir. Similarly knights of an order of chivalry are ceremonially led to their stalls in the chapel of their order.

INSTALMENT PURCHASE, in the law of contract, a form of purchase of goods on a system of extended credit. Originally applied to the sale of the more expensive kinds of goods, such as pianos and articles of furniture, the instalment system has now been extended to almost every description. The agreement is usually in writing, with a stipulation that the payments to purchase shall be by weekly, monthly or other instalments. The agreement is virtually one to purchase, but in order that the vendor may be able to recover the goods at any time on non-payment of an instalment, it is treated as an agreement to let and hire, with a provision that when the last instalment has been paid the goods shall become the property of the hirer. A clause provides that in case of default of any instalment, or breach of any part of the agreement, all previous payments shall be forfeited to the lender, who can take possession of the goods. Such agreements, therefore, do not pass the property in the goods, until all the instalments have been paid. But the terms of the agreement may sometimes purposely obscure the nature of the transaction between the parties, where, for example, the instalment purchase is merely to create a security for money. In such a case a judge will look to the true nature of the transaction. If it is not a real letting and hiring, the agreement will require registration under the Bills of Sale acts. If the agreement contains words to the effect that a person has "bought or agreed to buy" goods, the transaction comes under the Factors Act, 1889, and the person in possession of the goods may dispose of them and give a good title (*see* FACTOR). The doctrine of reputed ownership, by which a bankrupt is deemed the reputed owner of goods in his apparent possession, has been somewhat modified by trade customs, in accordance with which property is frequently let out on the instalment system (*see* BANKRUPTCY).

In the principal British dominions, such as Canada and Australia, real property is frequently sold for payment on the instalment system, usually during three years, some particulars of which will be found in Burge's *Foreign and Colonial Laws*, vol. iv. part ii. Instalment purchase is also the system followed by the building societies (*q.v.*), under which their members buy houses for themselves.

See also INSTALMENT SELLING. (W. A. B.)

United States.—Instalment purchase in the United States takes either the form already described above, and known as the conditional sale, or the form of a sale outright with chattel mortgage (*see* BILL OF SALE) for the unpaid portion of the price. An apparent lease which in substance amounts to a conditional sale is almost universally treated as the latter, regardless of its form.

The fact that the goods are in full use of the buyer and hence appear to be his, opens the possibility of his creditors being misled by his apparent ownership, and even more the possibility that *bona fide* purchasers of the goods from him may be misled, if the secret rights of the seller are given full force. These considerations have led in more than half the States to legislation under which a contract of conditional sale fails to preserve the seller's rights as against *bona fide* purchasers from the buyer, or as against described classes of the buyer's creditors (including his trustee in bankruptcy) unless the contract is publicly filed or recorded in much the same manner everywhere required for a chattel mortgage. Where such filing is not required, sellers commonly use the conditional sale in the instalment purchase, to save the expense of filing, as also to avoid the publicity of filing, which generally is objectionable to the buyer as reflecting on his credit. On the other hand, wherever such filing is required—except in the nine States which have adopted the Uniform Conditional Sales Act—there is much to be said in favour of using the chattel mortgage back as the lender's security. For there are disadvantages in the conditional sale when it comes to realization on the security. If a chattel mortgagee retakes the goods and forecloses on default, he is still entitled to recover at law any difference between the amount of the unpaid debt and the value of the goods, or the amount for which they sell on foreclosure. But, except under the Uniform Act, a conditional seller must elect between retaking the goods and recovering the unpaid portion of the price; both he cannot do, and the retaking of used goods often results in a loss to him. On the other hand, under the conditional sale the seller may in a very favourable case stand to win, since he can keep as forfeited all that has been paid, even though his resale of recaptured goods should result in a profit. In the case of a chattel mortgage, he would then have to pay over the difference to the defaulting buyer (mortgagor); and such is the vastly preferable rule for the conditional sale, as well, as evidenced by the Uniform Act.

In the case of street cars and railroad rolling stock, instalment purchase has been introduced to permit specific new financing to companies whose credit standing has somewhat suffered, and whose properties were already covered by a blanket mortgage framed to include after-acquired chattels. The buyer-company's interest, and hence the blanket mortgagee's, is held to be subordinate to that of the instalment seller, whether the form be con-

ditional sale, purchase money mortgage, or the peculiar Pennsylvania "bailment-lease." Hence "equipment trust" securities can be marketed by a company whose new mortgage bonds cannot; since, too, the equipment in case of default can be removed and sold irrespective of the possible unprofitable location or condition of the road itself.

Land and houses, especially in the case of subdivision development, are often sold on an instalment basis. In that situation radically different rules of law apply; there is no possibility, for instance, of resale by the buyer to a *bona fide* purchaser; forfeiture on default of what the buyer has paid in is almost universal, yet often subject to mitigating periods of grace by virtue of liberal construction of the contract.

See Bogert's *Commentaries on Conditional Sales* (1924); W. A. Estrich, *Law of Instalment Sales of Goods* (1926); K. Duncan, *Equipment Obligation* (1924); E. R. A. Seligman, *The Economics of Instalment Selling* (1927). (K. N. L.)

INSTALMENT SELLING, a system of retail trading which is in essence an extension of credit to purchasers, under some form of contract by which the purchaser agrees to make partial payments at stated intervals over a period of weeks, months or even years. In this article a résumé of American developments will be given first. (X.)

I. IN THE UNITED STATES

In the United States real estate instalment selling is handled mainly through building and loan associations. High-grade furniture houses were the first business houses to make use of instalment selling in the United States. They introduced it early in the 19th century. Soon this method was extended to the marketing of many commodities, among the most important being books, sewing machines, pianos, gramophones, stoves, washing machines, automobiles, vacuum cleaners, clothing, jewellery and radios.

Although instalment selling was first confined to the marketing of high-grade commodities, it is at present used by merchants who sell practically all classes of goods. A certain social stigma came to be attached to the purchase of goods on the instalment plan, especially when it came into use by firms who handled low-grade goods and used questionable methods of marketing their products. Furthermore, there has always been a prejudice against the use of bank credit to finance consumers' purchases. The belief, which has been fostered by economists, has been that bank credit should be confined to the promotion of production, where there would be an increased value created as a result of the extension of this credit. If a person did not have sufficient funds to purchase commodities for consumption, the feeling was that he should go without them until such time as he could afford to purchase them out of accumulated savings. This antipathy was probably one of the causes of the various refinements in names which have been given to instalment selling, such as "deferred payment plan," "purchasing out of income" and "budgeting plan."

A distinction should be made between two broad classes of goods which are sold under instalment plans: consumption and production goods. In many cases it is difficult to determine into which class a sale falls, but the main point is that there is little or no criticism heard of selling production goods on instalment plans, while there is much criticism and discussion as to the justification of the application of these same methods of marketing to consumption goods. Purchases of railway equipment through the use of railway equipment bonds has been an accepted method of financing the acquisition of producers' capital. Payments are made on these bonds over a period of ten years under the same type of plan and contract as is used in instalment sales of consumers' goods. These goods are considered a sound investment and in many cases have shown themselves more secure than mortgage bonds.

Larger growth of instalment selling has taken place in the marketing of consumption goods and the increase is primarily the result of the development of the use of this form of credit in the automobile industry. Conservative estimates show that about 70% of all automobiles sold since 1925 have been financed through instalment plans. The most recent estimate made of the amount of instalment sales is $4,500,000,000 out of a total annual sale of $38,000,000,000.

The mainspring of the mechanism of instalment selling is the finance company of which there are two types: the independent company and the subsidiary company which is organized by the parent company for the sole purpose of financing sales of its products. An example of the first type is the Commercial Credit company of Baltimore, incorporated in 1910, while the General Motors Acceptance Corporation is the outstanding example of a subsidiary. The independent companies finance sales of a variety of commodities, and are divided into a number of different departments which handle the financing of particular groups of commodities. As a rule, the independent companies use what is termed the non-recourse plan, while the subsidiaries use the recourse plan. Under the recourse plan the dealer signs the instalment paper and thus assumes a liability for the failure of the customer to live up to the terms of the contract. In case of default by the customer, the dealer resumes possession of the article and must again dispose of it to recover the remainder of money still owed to him. Under the non-recourse plan the dealer does not assume any obligation, and in case of default the finance company repossesses the article and offers it for sale. Both types of finance companies furnish credit for wholesale as well as retail sales.

As the most important part of instalment selling is devoted to automobiles, this feature of the development should be considered in more detail. Instalment selling of automobiles did not come into existence until after 1910. It was about that time that dealers in California are said to have originated it. Growth was slow in the industry for the first few years, and the sales were financed by the dealers themselves without assistance from finance companies. There were a few scattered examples of firms which purchased automobile paper beginning about 1913, but this was uncommon. Rapid growth started after the World War. The amount paid at the time of purchase varies from about 25% to 40% of the purchase price of the car. The length of time covered by the subsequent payments is usually between 6 and 18 months. Ordinarily, a larger down payment and a shorter elapsed time is used in the case of second-hand cars. In the sale of new cars the best practice calls for a minimum down payment of one-third the purchase price and the length of time for subsequent payments to be spread over a period of not more than 12 months. However, these terms are not followed closely, and there are many exceptions. It is found that the number of repossessions necessary and the losses of finance companies increase alarmingly when the terms are made more lenient. The terms of all instalment paper should be drawn up so as to give the purchaser sufficient equity in the commodity to make it his interest to keep up the remaining payments. Fire and theft insurance is paid by the purchaser, and the rate is usually high enough so that it will cover the risk of conversion, that is, the chance that the purchaser may steal the car before all his payments are made.

The most widely used form of contract in instalment selling is the conditional sale, which is signed by the purchaser. It contains three distinctive features: (1) title remains in the seller, (2) possession is generally held by the purchaser, and (3) title passes to the purchaser on complying with the conditions of the sale. If the buyer fails to meet his payments the seller may repossess, and the seller is not compelled to refund any of the payments already made unless there is legislation to this effect in the State where the sale is made. In event of such legislation, the seller may be required to return to the purchaser any amount he receives on resale of the article above the amount which remains due from the purchaser and his costs. In those States where a conditional sale is not legal, a lease plan or chattel mortgage is used to finance instalment sales. In this case, the purchaser is considered to have leased the article and pays rent for the length of time covered by his payments (see *infra*). There is no fundamental difference to the purchaser in the cost of these various plans.

It is difficult to estimate the pure interest rate which the purchaser pays for the money he borrows in instalment buying, because of the fact that the costs of financing are included in the payments made, in addition to the insurance charge, and the loan

is amortized in the periodic payments. In general the cost of the credit varies between 10 and 30%.

In order to secure funds to finance this paper, finance companies resort to the sale of short-term paper to banks. They keep a certain amount of instalment paper in a selected bank under a deed of trust, and against this collateral, they issue short-term paper which is offered to banks for short-term investments. The losses of finance companies have been relatively small, some reporting losses through repossessions of about ⅛ of 1%. Large losses have, however, occurred where the terms or the credit departments have become too lax.

Undoubtedly, the volume of production of certain groups of articles has been increased through the development of instalment selling. This increase has brought about lower costs, so that in many cases the consumer has benefited. But against the gain we must consider the cost of the necessary credit to the consumer. It is probable that production of goods which have not lent themselves so readily to instalment has suffered in consequence, with the result that the articles which go to make up the various standards of living have changed in nature and quantity. One of the main drawbacks to the consumer is that he has not been able to budget his income properly. He does not know from experience what margin of safety he should keep. For this reason it is imperative that there should be improvements in the credit investigation departments of finance companies.

Instalment selling has undoubtedly come to stay, and may be expected to improve in the future with further experience. At the present time, the United States has abundant credit which is available at a low rate of interest. Should the interest rate go up with an increased demand for credit in other fields, the cost of instalment financing would have to increase. At the same time another fact should be noted; the country has not been through a severe crisis since instalment selling has become so important. It remains to be seen whether it is possible for the consumer to resume his buying as soon after a crisis as has been the case in the past. If his return to the market is delayed because of obligations which he has assumed already and which must be met before he can become part of the effective demand for new goods, then the recovery of business after a crisis will certainly be delayed. (B. G.)

II. INSTALMENT SELLING IN GREAT BRITAIN

Instalment selling has proved an invaluable aid to certain young and some old British industries since the World War. It is unlikely that the motor, wireless, electrical equipment, pianoforte or furniture industries would be in their present healthy state, had not instalment selling come to their assistance. For long years past, the British building societies have fostered the wise plan of buying houses on the instalment system and their growth has been remarkable. (*See* BUILDING SOCIETIES.)

Estimates of Extent.—How far instalment selling is responsible for sales in the wide range of industries it serves, no one can estimate. British industries collect few data for such a computation. The Hire Purchase Traders' association has estimated that 4,000,000 instalment agreements are entered into annually, and that 16,000,000 such agreements were in 1928 in force. The association also estimates that instalment agreements account for 50% of motor-car sales; for 50% of furniture sales; and for 10% of jewellery sales in Great Britain. These figures are given with reserve; they are rough estimates and nothing more. It is clear, however, that a large percentage of the farm implement, factory equipment, office machinery, bicycle trades and a small percentage of the clothing, bible and bookselling trades is done on the instalment basis.

Certain other services seem to be suited to the instalment method of selling. One of these is insurance, which has been sold to the British working classes by weekly payments for half a century or more. One company is selling life policies to the middle classes on the monthly payment system, while another has announced its intention of following suit. Travel is being sold in the same way. One of the British railway groups is to sell holiday tickets on instalments, collecting sixpence or a shilling weekly. The British income tax is collected in instalments.

One is often asked the question: by how much will instalment selling increase sales? The answer depends on the nature of the article, the type of public appealed to, the terms offered, the state of competition and other factors. A specific case will illustrate the possibilities of the method.

The Remington Typewriter Company offered their portable typewriters on the instalment system in April 1925, their terms being an initial payment of £2 2s., followed by 11 monthly payments of £1 1s. Taking the sales for the six months preceding this offer at the index figure of 100 per month, it was found that the index of sales had increased in Oct. 1925 to 210, in November to 269, and in December to 325. In eight months instalment selling had increased the sale of portable typewriters by over 200% while the newspaper advertising for the eight months was only about 5% above that for the preceding six months.

Tempting the Consumer.—The question has been raised whether the consumer may be tempted by instalment selling to buy beyond his means. There are undoubtedly instances in which working-class families become indebted for furniture, a gramophone, clothing, etc., at one and the same time. In such cases the instalment payments due on a given date may exceed the wages available. Is not this the genesis of a grave social evil?

The answer to that question is that experience shows that the percentage of bad debts incurred in instalment selling in Great Britain is astonishingly small. The members of the Hire Purchase Traders' association have for many years past kept their bad debts below 2%; many concerns keep them well below 1%.

The social reformer is apt to assume that the temptation to reckless buying is greatest to the poorest. It may be so, but the fact remains that the *ability to budget expenditure*—and here lies the crux of the question—seems to vary in proportion to the shallowness, and not the depth, of the housewife's purse. The Frenchwoman buys more carefully and expertly than the Englishwoman, while the latter makes money go farther than the American housewife. It is probable that the danger of instalment selling to the working-classes in Great Britain has been exaggerated.

On the other hand, it cannot be too clearly recognized that with instalment selling a new situation has arisen. The balance of power as between salesman and customer has been upset. While Mrs. Brown may be quite competent to deal with her local shopkeeper, she may not have the skill to cope successfully with the travelling salesman or with the salesman of a department store. A superior technique of salesmanship may be opposed to an inferior technique of buying. In such circumstances, there may be cases in which the housewife is tempted to purchase beyond her means.

Until 1928, instalment selling was managed on a more conservative basis in Great Britain than in America. While the American banks only attempted to set standards of practice in 1925, the long experience of British business and the conservative policy of the British banks have secured a cautious policy; factors of safety have been operative.

At the same time, it has to be admitted that one or two British industries are now leaving these standards of practice behind them. Certain firms for instance are now working on the "no deposit, long term agreement" system. As most of the companies concerned are large and possess corresponding financial resources, there need be no need for anxiety in their interests. Inevitably both they and their customers must pay a little more for the facilities offered: how much, is a matter of accountancy.

Facilities for Instalment Trade.—There are now several British financing companies ready to take over the small trader's accounts and to give his customers instalment credit. This accommodation will enable the small retailer increasingly to compete with the large concerns. In some cases these financing companies allow the retailer himself to collect accounts, so that he does not lose contact with his customers.

In 1928 the facilities available for the small trader to give his customers instalment terms were multiplying in other directions. A number of manufacturers were prepared to finance the instalment sales of their dealers on a reasonable basis; a few whole-

salers in certain lines offered the same facilities; and the banks themselves ceased to protest that they would not finance instalment sales. This change of attitude was sponsored by the Midland Bank in its *Bulletin* (Feb.–March 1928) in the following terms:—

The banks, in the ordinary course of providing direct accommodation to their own customers, probably provide a considerable part of the funds required for carrying on hire-purchase business. This does not imply that the banks actually lend specifically for hire-purchase trade, but in the ordinary course of operation of their overdraft facilities, substantial sums, though unidentifiable in detail, are probably lent for this purpose. Similarly, the banks are called upon from time to time to lend large amounts to finance the operations of manufacturers, some of whom may be producing partly or wholly to meet the hire-purchase demand. In these cases again the banks are indirectly financing this particular type of business. Consequently it would be wrong to say that the banks do not grant accommodation for hire-purchase business, merely because they do not hold themselves out to participate in exactly the same way as in America.

How much does instalment credit cost? The financing company may charge 5% to 8% on each transaction for 12 months' accommodation. Obviously, the actual rate of interest paid is 10% to 16%, since the average amount on loan is only half of the total. It must be remembered, too, that the retailer is normally charging his customer from 5% to 8% for the credit given so that the net cost to the retailer is trifling. It will be clear, however, that the instalment method of selling entails the use of greater capital in relation to turnover than cash selling.

See also TALLYMAN AND TALLY SYSTEM. (C. CH.)

INSTERBURG, a town in the province of East Prussia, at the point where Angerapp and Inster join to form the Pregel, 57 m. E. of Königsberg by the railway to Eydtkuhnen, and at the junction of lines to Memel and Allenstein. Pop. (1925) 39,390. Insterburg, the "burg" on the Inster, was founded in the 14th century by the knights of the Teutonic order. Having passed to the margraves of Brandenburg, the village which had sprung up round the castle received civic privileges in 1583. During the next century it prospered greatly, partly owing to the settlement in it of several Scottish trading families. In 1679 it was besieged by the Swedes; in 1690 it suffered severely from a fire; and in 1710–11 from pestilence. The town church is celebrated for its fine wood carvings. Besides flax-spinning and iron-founding, Insterburg has manufactures of machinery, cement, leather and beer, along with a considerable trade in cereals and wood, while horse-breeding is extensively carried on in the neighbourhood.

INSTINCT: *see* ANIMAL BEHAVIOUR; PSYCHOLOGY; COMPARATIVE PSYCHOLOGY.

INSTINCT IN MAN. The current views regarding human instinct at the beginning of the modern period are very well represented in Lord Herbert of Cherbury's *De Veritate* ("On Truth"), published in 1625. In enumerating the human faculties Lord Herbert starts with "Natural Instinct." This has two aspects. On the one hand, it is the source of the motives which urge both men and animals irrationally to seek to preserve their lives and to secure happiness. On the other hand, it furnishes certain innate principles of knowledge—"common notions," Lord Herbert called them. The prevailing usage of the word "instinct" up to the middle of the 19th century is fairly well represented by Lord Herbert's *Instinctus Naturalis*. In the discussion of human instinct, however, the first aspect was more and more emphasized. "Natural propensity," or "natural inclination" was essentially the meaning of the word, when applied to the human being.

New Meaning of Instinct.—During the 19th century, and especially after Darwin, the problem of instinct began to be approached from a new standpoint. The direction of approach was now from the side of animal behaviour, in place of human conduct. The word "instinct" was taken as designating forms of behaviour which were not acquired by an animal through experience and learning, but provided for congenitally in the animal's structure, and manifested on the first occasion of performance, if not perfectly, at least adequately to secure the survival of the individual and the continuance of the species. When this meaning was carried over to the case of the human being, the stage was set for the acute controversy regarding Instinct in Man, which has characterized the first three decades of the 20th century. The two parties in this controversy are, on the one side, those who adhere more or less firmly to the original meaning of the word "instinct" as "natural impulse" or "urge," and, on the other side, those who, taking their departure from the complex types of instinctive behaviour characteristic of some of the lower forms of life, take the word as meaning "congenitally organized patterns of behaviour." On the whole the line of division between these opposing views corresponds in psychology to the line between the introspectionist and the behaviourist, and in general philosophy to the line between the finalist and the mechanist.

The controversy has largely centred round the problem of the relation of Instinct to Intelligence or to Habit. As far as the science of psychology is concerned the opposing standpoints can be reconciled. If we define psychology as the science which studies the behaviour of the living organism, and seeks to understand and interpret that behaviour in terms of the inner life of thought and feeling, it is possible to preserve the traditional sense both of "psychology" and of "instinct," and at the same time to cover the new fields in both cases. There is no opposition between Instinct and Intelligence, provided we consider both at the same level in the animal scale. Low down the scale there is almost complete provision in the structure of the organism at birth for all actions necessary to preserve its own life, and to secure the continuance of the species. The part left for intelligence to play is insignificant, and we have no evidence of the presence of any high degree of intelligence. Higher up the scale the congenital provision for necessary actions is incomplete, and a special supplementing through individual learning is required. Intelligence has a more important rôle to play, and the evidence for the possession of the necessary intelligence begins to accumulate. At the top of the animal scale the congenital provision in the structure of the organism for those actions which are necessary to maintain life is incomplete and fragmentary in the highest degree, so much so that there may well be doubts in some cases whether it exists at all. At this level the part which intelligence must play becomes very important, and the evidence for a high degree of intelligence becomes overwhelming. From the bottom to the top of the scale, however, there is evidence of the presence of a powerful impulsion from within, urging the organism towards actions, guided by such intelligence as there is, which tend to serve great biological ends. It was this impulsion, to which the name "instinct" was originally given, and it is this impulsion upon which we must concentrate attention, if we would understand human instinct.

Instinct and Emotion.—The chief human instincts—regarding instincts from this "impulsion" point of view—are those associated with fundamental human emotions, like fear, anger, sex love, parental love, etc. The relation of Emotion to Instinct has been another fruitful source of controversy. Early and modern writers are both agreed that there is some close relation. By the early writers the relation was more or less tacitly assumed. William James, on the other hand, in more recent times, explicitly asserted it. It was left to William McDougall, however, to define the relation more precisely, and the controversies have centred mainly round McDougall's work. According to his view each instinct has associated with it a characteristic emotion, which is always the stable and peculiar mark of the activity of that instinct. This view has been challenged by A. F. Shand, who maintains that McDougall has reversed the actual relationship, and that the activity of an instinct is rather to be regarded as a constituent element in the activity of an emotional system. J. Drever has also criticized McDougall on the ground that he has over-simplified the situation, and that emotional excitement always exhibits a bipolarity characteristic of the whole life of feeling, so that, even if we admit that emotional excitement always accompanies instinctive activity, we must assume that two emotions of opposite polarities—"joy" and "sorrow" emotions—are involved in the case of each of the instincts. Drever, however, refuses to admit that all instinctive activity necessarily involves emotional excitement, holding that emotion is experienced only when the instinctive impulse is facilitated or impeded in the attainment of its end, and that some instincts, like imitation and play, have no characteristic emotion at all associated with them. Larguier des Bancels, again,

holds that emotional excitement represents in essence a disorder of instinct.

Enumeration and Classification of Human Instincts.—McDougall's teaching in its general features has been widely accepted, more particularly as regards the enumeration of the human instincts. His list includes: the instincts of fright or escape, pugnacity, repulsion, curiosity, self-display, submission, sex, acquisitiveness, the parental instinct, the gregarious instinct, the hunting instinct. To these must be added: imitation, play, certain simple instincts showing themselves in early childhood, the natural appetites, and possibly the wandering instinct. This enumeration is based on the view of Instinct as natural impulse. Writers who approach Instinct from the behaviour side, like Thorndike, for example, enumerate many more, while the psycho-analysts, though making extensive use of the notion of Instinct, rarely attempt any enumeration at all. S. Freud, the leader of the psycho-analysts, employs the term "wish" in a sense which is practically equivalent to "impulse" or "instinct."

The classification of human instincts presents considerable difficulty. The most popular classification is probably into ego instincts, sex instincts, and herd instincts. This classification is based on the Freudian psychology, but it is unfortunately biological rather than psychological. At least two psychological classifications have been suggested: into instincts of attraction, repulsion and aggression, and, harking back to Plato, into appetitive and reactive instincts, and under each head into general and specific. W. H. R. Rivers, who may be said to mediate between the views of the psycho-analysts and those of McDougall, has suggested a classification of an entirely new basis. He contends that the activity of some instincts shows an "all-or-none" character, a want of control and discrimination, while in other cases there is a grading of intensity of action, and a delicate adjustment of activity to end. The two types might therefore be called "protopathic" and "epicritic," respectively. This distinction seems equivalent to a distinction between presence and absence of emotion.

For instinct in animals *see* ANIMAL BEHAVIOUR.

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INSTITUTE OF THE CHRISTIAN BROTHERS, or, more fully, "Institute of the Brothers of the Christian Schools," a religious fraternity founded at Reims in 1680, and formally organized in 1683, by the priest, Jean Baptiste de la Salle, for the purpose of affording a free education, especially in religion, to the children of the poor. Though not officially connected with the Jesuits, their organization and discipline are very similar; and their work is now carried on in all parts of the world.

See J. B. Blain, *La vie du vénérable J. B. de la Salle* (1887); and P. Joseph, art. "Institute of the Brothers of the Christian Schools" in the *Catholic Encyclopaedia* (with many references).

INSTRUMENT, that which can be used as a means to an end, hence a mechanical contrivance, implement or tool; the word is more particularly applied to the implements of applied science, in mathematics, surgery, surveying, etc., while those of the handicrafts are generally known as "tools." A specific use of the term is for the various contrivances used to produce musical sounds, "musical instruments."

In law an "instrument" is any formal or written document by which expression is given to a legal act or agreement. This is a classical use of the Lat. *instrumentum,* a document, record. The term may be used in a wide sense, as a mere writing, meant only to form a record, or in a particular sense with reference to certain statutes. For example, the Stamp Act 1891 defines an instrument as an expression including every written document; for the purposes of the Forgery Act 1861 a post-office telegram accepting a wager has been defined as an instrument.

INSTRUMENTATION is the aspect of music which deals with timbre, and with the technical possibilities and characters of instruments and voices. The treatment of the orchestra has for the last hundred years been the most popular branch of the art. Hence the vogue of the narrow term "orchestration." The colloquial word "scoring" is the only adequate name for an art that ought to include all other aspects of timbre and performance, such as chamber-music (*q.v.*), pianoforte writing and organ registration.

Method of Study.—The first requisite for good scoring is an imagination exercised by training. Rules are not enough; and neither is mere practical experience. Schumann's scoring grew worse as experience discouraged him; and a student who masters good rules without training his imagination merely protects himself from learning by experience. Many musicians who ought to know better are doing serious mischief by denying the possibility of arm-chair score-reading. Exaggerated claims are harmless for they are nearer to the truth of what an accumulation of study can achieve. The common-sense of the matter is obviously this: the arm-chair reader can vividly imagine effects that he has heard; he can recognise similar effects when he sees them in a score that is new to him; and so with effort and practice he can realise the effect of known sounds in new combinations. The complexity of the combinations has, in reason, little to do with the difficulties of imagination; and familiarity with the type of music is always a paramount factor.

William Wallace, in *The Threshold of Music,* seems to believe that modern progress in orchestration has produced new cerebral powers. This is a fallacy: listeners or conductors who have become familiar with Richard Strauss's orchestration will vividly imagine the sounds of a page of the master's latest and fullest scoring long before scrutiny has shown more than the main entries and the general type of colouring. But such readers may get nothing but abstract grammatical propositions from a page of Palestrina if they have never heard pure polyphony sung without accompaniment in a vaulted building. The music of each great period has its own proper scoring which sounds well under its proper conditions. The student should take opportunities of hearing each kind of music well produced; and he should multiply his experience by reading the scores of all periods, besides those of his own day. An imagination thus trained is obviously useful to conductors. It is not less useful to composers, for it is no mere antiquarian lore by a widely generalised capacity to imagine correctly all kinds of significant musical sounds. Its possessor will never produce the woolly scoring of the unimaginative composer who goes by rule; and if he makes errors of calculation these will be remediable as errors of imagination are not.

Rules are useful in preventing errors of calculation. The only extant treatise on instrumentation that gives correct rules is the posthumous work of Rimsky-Korsakov. Starting with the proposition that good scoring is good part-writing, this brilliant and fantastic Russian composer lays down surprisingly severe rules for combining good part-writing with well-balanced orchestral values. At first it seems incredible that any free art could live on such terms; yet the marvellous purity of Mozart's orchestration supports Rimsky-Korsakov's system in an art a century earlier and far more complex. For there is less wonder that Rimsky-Korsakov's colouring should be pure since his ideas never overlap, and his hundreds of illustrations from his own works consist (except for a few scraps of recitative) exclusively of 2-bar or 4-bar phrases that repeat themselves. We shall not learn Mozart's art from this, and rules will not endow us with Rimsky-Korsakov's imagination. Nor was that imagination equal to distinguishing blunders from subtleties in the score of his friend Moussorgsky's *Boris Godounov.* Much less, then, is it to be trusted when he dismisses Beethoven's orchestration with the remark that the execution of Beethoven's ideas is far inferior to their conception. This really means that the narrow cross-section of Beethoven's ideas that comes within the aesthetic range of Russian ballet-music could have been scored more easily and brilliantly by a Russian composer in 1890. Apart from this, Beethoven is doubtless not infallible. But perkiness starves the imagination.

Pure 16th Century Polyphony.—In the article HARMONY (*q.v.*) the grammar of pure polyphony is shown to be equivalent

to the art of vocal scoring. A modern choir soon learns the truth of the 16th century rules when it faces the task of unaccompanied rehearsal. The old rules secure singability as well as euphony. But they also leave the composer's imagination free for many subtleties. Our stereotyped full chorus of soprano, alto, tenor and bass is roughly that of the 16th century, though we have forgotten the ways of the genuine boy-alto who delights in manly growls down to D and becomes shy above A in the next octave. The 16th century knew no other alto, and Palestrina has 17 ways of grouping 4 parts and 12 different ways for 3 parts, besides equally various 5-part and 6-part grouping. In 8-part works for double choir the two choirs are often contrasted, as in Palestrina's motet and mass *Hodie Christus natus est,* where the second choir, led by the altos, makes a terrestrial antiphony to a choir of angels.

The infinite subtleties of 16th century part-writing are beyond the scope of this article and very remote from the experiences of any instrumental music. But every conductor and every composer may learn much from Palestrina's and Lasso's devices of producing by part-crossing beautiful progressions that would be crude if the planes of tone were not kept distinct. In all later periods the distinction of planes of tone is a fundamental principle. In the 16th century it enters into these delicate intricacies, and appears more obviously in the rule formulated by the first composers for double and triple choirs, viz., that the harmony of each choir must be complete even when all are singing together. Lasso disregards this rule, but its common-sense becomes evident when the choirs are on opposite sides of the building.

Archaic Instrumentation.—At the end of the 16th century monody arose. It was the art of non-polyphonic vocal declamation with an instrumental accompaniment. With characteristic acumen the Italian monodists promptly recognised that voices and instruments will not meet on the same plane of tone. Not all composers understood the new problems. The habit, in private performance, of using viols to replace missing voices in madrigals had gone far to make composers incautious in dealing with more penetrating instruments. The flat-backed viols with their husky and reedy tone (nowadays still noticeable in the double-bass) were already giving place to the royal family of the violin in all its sizes; this family was no longer on singing terms with voices; yet many composers at first saw no difficulty in using any instrument as equivalent to any other instrument or voice at the same pitch. Schütz (1585–1672) writes for triple and quadruple choirs of voices mixed with instruments. He writes the words under the instruments as well as under the voices; he often merely designates a part *Vox instrumentalis;* but he also takes the trouble to suggest *Tromba o flauto,* as if these instruments, in low register, had the same weight! Beauty often emerges from the chaos—associated with some practical suggestion that leaves us in doubt whether the composer knew what he achieved; as when Schütz proposes that his wonderful *Lamentatio Davidi,* a perfectly scored masterpiece for bass voice, 4 trombones and organ, should be played with two violins an 8vo higher as a substitute for the first two trombones!

Continuo Instrumentation.—By the time of Bach and Handel instrumentation had become a mature art; but an art depending on conditions no longer familiar to us. When these conditions are restored the resulting aesthetic system completely justifies itself. It recognises that no group of instruments can make homogeneous harmony like a vocal chorus, but that all instrumental scoring consists normally of a top, a bottom, and a *tertium quid* that completes the harmony but remains in the background. Bass instruments support the bass; all other instruments, whatever their pitch, are aesthetically top parts, and their most elaborate counterpoint does not profess to make their tones blend. They are woven into patterns of coloured threads, not blended like the colours of a landscape. The *tertium quid* is provided by an organ or a harpsichord; and it obeys the normal grammar of choral harmony. Only a keyboard instrument can provide such harmony ready-made on one plane of tone. At the present day one of the commonest faults of unimaginative scoring is the habit of treating the orchestra like a 4-part chorus. Continuo orchestration shows the true principle with drastic clearness, but it shelves the problem of how to keep subordinate parts in their places. The continuo player represents an army of slaves upholding an aristocratic civilisation.

Besides gaining a capacity to attack discords boldly, the vocal chorus has undergone a radical change in the treatment of the bass voice when supported by instruments. When the tenor is low but still inferior to the harmony, the bass is no longer obliged to go lower, but is free to sing in its upper register, crossing freely above the tenor but relying on instruments which double it an 8vo lower as the true bass. Bach and Handel never once cross the bass over the tenor in any other way; the tenor in such places never gives the true bass. And Bach's so-called unaccompanied motets thus show in every line that they were conceived as supported by at least an instrumental bass. In fact, unaccompanied choral writing practically disappears from classical music between Palestrina and Schubert. It appears modestly in part-songs, and is first taken fully seriously by Brahms; though some older conductors of choral societies honourably kept up its tradition.

The basis of the continuo orchestra was, as now, the string band, an instrumental chorus of first and second violins, violas and violoncellos, supported an 8vo lower by double-basses which are never independent. Wind instruments did not form a complete mass of harmony but stood out against the strings in double or triple threads of each timbre, except when (as often in Handel) they doubled the strings. Flutes were used much more in their lower registers than we think fit in modern orchestration. In the organ-loft of a vaulted building low flutes are more effective than in ordinary concert-rooms. The ordinary flute is called traverso. The term flauto, with the use of the treble clef on the bottom line, indicates the flute-à-bec, a kind of flageolet, with rather a higher range. Bach uses pairs of each kind in the *Matthew Passion* but not in the same movements.

Oboes are also used in threes or pairs, and the ordinary oboe alternates with a variety a 3rd lower, the oboe d'amore, with the bell (and therefore the tone) of a cor anglais. Strauss has revived it. The real cor anglais figures in Bach's orchestra as the oboe da caccia or the taille. Some authorities tell us that one or other of these was not an alto oboe but a tenor bassoon. It is easier to relabel a museum specimen than to rewrite the whole of Bach's oboe da caccia music.

Bassoons hardly ever emerge from doubling the bass. The *Quoniam* of Bach's B minor Mass is a bass solo accompanied by a horn, two bassoons and continuo. It would be delicious if we could find proper acoustic conditions for it and could handle the continuo discreetly enough. A great moment is the rising of the spirit of Samuel in Handel's *Saul,* where the bassoons are as ghostly and awesome as the prophet's message. In large enough numbers they would also astonish us in Handel's scoring of the "thick darkness" in *Israel in Egypt.* Handel, whose oratorio performances were on a large scale, must have had more reed-tone than string-tone in his orchestra; for he often had 20 oboes and 20 bassoons. Multiplication greatly mellows the tone of an instrument; and we, who seldom hear more than 4 oboes in unison, even in Mahler's 8th symphony, must not hastily judge our ancestors on this point.

Trumpets and horns, not being provided with modern valves, could produce only the natural harmonic series of the key to which their length of tube was set. That series does not close up into anything like a scale until the 8th harmonic. Accordingly trumpeters devoted themselves to acquiring extraordinary command of the delicate distinctions of high lip-pressures (*embouchures*) between the 8th and 20th harmonics. A long mouthpiece, with a little play in its adjustment, enabled the trumpeter to correct the out-of-tune 11th, 13th and 14th harmonics. (This secret was already forgotten by 1785, so that Burney, describing the Handel Centenary Festival, tells us that whenever the G and G♯, alternately represented by the 11th harmonic, were heard in "The trumpet shall sound" displeasure was seen on every countenance.) Humbler players called themselves *Principal-bläser* and produced the lower notes to which the tight-lipped clarino-player could not descend. Horn-players developed a similar hazardous technique of high notes. In modern performances special training and special instruments are required for early 18th century trumpet and horn

music. A modern tendency to strain all instruments up to high notes has facilitated this revival. Trombones, when they occasionally appear in continuo orchestration, are treated exactly like choral voices, and are, indeed, mainly used in unison with the chorus. A soprano trombone at first completed the group but Bach already had to replace it by some kind of slide-trumpet (corno da tirarsi).

Bach's full orchestra consists, then, of the string band (preferably larger than he ever had) oboes (ordinary or d'amore) in pairs or threes, flutes or flutes-à-bec in pairs or threes, bassoons (taken for granted) in unison with the basses, three trumpets (two clarini and one principal) three horns (not often used together with the trumpets) and a pair of kettle-drums. If the string band is large the wind parts, other than the trumpets, should be doubled, trebled, or (in festival performances) multiplied. The organ supplies the continuo in choruses, and the harpsichord supplies it in solo movements. The pianoforte is really (as Philipp Emanuel Bach already urged) better than the harpsichord, if only the player will avoid a self-assertive touch.

The orchestral combinations of solo movements range from Handel's perfunctory *tutti unisoni* to Bach's and Handel's richest schemes. Instruments obsolescent from incompatibility or feebleness live awhile in the arias and recitatives, protected from competition with the orchestra; and so we learn from Bach's *Passions* and *Trauer Ode* the use of the lute and viola da gamba, and from Handel's *Alexander Balus* the use of the theorbo, a large double-necked lute. Each movement has its own scheme of instrumentation as a set pattern which cannot change while the movement lasts.

The scheme of a chorus with independent full orchestra is in three planes of tone. These planes do not interfere with each other, and each plane has variants of the same harmonic scheme which would produce appalling collisions if all were projected on to a single plane (say, in an arrangement for two pianofortes). The principal plane is that of the voices. Above it, mostly higher in pitch, all the instruments that are not doubling the bass flourish with more rapid detail than the voices. Behind, and supporting the whole, is the continuo which moves more slowly than the chorus. The bass is common to all the planes, though it is enlivened by instrumental details. The results of this scheme, realised by competent execution under scholarly guidance, are as true in our age as they were when Bach and Handel wrote. Scholarship must show us the right conditions for performance, but it need not recover too precisely the actual original conditions. An old man who had been a chorister under Bach at Leipzig once told Wagner's teacher, Weinlig, how Bach's cantatas were performed. His account was, "It went atrociously and we always got a flogging afterwards."

Symphonic Orchestration.—Gluck (*q.v.*) laid down one of the cardinal principles of symphonic as well as dramatic orchestration when he said that instruments ought to be used according to dramatic vicissitudes. This means that for Gluck it is neither sufficient nor often possible to use them according to a set pattern. Another cardinal principle results from the disappearance of the continuo. This first happened merely by neglect, as the severe training needed for it repelled a generation of musicians excited by non-polyphonic styles. But mere neglect soon passed into a disposition to make the orchestra provide its own continuo. If old music sounded hollow without a continuo, why should not new music contrive better? This at once put many instruments into categories unrealized by Bach and only sporadically realized by the eclectic Handel. An instrument could now have two values: one, the old cantabile function; the other a capacity to provide unobtrusive notes for the background. Holding-notes for the horns revealed a wonderful beauty and usefulness in this way, with all a singer's power to swell and diminish the sound.

The bassoons became the hardest worked wind instruments in the early symphonic orchestra, for they could do everything required of continuo-work, from doubling the bass to supplying the many notes the natural horns could not reach. Their tone, so beautifully if unwittingly described in *The Hunting of the Snark* as "meagre and hollow but crisp, like a coat that is rather too tight in the waist, with a flavour of will-o'-the-wisp" had a most useful capacity for vanishing; and "too tight in the waist" is a very apt description of instruments which, like the bassoon and the viola, show in their half-veiled tones the results of a compromise between the dimensions proper to their pitch and the practicable stretch of human hands.

The viola had at first a curious position in the early symphonic style. That style was so unpolyphonic that the viola could for a long time find nothing to do but to double the violoncello in the upper octaves as the basses double them in the lower. The result is so good that in early symphonies it is carried out mechanically even where it takes the violas above the second violins. But Mozart uses this primitive device with full imaginative insight in mature works where he hardly less often divides the violas into two independent parts.

The trumpets of the symphonic orchestra have become degraded to the fanfares and signallings of the *Principal-bläser*. The clarino player was finally ousted by players of a cheap substitute called the clarinet, which could play high trumpet parts with ease, if with rather a vinegar tone. But the clarinet had a wide compass; these trumpet-sounds are its worst. Below them it had a rich cantabile octave, and below that a few rather dull notes; and below these a coldly mysterious and reedy lowest octave, the chalumeau register. The dull middle notes proved astonishingly useful for continuo purposes; they are higher than the bassoon can attain without self-assertion, and they are not limited like the horn notes. Gluck uses the clarinet only in this neutral region; and even Mozart gives the instrument nothing better when the orchestra is in the key of D. This primitive treatment survives as late as Beethoven's 2nd Symphony, and revived by him in quite a late work, the fugal overture, *Zur Weihe des Hauses* (op. 124).

But when Mozart uses clarinets in the keys of A major, E major, E flat and B flat he reveals the clarinet as richer and more resourceful than any other wind instrument. The chalumeau octave is deliciously nutty in arpeggios, and dramatically hollow in sustained notes. The cantabile octave is magnificent (see the trio of the minuet of the great E flat symphony, for its contrast with echoes on the flute and with low arpeggios on the second clarinet). The military high notes (or "fife sounds") Mozart does not care for. Beethoven's view of the clarinet is less sympathetic than Mozart's, his idea of its cantabile register being just a tone too high. Schubert understands it perfectly.

The oboe can never efface itself. Run through the individual wind-parts of some such encyclopaedic score as Wagner's *Meistersinger* and you will be astonished at the unfailing beauty of the oboe parts and at the large tracts of drudgery in the excellent, uncomplaining clarinets.

The flute has no power in its lower octave and blends with other instruments in none, except, paradoxically, with extremely high Bach-like trumpet notes (if the experiment were ever tried). But in its top octave (from A to A) it is a very adequate and euphonious treble to the wind-band, and gains greatly by doubling. Haydn hardly ever writes his orchestral flutes high enough and often seems to expect low notes to be heard under conditions that would not have satisfied Bach. It is possible that his long period of experiment at Esterhazy did him less good than he or historians have thought. His Esterhazy symphonies show that he had a primitive orchestra diversified by astonishing solo players. He was able at Esterhazy to produce horn-passages that would astonish Bach. But in the world outside he found that orchestras, though better in the rank and file, were seldom troubled by virtuoso members. In his last symphony the theme of the finale is a typical and easy horn tune, but he dare not give it to the first horn of Salomon's London orchestra except under cover of a tutti! All his mature scoring is full of strokes of genius but deeply marked with signs of disillusion.

Beethoven's Instrumentation.—Beethoven enlarged the range of orchestral thought more than any composer between Gluck and Wagner. The circumstance of his deafness made him the victim of some miscalculations; and pedantic views of orchestration lead many critics to exaggerate these into grounds for a worse perkiness than Rimsky-Korsakov's damaging patronage of

Beethoven's scoring. Two things must be learnt by everybody who wishes to understand Beethoven; first, that errors of calculation are not the same thing as errors of imagination; secondly, that a symphony is not an opera. Beethoven's errors of calculation are no greater than those of any composer who has not been able to hear a rehearsal of his own orchestral work. Their correction, as shown by Weingartner (*Ratschläge*), is equivalent to any pianoforte player's control of his own touch, and would amount to little more than a conductor's ordinary exercise of his skill were they twice as extensive.

Errors of imagination do not exist in Beethoven's art; and only a school of criticism by rule of thumb would suppose that they did. Compared with Mozart's, Beethoven's scoring is rough, redundant and capricious. But Beethoven's ideas are not Mozart's and can be expressed neither in Mozart's nor in Wagner's scoring. When critics tell us that bars 5–8 of the first movement of Beethoven's 8th Symphony are badly scored, all they mean is that to let two oboes and a flute crowd in upon a quiet phrase in the clarinet is not a proper way to score the first fateful appearance of a Wagnerian *leit-motif*, which may not be heard again for an hour. But it is an admirably dramatic and symphonic way to score a formal phrase which is going to be shouted at the top of the full orchestra immediately afterwards. The conductor need only say four words to the oboes, "Let the clarinet through," and the passage becomes perfectly clear. But it is already intelligible without any such precaution, and only bad playing can spoil it.

The symphonic orchestra which suffices for Beethoven, and for Brahms two generations later, consists of strings, pairs of flutes, oboes, clarinets, and bassoons, one or two pairs of horns, a pair of trumpets and kettledrums. Trombones, reserved for climaxes, are used in spacious 3-part harmony, and Beethoven requires them in three sizes, alto, tenor and bass. For lack of the alto trombone many of Beethoven's top notes must nowadays be lowered; and then our smart young orchestrators blame Beethoven for his ill-balanced chords. The full wind tone is extended upwards by the dangerously shrill piccolo, and downwards by the contrafagotto which gives the bass a richness without asserting itself. The big drum, cymbals and triangle are called "Turkish music" and, when used at all by Beethoven, are used according to Viennese ideas of Turkishness. Beethoven's intentions, whatever we may think of their execution, cover the whole field of symphonic art; and it is to dramatic orchestration that we must look for any addition to his range of thought.

Dramatic Orchestration.—The change from continuo-orchestration to the symphonic style was, as we have seen, essentially a change towards drama. Hence the dramatic and symphonic styles do not become separated at once; and with Mozart, who was equally happy in both, they are not easy to distinguish. The distinction is, even in Mozart, a paradox to people who think that opera is the most dramatic form of music. Sonatas and symphonies, even by Mozart, turn out to be far too dramatic for the stage. The fight at the beginning of *Don Giovanni* is perfectly adequately represented in musical sequences which would be too cold for any but his earliest symphonies. Theatre music will no more stand a symphonic environment than stage scenery will stand daylight.

And yet there is no limit to the refinement of dramatic orchestration whether in Mozart or Wagner. The gradations that a symphonic composer uses in 20 bars must be spread over a hundred in any continuous part of an opera, even on Mozart's scale. Here we already have a reason why opera should encourage very delicate gradations. Wagner's scale is given by the three minutes of the chord of E flat at the beginning of *Das Rheingold;* but still more significant is his management of a tensely emotional quarter of an hour with no more orchestra than strings and two horns, without double-basses, in the first act of *Die Walküre*. His enlargements of the orchestra all have an ultimate effect of purifying the timbre and so removing complications from the method of scoring. There was nothing new in large orchestras: both Mozart and Beethoven had rejoiced in performances with double wind; and in Wagner's early Dresden days Spontini requisitioned "douze belles contrebasses" for the performance of his operas. The experienced Wagner of Bayreuth is contented with eight.

A great stimulus was given to all orchestration by the invention of ventil trumpets and ventil horns. When these instruments thereby acquired a complete scale the aesthetics of all brass instruments needed reconsideration. Unimaginative composers of course saw no difficulty. A trumpet penetrates everything else like a red-hot poker, so why not give it the melody in every tutti? Wagner thought otherwise; he felt that brass tone was coarse unless it was used in large harmonic masses, and he accordingly invented new brass instruments to make the masses complete and coherent. Meanwhile he took his wind instruments in threes instead of twos. Already in the comparatively simple scores of *Der Fliegende Holländer* and *Lohengrin* this greatly clarified the colour-scheme. Half the art of scoring for wind instruments in the classical symphonies consists in making the best of the fact that instruments of contrasted tones will not make homogeneous triads when taken in couples. In *Tristan und Isolde* the threefold arrangement (two oboes and cor anglais; two clarinets and bass clarinet) adds its advantages to the maturest Wagnerian harmony, with a polyphony as profound as that of Beethoven's last quartets. In the tetralogy of *Der Ring des Nibelungen* Wagner takes his wind groups in fours, and introduces his new brass instruments. They originated in the bass-tuba which had come to replace the grotesque ophicleide and the still more primitive serpent as a bass to the trombones. These makeshifts had served Mendelssohn's purpose and failed to serve Berlioz's. The tuba could put an imposing bass below the trombones. Its tone is fat and puffy whereas that of the trombone is red-hot. A sensitive ear may notice, and a wise ear may refuse to notice, that the tuba is putting a black line below the red. But Wagner saw the possibility of a new aesthetic value here; and so in his tetralogy five tubas ranging from contrabass to high tenor show as clear a contrast from trombones as oboes from clarinets (Rimsky-Korsakov utterly fails to grasp this point).

The composers, having learnt new powers from such enlargements, can henceforth use these powers without extra apparatus. The orchestration of *Die Meistersinger* is the most complex in all Wagner, just because it is written for Beethoven's orchestra plus one tuba and a harp, and, of course, the now ubiquitous ventil horns, the most perfect of all continuo-players. In *Parsifal* the extra tubas are abandoned but the remaining contrabass-tuba has permanently won its independence of the trombones.

It seems paradoxical to leave Berlioz out of account in a history of instrumentation. Yet, short of a detailed appreciation of his individual strokes of genius, all that can be said of him is that he drew attention to the subject in an epoch-making but capricious treatise, and that he achieved all that was possible to a highly imaginative musician who happened to hate polyphony. And that is more than some critics might expect. But it cannot have much direct influence on more ordinary musicians.

Post-Wagnerian Instrumentation.—A great many loudly proclaimed "new" tendencies in orchestration are nothing but the discovery of some single elementary principle. It would be quite easy to write a history of post-Wagnerian scoring in which single characteristics from each of the historic schools here described were assigned haphazard, one to each living composer; and quite impossible to argue against its results. The silliest *a priori* theories seem incontrovertible if we forget how music is actually made. If, for example, we believe that music is made for instruments instead of instruments being built to make the best music they can, we may come to believe in the theory ascribed to Stravinsky, that each instrument should produce no passages that are not peculiar to its own timbre and inappropriate to any other. This is as if no gentleman should ever say anything that could be said by a lady; and vice versa.

When we have dismissed all such precious nonsense, several real phenomena remain. New harmonic ideas, such as multiplanar harmony, depend inextricably on instrumentation as surely as did the classical grammar of counterpoint. Less important is what Richard Strauss has called *al fresco* orchestration. This means a perception that there is not only safety in numbers, but a high aesthetic value in the average result of sixteen wild-cat attacks at

a passage that no individual can play properly. It is doubtful whether that is the real reason of the splendour of such passages. For one thing, the splendour is enhanced by rehearsal, and in the best orchestras the players eventually learn such passages fairly accurately.

Mahler made a systematic study of the possibilities of very large orchestras: almost a quarter of the size of that of our Crystal Palace Handel festivals, but with music specially written for them. His 8th Symphony is a choral symphony requiring at least 750 performers, and going much more satisfactorily with 1,000. Berlioz never really contemplated anything larger. Such propositions are not decadent; they are severely disciplinary and require an imagination of the highest efficiency. On a large scale most orchestral colours fade; especially horns, which must be greatly multiplied if they are to tell.

More fascinating to most artists, and more practical in the present lean years, are the aesthetics of small groups and chamber-orchestras. But this is a subject which cannot be pursued here. It is as much as a young composer's prospects are worth to come before modern critics without a new aesthetic system of his own invention. But a general article cannot deal with such private affairs. (D. F. T.)

INSTRUMENT OF GOVERNMENT, the name given to the decree, or written constitution, under which Oliver Cromwell as "lord protector of the commonwealth" governed England, Scotland, and Ireland from Dec. 1653 to May 1657.

The Long Parliament was expelled in April 1653 and the council of state dissolved; the Little, or Nominated, parliament which followed ended its existence by abdication; and Cromwell, officially lord general of the army, with a new council of state, remained the only recognized authority in the country. It was in these circumstances that the Instrument of Government, drawn up by some officers in the army, prominent among whom was John Lambert, was brought forward, and after certain emendations accepted by Cromwell on Dec. 16. Consisting of 42 articles, the Instrument placed the legislative power in the hands of "one person, and the people assembled in parliament"; the executive power was left to the lord protector, whose office was to be elective and not hereditary, and a council of state numbering from 13 to 21 members. The councillors were appointed for life; 15 were named in the Instrument itself, and Cromwell and the council were empowered to add six. To fill vacancies parliament must name six persons, of whom the council would select two, the choice between these two being left to the protector. A parliament was to meet on Sept. 3, 1654, and until that date the protector with the consent of the council could make ordinances which would have the force of laws. After the meeting of parliament, however, he had no power of legislation, nor had he any veto upon its acts, the utmost he could do being to delay new legislation for 20 days. A new parliament must be called "once in every third year," elaborate arrangements being made to prevent any failure in this respect, and for five months it could not be dissolved save with its own consent. The parliament, composed of a single chamber, was to consist of 460 members—400 for England and Wales, and 30 each for Scotland and Ireland—and the representative system was entirely remodelled, growing towns sending members for the first time, and many small boroughs being disfranchised. A large majority of the English members, 265 out of 400, were to be elected by the counties, where voters must possess land or personal property of the value of £200, while in the boroughs the franchise remained unaltered. In Scotland and Ireland the arrangement of the representation was left to the protector and the council. Roman Catholics and all concerned in the Irish rebellion were permanently disfranchised and declared incapable of sitting in parliament, and those who had taken part in the war against the parliament were condemned to a similar disability during the first four parliaments. The protector was empowered to raise a revenue of £200,000 in addition to a sum sufficient to maintain the navy and an army of 30,000 men, and religious liberty was granted "provided this liberty be not extended to Popery or Prelacy." The chief officers of state were to be chosen with the consent of parliament, and a parliament must be summoned at once in case of war. The practical effect of the Instrument was to entrust the government of the three countries to the parliament for five months out of every three years, and to the protector and the council for the remainder of the time. Although the Instrument bristled with possibilities of difference between parliament and protector, "it is impossible," as Gardiner says, "not to be struck with the ability of its framers."

Cromwell governed according to the Instrument until the meeting of parliament on Sept. 3, when he endeavoured to obtain parliamentary sanction for the Instrument. Prolonged disputes followed and he dissolved the parliament on Jan. 22, 1655, without obtaining his object. Regarding the Instrument as still in force, the protector sought for a time to rule in accordance with its provisions; but new difficulties and growing discontent forced him to govern in a more arbitrary fashion. A second parliament met in Sept. 1656, and in the following May Cromwell assented to the Humble Petition and Advice, which supplanted the Instrument of Government.

The text of the Instrument is printed in S. R. Gardiner's *Constitutional Documents of the Puritan Revolution. See* also S. R. Gardiner, *History of the Commonwealth and Protectorate,* vols. ii. and iii. (1807–1901); L. von Ranke, *Englische Geschichte* (1859–68); and T. Carlyle, *Cromwell's Letters and Speeches* (1897–1901).

INSTRUMENTS, ELECTRICAL. On account of the great extension of electrical power supply, cable and radio telegraphy and telephony, and research, electrical measuring instruments have become extremely numerous of recent years; and it is therefore desirable to preface a description of the leading types by a short summary and classification of their principles.

In order that an electric current should flow through a conductor, there must be a potential difference, or P.D., usually expressed in volts, between its ends. The resulting current expressed in amperes always produces two effects: (*a*) an external magnetic field encircling the conductor and proportional to the current, and (*b*) an internal heating of the conductor due to agitation of its molecules which is proportional to the square of the current. If the conductor is a liquid compound or electrolyte, the passage of the current also produces a separation of its constituents or electrolysis, causing a liberation of gas or deposition of metal, the amount of which is proportional to the current and to the time for which it passes. All these three effects of the current have been employed as bases for its measurement. Conversely, the introduction of a magnetic field into a circuit (dynamo or transformer), or the heating of the junction of two conductors (thermopile), or chemical action (voltaic cell) causes an electromotive force to be set up, and electrical instruments based on these effects are in use. In addition when a difference of potential exists between two conductors there is an electrostatic attraction between them which can be used as a method of measuring the P.D.; and when electrified particles or electrons are projected across a vacuous space as in a valve tube they can be deflected either by electrostatic attraction or a magnetic field.

The steady current in a metallic conductor in amperes is equal to the P.D. in volts between its terminals divided by its resistance in ohms; and resistance measuring devices form a very important section of electrical instruments, with which are associated potentiometers for P.D. and current measurement. The power taken from or imparted to a circuit in Watts at any instant is obtained by multiplying the P.D. in volts by the current in amperes at that instant, and wattmeters enable this power to be directly indicated; while the energy consumed, generally measured in kilowatt hours or Board of Trade units (B.T.U.), is obtained by multiplying the power in kilowatts (1,000 watts) by the time in hours it is utilized, and is registered by energy meters; but if the supply P.D. is constant the product of the current and time or quantity of electricity is sufficient and is indicated by *quantity meters.*

Inductance and capacity are two electrical quantities which are of great importance in electrical circuits especially with high frequency alternating currents. The former is the magnetic field which is linked with the circuit whenever a current flows through

it, and therefore produces an e.m.f. whenever the current is increasing or diminishing, just as a mass resists acceleration or change of its velocity. The unit of inductance is termed the Henry (after the American physicist Joseph Henry, *q.v.*) and is such that it requires 1 volt to increase the current in it at the rate of 1 ampere per second. Capacity on the other hand has the opposite effect to inductance, as it offers infinite resistance to a steady motion or current, but allows alternating current to pass. It is the analogue of a spring which yields to changes of force, but remains stationary for a steady force.

Electrical and magnetic measurements are so closely related that they must be considered together, and we have to deal with magnetic force corresponding to electrostatic force, and magnetic flux corresponding to electric current.

The classification of electrical measuring instruments may be set out in the following table:—

Quantity to be measured	Practical unit	Definition of unit	Measuring instruments	
			Indicating	Laboratory
Current	Ampere	0·0111800 grams of silver deposited per second	Ammeters	Galvanometers and voltameters
Resistance	Ohm	106·300 centimetres of mercury 1 sq.mm. section (14·4521 grams) at 0° C	Ohmmeters	Wheatstone bridges Resistance standards
Electromotive force (e.m.f.) or Potential difference (p.d.)	Volt	Applied to resistance of 1 ohm produces a current of 1 ampere	Voltmeters	Electrometers or potentiometers and standard cells
Power	Watt	1 Volt-ampere	Wattmeters	
Quantity	Coulomb	1 Ampere-second	Quantity meters	Voltameters or ballistic galvanometers
Energy	B.T.U.	1 Kilowatt-hour	Energy meters	
Inductance	Henry	1 Volt for increase of current at 1 ampere per second		Inductance and capacity bridges Standard inductances Variometers
Capacity	Farad	1 Coulomb for 1 volt		Standard condensers
Magnetic force	Gauss		Permeameters	Magnetometers
Magnetic flux	Maxwell		Fluxmeters	Ballistic galvanometers

I. STANDARD INSTRUMENTS

The two primary electrical units are those of current (ampere), and resistance (ohm). From these can be derived the unit of potential difference (volt) and any one of these three can be deduced by Ohm's law from the remaining two. Standard instruments are divided into two classes (*a*) primary, and (*b*) derived or practical; the first, demanding extreme care and accuracy in design and construction, are being confined to the standardizing laboratory, the second being convenient portable devices for reproducing the standard.

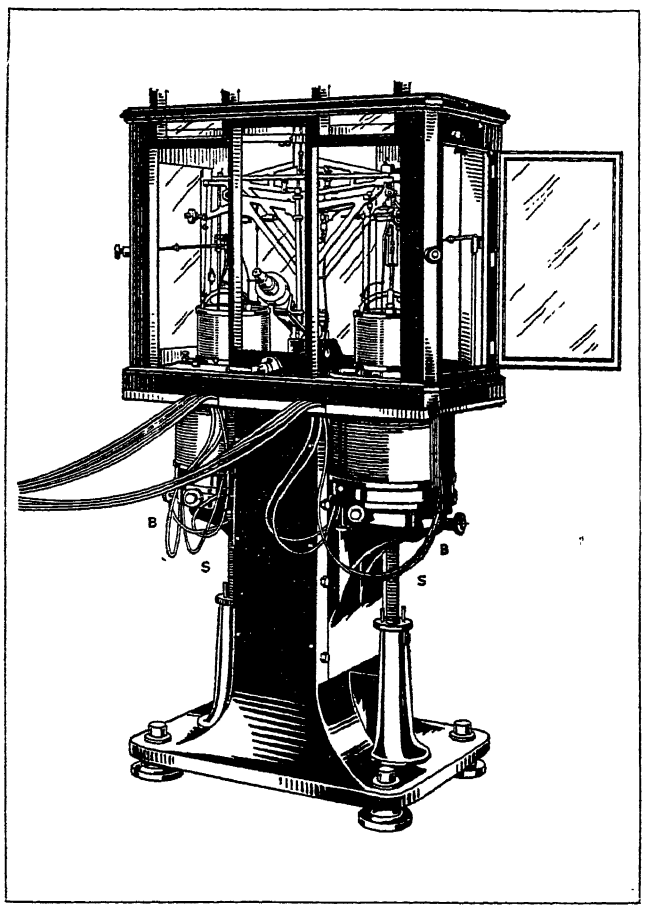
The two primary standard instruments employed at Government standardizing institutions such as the National Physical Laboratory are the *current balance* for determining the ampere, and the Lorenz apparatus for determining the ohm. The former (fig. 1) is a highly accurate form of Kelvin current balance (*q.v.*) in which both the fixed and moving coils are wound in screw threads cut on marble cylinders of accurately measured dimensions, and the force on the moving coils due to current circulating through the whole system is measured by an accurate balance. This instrument is generally connected to a silver voltameter, consisting of a platinum bowl containing a solution of pure silver nitrate and a plate of pure silver held horizontally in the liquid. On passing current from the silver anode plate to the platinum bowl, silver is deposited on the latter, and the amount of the deposit can be found by weighing the bowl before and after the deposition. Such a silver voltameter constitutes the derived practical standard of current, and can be set up in any laboratory. The "International ampere" was defined by the International Conference on Electrical Units and Standards in 1908 as "the unvarying electric current, which, when passed through a solution of nitrate of silver in water, in accordance with specification II. attached to these resolutions, deposits silver at the rate of 0·00111800 of a gram per second." The more recent work of Dr. F. E. Smith at the National Physical Laboratory indicates that the true ampere should deposit ·00111828 gram per second.

The best primary standard instrument for the determination of the ohm is that originally due to Lorenz in 1873. Essentially it consists of a metal disc (fig. 3) rotated steadily in the magnetic field of a coaxial cylindrical coil through which a current is passed. The arrangement is therefore equivalent to a "Faraday disc" in which the magnet is replaced by the current carrying coil, and an e.m.f. is induced between the centre and edge of the disc. If M is the coefficient of mutual inductance between the coil and disc (the magnetic flux through the disc for unit current in the coil), i the current in the coil, and n the number of revolutions per second of the disc, any radius of the disc cuts across the whole flux Mi in each revolution or Mni lines of force or Maxwells per second. This is, by definition, the e.m.f., E between the centre and edge of the disc. The current passing through the coil is also led through the resistance R to be tested producing a P.D. $V=Ri$, and the ends of this resistance are connected through a galvanometer G to two contacts at the centre and edge of the disc. On varying the speed of the disc a speed can be found for which the galvanometer remains at zero, indicating no current in which case $V=E$, or $Ri=Mni$, so that $R=Mn$. The mutual inductance M is a constant of the apparatus which can be calculated from the dimensions and number of turns of the coil and the diameter of the disc, so that when balance is obtained the resistance R can be determined by multiplying this constant by the speed, which is easily measured with accuracy.

The most recent form of Lorenz apparatus as designed and used at the National Physical Laboratory differs from the original form principally in having two discs and four coils wound on marble cylinders so arranged (*a*) that the system is astatic or unaffected by uniform external magnetic fields such as that of the earth, and (*b*) that the magnetic field of the coils at the edge of the disc is very low so that small errors in the dimensions have less effect. As the e.m.f.'s in the two discs are in opposite directions two contacts only on their edges suffice. The convenience of this apparatus enables standard resistance coils to be determined directly, and this appears preferable and likely to be adopted in the future; but at present the practical derived standard is the mercury ohm consisting of a glass tube having a bore of 1 square millimetre in cross section and a length of 106·300 centimetres filled with mercury and at a temperature of 0° C. As the cross section of the tube is always determined by filling it with mercury and weighing the latter, the practical definition of the ohm has been modified, and the International ohm is now defined as "the resistance offered to an unvarying electric current by a column of mercury at the temperature of melting ice, 14·4521 grams mass of a constant cross-sectional area and of a length of 106·300 centimetres."

The mercury standard ohm is constructed by employing a glass tube having a perfectly uniform bore of 1 square millimetre cross

section (1·129 mm. diameter) which is carefully calibrated for uniformity of cross section along its length by measuring the length of a known small volume of mercury as it is displaced to different positions along the tube. The tube is then cut and carefully ground to the required length and two additional short lengths of it have bulbs blown on their ends and are cemented in exact line on to the ends of the main tube, with very thin sheets of platinum foil between. The foil is then perforated so as to make a continuous uniform tube with contacts at the exact length apart. This tube is filled with pure redistilled mercury and current is passed through it from bulb to bulb, while the P.D. between the platinum contacts can be balanced by a potentiometer and standard cell, thus giving the e.m.f. of the latter in terms of the ampere and ohm. Comparisons between the standard mercury ohm and a standard resistance coil can also be effected by a Kelvin double bridge. Whenever the mercury ohm is in use it is laid horizontally in a trough filled with melting ice. The testing current must be only a small fraction of an ampere to avoid heating the mercury, on account of its somewhat high temperature coefficient of resistance (0·090% per 1° C).



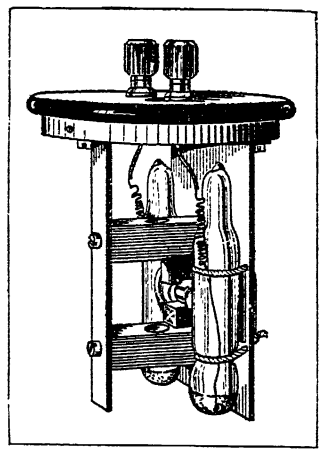
FROM AYRTON, MATHER AND SMITH, "PHILOSOPHICAL TRANSACTIONS" (COUNCIL OF THE ROYAL SOCIETY)

FIG. 1.—CURRENT BALANCE

The mercury standard ohm is, however, far too difficult to construct to be of practical use, and consequently the standard resistances which are generally employed are in the form of platinum-silver or manganin coils carefully annealed and adjusted and standardized against the mercury standard at a standardizing laboratory. Many standard resistance coils have been devised, such as the original B.A. standard having a platinum-silver coil embedded in paraffin wax, the manganin standards of the Reichsanstalt and the more open forms of Fleming Burstall and Drysdale.

Having defined the ampere and ohm, the International volt is therefore defined as "that electrical pressure which, when steadily applied to a conductor whose resistance is one International ohm, will produce a current of one International ampere."

As in the other cases a practical standard is desirable, and this is provided by a standard cell, of which the best and now universally used example is the cadmium cell first devised by Dr. Weston in 1892. This cell as now made consists of a small glass vessel of H form (fig. 2) having platinum wires sealed into the bottoms of the main tubes. At the bottom of one of them a small quantity of mercury is placed, and in the other some 10% (by weight) cadmium amalgam. Above the mercury there is a layer of mercurous sulphate and cadmium sulphate pastes, and above the amalgam, a layer of cadmium sulphate crystals. Some cadmium sulphate crystals are also placed over the above pastes, and the remaining space in the two main tubes and the connecting tube is partly filled with saturated acidic cadmium sulphate solution, the upper ends of the main tubes being hermetically sealed. In order to make the cell more portable by reducing the risk of displacing the contents, Dr. F. E. Smith introduced constrictions at the lower part of the tubes, these constrictions preventing movements of the solid chemicals. The utmost care must be taken over the purity of the materials and cleanliness of the glass vessel and seals, and when the cell is made to the specification its e.m.f. is 1·0183 International volts at 20° C with a temperature coefficient of −0·004% per 1° C. The e.m.f. at any temperature t° C is given by the formula

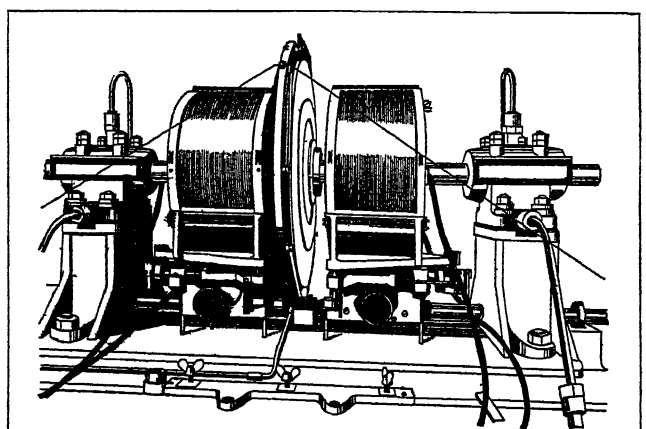


BY PERMISSION OF CAMBRIDGE INSTRUMENT CO.

FIG. 2.—METHOD OF MOUNTING WESTON NORMAL CELL

$$E_t = E_{20} - 0{\cdot}000{,}0406\,(t-20) - 0{\cdot}000{,}000{,}95(t-20)^2 + 0{\cdot}000{,}000{,}01(t-20)^3$$

The standard cadmium cell properly made up is the most accurate and convenient of all practical electrical standards, and measurements of any P.D. can be conveniently made with it, in conjunction with a potentiometer (*q.v.*). Another standard cell is the Clark cell. In this cell the cadmium of the Weston cell is replaced by zinc. The positive pole of a Clark cell consists of an amalgam containing 10% of zinc, a paste of zinc sulphate and mercurous sulphate, zinc sulphate crystals and zinc sulphate solution. In all other respects the construction of the Clark cell is similar to the Weston cell. The e.m.f. of the Clark cell at a temperature t° C is given by Watson as



FROM GLAZEBROOK, "DICTIONARY OF APPLIED PHYSICS" (MACMILLAN)

FIG. 3.—LORENZ APPARATUS

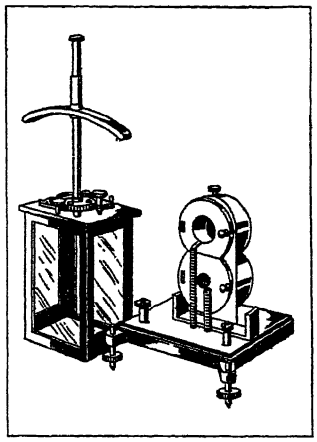
$$E_t = 1{\cdot}4328 - 119\times10^{-5}(t-15) - 0{\cdot}7\times10^{-5}(t-15)^2.$$

II. CURRENT MEASURING INSTRUMENTS

These can be divided into two chief classes: (*a*) Galvanometers

or sensitive laboratory instruments for measuring very small currents, and (*b*) ammeters or indicating pointer instruments for large currents. The former are practically exclusively on the electromagnetic principle, while the latter are very diverse in form, and may be either electromagnetic or thermal.

Galvanometers.—These can again be divided into two types, known as the moving needle and moving coil forms respectively. The first are derived from the original discovery of Oersted in 1820 that if a conductor is stretched straight over a pivoted magnetic needle and parallel to it, the needle tends to turn at right angles to the conductor when current is flowing through the latter. If the current is reversed the needle turns in the opposite direction. The same reversal effect is produced by moving the conductor to the under side of the needle, so that if the conductor is wound into a flat coil encircling the needle, all parts of it tend to deflect the needle in the same direction and the effect is enhanced. This was put into practical form as the first galvanometer by Schweigger in 1820. Since the deflecting force or torque due to the coil is resisted by the controlling torque of the earth's magnetic field, it was obvious that the sensitiveness would be increased by reducing the latter or its effect, and Nobili in 1825 therefore introduced the "astatic" needle system in which two equal magnetic needles were mounted with opposite polarities on the same vertical stem, one being inside and the other outside the coil. The system was suspended by a silk thread and provided with a light pointer. It was left, however, for Lord Kelvin in 1858 to produce the highly sensitive reflecting type of galvanometer (fig. 4) which has persisted with minor modifications to this day. He employed an astatic system like Nobili's but with each of the needles inside a coil, the currents in two coils being in opposite directions, so that the deflectional torque was doubled while preserving the small control of the astatic system. The needle system was composed of a thin vertical aluminium wire across which two sets each of three or four short pieces of hardened watch spring were cemented; the two sets being magnetized in opposite directions by being placed between the poles of a powerful electromagnet. Midway between the magnet systems, a light concave mirror was cemented to the aluminium stem (sometimes with a thin mica disc behind it to assist in damping the instrument), and the whole system was suspended by a single fibre of cocoon silk cemented to the top of the stem, from the upper bar of a frame. Each of the coils was made in two halves in ebonite cases hinged to the side of this frame so that they could be closed together like a book with the needles in the small space between, and the instrument was therefore generally known as the four coil galvanometer. The mirror was usually exposed through a small space between the upper and lower coil systems. The whole instrument was enclosed in a brass case and glass case on an ebonite base provided with levels and levelling screws, which enabled the base to be accurately levelled and the needles to swing freely in the small space between the coils. On the top of the case was a vertical brass rod on which was mounted a curved permanent magnet on a sleeve which permitted of its being raised or lowered or turned, and a tangent screw on the rod allowed the final turning to be effected gradually and accurately. This magnet being nearer to the upper than the lower needle system exercised a resultant control on it which could be varied to any extent by raising or lowering the magnet, and the zero could be adjusted by the tangent screw. A good galvanometer of this type wound with coils having a resistance of 6,000 ohms, when adjusted to have a periodic time of 20 sec. gave a deflection of about 8,000 mm. per microamp. on a scale at 1 metre distance.



BY PERMISSION OF KELVIN, BOTTOMLEY AND BAIRD

FIG. 4.—KELVIN ASTATIC MIRROR GALVANOMETER

Improvements were made in the magnet system by Broca and Paschen and great improvement in sensitiveness and definiteness of zero was secured by employing the quartz fibres invented by Prof. C. V. Boys in 1890, but the most remarkable advance has been made quite recently by Prof. A. V. Hill and Mr. Downing at University college in conjunction with Dr. Daynes of the Cambridge Instrument company. Their galvanometer is similar to the Kelvin four coil instrument above described, but the magnet system has been made still smaller and of the recently discovered cobalt magnet steel (steel with 35% cobalt) which has a much greater intensity of magnetization and permanence than any previous form of permanent magnet steel, while the mirror has been reduced to the smallest and thinnest dimensions compatible with optical efficiency. The needle system weighs only 0.0045 grams and is suspended by a fine quartz fibre. The coils are also made much smaller so as to obtain the maximum magnetic field for a given resistance. The great obstacle to the general use of the moving magnet galvanometer has been its disturbance by stray variable magnetic fields such as those produced by electrical machines or tramways in the vicinity, as no system can be made sufficiently perfectly astatic as to prevent such disturbance, and attempts have been made to shield the galvanometer against such disturbances by enclosing it in heavy bells of soft iron, but with only partial success. Within the last few years however a new nickel-iron alloy (78 nickel to 22 iron) known as *Permalloy* or *Mumetal* has been introduced, which has a remarkably high permeability in weak magnetic fields, and it was suggested by Drysdale that this would enable an effective magnetic shield to be constructed with only a small thickness of this alloy. Acting on this suggestion Prof. Hill and Mr. Downing made a cylindrical mumetal case for their new type of galvanometer and found that the shielding was so perfect that the galvanometer was unaffected by the starting and stopping of a motor within a few yards of it. This important improvement has enabled the full sensitiveness of the galvanometer to be utilized without difficulty, and a 1 ohm galvanometer of this type with a periodic time of 10 sec. has given a deflection equivalent to 50,000 mm. per microamp. on a scale at a metre distance, or about 500 times the equivalent sensitivity of the Kelvin galvanometer. This achievement may lead to the renewed popularity of the moving needle galvanometer which has been discarded in favour of the moving coil form owing to the freedom of the latter from magnetic disturbance.

Standard Galvanometers.—The instruments so far described have been designed to obtain the highest possible sensitivity, but before the advent of accurate direct-reading ammeters, the tangent and sine galvanometer, devised by Pouillet in 1837, was in very general use for current measurement. In its simplest form this galvanometer consisted of a short pivoted magnetic needle provided with a long light cross pointer moving over a scale of degrees, and mounted at the centre of a large vertical coil through which the current could be passed. This galvanometer was set up and rotated until the magnetic needle was in the plane of the coil when no current was passing. On making the circuit a magnetic field was produced in the coil perpendicular to the earth's magnetic field and combining with it to produce a resultant field to which the needle deflected. The magnetic field at the centre of a coil of mean radius r and number of turns n when traversed by a current of i amperes is $H'=0{\cdot}2\,\pi ni/r$, and if H is the horizontal component of the earth's magnetic field the resultant field will be inclined to it by an angle θ such that

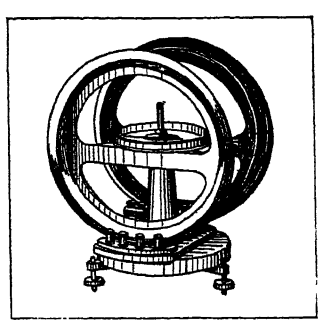


FIG. 5.—HELMHOLTZ TANGENT GALVANOMETER

$$\tan\theta = \frac{H'}{H} = 0{\cdot}2\pi ni/rH \text{ from which } i = \frac{rH}{0{\cdot}2\pi n}\cdot\tan\theta.$$

If the dimensions of the coil and the horizontal intensity of the earth's field are known, therefore, the tangent galvanometer serves as an ammeter. The value of H in London may be taken as 0·18 but it is liable to variation owing to the proximity of iron objects, so that for accurate work it should be determined in situ.

The accuracy of the tangent galvanometer depends on the uniformity of the magnetic field of the coil in the neighbourhood of the needle, and this is only the case over a very small area. For this reason the magnetic needle should be as short as possible, but this is in itself insufficient, and a great improvement was made by Helmholtz who used two equal and parallel coils, separated by a distance equal to the radius of either (fig. 5). With this arrangement and large coils very perfect uniformity of the field is secured and the tangent law is very accurately followed. By a slight addition to the tangent galvanometer it can be used for the measurement of current in another way which has certain advantages. The addition consists of mounting the coils and compass box on a rotatable vertical axis and providing them with a pointer which travels over a scale fixed on the base and divided in degrees. The galvanometer is first set up and turned till its needle is at zero (*i.e.*, in the plane parallel to the coils and to the earth's field, as before) but when the current is switched on and the needle deflects, the whole system is turned round the vertical axis to follow the needle, until the zero of the compass box catches up with it. In this case the field H' of the coils rotates with, and is always perpendicular to them, so that when the zero catches up with the needle the galvanometer has been turned through an angle α such that

$$\sin\alpha = \frac{H}{H'}, \quad \text{and} \quad i = \frac{rH}{0{\cdot}2\pi n}\sin\theta$$

for a single central coil. For this reason the galvanometer so used is termed a sine galvanometer, and the method has some advantages as the needle is always in the same position as regards the field of the coils when reading, and the angle of rotation can be more accurately read on the fixed scale used for the coils. Although good tangent galvanometers can usually be used in either manner, the tangent principle has been more generally employed.

Ballistic Galvanometers.—The foregoing galvanometers are used for the detection of measurement of very small steady currents, and are therefore preferably damped so as to attain their steady deflection as quickly as possible without oscillating about it. There is another class of galvanometers, however, which are employed for measuring the extremely sudden charging or discharging of a condenser or inductance, etc., and are termed ballistic galvanometers as being equivalent to the ballistic pendulum for measuring mechanical impulses. If I is the moment of inertia of the magnet system, K the controlling torque per unit angle, T the total torque and a the deflecting torque per unit current we have

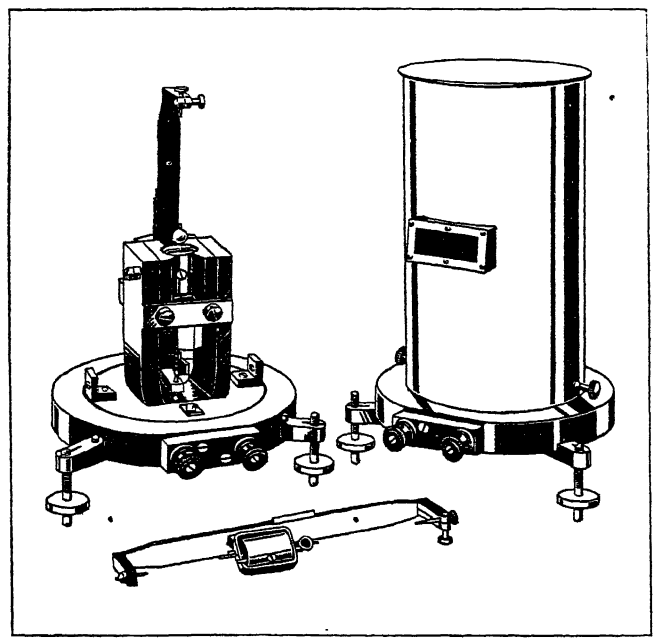
$$I\frac{\partial^2\theta}{\partial t} + K\theta = T = ai,$$

and if the system is at zero

$$I\frac{\partial^2\theta}{\partial t^2} = ai \quad \text{so that} \quad I\frac{\partial\theta}{\partial t} = I\omega_0 = a\int_0^t i dt = aQ$$

where ω_0 is the initial angular velocity of deflection and Q the quantity of electricity which has passed through the coil, provided that it has passed before the system moves appreciably from its zero position. The initial kinetic energy of the system is $\frac{1}{2}I\omega_0^2$ and the system will swing until this is converted into potential energy against the control which $= \int Td\theta = K\int_0^\theta \theta d\theta = \frac{1}{2}K\theta^2$, so that $\theta = \sqrt{\frac{I}{K}}\omega_0 = \sqrt{\frac{I}{K}}\frac{a}{I}Q = \frac{a}{\sqrt{KI}}Q$. The maximum deflection or first swing of the galvanometer therefore measures the quantity which has passed, provided that it has all been converted to potential energy against the control and not dissipated in air resistance or damping. For this reason ballistic galvanometers are made as undamped as possible by having somewhat heavy cylindrical magnets to offer the smallest air resistance. In other respects they are similar to other galvanometers.

Moving Coil Galvanometers.—The moving coil galvanometer arose from the discovery by Ampere, in 1820, that a conductor carrying an electric current tended to move transversely across a magnetic field. (*See* ELECTRICITY.) The first application of this



BY PERMISSION OF ELLIOTT BROTHERS

FIG. 6.—MOVABLE COIL GALVANOMETER

principle to galvanometers was by Sturgeon in 1836, followed, in 1867, by the Siphon recorder of Lord Kelvin; but this was used for recording cable signals, and d'Arsonval in 1882 introduced the first reflecting moving coil galvanometer. It consisted of a light rectangular coil of fine wire suspended by the thinnest possible wires between terminals as shown in fig. 6 between the poles of a vertical horseshoe magnet. In order to intensify the magnetic field, a soft iron cylinder was mounted inside the coil without touching it. On passing a current round the coil through the suspensions the coil turned and its movements were indicated by a concave mirror on the coil reflecting a beam of light on to a scale. This type of galvanometer still persists, but Ayrton and Mather improved it in 1890 by making the coil very narrow and discarding the iron core. Various minor improvements have since been introduced, notably by Moll, who employs an electromagnet for his field.

A good standard Ayrton-Mather type of moving coil galvanometer has a sensitivity of 800 mm. per microampere at a metre for a resistance of 400 ohms and periodic time of 6 sec., and the Moll galvanometer gives 200 mm. per microampere for a resistance of 50 ohms and periodic time of 1·3 sec.

These sensitivities are far below those of the corresponding moving needle types, but the moving coil galvanometer has the great advantage of being undisturbed by outside magnetic fields, and of having constant sensitivity. On the other hand it has the disadvantage of being heavily overdamped on short circuit, and of being less suitable for very low P.D. measurements such as those on thermocouples, owing to the high resistance of its suspensions. Up till recently the advantages in most cases heavily outweighed the disadvantages and moving coil galvanometers have consequently been in universal use for all but exceptional cases, but the introduction of the nickel iron magnetic screening by Prof. Hill and Mr. Downing may restore the moving needle instrument to favor.

Duddell Thermo-galvanometer.—Neither of the above types of galvanometer is of any use for alternating currents, and the great need for a sensitive alternating current galvanometer

especially for radio measurements, led Duddell in 1904 to adopt the Boys radio-micrometer for this purpose. This instrument consists in principle of a moving coil galvanometer consisting of a single loop of thin copper wire hung up by a quartz fibre between the poles of a magnet. The lower ends of this loop are soldered to two small vertical bars of bismuth and antimony which are soldered together to a small copper disc at their lower ends to complete the loop and form a thermo-junction. When heat radiation falls on this junction a current flows through the loop and deflects it, and Prof. Boys has used this instrument to measure the heat received from stars. Duddell utilized this instrument by fixing a "heater" consisting of a small length of Wollaston wire just under the junction, and the passage of a current through this heater warms the junction and deflects the coil.

Shunts.—The very high sensitiveness of reflecting galvanometers renders it frequently desirable to be able to reduce it by definite fractions so as to be able to measure larger currents, and this is effected by shunting the galvanometer. If a resistance of one-ninth of that of the galvanometer is connected across the terminals, $\frac{9}{10}$ of the total current passes through the resistance and only $\frac{1}{10}$ through the galvanometer, and if the resistance is $\frac{1}{99}$ or $\frac{1}{999}$ that of the galvanometer, $\frac{1}{100}$ or $\frac{1}{1000}$ respectively of the total current passes through it. Shunt boxes in which the requisite resistances can be converted by plugs are therefore often employed, but must be made for the particular galvanometers they are to be used with. In 1894, however, Profs. Ayrton and Mather devised a "universal" shunt box which could be used with galvanometers of a fairly wide range of resistances, and these universal shunts are now most commonly employed.

Vibration Galvanometers.—The great extension of bridge or null methods of testing inductance and capacity, etc., has created a demand for highly sensitive galvanometers for alternating currents, comparable with those used for direct-current measurements. None of the alternating current instruments so far described in any way meet this requirement, and such measurements have generally been made with telephones as detectors. This, however, confines the measurements to audible frequencies, and there are other objections to their use, so that vibration galvanometers have come into favour. Such galvanometers are in principle direct current galvanometers of high and variable natural frequency and capable of being "tuned" into resonance with the supply, in which case they produce a vibrating streak of light on the scale and are exceedingly sensitive.

The first practical form of vibration galvanometers was that of Rubens (about 1900), which consisted of a vertical stretched wire carrying a magnet and mirror system and two coils like that of a moving needle galvanometer (*q.v.*) but non-astatic. By altering the tension on the wire and its length by two bridges like those of a monochord, the natural frequency of this system could be brought into unison or resonance with the alternating current in the coils, whereupon the spot of light on the scale broadened out into a long streak. This type was somewhat difficult to "tune." Duddell followed in 1910 by a vibration galvanometer on the lines of his oscillograph (*q.v.*), but with two long strips, a tension pulley, and two bridges which could be moved by a right and left handed screw. This instrument was remarkably sensitive and covered a frequency range from about 25 to 2,000 ~ per second, but was liable to respond to harmonics on the wave form. In 1911 Drysdale, with the help of Tinsley, devised a vibration galvanometer, primarily for use with his A.C. potentiometer (*q.v.*), in which the moving system was like that of Rubens, but mounted on a silk fibre. The control was exercised by a large horizontal permanent magnet, the strength of which could be varied by varying the distance between its pole pieces and by sliding an armature or "magnetic shunt" along it, so that tuning could be effected without touching the moving system. In 1920 he substituted an electromagnet controlled from outside by a battery and rheostat, and this form has since been independently conceived and constructed by the Cambridge Instrument company. Moving coil variable bifilar suspension vibration galvanometers of great sensitivity have been introduced by Campbell, Gall and others, while a most ingenious single fibre unbalanced instrument has recently been devised by Prof. Moll. All such instruments are extremely sharp in their tuning, and therefore require the frequency of the supply to be kept constant to within about 0·1% for their satisfactory use.

Oscillographs and String Galvanometers.—The extensive employment of alternating currents of all frequencies from 25 to thousands or millions of cycles per second has caused a great demand for instruments which will give a record of the variation or wave-form of such currents, just as the steam or gas engine indicator records the variations of pressure in the cylinder, and these instruments are known as oscillographs. Prior to their introduction, such wave forms were somewhat laboriously determined by an instantaneous contact method originally devised by Joubert, and the Hospitalier "Ondograph" based on this principle enables the form of the wave to be automatically traced on paper by a pen. But such methods can only deal with currents which vary in the same manner over some seconds or minutes of time, while the true oscillographs will deal with transient currents which may last only a few hundredths of a second.

Oscillographs are, therefore, galvanometers capable of following rapid fluctuations in the current, and may be either of the moving needle or moving coil type. The inertia of their moving systems must be as low as possible, their natural frequency of oscillation very high, and their damping as nearly as possible critical. For these reasons, the moving system must be as small and light as possible. Blondel in 1891 devised the first oscillograph on the moving coil principle, and was closely followed by Duddell who in 1893 produced the form of oscillograph which has since been most largely used in this country. In order to diminish the inertia of the coil to a minimum it was reduced to a single loop of fine phosphor bronze strip, and as with even this small inertia a large control was found necessary to obtain the high natural vibration frequency aimed at (10,000 ~ per sec.), the two upper ends of this loop were attached to the terminals and the lower portion passed over a small ivory pulley which was pulled upwards by a spring, so that both sides of the loop were equally strained nearly up to their elastic limit. The loop with its pulley and terminals was mounted on a brass plate and could be mounted between the poles of a powerful electromagnet, taking the place of the permanent magnet of the d'Arsonval moving coil galvanometer (*q.v.*). In order to obtain the strongest possible magnetic field iron pieces were fixed on both sides of and between the strips, and for observing the deflections a very small thin rectangular mirror was cemented across the two strips at their centre. Damping was secured by closing the front by a glass plate and filling the space with oil. On passing current round the loop, one strip moved transversely forward and the other backward in the gaps, so that the mirror was tilted sideways and deflected a beam of light projected on to it by an arc lamp. By suitable optical arrangements the reflected beam was focussed on to a photographic plate or film which could be dropped or driven vertically downwards, and the variations of current in the loop were then recorded as a wave on the film.

In order to enable the wave form of a constantly alternating current to be seen or projected on a screen, Duddell also introduced a second mirror caused to oscillate in a direction perpendicular to that of the first mirror, by a cam driven by a synchronous motor from the alternating supply mains. The reflected beam from the oscillograph mirror was caused to fall on this second mirror and then on to the screen, causing the wave form of the current to be exhibited as a continuous picture, owing to the persistence of vision.

In nearly all alternating current investigations it is desirable to have simultaneous traces of the variation of the current and the P.D. and for this purpose Duddell employed two loops side by side in the same magnetic field with an iron plate between them to keep the field as strong as possible. One of these loops carried the current to be recorded or was connected across a low resistance so as to shunt a fraction of the current when it was too large for the strip; while the other was connected, in series with a large non-inductive resistance, across the circuit so that the current through it was proportional to the P.D. at each instant. Each of

the loops was provided with mirrors and a third "zero mirror" was arranged between them, so that when the light from the arc fell on them three beams were reflected, giving the P.D. and current waves and the zero axis respectively.

Portable oscillographs on this principle have recently been introduced by the Westinghouse company in America and the Cambridge Instrument company in England, the vibrators being made up as separate elements each with its own permanent magnet, and the illumination being produced by a metallic filament lamp which is temporarily overrun during exposure of the film. For high voltages the electrostatic vibrator of Ho and Kato is often substituted for one or more of the vibrators in the outfit.

An ingenious oscillograph on the hot wire principle was devised by J. T. Irwin in 1907, but has not come into general use. In France, M. Dubois has recently devised an oscillograph of the soft iron type in which a tongue of soft iron is caused to vibrate between the poles of a permanent magnet, and communicates its motions to the mirror through a strip and pulley.

String Galvanometers.—In 1901 Prof. Einthoven introduced a form of galvanometer which has proved of great value for a large variety of work. It is similar in principle to the moving coil oscillograph but is much more sensitive, although incapable of working at such high frequencies. Instead of the loop a single straight fibre usually of silvered or gilded quartz is employed. This fibre is mounted in the narrow gap between the poles of an electromagnet as in the oscillograph, and moves transversely across this gap. As there is no second fibre to which to attach a mirror, the poles of the magnet are bored through so that a small portion of the centre of the fibre can be seen, and a compound microscope with a scale in its eyepiece is mounted in one of these holes and a condenser in the other. The movements of the fibre can therefore be observed and measured through the microscope, or the fibre and scale can be projected on to a screen by an arc lantern directed on to the condenser.

The Einthoven galvanometer is, unfortunately, very costly, owing to the difficult construction of its poles and optical observing arrangements, and an ingenious attempt at securing its advantages with the ordinary simple reflecting mirror device has recently been made by Mijnheer van Dyck of Leyden in his "Torsion String" galvanometer. In this galvanometer the fibre is of the finest silicon bronze wire, and a second thin wire of hard drawn copper lies close to and parallel to it over the portion between the magnet poles and is soldered to it at its top and bottom. As the copper wire is of much lower resistance than the central bronze wire, the bulk of the current flowing down the latter is shunted into the copper wire which, therefore, becomes a moving coil with half a turn, and tends to rotate round the central wire, being controlled by the torsion of the latter. As the system is unsymmetrical and therefore unbalanced, a strip of aluminium foil is cemented across the two wires at their centre and a small silvered mirror is cemented on this strip on the opposite side so as to balance the loop, a cleft being made in the corresponding magnet pole to allow of its free rotation. This galvanometer can be used with the ordinary lamp and scale, and with a resistance of 10 ohms and periodic time of 0·01 sec. is stated to give a deflection of 3 mm. per microampere at 1 metre, which is nearly equivalent to the sensitivity of the Einthoven galvanometer.

Cathode-ray Oscillographs.—For frequencies higher than about 2,000 ~ per second, all the above types of oscillograph are unsuitable, and for higher frequencies up to those employed in radio work the cathode-ray oscillograph has come into use. If a high P.D. is applied between two plates in a very perfectly evacuated tube, negatively electrified particles or electrons are ejected from the negative plate and travel in straight lines with high velocity across the tube. Such a stream is known as a beam of cathode rays, and when it falls on a phosphorescent screen a brilliant illumination is produced. (*See* ELECTRICITY: *Conduction of in Gases.*) A filament may be substituted for the negative plate and gives out electrons when heated by passing a current through it, especially when it is coated with lime or thorium oxide as in "dull emitter" valves. If such a heated filament is enclosed in an evacuated bulb near to two plates each perforated by a fine hole, and a high P.D. is applied between the filament and a ring near the plates, the electrons are driven towards the plates with high velocity, and some of them pass through the holes forming a very narrow pencil of cathode rays. When such a pencil passes between two plates and a P.D. is applied between them the electrons are attracted towards the positive plate and the beam is deflected in that direction; while if the plates are the poles of a magnet the electrons tend to move transversely between them like a conductor carrying a current and a deflection in the perpendicular direction is produced. The most simple oscillograph on this principle is known as the "Braun tube," having been invented by Braun in 1897, and a tube of this kind is now manufactured by the Western Electric company. It is composed of a conical highly evacuated glass bulb having the larger end coated inside with a layer of zinc sulphide or other luminescent material, and a thoriated filament at the smaller end, with a disc with fine perforation as anode. The fine cathode pencil passing through the pinhole, travels between two sets of plates at right angles, so that if two alternating P.D.'s from different parts of a circuit are connected to them, a trace in the form of a Lissajous figure is generally obtained. It is possible to show the hysteresis loop of an iron specimen directly in this manner.

The above type of oscillograph has the advantage of being permanently evacuated, but it is only suitable for the observation of certain cyclic phenomena, and does not permit of the photographic recording of intermittent or transient ones. Prof. Dufour in France and Dr. A. B. Wood in England, have therefore produced cathode ray oscillographs in which photographic plates can be inserted, and by using a cold cathode with a P.D. of 50,000 volts the former has obtained records of the wave form of radio transmitters up to over 1,000,000 ~ per second. Such oscillographs require to be evacuated after the removal of the camera or photographic plate, and not being hermetically sealed, are kept continuously evacuated during use.

Ammeters and Voltmeters.—As their names imply these instruments are respectively intended for directly measuring electric currents in amperes, and potential differences in volts, and they may conveniently be considered together as they are often similar in construction. For the majority of purposes these instruments are of the electromagnetic type, but thermal or "hot wire" instruments are used for alternating currents especially for those of high frequency such as are employed in radio working. The electromagnetic instruments are however of very diverse types. There are first (*a*) the moving magnet and (*b*) moving coil types corresponding to galvanometers; but in addition there are moving soft-iron dynamometer, and induction instruments, all of which can be used with alternating currents, the last being for alternating currents only.

Electromagnetic Instruments. (*a*) *Moving Magnet Type.*—The first direct reading ammeters and voltmeters introduced by Ayrton and Perry in 1879 were of this type. It consisted of a small magnetic needle on a short spindle between two pivots, and provided with an aluminium pointer. A small coil encircled the needle, and the whole system was fixed between the poles of a powerful permanent magnet, so that extraneous fields had little influence. The instrument has some similarity to the tangent galvanometer in principle, but the coil is small, and the earth's field is replaced by that of the horseshoe magnet. The large control given by such a magnet is an advantage in this case where sensitivity is ample, as it increases the rapidity of the readings. An interesting feature of this type of instrument was the winding of the coil with ten separate insulated strands which could be connected in series or parallel thus giving two ranges of a tenfold ratio of current. The same type of instrument could be used as a voltmeter by winding the coil with fine copper wire and connecting it in series with a high resistance coil of German silver and other wire of low temperature coefficient so that its total resistance was sensibly constant, and the current flowing through it was proportional to the P.D. applied to the terminals of the instrument. This device can be employed with almost any type of ammeter. The moving magnet type of ammeter has gone out of use for many years owing to its cost, but it has recently been

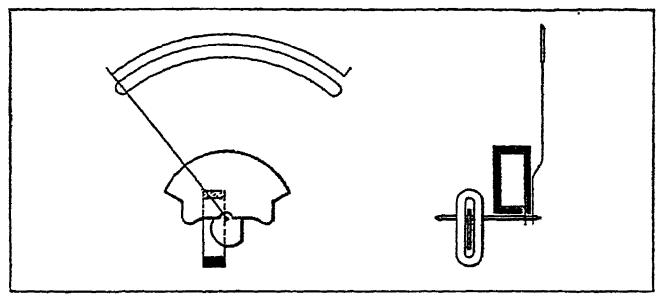
revised in an interesting form by the Westinghouse company, who substitute a second horseshoe of nickel iron with its poles at right angles to those of the permanent magnet. This horseshoe projects through the back of the case, and the conductor carrying the current is simply threaded through it, so that the conductor need not be divided and the instrument has no terminals.

(*b*) *Moving Coil Permanent-magnet Indicating Instruments* were introduced by Dr. Weston in 1888 and were similar to the d'Arsonval galvanometer, except that the coil was pivoted and controlled by spiral springs carrying the current, and a pointer was substituted for the mirror. This type has been developed into the most accurate of all direct current indicating instruments in the Weston and other laboratory standards, and has assumed many different forms, notably the "Cirscale" instruments of Messrs. Record, in which the poles are so arranged that the coil and pointer can rotate through nearly 270°. As the thin control springs can only carry a very small current (75 milliamperes is the usual maximum) the instrument can be used as a voltmeter by connecting a high resistance in series with the coil, but if it is to be employed for measuring larger currents, "shunts" are provided consisting of manganin or constantan strips having two terminals through which the current is passed, and two other terminals to which the instrument is connected, so that it acts as a low reading voltmeter measuring the current by the P.D. across the shunt. A single moving coil instrument with a set of series resistances and shunts will therefore serve for a very wide range of P.D. and current measurements, and portable "test sets" are commonly made covering the range from about 0·1 to 600 or more volts or amperes.

Moving Soft-iron Instruments.—These are the most simple and inexpensive ammeters and voltmeters and can be used both for direct and alternating current measurements. If a current is passed through a coil, a piece of soft iron will be sucked into it, and if a suitably shaped piece of soft iron is pivoted and provided with a pointer a very useful form of ammeter can be made. If the coil is wound with fine wire and a series resistance added the instrument becomes a voltmeter. The first instruments of this type were introduced by Ayrton and Perry in 1884 and others by Lord Kelvin, Schukert, Siemens, Nalder, Weston, etc. The last two are on what is called the repulsion principle, having two soft iron rods lying parallel to one another and to the axis of the coil. When the current flows these two rods are magnetized with the same polarities and consequently repel one another like the pith balls of an electroscope, so that if one is fixed and the other attached to a pivoted arm provided with a pointer, a deflection is produced. This last construction has some advantages over the others, as the two pieces of iron lie close together when the current is small, and are farther apart for large currents. For a given distance apart the force between the irons is proportional to the square of the current, so that it is very small for small currents, but this is partially compensated by their greater proximity, and the torque is consequently much more nearly proportional to the current and the instrument has a larger useful range than the single iron form. The same result may be obtained in the attraction forms by shaping the iron, but this requires careful experiment.

The moving soft-iron instruments are of great value in principle as they are not only simple in construction but are equally suitable for direct or alternating currents, as they obviously indicate the square root of mean square (R.M.S., or effective) current; while the moving coil permanent magnet instruments will only read on continuous current. Until quite recently, however, this valuable property was not taken full advantage of, owing to certain apparently inherent defects in the type. The first is the want of proportionality of magnetization in the iron to the current, and the hysteresis in the iron, which causes the instrument to read higher for a certain current when it has fallen from a higher value, than when it has risen from a lower one. In addition there is the high inductance of the coil with its iron cores, which causes a voltmeter of this type to read lower for the same P.D. as the frequency is increased and prevents the use of shunts for ammeters; and lastly, the demagnetizing effect of induced eddy currents in the iron and any metal parts close to it. All these errors have militated against the adoption of this type as a universal instrument, although A.C. ammeters and voltmeters for a single frequency have been largely employed.

Within the last few years, however, a great advance has been made notably by the substitution of Permalloy or Mumetal for the moving iron, which has resulted in the practical elimination

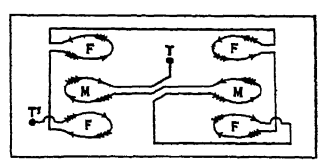


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FIG. 7.—PRECISION MOVING IRON INSTRUMENT

of wave form and hysteresis errors, and by making the coil as small and flat as possible so as to allow of a thin plate of this alloy to be attracted into it, thus greatly reducing the inductance and eddy-current errors. It was pointed out by Drysdale in 1924 that since the electromagnetic energy in an inductive coil $E=\frac{1}{2}Li^2$ where L is its inductance and i the current passing through it, the torque $T=\dfrac{\partial E}{\partial\theta}=\frac{1}{2}i^2\dfrac{\partial L}{\partial\theta}$, so that the instrument always operated by the increase of its inductance from L_0 at zero to L_{max} at its highest reading; and he proposed the term "electromagnetic efficiency" for the fraction $(L_{max}-L_0)/L_{max}$. On examination of existing instruments it was found that this efficiency was only 1 or 2% or less, so that of the total inductance about 99% was useless and noxious, and only about 1% useful in deflecting the instrument. Acting on this principle Col. Edgcumbe and Mr. Ockenden devised an ammeter on the lines above indicated (fig. 7), with the result of obtaining practically negligible hysteresis and eddy current errors and of increasing the electromagnetic efficiency to about 30%, and the current range to 15 or 20 fold. This has enabled it to be employed with shunts or series resistances like the moving coil instruments, either for direct current or with alternating currents up to 200 periods per second. It is claimed, and with apparent justice, that such instruments need not be inferior in accuracy to moving coil or other high-grade instruments. By using one fixed and two independently moving irons, Record has produced a moving iron instrument having a scale covering about 270°.

Dynamometer Instruments.—These form an important class of current measuring instruments as they are equally suitable for direct or alternating currents, and can be made either as standard, sub-standard or deflectional indicating instruments. They depend fundamentally on Ampere's discovery (1820) that parallel conductors carrying currents attract each other if the currents are in the same direction or repel each other if they are in opposite directions. In 1843 Weber produced a simple form of "electrodynamometer" on this principle, but the first practical measuring instruments appeared in 1883, when Kelvin and Joule devised the standard current weigher or balance, and Siemens the substandard dynamometer.



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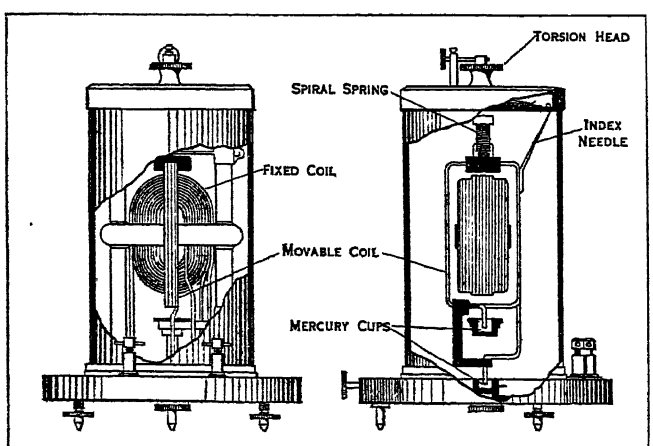
FIG. 8.—CONNECTIONS OF KELVIN AMPERE BALANCE

The principle of the Kelvin balance is shown in fig. 8. The instrument consists essentially of six horizontal coils, four of which are fixed (F) and two movable (M), and the current to be measured traverses the whole of the coils in series. In order to allow the two movable coils to swing freely between the fixed ones, they are suspended by a large number of straight line wires

forming straight straps or ligaments. The current passes round the coils as shown by the arrows, and it will be seen that on the right hand side the current in the centre moving coil is in the same direction as that in the upper and in the opposite direction to that in the lower of the fixed coils. The moving coil is therefore attracted to the upper and repelled from the lower coil and tends to move upwards, while the left hand moving coil in which the current circulates in the opposite direction tends to move downwards. The whole moving coil system therefore cants upwards at its right hand end, and can be brought back to the level or zero position by a weight hung at that end. To simplify the measurement the moving coils are mounted in a light frame having a long bar and scale in front, along which a weight can slide as in a steelyard balance and this is operated by a silk cord passing through the ends of the cover and provided with a device for freeing the cord from the weight when the latter is in position. Each balance has four weights for obtaining different ranges.

The electromagnetic potential energy of two circuits traversed by currents i_1 and i_2 and having a coefficient of mutual inductance M with one another is Mi_1i_2, so that the torque developed is $i_1i_2\frac{\partial M}{\partial \theta}$. In the Kelvin balance the two circuits are in series so that $i_1=i_2=i$, and the torque is $i^2\frac{\partial M}{\partial \theta}$, or is proportional to the square of the current, so that the instrument serves equally for direct or alternating current measurements. Various sizes of these balances, "Centiampere," "Ampere," "Deka-Ampere," "Hector-Ampere," and "Kilo-Ampere" have been constructed, but the latter, on account of their large conductors, are not accurate for high frequency currents owing to eddy currents, although the conductors are stranded or laminated.

The Siemens dynamometer (fig. 9) was for many years the most useful form of substandard instrument for both direct and alternating current testing. It consists essentially of two coils at right angles, the inner (F) having a large number of turns and being fixed with its axis horizontal on a wooden frame, and the outer (D) in the form of a loop encircling the fixed coil and suspended by a silk thread, with its two ends brought out at the bottom to dip into two mercury cups MM. On the top of the frame a circular scale is fixed, with a torsion head T and pointer,



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FIG. 9.—SIEMENS ELECTRODYNAMOMETER

a cylindrical spring S encircling the suspension being mounted between the torsion head and the top of the coil. The current circulates round both coils in series and causes the swinging coil to turn, whereupon the torsion head is turned until the torsion of the spring brings the coil back to its zero position as indicated by a pointer I fixed to the top of the coil. The current then $=K\sqrt{D}$, where K is the constant of the instrument and D the angle turned by the torsion head. In order to increase the range of the instrument, the fixed coil is generally made of two portions with different thicknesses and number of turns of wire, and either of these can be connected in series with the moving coil.

Both of the above instruments are of the standard type in which it is necessary always to bring the coils into the same position, in order that the theoretical square law shall be followed. But deflectional direct indicating instruments can be made by simply providing the moving coil with a pointer and control spring, in which case they are equivalent to permanent magnet moving coil instruments in which the magnet is replaced by the fixed coil. In 1890 the first instrument of this type was introduced by Dr. Weston as a dynamometer voltmeter, the fixed and moving coils being circular, wound with fine wire, and connected in series through the spiral springs which provided the control. A high non-inductive resistance was connected in series with the combination and the instrument was graduated as a direct reading voltmeter. Additional ranges were provided by extra series resistances. Dynamometer ammeters have also been constructed by making the fixed coil of thicker wire and connecting the moving coil in series with a small non-inductive resistance across the terminals of the fixed coil or an additional shunt, but it is difficult to eliminate inductive errors sufficiently in such instruments.

The most valuable application of the dynamometer principle is to standard and deflectional wattmeters, and to energy meters, which will be described later.

Induction Instruments.—These instruments may be described as dynamometer instruments in which current is led into the moving system by induction or transformer action instead of by conduction through springs or ligaments, and they can therefore only be used for alternating currents. They were initiated by Prof. Ferraris, the pioneer of polyphase working, in 1885, but have assumed many different forms, and have been adapted for many different measurements.

Induction instruments may be divided into three main classes, (*a*) repulsion, (*b*) shaded pole and (*c*) double pole instruments. The first depend upon the repulsion effect first discovered by Prof. Elihu Thomson, that a metal disc or ring is repelled from an electromagnet excited by alternating current. The explanation is that the magnet induces an e.m.f. in the disc or ring in quadrature with the magnetic field, which consequently produces eddy currents in it. If these currents were in phase with the induced e.m.f. they would also be in quadrature with the magnetic field and there would be no resultant force, but owing to the inductance and low resistance of the disc they lag behind the e.m.f. and become somewhat in antiphase with the magnetic field, producing a resultant repulsion.

The simplest application of this principle to ammeters is that of the Westinghouse company, in which the moving element consists simply of a thin aluminium or copper disc on a pivoted spindle perpendicular to its plane. The edge of this disc is however cut in the form of a cam and can turn in the gap of a laminated electromagnet through the coil of which the alternating current to be measured is passed. A control spring and pointer is attached to the spindle and when the system is at zero the whole of the pole face is covered by the disc. When the current is passed the repulsion effect causes the disc to turn so that less of the pole face is covered by the disc, and by suitably shaping the edge a long and fairly even scale can be obtained. In order to damp the swinging of the disc, a permanent magnet is mounted on the other side of it, which retards its movements by the eddy currents induced.

The shaded pole type of instrument is next in simplicity of construction, but is best understood by first describing the double pole form. If two laminated electromagnets A and B are fixed close together and act on a single circular disc, the alternating magnetism of A induces currents in the disc part of which pass through the gap of magnet B, so that the disc behaves as a moving coil carrying current derived from A and traversing the magnetic field of B, and thus producing a torque. But, reciprocally, the currents induced in the disc by magnet B traverse the field of A, and it is fairly obvious from the symmetry of the arrangement that if the two magnetic fields vary in the same phase, there will be no resultant torque, as there is no reason why it should move from A to B rather than from B to A. But if the magnetic

field in B lags in phase behind that of A there is a resultant torque from A to B and this torque is proportional to $I_1 I_2 \sin\phi$ where I_1 and I_2 are the currents in the two coils and ϕ the angle of phase different between the fields. This difference in phase may be secured in several ways, *e.g.*, by shunting one of the magnets or connecting it in series with a condenser, or by supplying the currents from different parts of the circuit, as will be described under wattmeters and energy meters.

The most simple application of this principle however to current measuring instruments is by "shading" part of a single pole (fig. 10). If a single laminated electromagnet has a cleft in its pole and a thick copper ring C encircles one part of it, B as shown, the eddy currents induced in this ring by the magnet react on its field and cause the magnetism of the part of the pole encircled by the ring, or "shaded" portion, to lag behind that of the remainder or unshaded portion A. Thus the single magnet behaves like the two magnets above referred to, and a pivoted disc arranged in the field of this magnet tends to turn from A to B. By adding a spring and pointer and damping magnet, a useful form of ammeter can be produced, and the scale can be of any length up to nearly 360°. The theory of induction instruments is very complex, and they are liable to many errors, but by careful design they may be made very useful and accurate instruments.

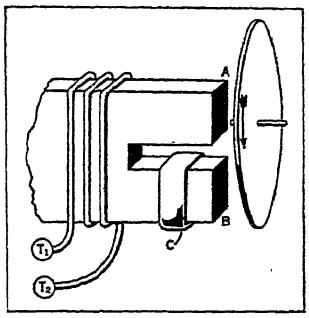


FIG. 10

Current and P.D. Transformers.—A great difficulty with alternating current instruments is their lack of range, as since the forces in them are generally proportioned to the square of the current, a reduction of the current to one-third reduces the force to one-ninth of its maximum value, and many instruments therefore only have about a fourfold useful range. On the other hand, the range of currents and voltages to be measured is enormous, from fractions to tens of thousands of amperes or volts. With nearly all such instruments shunts are useless owing to the induction errors they introduce, and for many years past the practice of employing transformers has been adopted. If a transformer is made with a good well-laminated magnetic circuit and two coils wound close together, one of which is short circuited through an ammeter, while the other has the alternating current to be measured passed through it, the current induced in the secondary coil will be proportional to that in the primary coil and approximately in the ratio of the number of turns in the coils. For example if an alternating current of 5,000 amperes is to be measured, a transformer may be made with a single bar or turn carrying this current, and a secondary coil of 1,000 turns which is connected to a 5 ampere ammeter. This device has the further important advantage of isolating the ammeter completely from the main circuit, which may be at a dangerously high potential on modern supply circuits. In like manner, if a transformer is wound with two coils of fine wire, one having 100 times as many turns as the other, and an alternating P.D. of 10,000 volts is applied to the coil having the larger number of turns, it will induce 100 volts in the other coil which can be measured in an ordinary voltmeter, without connecting it to the high voltage circuit. By the use of the Mumetal for the iron of the transformers, Col. Edgcumbe and Mr. Ockenden have recently made instrument transformers of very high precision.

Thermal or Hot Wire Instruments.—These instruments, as has been mentioned, depend upon the heating effect of a current passing through a conductor, and are equally suitable for direct or alternating current measurement. The power developed in a circuit having a resistance r ohms and carrying a current i amperes is ri^2 watts, and produces a heating effect of 0·24 ri^2 calories per second. Since the heating is proportional to the square of the current, it is the same for either direction of flow, and the average heating with alternating current is proportional to the mean square of the current.

Hot wire instruments are of two types (*a*) expansion and (*b*) thermo-junction. In the former the linear expansion of the wire caused by the heating is utilized; in the latter the heat is communicated to a thermo junction, which is connected to a millivoltmeter.

Until the last few years hot wire instruments have all been on the expansion principle, the earliest form being the voltmeter, devised by Maj. Cardew in 1883. In this instrument a long thin platinum-silver wire was strung over pulleys in a brass tube, and the ends of the wire were connected to the terminals; while the pointer was mounted on a spindle geared to a pulley which was turned by a thin strip. One end of this strip was attached to the axle of a pulley at the centre of the wire and the other, through a cylindrical spring, to a fixed support. When current passed through the wire, causing heating and expansion, it yielded to the tension of the spring and caused the pointer to turn; while when the current was broken, the wire contracted and pulled the pointer back to zero.

This form of voltmeter was very clumsy and inconvenient and wasteful of power, but its freedom from inductance was such a valuable feature as to stimulate improvements, and modern hot wire instruments have been constructed on the "sag" principle originally suggested by Ayrton and Perry, but first carried into execution by Hartmann and Braun. In these instruments the heated wire is straight and only a few inches long, and both ends are fixed; but the strip attached to the pointer and antagonistic spring is attached near the centre of the wire, so that the tension tends to pull it to one side or cause it to sag. A very small increase of the length of the wire will greatly increase this sag, and approximately as the square root of the extension, so that not only does this method give a large magnification, but it helps to compensate for the natural square law of the expansion, and gives a more uniform scale. The magnification secured by a single application of this principle was, however, hardly sufficient, so that in the Hartmann and Braun instrument (fig. 11) the transverse wire S_2 was again treated as a sagging wire and the strip actuating the pointer was attached to its centre, making it what may be called a double-sag instrument. A thin aluminium sector passing between the poles of a permanent magnet served to damp the indication. An average instrument of this type takes about 0·2 ampere at its maximum reading and has a resistance of about 17 ohms, implying a power consumption of ·7 watt in the wire; but when used as a voltmeter for 120 volts it consumes a total of 24 watts, as compared with only 4 or 5 watts for moving iron wattmeters. To adapt this type of instrument as an ammeter, one method is to lead the current in and out of the wire at several points by means of very thin and flexible strips S_1 and S_2. If the current is led in at the centre of the wire and out by its two ends the range is doubled, and so on. For still heavier currents a large number of exactly similar wires can be connected in parallel, and shunts can also be employed.

Expansion instruments have done valuable service for alternating current measurements, especially at high frequencies, but they have never attained the accuracy of good electromagnetic instruments, owing to the changes of zero due to expansion of the supports. Various methods of compensation have been devised with good results, but none have been completely satisfactory under all conditions. Another objection to them is their very small overload capacity, as the wire must be raised to a high temperature to obtain sufficient expansion. Doubling the current produces four times the heating effect. Fusing of the working wire involves remounting and recalibration of the instrument.

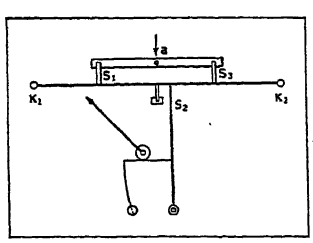


FIG. 11.—HARTMANN AND BRAUN'S AMMETER

The thermo-junction instruments which were first put into commercial form by the Weston company are much more convenient than the expansion type, and are probably destined to supersede it, as they only involve a simple attachment to a stand-

ard type of moving coil millivoltmeter. For many years before their advent a very common laboratory device for measuring high frequency currents was the "crossed thermo-junction," consisting of two fine wires, one of copper and the other of constantan (nickel-copper alloy) crossed at right angles and soldered together at their crossing point. Current was passed from one end of the copper wire through the junction to one end of the constantan wire, causing the junction to be heated; while the other two ends were connected to a moving coil galvanometer. As the thermo e.m.f. of such a junction is about 40 microvolts per degree, a rise of 300° C produces an e.m.f. of 12 millivolts, which will produce a reasonable deflection on a moving-coil pointer instrument. The Weston company therefore employed one of their standard forms of moving coil millivoltmeter with a recess in the base in which a strip carrying a short heating wire and thermo-junction was clamped. This can be easily replaced if burnt out.

Dr. Moll has recently greatly improved on this device by what he calls his "thermo-converter," having a fairly long heating wire threaded through about 50 insulated thermo junctions. By this means he secures a thermo e.m.f. of 8·5 millivolts for 16 milliamperes in the heating wire and a rise of temperature of only 10° C, which allows a very ample margin for overload.

III. WATTMETERS

These instruments are intended for the direct measurement of electrical power, especially in alternating current circuits. As the power expended in, or taken from, an electrical circuit, in watts, is equal to the product of the P.D. in volts and current in amperes, it can be measured on direct-current circuits by a voltmeter and ammeter. But with alternating or pulsating currents this is not the case, and a special instrument is needed in which the torque is proportional to the product of the P.D. and current *at each instant*, and indicates the mean value. Such instruments are termed wattmeters and are essential for all alternating current power measurements. They may be either electromagnetic, electrostatic, or thermal, but practically all indicating wattmeters are on the electromagnetic principle, and most are of the dynamometer type. It has been stated above that if two current carrying coils are near together, the force or deflecting torque between them is proportional to the product of the strengths of the two currents, so that if one of the coils carries the current in the circuit by being connected in series with it, and the other is wound with fine wire and shunted across the circuit like a voltmeter, the current in the second coil is proportional to the P.D. if its resistance is constant, and the force or torque between the coils is proportional to the product of the P.D. and current, *i.e.*, to the power in the circuit, at each instant. If the shunt coil is suspended inside the series coil and provided with a pointer and control spring the deflection is proportional to the average power, as the inertia of the coil prevents it from following the rapid variations of the alternating currents.

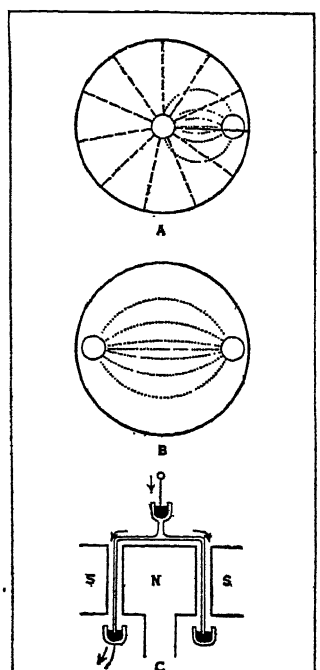


FIG. 12.—ELECTRIC SUPPLY METER

The principle of the electrodynamometer wattmeter was first put forward by Ayrton and Perry in 1881, and was adopted by Kelvin in his Watt balance, and by Siemens in 1884, the moving coils of the Kelvin balance or Siemen's dynamometer being replaced by fine wire coils with series non-inductive resistances. Unfortunately, Ayrton and Perry, from a theoretical consideration of its behaviour on alternating current circuits at various power factors, were led to the conclusion that large and indeterminate errors would appear at low power factors (*i.e.*, large angles of lag or lead of the current), and as this was apparently confirmed by some tests with a defectively constructed wattmeter of Swinburne's, the dynamometer wattmeter fell into disrepute. It was not till 1901, when Drysdale gave a different treatment of the errors, and showed that they could be made perfectly determinate, and be reduced to inappreciable proportions by suitable design, that confidence was restored. He showed that if the ratio of resistance to inductance of the shunt circuit was over 300 ohms per millihenry, and if the instrument was kept free from metal other than the carefully stranded coils, no readable error could exist, and produced a wattmeter in which these requirements were fulfilled. A little later Duddell and Mather produced an astatic wattmeter on very similar lines. Both of these instruments were of the torsional or standard type, and their current ranges could be varied by combining the strands of the current coils in various series and parallel combinations, while the P.D. range could be extended to almost any extent by series resistances.

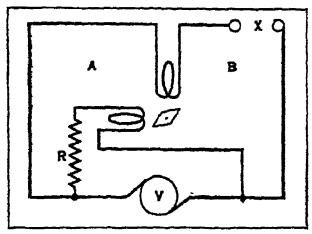
Deflectional direct reading dynamometer wattmeters have been devised by Kelvin, Heap, Hartmann and Braun, the Weston Instrument company, and many others, and are similar to the corresponding forms of dynamometer voltmeters, but with the fixed coils wound with thick wire to carry the current. The Weston wattmeter has a circular formerless moving coil fixed on a pivoted spindle with two spiral springs serving as control and leading-in wires, and a light truss-form pointer at the upper end, and damping vanes at the lower end. Two fixed current coils are held in a frame of high resistance metal alloy to reduce eddy currents, and the moving coil swings inside them over an arc of about 90°.

The quadrant electrometer can also be used as a wattmeter since the deflection is proportional to the product of the P.D. between the quadrants and of that between the needle and the mean of the quadrants or to $(V_2-V_1)\left(V-\frac{V_1+V_2}{2}\right)$ where V, V_1 and V_2 are the potentials of the needles and of the two quadrants respectively. If a non-inductive resistance r is connected across the quadrants and the current i is passed through it $V_2-V_1=ri$ or is proportional to the current, and if the P.D. is applied between the midpoint of this resistance and the needle, the deflection is proportional to the product of the current and P.D., *i.e.*, to the power. This electrostatic method was also devised by Ayrton and Perry, and was developed about 1900 by Addenbrook and later by Paterson and Rayner at the National Physical Laboratory, where it is used as the standard for checking commercial wattmeters. It is not, however, suitable for portable or switchboard instruments owing to the small forces available. Thermal or hot wire wattmeters have also been devised by Field, Irwin, and others but have not come into general use.

The induction type of instrument however lends itself excellently to switchboard wattmeters of moderate accuracy owing to the simplicity and robustness of its construction. In discussing the double magnet induction ammeter (*q.v.*) it is stated that the torque on the disc is proportional to $I_1I_2\sin\theta$ where I_1 and I_2 are the currents in the coils and θ the angle of phase difference between them. If one of the magnets is wound with thick wire and connected in series with the circuit like an ammeter, and the other is wound with fine wire and connected across the mains like a voltmeter, the current in the latter coil is proportional to the P.D. across the mains but nearly in quadrature with it owing to its high inductance so that $\sin\theta=\cos\phi$ where ϕ is the phase difference between the circuit P.D. and current. The torque is therefore proportional to $VI\cos\phi$ *i.e.*, to the power. Certain compensations are necessary, as the resistance of the shunt coil destroys the perfect quadrature, but they can be effected with sufficient accuracy, and if the disc is provided with a damping magnet and control spring a long scale indicating wattmeter with proportional scale is produced. A large number of such wattmeters have been devised and Edgcumbe and Ockenden, and Lipman have recently carried the design to great perfection. On the other hand if the control spring is removed, the torque developed by the damping magnet is proportional to the speed, and as it is

also proportional to the power, the disc will rotate at a uniform speed proportional to the power. The amount of the rotation in a given time will thus be proportional to the time integral of the power, or to the total energy supplied or absorbed. The instrument then becomes an energy supply meter, and the bulk of the supply meters used on A.C. circuits to-day are on this principle.

Polyphase Wattmeters.—About 1896 Dobrowolski pointed out that the power either on a two phase supply or on a three phase three wire supply could be obtained by using two wattmeters and adding their readings together. Following on this, Drysdale in 1901 produced a double wattmeter with two similar moving coils at right angles, one below the other, on the same spindle, and with two similar sets of stranded fixed coils also at right angles, so that the indications of the two systems were mechanically added together on the spindle and could be balanced by torsion in the usual manner. Deflectional direct reading polyphase wattmeters have since been made on this principle by the Weston Instrument company, and many others. The induction wattmeter and energy meter can similarly be adapted for polyphase supplies, by using two sets of series and shunt magnets on opposite sides of the same disc.



FROM GLAZEBROOK, "DICTIONARY OF APPLIED PHYSICS" (MACMILLAN)

FIG. 13.—OHMMETER: A & B, COILS; R, RESISTANCE; V, BATTERY; X, UNKNOWN RESISTANCE

Electric Supply Meters.—These meters are used for indicating the total energy supplied to a consumer or from a generating station and are, therefore, used in large numbers, and have assumed a great variety of forms. There are two chief classes, "quantity" or "ampere-hour" meters, and "energy" meters, both of which are in vogue. The power developed by or given to a circuit in watts at any instant is $W=VI$, or in kilowatts $KW=\frac{VI}{1000}$, and the energy in kilowatt-hours or Board of Trade Units (B.T.U.) is therefore $\frac{VIt}{1000}$ where t is the time of supply in hours, if V and I are constant over the time, or $\int_0^t VIdt=\int_0^t Wdt$ if they vary. An energy meter may therefore be called an integrating wattmeter; but since most electrical supplies are at an approximately constant voltage $\int_0^t VIdt=V\int_0^t Idt$, and it is sufficient to measure $\int_0^t Idt$ or the total "quantity" in ampere hours; hence the above names.

Quantity meters are obviously the more simple, as they do not require to take the P.D. into account; and the most simple of all are those on the voltameter or electrolytic principle. The weight of metal deposited or volume of gas liberated in an electrolytic cell is proportional to the quantity of electricity passing. The first supply meter invented by Edison in 1879 was of this type and employed zinc plates in zinc sulphate solution. Bastian in 1898 produced a meter on the water voltameter principle, consisting of a glass vessel containing two electrodes through which the current passed causing the evolution of hydrogen and oxygen and the descent of the level of the water, which was indicated by a scale on the side of the vessel. The only electrolytic meter, however, which has proved satisfactory in service is the mercury meter of Wright in which mercury is deposited from a solution of mercurous nitrate (later a mixture of mercury, sodium and hydrogen chlorates) and drops into a graduated tube which siphons over when full into a larger graduated tube. The whole apparatus is sealed and hinged in a case, so that when both tubes are full it can be filled up and the mercury repeats its course.

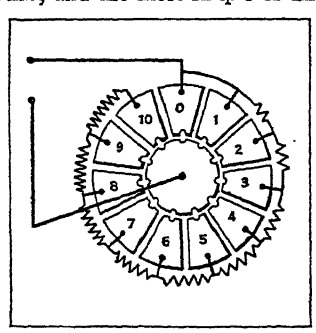


FIG. 14.—MOTOR METER

Motor Meters.—The majority of supply meters now in use are on the motor principle in which the current or power supply causes a moving element to rotate against some form of brake so that its speed is proportional to the current or power and the total rotation in any time indicates the quantity in ampere hours or the energy in kilowatt hours (Board of Trade Units or B.T.U.). Fundamentally there are two types of such meters, those in which the driving torque is proportional to the current or power and the braking torque to the speed, and those in which the driving torque is proportional to the square of the current and the braking torque to the square of the speed. The great majority of meters in present use, however, are of the former type, and the first practical suggestion of an energy meter on such lines was made by Ayrton and Perry in 1882. It may be briefly described as a rotating or integrating wattmeter in which the swinging moving coil is replaced by an armature, commutator and brushes, the former being wound with fine wire and connected in series with a high resistance across the mains; while the fixed current coil is connected like an ammeter in series with one main. When current passes through both coils a torque is produced which is proportional to the product of the two currents or to the product of the P.D. and main current, *i.e.*, the power. In the ordinary moving coil instrument the coil only deflects through a definite angle but the commutator rotating between the brushes brings new coils into the field and tends to produce a continuous rotation which is secured by removing the control and using a copper disc with permanent magnet as a brake, and a counting train to register the revolutions or B.T.U. Prof. Elihu Thomson developed this into a successful supply meter which is still used for direct currents, and could also be used for alternating current supply, but has been almost superseded for the latter purpose by the induction energy meter based on the induction wattmeter already described. Many attempts have been made at improving the commutator motor meter, especially as regards diminishing the friction of the brushes, which tends to cause it to stick or under register at low loads; the most successful being the "frictionless" motor meter of S. Evershed, in which the commutator strips are in the form of elastic springs rotating between "brushes" in the form of friction wheels. The greater part of the weight of the moving system is compensated by a permanent magnet attracting the top of the spindle, and the movements are communicated to the counting train magnetically, instead of by direct coupling. Unfortunately the cost of this meter prevents its general use, but it stands as the highest achievement in the supply meter field.

By substituting a permanent magnet for the fixed coils in the motor energy meter and passing the main current, or a fixed fraction of it derived from a shunt, through the armature, a more simple and robust form of meter can be constructed, owing to the more intense field of the magnet; but the meter then becomes a quantity meter suitable for direct currents only. This type has been developed by the Bat Meter company and others and by the British Thomson Houston company for use on electric cars. The chief difficulty as regards the satisfactory performance of the above motors is, as has been above said, the brush friction; and, therefore, several types of quantity meter have been developed by Chamberlain and Hookham, Prof. Perry, and Messrs. Ferrandi, etc., in which the armature is reduced to a pool of mercury or to a metal disc floating in it. These meters are practically always of the quantity type with a permanent magnet or electromagnet field, and the current flows through the mercury either from its centre to its circumference, across its diameter or axially. Whenever it happens that the magnet is permanent, its field is constant, and the torque is proportional to the current, in which case the braking is effected by the

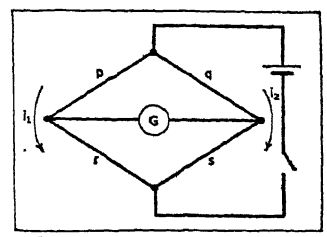
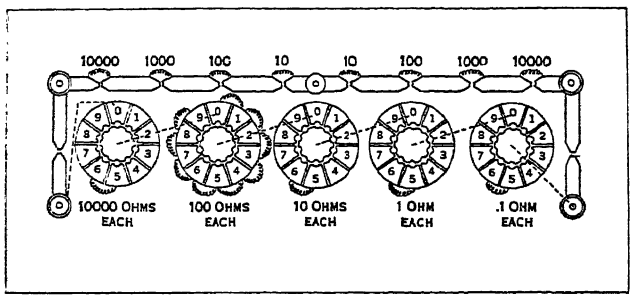


FIG. 15.—WHEATSTONE BRIDGE

eddy currents induced by the magnet; but when it is an electromagnet in series with the mercury the torque is approximately proportional to the square of the current, and the braking is effected by roughening the inside of the mercury container, in which case the braking torque at high speeds is proportional to the square of the speed. The meter may be used with alternating currents, but the inductance of its magnet is generally too high.

Of alternating current motor meters by far the most generally



FROM GLAZEBROOK, "DICTIONARY OF APPLIED PHYSICS" (MACMILLAN)

FIG. 16.—IMPROVED WHEATSTONE BRIDGE TO ELIMINATE CONTACT RESISTANCE OF A NUMBER OF PLUGS

useful at the present time is the induction energy meter which has assumed a great variety of forms, most of which give a good performance. As above described, the induction wattmeter consisted simply of an aluminium disc between the poles of two adjacent laminated electromagnets, one of which was wound with thick wire which carried the main current, while the other was wound with fine wire and connected across the mains. The torque tending to rotate the disc is then proportional to the power in watts and if the control spring is removed, and a permanent magnet brake is employed, the speed of rotation of the disc is proportional to the power, and the total rotation in a given time is proportional to the total energy supplied during that time, which is registered by a counting train geared to the spindle of the disc. The first purely alternating current motor meter, however, was the quantity meter of Schallenberger, in which a light aluminium disc was pivoted on a spindle through its centre, and turned in the field of two main coils. Inside these coils, was a number of flat copper strips slotted in the centre to allow the disc to pass through, and set at an angle of about 45° with the main coils. These strips, therefore, acted as short circuited coils through which a portion of the main field passed and induced lagging currents in them, so that the whole arrangement acted as a crude two-phase or rotating field motor in which the disc was carried round by induction. As the driving torque was proportional to the square of the current, as in the dynamometer ammeter, the breaking torque had to be proportional to the square of the speed, which was effected by having four damping vanes revolving at high speed in the air. An even more simple A.C. motor meter was devised by Prof. George Forbes on the hot wire principle, the current passing through a horizontal spiral ring of resistance wire and causing hot air currents to rise from it and turn a light windmill, which provided its own braking torque. Clock meters, which were also originally devised by Ayrton and Perry in 1882, and which were developed to an extraordinary extent by Dr. Aron, have had a considerable amount of popularity owing to their great adaptability, but are now almost superseded. If an ordinary pendulum of length l is allowed to swing freely, its periodic time $t=2\pi\sqrt{\frac{L}{G}}$ where G is the constant acceleration of gravity, and its frequency of oscillation is therefore $n=\frac{1}{2\pi}\sqrt{\frac{G}{L}}$. If G can be effectively increased by attracting the bob by a magnet or coil to some value $(G+g)$, the frequency n will be increased to $n'=\frac{1}{2\pi}\sqrt{\frac{G+g}{L}}=\frac{1}{2\pi}\sqrt{\frac{G}{L}\left(1+\frac{1}{2}\frac{g}{G}\right)}$ approximately, so that the increase of frequency or rate of the pendulum $=(n'-n)=\left(\frac{1}{4\pi\sqrt{[GL]}}\right)g$, or is proportional to the attraction g. If, therefore, two clocks are mounted side by side with exactly similar pendulums, and one is attracted, this one will gain on the other, and the difference of time indicated by the two clocks will be proportional to $\int_0^t g\,dt$. If the pendulum bob is a permanent magnet swinging over a coil traversed by the main current, i, g is proportional to i and the difference of time is proportional to $\int_0^t i\,dt$ or to Q, so that we have a direct current quantity meter. If a fine wire shunt coil is fixed on the pendulum and swings over the current coil, g is proportional to Vi so that the gain of rate is proportional to $\int_0^t Vi\,dt$ or to the energy, and this is applicable either to direct or alternating currents. By coupling the two clocks together by differential gear, by arranging one pendulum to be attracted and the other repelled, and by other ingenious devices, Dr. Aron produced fairly accurate supply meters, and meters on this principle have also been devised by Féry and others.

Lastly, we have had a very large variety of continuous and intermittent integrating meters with very ingenious mechanisms, of which the Frager meter was the pioneer; and also, in recent times prepayment meters of both the electrolytic and motor types, in which the insertion of a coin switches on the current and releases the mechanism until a certain amount of quantity or energy has passed when the latter first breaks a switch shunted by a resistance so that the lights are dimmed as a warning, and breaks entirely later, if the warning is disregarded. The growing practice of inducing consumers to keep their maximum call on the supply as little as possible above their average demand, by charging according to the latter, has involved the introduction of a maximum demand indicator, usually as a separate adjunct to the meter.

IV. RESISTANCE MEASURING INSTRUMENTS

The majority of instruments for electrical resistance measurement are of the comparison type, and only a few give direct indications on a dial. Taking the latter first, these are generally known as ohmmeters from the original instrument of Ayrton and Perry, but as they are used in great numbers for insulation testing, trade names such as "Megger," "Ohmer," "Omega," "Metrohm," etc., are in vogue. Their fundamental principle is based on Ohm's law, which may be written in the form $R=\frac{V}{i}$, so that if we could produce an instrument the indications of which are proportional to the ratio of P.D. to current, it would indicate resistance directly. In dealing with the Wattmeter it was shown that if two coils are at right angles, one carrying the current and the other connected as a shunt to the circuit, the torque between them was proportional to the *product* Vi, but if both coils are fixed and a magnetic needle is pivoted at their centre it will set itself along the resultant magnetic field of the two coils (neglecting for the moment the earth's magnetic field). If one coil is connected in series with the circuit it will carry the current i and produce a magnetic field H_1 proportional to i, while if the other is wound with very fine wire and connected as a shunt to the mains it will carry a current proportional to the P.D. V and producing a magnetic field H_2 proportional to V and at right angles to H_1. The instrument therefore acts as a tangent galvanometer in which the field H_2 is substituted for the earth's field, and $\tan\theta=\frac{H_2}{H_1}$ is proportional to $\frac{V}{i}$ or to R. It is readily seen that variation of the P.D. of the mains does not affect the deflection, as if it is doubled both H_2 and H_1 are doubled and their resultant maintains the same direction. The effect of the earth's field can of course be eliminated by making the system astatic with one needle outside the coils.

The great use of this instrument has been the testing of insulation resistance, in which R may amount to many millions of ohms (megohms), so that in order to get a good testing current the P.D. V must amount to a few hundred volts. This is the more

desirable as a circuit may show a high insulation resistance with a few volts, but break down with a large P.D.; and it is therefore important to make the test with at least twice the P.D. the circuit is intended for. As the chief object of the ohmmeter is testing in situ; and as high voltage batteries are heavy and clumsy, their place is taken by a hand magneto generator which generates the required P.D. of say 250 or 500 volts or more by turning an armature in the field of a permanent magnet by means of a handle and gearing.

In the more recent Evershed "Megger" and some other instruments the moving needle system is replaced by a permanent magnet moving coil system with two moving coils (current and P.D.) on the same spindle. The same magnet is sometimes employed to produce the field for the moving coils and for the generator, the whole of the apparatus being in a single case with the handle and gearing with a slipping clutch for obtaining approximately constant speed and P.D. at one end, and the ohmmeter movement at the other. By shunting the series coil, a lower range is obtainable for low insulations, and the device may be made capable of measuring resistances of a fraction of an ohm. The Cox-Nalder "Ohmer" is on a somewhat similar electrostatic principle, but the double moving coil is the most common.

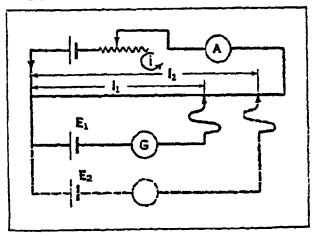


FIG. 17.—POTENTIOMETER

Resistance Boxes and Wheatstone Bridges.—The most accurate method of measuring resistance is by comparison with a known resistance, and for this and other purposes, boxes of accurately adjusted resistances with convenient arrangements for connecting any number of them in series are largely employed. Two types in use are the plug and sliding-contact types. In the former, the resistance coils are connected between brass blocks, and plugs with ebonite tops are provided which on insertion into the tapered holes between the blocks short circuit the respective coils, so that the total resistance between the terminals is the sum of the resistances of the coils unplugged. A common arrangement of the coils in this case is 0·1 ·2 ·3 ·4; 1, 2, 3, 4; 10, 20, 30, 40, etc., ohms, so that any value up to the maximum can be obtained in steps of 0·1 ohm. An alternative and more convenient arrangement is a dial form, which has one central block with eleven others surrounding it, any one of which can be plugged into contact with the central one. In this case ten coils of equal resistance are used connected between successive outer blocks as shown, and the resistance in each dial is then indicated by the figure on the block in which the plug stands.

The sliding contact type is always of the dial form and is equivalent to that just described except that contact is made between the central and outer blocks by a well laminated copper brush which slides over the blocks. In the best types a spring "click" is also provided which slips into notches in a steel plate as the brush passes the centre of each block, so as to avoid the necessity for observing whether it is in position. The sliding contact form is more convenient and rapid in use, but not so accurate as the plug form. The resistance of a good plug contact is only about 50 microhms, while that of brush contacts is from 160 to 500 microhms or more, though Messrs Tinsley have recently introduced a new form for which they claim a contact resistance of about 20 microhms.

The construction and adjustment of the resistance coils demands considerable care. The wire is now almost universally of Manganin (Cu 84, Mn 12, Ni 4 with a trace of iron) discovered by Dr. Weston in 1889 and largely used by St. Lindeck. This combines high specific resistance (about 50 microhms per cm. cube) with extremely low temperature variation, and low thermo e.m.f. to copper. A length of silk covered wire of approximately the required resistance is first doubled on itself and wound on a short length of brass tube which has previously been wound over with silk tape and varnished with shellac varnish. After winding and securing the coil in place with silk thread it is varnished and baked for some hours at a temperature of 140° C to anneal it, and after cooling its resistance is carefully measured on a Wheatstone bridge with knife edge clips which allow the wire to be pushed through until the exact resistance is obtained. Small copper washers are then silver-soldered to the ends of the wire, and the finished coils are then screwed into position on the box and the washers screwed up and soft-soldered on the screwed lugs from the blocks. After this the whole box should if possible be stored for several months to allow the coils to settle down in resistance, and exact adjustment is then effected by scraping the wires near to the terminals. The hollow brass tubes have holes drilled near their attachment to the base so that they are open top and bottom, and allow of air circulating through them when the coil is heated by a current. Other forms of coil are in use for very high frequency work, but the great majority are now constructed much as above described.

For the measurement and adjustment of resistances, except of very low values, the Wheatstone bridge is the most convenient and commonly used device. It consists essentially of a resistance box of any one of the above types to which is added a set of "ratio coils" which enable its resistance to be balanced or compared with any unknown resistance.

Resistance standards of 0·1 ohm or less are usually provided with four terminals, two for the passage of the current, and the other two for enabling the P.D. to be tapped off. For the measurement of such currents the Kelvin double bridge having two sets of ratio coils is used. Many special forms of bridge have been devised for the accurate comparison of standard resistances of which the best known are those of Carey-Foster, Fleming, F. E. Smith and Drysdale. The two latter enable either two or four terminal resistances to be compared to an accuracy of within one part in a million.

V. POTENTIAL MEASURING INSTRUMENTS

Direct Current Potentiometers.—The potentiometer is the most generally useful of all accurate electrical instruments. As its name implies its primary function is the measurement of potential differences, but it is equally applicable for the measurement of currents of any value, when a few suitable resistance standards are available. Its fundamental principle is derived from a method devised by Poggendorf for comparing the e.m.f's. of two cells and consists in employing a long uniform wire through which a steady current is kept flowing and in which consequently there is a uniform fall of potential from one end to the other (fig. 20). If r is the resistance of the wire per unit length and i the current flowing through it, the fall of potential per unit length is ri, so that the P.D. between any two points on the wire is $V=ril$ where l is the distance between them. If, then, a cell having a known e.m.f. E_1 is connected in series with a galvanometer to two contacts on the wire, and one of them is moved until the galvanometer is at zero, indicating that no current is flowing, then $E_1=V=ril_1$. On substituting another cell of unknown e.m.f., E_2, and moving the contact until balance is again obtained, $E_2=ril_2$, so that if the current in the wire has kept constant during the whole process

$$\frac{E_2}{E_1}=\frac{l_2}{l_1} \quad \text{or} \quad E_2=\frac{l_2}{l_1}E_1.$$

The method is analogous to weighing by a steelyard with sliding weight.

If the wire is made of a definite resistance, say 2 ohms for a length of a metre, and is traversed by a current of ·05 ampere, then the total P.D. for 100 cm. is 0·1 volt or 0·0001 volt per millimetre. Further, if at one end of this wire any number of resistances each of 2 ohms are connected in series, each of them will have a P.D. of 0·1 volt, which can be added to that of any section of the wire, as additional weights to a steelyard. This is the basis of the first accurate form of potentiometer devised by Prof. J. A. Fleming in 1885, and practically developed by Crompton. It consists of a rectangular base carrying the slidewire in front, the dial of 14 extra coils on the left, coarse and fine rheostats R for adjusting the current in the centre, and a selector switch, which enables the sliding contacts and galvanometer G to be connected to a number of different cells or circuits to be tested. The

main current is supplied from a 2 volt secondary cell, B, and it is adjusted by the aid of a standard cell C. If this cell is a Cadmium cell (*q.v.*), having an e.m.f. of 1·0183 volts, the potentiometer contacts are set to 10 on the dial (=1 volt) and 18·3 divisions on the slide wire, and the rheostats adjusted till balance is obtained. The potentiometer is then ready for use, and will measure any P.D. up to 1·5 volts directly. Higher P.D.'s up to 600 volts or more are measured with the aid of a "volt box," which consists simply of a series of resistance coils having convenient relative values totalling say 100, 500, 1,000, 5,000, 10,000 ohms etc., from the left hand terminal. If the P.D. to be measured is in the neighbourhood of 100 volts it is connected across the 10,000 ohm resistance, and the P.D. across the 100 ohm coil is balanced on the potentiometer. The actual P.D. is then read on the potentiometer multiplied by the ratio of the resistance 10,000/100=100, so that the instrument is equally direct reading. For the measurement of current it is passed through a standard resistance S of 1 ohm, 0·1 ohm, or 0·01 ohm, etc., and since the P.D. $V=Si$, $i=\frac{V}{S}$. For example, if a current of the order of 100 amperes is to be measured, a resistance of 0·01 ohm is employed and if the P.D. across it measured by the potentiometer is 1·2635 volts, the current is 126·35 amperes.

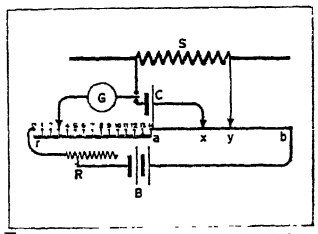
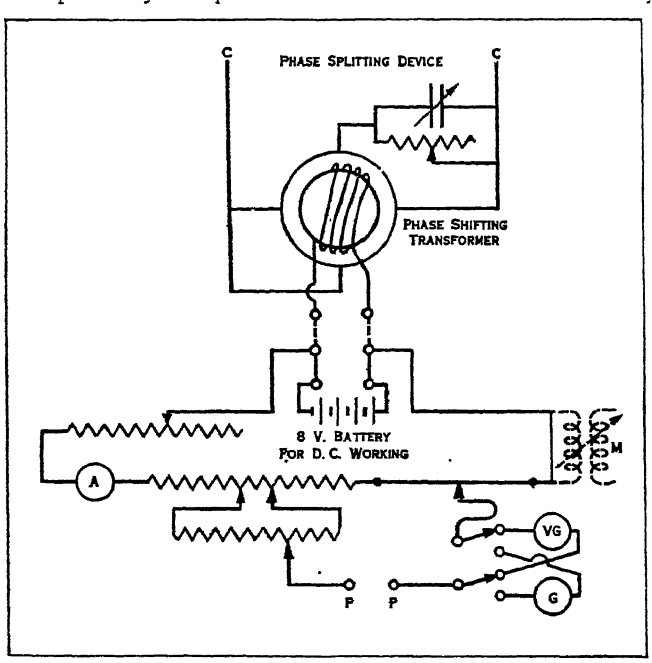


FIG. 18.—COMPTON POTENTIOMETER

The wide range of application and accuracy of the potentiometer has led to the devising of a number of different forms. In Germany and the United States, dial potentiometers based on the original form of Feussner are most generally used, the device being equivalent to two dial resistance boxes in series and mechanically coupled so that any increase of the resistance in one box is accompanied by an equal decrease in the resistance in the other, and the total resistance and consequently the current remains constant. This is practically effected by making each dial with 20 coils and two contacts moved by the same handle. Special potentiometers for measuring very small P.D.'s such as thermo e.m.f.'s have been devised by Hausrath and Diesselhorst, in which no sliding contacts are encountered in the galvanometer circuit.



FROM DRYSDALE, "JOURNAL OF SCIENTIFIC INSTRUMENTS"
FIG. 19.—DRYSDALE-TINSLEY A.C. OR D.C. POTENTIOMETER

Alternating Current Potentiometers.—The great range, adaptability, and accuracy of the potentiometer for direct current measurements, led to a strong desire for a similar instrument for alternating current testing, especially as the range of most alternating current instruments is small. A suggestion was made by Swinburne for balancing an alternating P.D. against a direct one derived from a potentiometer by means of a differential quadrant electrometer, but this was almost impracticable owing to the low sensitivity of such an instrument; and the first sensitive and practical A.C. potentiometer was devised by Drysdale in 1910 on the principle of balancing two alternating P.D.'s, both in magnitude and phase, and using a telephone or vibration galvanometer as the detector. The schematic diagram of this potentiometer is shown in fig. 19. It consists of an ordinary dial and slide wire potentiometer with a dynamometer milammeter in series with its main circuit, and provided with a change-over switch so that it can be fed either with direct current from an 8-volt battery, or with alternating current from a special "phase shifting" transformer. This consists of a ring shaped primary wound like a two-phase induction motor (*q.v.*) both circuits of which are connected across the A.C. mains—one directly and the other through a variable condenser and resistance box, by adjusting which a constant uniformly rotating magnetic field is secured. The secondary consists of a slotted cylinder with a simple diametrical winding, and as this is turned in the primary the induced e.m.f. remains constant for all positions, but its phase alters by the same angle as that of the rotation. The potentiometer is first supplied with direct current and balanced against a standard cell in the ordinary manner, and the dynamometer then adjusted to a fiducial mark, by means of its zero adjustment; after which it is changed over to the transformer and its rheostats adjusted until the dynamometer indicates the same current, when the alternating P.D. for any position of its potential contacts will be the same as that for direct current. The P.D. across any part of a circuit supplied from the same A.C. mains can then be balanced by moving the potentiometer contacts and turning the transformer, a vibration galvanometer being used which is comparable in sensitiveness to the ordinary moving coil galvanometer. When balance has been obtained, the magnitude of the P.D. is read off from the potentiometer in the ordinary way, and its phase angle or cosine or sine from a pointer and dial on the transformer. The P.D.'s and currents of any magnitude can be measured with the same volt-boxes and shunts, as for direct current, provided they are sufficiently non-inductive, and power by measuring the P.D. and current and applying the formula $W=Vi\cos\phi$. Inductances, capacities, and alternating magnetic fields can also equally easily be measured, if the frequency of the supply is known. For accurate measurements, the wave form of the supply must be fairly closely sinusoidal, and its frequency must be constant.

Three other alternating current potentiometers on a somewhat different principle have since been evolved. An alternating P.D. may be represented as a vector, as it has magnitude and direction (phase angle), and such a vector may be defined either by this magnitude and angle (polar coordinates) or by its two rectangular components (Cartesian coordinates). The Drysdale potentiometer may therefore be called a polar potentiometer, and is the only one of this class, but the Cartesian principle may be employed, and the potentiometers of Larsen, Gall, and Pedersen are on that principle.

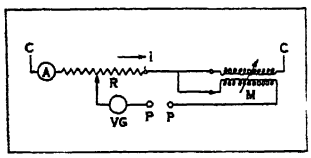
In the Larsen instrument (1910) an ordinary potentiometer is connected in series with the primary of a variable standard of mutual inductance M as in fig. 20. If i is the current through the potentiometer, it produces a P.D. $V_1=Ri$ in phase with i across its contacts if R is the resistance between them, and also an e.m.f. $V_2=M\omega$ across the secondary of the mutual inductance and in quadrature with i, where ω is the pulsatance ($2\pi\times$ frequency) so that if the secondary is joined in series with one of the contacts of the potentiometer, any P.D. can be balanced by moving the contacts and turning the secondary of the mutual inductance standard.

In the Gall "Coordinate" potentiometer (1923), two potentiometers fed with two equal currents in quadrature supplied from a special transformer are employed; while the Pedersen instrument consists of two similar potentiometers in series with an inductance and a condenser respectively, the two circuits being connected in parallel across the supply.

VI. CAPACITY AND INDUCTANCE MEASURING INSTRUMENTS

Measurements of capacity and inductance are generally made by comparison with fixed or variable standard condensers or inductances. Condensers are of various forms, fixed condensers of high capacity from 0·001 to many microfarads, variable vane condensers of low capacity such as are used in radio work, standard air condensers, and high voltage glass condensers of the Leyden jar type.

High capacity fixed condensers are generally made of rectangular sheets of tinfoil between somewhat larger sheets of paper impregnated with paraffin wax. Each tinfoil sheet is provided with a projection or lug at one side, and alternate sheets have their lugs projecting in different places so that they can be connected together. Where a sufficient number of tinfoil and paper sheets have been laid together to give the required capacity the whole condenser is pressed between hot plates so as to form a solid block when cold, the alternate lugs are soldered together and connected to the terminals, and the whole block inserted in a wooden or metal case which is filled up solid with paraffin wax. For highly accurate standards thin sheets of the best ruby mica are substituted for the paper, and these sheets are frequently silvered on one side to form the plates, the silvering being removed for a short distance around the edges. A number of such paper or mica condensers are frequently included in a single case and can be used singly or in parallel, and dial condensers resembling resistance boxes, enabling the capacity to be adjusted from 0·001 to 1·111 microfarads are now commonly used.



FROM DRYSDALE, "JOURNAL OF SCIENTIFIC INSTRUMENTS"

FIG. 20

Variable vane condensers consist of two sets of thin metal plates, usually of semicircular form, but of different diameters. The larger or fixed plates are built up on a frame so as to be accurately parallel to one another and equally spaced, while the smaller are threaded on a spindle with distance pieces between them so as also to be parallel and similarly spaced. The spindle is mounted in the frame so that the movable plates or vanes can turn between the fixed plates without touching them, and the two systems of fixed and moving plates are insulated from one another. An insulating handle provided with a pointer or a rotating dial enables the spindle to be turned, and the capacity varies continuously, from a low minimum value when the moving vanes are outside the fixed plates, to a maximum when they are completely inside them. By inserting the whole system in a case filled with oil both the capacity and maximum safe P.D. of the condenser may be considerably increased. The vanes are sometimes made of various forms in order to obtain a "square law" variation of capacity with angle, or a uniform frequency scale, etc.

Standard air condensers are only used for fundamental measurements and usually consist of a number of concentric accurately turned and measured cylinders on an insulating base so that their capacity can be calculated from the dimensions.

The most simple method of comparing the capacity of condensers is by the direct deflection method using a ballistic galvanometer (*q.v.*). If a condenser of capacity C is connected to a battery of e.m.f. E, it suddenly becomes charged with a quantity $Q=CE$, so that if two condensers of capacities C_1 and C_2 are connected successively to the same battery $Q_1=C_1E$, and $Q_2=C_2E$; thus $\frac{Q_2}{Q_1}=\frac{C_2}{C_1}=\frac{D_2}{D_1}$, where D_1 and D_2 are the corresponding swings of the ballistic galvanometer.

Inductance standards may be either fixed or variable, and of self or mutual inductance. Fixed self-inductance standards are simply coils wound on rigid insulating bobbins, so as to have constant conformation. Marble is used for the most accurate, and carefully seasoned paraffined teak or boxwood for the ordinary standards. The first accurate variable inductance standard or variometer was that of Ayrton and Perry, and consisted of two coils each of about ten inches diameter wound in single layers on circular wooden or ebonite formers curved so as to be parts of spheres and to enable one to fit as closely as possible inside the other. The inner coil was mounted on a spindle passing through the outer coil and having a pointer reading on a large dial at the top. The two coils were connected in series through flexible leads, and when they were parallel but the current passed round them in opposite directions their inductance was very low as the magnetic effects of the two coils almost neutralized each other, while on turning the inner coil round, the magnetic field (and therefore the inductance) increased steadily to a maximum when it was again parallel to the fixed coil. By careful construction a tenfold range of inductance was secured.

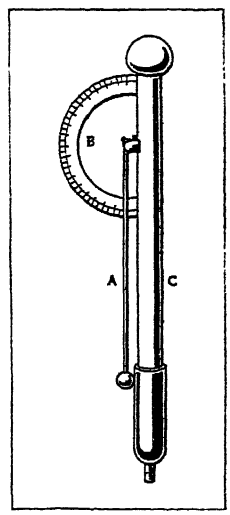


FIG. 21.—HENLEY'S ELECTROSCOPE

Variable mutual inductance standards are, however, to be preferred, as they can easily be made of very long range. The best known is that of Campbell who employs three circular coils on marble formers and with their planes parallel. The centre coil is mounted on a spindle at its edge so that it can be swung like a vane between the two fixed coils, and this spindle is provided with a handle and pointer travelling over a scale calibrated in microhenries. The winding on the fixed coils is of ten insulated wires stranded together so as to have equal magnetic effect. In addition there are a number of fixed bobbins with primary and secondary windings which can be thrown into the circuit when this is desired.

Capacity and inductance measurements are now most commonly made by bridge methods using alternating current and telephones or vibration galvanometers, and such bridges allow of condensers, self, or mutual inductances to be compared in any combination. The best known forms of such bridges are those of de Sauty, Maxwell, Campbell, Drysdale and Schering.

VII. ELECTROSTATIC INSTRUMENTS

Electroscopes and Electrometers.—As their names indicate, these instruments are intended respectively for the detection and measurement of electric charges or differences of potential. Electroscopes were the first electrical instruments to be devised, and take their origin from William Gilbert (1544–1603), who first developed the knowledge of electrical phenomena from the isolated fact known to the ancient Greeks, that amber could be electrified by friction. His electroscope consisted simply of a light pivoted metallic needle, either end of which was attracted on the approach of an electrified body. The next step was to utilize the repulsion of two similarly electrified bodies. Benjamin Franklin, employing two linen threads hanging close together, and du Fay, Canton, Henley and Cavello double straw or pith ball electroscopes. Henley's electroscope (fig. 21) was a crude form of electrometer, and consisted of a pith ball suspended at the lower end of a light pivoted arm and normally just touching a metal sleeve. When the latter was charged, it imparted part of its charge to the pith ball and repelled it, and the amount of the charge was roughly indicated by an arc divided in degrees with its centre at the pivot. Cavallo's electroscope (*c.* 1770) was the prototype of the modern repulsion electroscopes, having a glass bell jar with a metal stem sealed into its neck (fig. 22). At the top of this stem was a bell-shaped metal cap A, which served as a charging knob and also protected the glass and insulation of the stem from rain if the instrument was used in the open air; while at the bottom of the

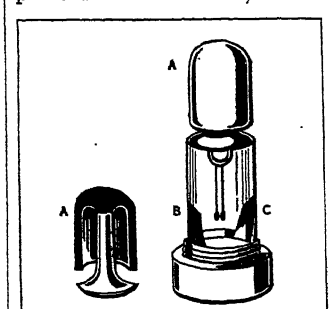


FIG. 22.—CAVALLO'S ELECTROSCOPE

stem two pith balls were suspended by fine silver wires. Two metal strips, B and C, were cemented on the inner surface of the bell jar and connected to earth. In 1782 Volta increased the sensitiveness of this form of electroscope by adding a condenser, and Faraday showed that for its indications to have a definite meaning the interior of the glass vessel should as far as possible be covered with metal, leaving only small spaces for the observations of the movements of pith balls. In 1787 Abraham Bennet substituted gold leaves for the pith balls, the form of electroscope shown in fig. 23, in which the stem carrying the gold leaves and charging knob is supported on a rectangular glass frame inside the bell jar which is coated on the inside by a number of strips T of tin-foil, all connected to a terminal on the base, which can be connected to earth. The interior of the instrument is kept perfectly dry by means of a vessel containing calcium chloride and sulphuric acid, and an ebonite plug slides on the upper part of the stem. This plug normally closes the jar, but when the instrument is in use, it is slightly raised, leaving a small air space between the stem and the cap of the bell jar.

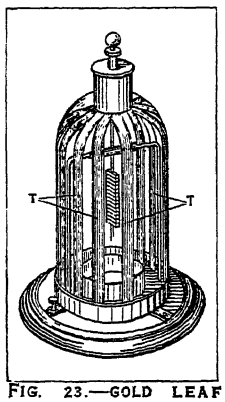


FIG. 23.—GOLD LEAF ELECTROSCOPE

Until about the commencement of the present century electroscopes were little used, except for teaching purposes in connection with electrostatics, but the discovery of radio-active materials and their power of discharging a charged body by ionization led M. and Mme. P. Curie to employ the rate of discharge of an electroscope as the best means of detecting the intensity of radio-active bodies, and a large number of new forms of electroscope have been introduced. That of M. and Mme. Curie is diagrammatically shown in fig. 24. It consists of a small brass case having a block of sulphur SS at its top, from which a metal strip B with a gold leaf L depends. The case is provided with two holes at its sides and a horizontal metal wire carries a charging knob C projecting through one of these holes and a condenser plate P′ at its other end. A second condenser plate P, just below the first, is connected to the case. The instrument is first charged by the knob C until the gold leaf L diverges from the strip B by a convenient amount, after which a cap is fixed over C and the leaf should maintain its position for some time if the insulation is satisfactory. On inserting a small amount of radio-active material between the plates P and P′, however, the ionization of the air between the plates causes the charge to leak away, and the rate of fall of the leaf L, which can be observed in a microscope through a window in the case, measures the amount of radio activity of the material.

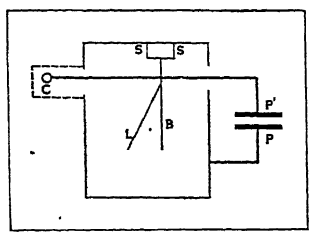


FIG. 24.—CURIE'S ELECTROSCOPE

Somewhat similar forms of electroscopes for radio-active measurements were made by Eloder and Geitel, and by C. T. R. Wilson (1901), but in 1903 a great improvement was made by the latter in his tilted electroscope (fig. 25). In this instrument a single gold leaf L is employed which is attracted towards a plate P by connecting a battery of about 200 volts between the plate and the case of the instrument. Any charge of the gold leaf L then causes it to be attracted more or less strongly towards P, and it is found that if the whole case is tilted as shown, a position can be formed at which the instrument is extremely sensitive, and the tip of the gold leaf moves several millimetres when its potential is raised by one volt. The latest improvement in this type of instrument has been made by Wilson and Kaye (fig. 26), and is similar to the above except that the case is permanently tilted through about 45° and the final adjustment of sensitiveness is made by varying the distance of the plate P by turning the micrometer head D. With 200 volts on the plate this electroscope gives a defection of two divisions on the scale in the observing microscope for only 0·01 volt on the leaf.

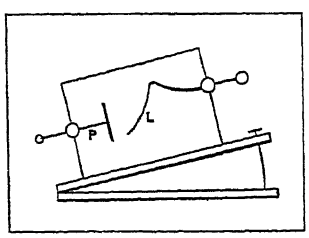
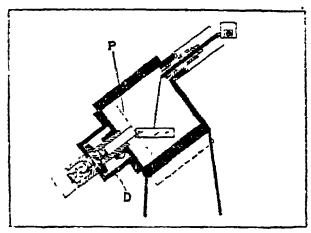


FIG. 25.—WILSON'S ELECTROSCOPE

The electroscope employed for radio-activity investigations, as well as the early electroscope of Henley, are in reality crude forms of electrometers, as they are actually used for approximate measurements. But the term electrometer is generally restricted to instruments intended for accurate measurements of potential differences, and designed to have a more or less definite law. The first instruments of this kind were on the "attracted disc" principle, which seems to have originated in 1746 by Daniel Gralath of Danzig, and to have been termed by him an "electrometer"; but the earliest practical forms were those of A. Volta and Sir Wm. Snow-Harris, in which a flat horizontal disc was suspended from the arm of a balance just over a similar fixed insulated plate. When the latter was electrified it attracted the suspended plate downwards, and balance could be restored by adding weights on a scale pan at the opposite end of the balance arm. Fig. 27 shows one form of Snow-Harris electrometer in which C is the suspended disc above the insulated disc which is shown connected to the knob of a Leyden jar, while the outer coating of the jar is connected to the frame of the electrometer and thus to the suspended plate, so that the P.D. between the plates is the same as that between the coatings of the jar. Snow-Harris found that the weight required to restore balance was proportional to the square of the charge or the P.D. of the jar.



BY PERMISSION OF CAMBRIDGE INSTRUMENT CO.
FIG. 26.—WILSON AND KAYE ELECTROSCOPE

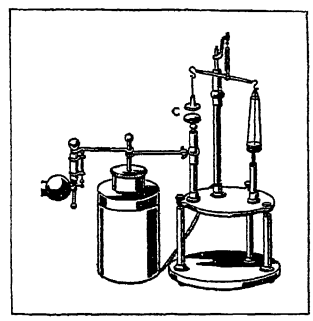
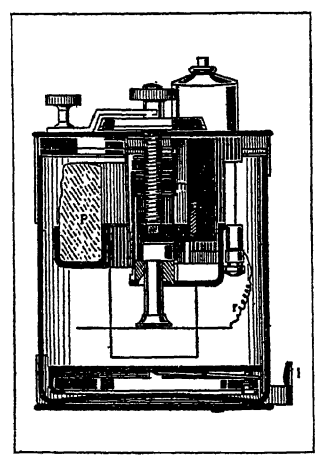


FIG. 27.—SNOW-HARRIS'S DISK ELECTROMETER

In 1857 Lord Kelvin turned his great mathematical and inventive skill to the subject of electrometers, and produced two forms which have persisted with only detailed improvements to the present day. The first form was derived from the attracted disc electrometer, but had the very important addition of a "guard ring," which made its indications of absolute value. In the simple attracted disc electrometer the electrostatic field between the two plates is not uniform, as the lines of force curve round from the edges of the two discs. But if the fixed disc is made much larger than the suspended one, and the latter is surrounded by a plate which nearly touches it all round, then if the movable plate is exactly in the same plane as the surrounding plate when the measurement is made, the electrostatic field between the suspended and fixed plates will be practically uniform, and it can be proved theoretically that the force in dynes between them ± will be given by the expression $f = \frac{A V^2}{8\pi d^2}$, where V is the P.D. between the plates in electrostatic units of 300 volts, A the area of the suspended plate in square centimetres,


BY PERMISSION OF KELVIN, BOTTOMLEY AND BAIRD
FIG. 28.—KELVIN'S PORTABLE ELECTROMETER

and d the distance between the suspended and fixed plates in centimetres, so that $V=d\sqrt{\frac{8\pi f}{A}}$. If d and A are known, therefore, the P.D., V can be determined directly from the force required to balance the attraction.

Lord Kelvin employed this principle in two forms of electrometer, one of them being known as his portable electrometer, fig. 28, the essential parts of which are shown diagrammatically in fig. 29. H.H. is a plain disc of metal fixed inside the bottom of a glass jar, which is coated inside and outside with tinfoil to form a small Leyden jar. In the middle of this disc H.H. a square hole F is cut, and a slightly smaller square plate of aluminium foil provided with an arm at one side is mounted on a horizontal stretched wire so that it will just swing through the hole F like a trap door. The wire is given an initial twist so that the aluminium plate normally rests a little below the upper surface of the disc H.H., and the arm which is provided with a crutch and cross wire is therefore tilted upwards. A circular plate G is fixed on the end of a micrometer screw above the disc H and is connected through the metal cover to the outer coating of the jar. When there is a difference of potential between the two coatings of the jar, and therefore between the two plates, the aluminium plate is attracted upwards and by varying the distance between the plates by the micrometer screw it may be made to come into exact register with the plane of the disc H.H. when the indicating arm will be at zero. As the force required to attract the disc to this position is always the same, the P.D. required to obtain balance is simply proportional to the distance d between the plates which is indicated by the reading on the head of the micrometer screw. The absolute electrometer (fig. 30) is similar in principle but, the guard plate B and aluminium trap door H are near the top of the glass case and the attracting plate A is mounted just below them on the micrometer screw. The trap door is suspended on springs so as normally to be a little above the lower surface of the guard plate, and the force necessary to bring it into exact register can be initially found by placing weights on the disc and observing the position of the latter through the lens L. When this force is known, any P.D. can be measured by connecting it to the two plates and turning the micrometer screw till the aluminium plate is brought to register, the formula being $V=d\sqrt{\frac{8\pi gw}{A}}$, where W is the weight initially required to produce register and g is the attraction of gravity.

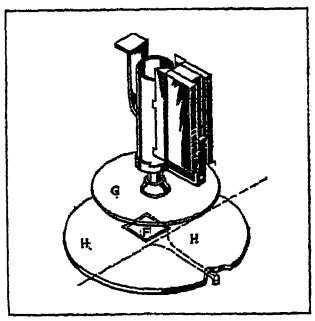
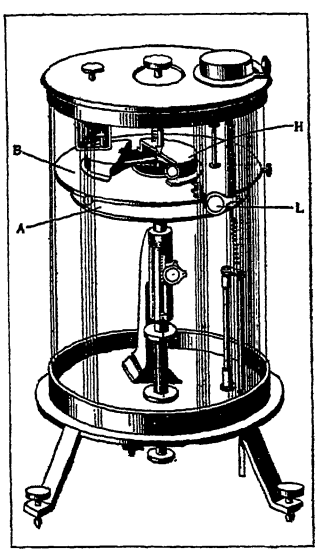


FIG. 29



BY PERMISSION OF KELVIN, BOTTOMLEY AND BAIRD
FIG. 30.—KELVIN'S ABSOLUTE ELECTROMETER

The second type of electrometer was developed from the symmetrical electrometer initially devised by T. G. Behrens in 1806 and modified by J. G. von Bohnenberger. In this type a single gold leaf is suspended midway between two vertical metal plates between which a dry pile is connected. If then the leaf is charged it will move towards the plate of opposite polarity. Fechner and Hankel made further improvements; the latter substituting a battery for the dry pile, and adding adjustments to the plates and a scale for measuring the movements of the leaf. Lord Kelvin greatly improved this type of instrument in his quadrant electrometer, the essential features of which are shown in fig. 31. A flat circular metal box is cut into four equal sections or quadrants A, B, C, D, and each section is supported on an insulating pillar and provided with a terminal, the opposite quadrant A and D and B and C being connected together by wires. A light flat paddle shaped aluminium vane U, shown by the dotted lines, is suspended by a bifilar cocoon silk suspension exactly in the centre of the quadrants and normally symmetrically between them as shown. From the centre of this needle hangs a fine platinum wire, which dips into sulphuric acid in the bottom of the glass containing vessel. This acid is conducting and it also serves the quadruple function of forming the inner coating of a Leyden jar, or keeping the interior of the apparatus dry, of establishing contact with the vane or needle, and of damping the movements of the latter. The outer surface of the glass container is partially coated with strips of tinfoil to form the outer coating of the jar. If this jar is charged, the needle can be maintained at a constant high potential by means of a small electrical machine or "replenisher" and a gauge, and if a small P.D. is then applied between the two pairs of quadrants the needle will turn so that a smaller portion of it is between the quadrants of similar potential and a larger portion between those of opposite potential to that of the needle, and its deflection can be observed by attaching a light concave mirror to the stem of the needle, and employing a lamp and scale as in reflecting galvanometers (*q.v.*). If V is the potential of the needle and V_1 and V_2 the potentials of the two pairs of quadrants respectively, theory indicates that the deflection $D=k(v_2-v_1)\{V-\frac{1}{2}(v_1+v_2)\}$ where k is a constant of the instrument. Unfortunately, Hopkinson, in 1885, and Ayrton Perry and Sumpner the following year, noticed that this law did not hold in the Kelvin electrometer, as instead of the deflection for a given P.D. across the quadrants rising proportionally with increase of potential of the needle, it increased up to a certain potential, after which there was little further increase, and in some cases a diminution. The latter investigators traced this action to openings in a guard tube which was employed to screen the platinum wire from external electrical disturbances, and devised an electrometer in which magnetic control was substituted for the bifilar silk suspension, and the quadrants were more exposed and more easily adjustable, thus enabling the theoretical law to be fulfilled, and with increase of sensitiveness. This improvement was of great importance, as it enabled the electrometer to be used as an accurate wattmeter (*q.v.*) for use in alternating current circuits, and this application was independently suggested in 1881 by Professors Ayrton and G. F. Fitzgerald and by M. A. Patier.

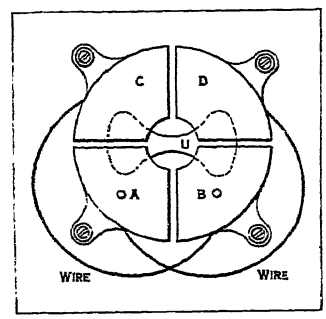
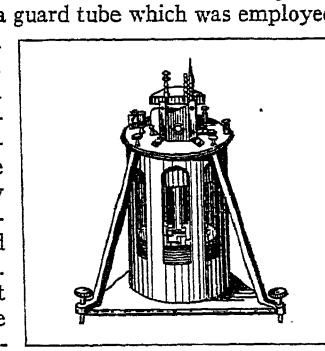
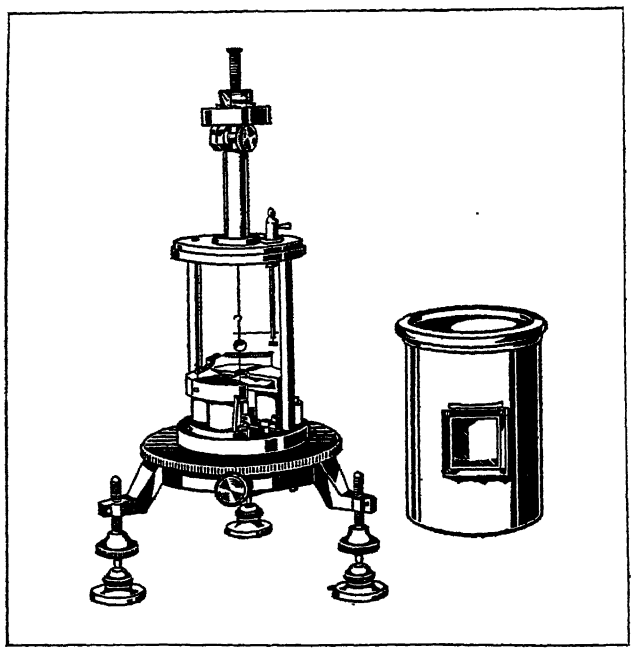


FIG. 31


BY PERMISSION OF KELVIN, BOTTOMLEY AND BAIRD
FIG. 32.—KELVIN'S QUADRANT ELECTROMETER

The invention of the quartz fibre by Prof. C. V. Boys has enabled quadrant electrometers to be made of much greater sensitiveness, owing to its extremely small and constant control. Among them that of Dr. F. Dolezalek (fig. 33) has been very successful, because of its high sensitiveness and low electrostatic capacity. The needle and quadrants are made of very small size; the latter being supported on short pillars of amber which give very high insulation, while the needle is of paper thinly coated with silver foil so as to have very small inertia and almost critical damping with the very small control of the quartz fibre. The latter

is rendered sufficiently conducting to charge the needle by dipping it in the first place into a solution of some hygroscopic salt, such as calcium chloride, so that its surface is always moist, or better by gilding it. The whole system is enclosed, like a galvanometer, in a brass case, which shields it from draughts and external electrostatic fields and the deflections are obtained by a small concave mirror on the needle, through a window in the case. A torsion



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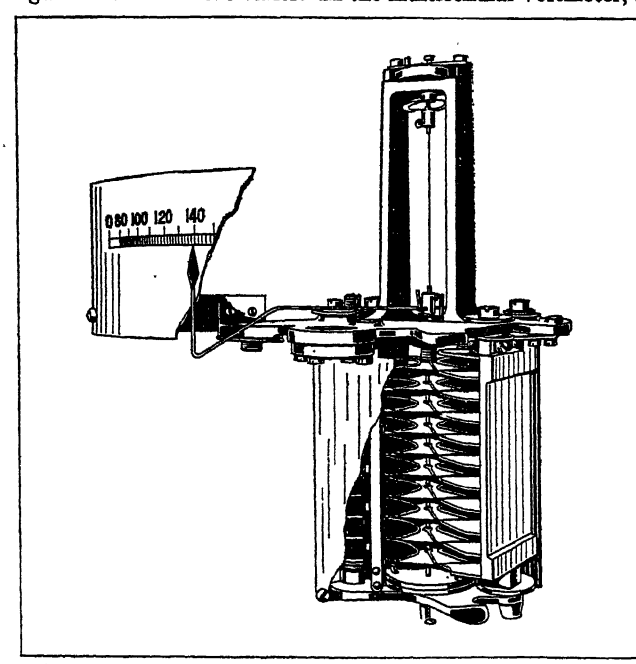
FIG. 33.—DOLEZALEK'S QUADRANT ELECTROMETER

head on the top of the suspension can be employed to adjust the zero of the instrument. With a quartz fibre suspension 60 mm. long and 0·009 mm. diameter and a potential of 110 volts on the needle, its periodic time was 18 sec. and a deflection of 130 mm. on a scale at 2 metres distance was obtained with a P.D. of 0·1 volt between the quadrants. Even greater sensitiveness has recently been secured with this type of instrument by the Cambridge Instrument Co. The latest improvement in the quadrant electrometer has been made by Prof. A. Compton, who has found that by slightly inclining the plane of the needle and giving a vertical adjustment to one of the quadrants, the control can be varied down to zero or even to a negative value. An instrument of this type with a gilded quartz suspension of 0·002 to 0·005 mm. diameter has given from 15 to 140 mm. deflection at a metre with 50 volts on the needle and only 0·01 volt between the quadrants, but the time to reach a steady deflection at the higher sensitivity is about 90 sec.

On the other hand the requirements of radio-activity research has caused the "string electrometer," based on the original instruments of Behrens and von Bonenberger, to be developed into instruments of high sensitivity, low capacity and rapid response by the aid of gilded quartz fibres. In a form of string electrometer made by the Cambridge Instrument company, a single quartz fibre of 0·002 or 0·003 mm. diameter suspended symmetrically between two plates with 25 volts between them, will give a deflection of ·044 mm. or about 5·5 scale divisions on a microscope for 1 volt on the needle with a critically damped period of under 1 second. Prof. Lindenmann has produced a deflectional "quadrant" electrometer having a 0·004 vertical gilded quartz fibre under slight tension, and two gilded glass fibres 2 cm. long and 0·02 mm. diameter cemented transversely and symmetrically upon it to serve as a needle. The ends of this needle move between four fixed plates serving as quadrants and the whole system is enclosed in a small sealed metal box with windows above and below, so that it can be placed on the stage of an ordinary microscope. Prof. Lindemann's deflectional "quadrant" electrometer is an instrument which gives ·4 mm. deflection or 136 divisions on the microscope for 0·35 volts between the quadrant plates and 1 volt on the needle.

Electrostatic Voltmeters.—For the measurement of high P.D.'s especially above a few hundred volts, electrostatic voltmeters are largely used as they have the great advantage of only requiring an infinitesimal current and power consumption and of being equally suitable for direct and alternating P.D.'s, in that they are entirely free from inductive errors. There are two main types of such voltmeters derived from Lord Kelvin's quadrant electrometer, and from Snow-Harris' attracted disc electrometer respectively (*q.v.*), but the latter are only used for very high P.D.'s of many thousands of volts.

When the electrometer principle was first applied to voltmeters, P.D.'s of only 100 or 200 volts were in use, and high sensitivity was consequently essential. The first practical electrostatic voltmeter was the "multicellular" form devised by Lord Kelvin in 1867 (fig. 34) and was equivalent to a number of quadrant electrometers arranged vertically above one another, their vanes or "needles" being mounted on a common stem so as to add their torques. Two sets of quadrant plates only were employed in each set, and were opposite one another and connected together to one pole of the circuit, the vanes being suspended by a fine wire and connected to the other pole. When the system was at zero, the vane system hung so that it was just about to enter between the fixed quadrants at two opposite edges. When a P.D. was applied between the vanes and quadrants the former were drawn further and further in against the torsion of the suspension as the P.D. was increased, and the P.D. could be indicated by a pointer attached to the vertical spindle on a scale as shown. This instrument was very similar to the variable vane condensers now so largely used for broadcasting sets and, in fact, its operation, like that of all electrometers, depends on this variable capacity. The energy stored in a condenser of capacity C and with a P.D. V between its plates is $E=\frac{1}{2}CV^2$, so that the force between them $F=\frac{\partial E}{\partial x}=\frac{1}{2}V^2\frac{\partial C}{\partial x}$, where x is the distance between them; or the torque $T=\frac{\partial E}{\partial \theta}=\frac{1}{2}V^2\frac{\partial C}{\partial \theta}$, where θ is the angle of rotation of the vanes. In the multicellular voltmeter, as



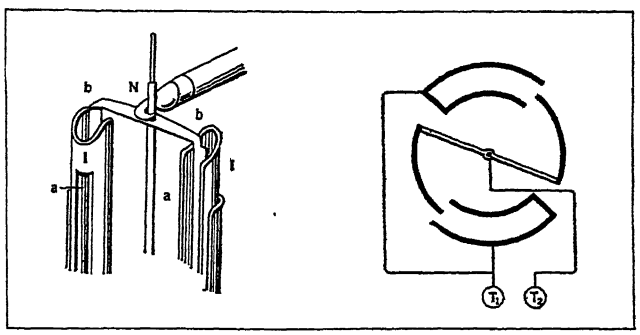
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FIG. 34.—KELVIN'S MULTICELLULAR ELECTROSTATIC VOLTMETER

in the vane condenser, the capacity is nearly proportional to the area over which the moving and fixed vanes overlap, *i.e.*, to the angle θ, so that $\frac{\partial C}{\partial \theta}$ is nearly constant. Thus, the torque, and

consequently the deflection θ, is approximately proportional to the square of the P.D. until the moving vanes are drawn nearly completely in, after which the increase of the deflection diminishes. Such voltmeters therefore only commence to have a useful reading at a moderately high fraction of their maximum voltage, but then have a widening scale, closing up again as the maximum is approached. This is a very suitable scale for supply circuits, though less suitable for general measurement.

The multicellular voltmeter came into fairly considerable use



FROM GLAZEBROOK, "DICTIONARY OF APPLIED PHYSICS" (MACMILLAN)

FIG. 35.—ELECTROSTATIC VOLTMETER ("QUARTER CYLINDER" PRINCIPLE)

for circuits up to a few hundred volts, but was very slow in indication owing to the large inertia of its vane system. It was damped by a disc at the bottom of the spindle which turned in a vessel of oil.

For higher voltages Lord Kelvin introduced another form having only two fixed vanes in a vertical plane, with a single vane moving system having a pivoted horizontal axis. Ayrton and Mather devised electrostatic voltmeters for both low and high P.D.'s on what they termed the "quarter cylinder" principle. It may perhaps best be described as a quadrant electrometer in which the moving vanes are bent over so as to form portions of cylinders parallel to the axis, and the quadrants are then also portions of cylinders which are arranged concentrically. This construction has the advantage of reducing the moment of inertia and increasing the rigidity of the system for a given capacity, and therefore of increasing the rapidity of reading. Suspended instruments of this type have been made for P.D.'s down to 80 volts and pivoted horizontal axis switchboard instruments for 3,000 volts or more. These latter instruments are damped by piston air dampers, but Carpentier has adopted the same form, but mounted between the poles of a powerful horseshoe permanent magnet which produces the damping by the eddy currents induced in the moving system. Extra high voltage voltmeters have been made by the Westinghouse company and others on the same lines, but with the system immersed in oil which gives a greater dielectric strength against arcing, a greater torque owing to the increase of capacity, and damping by the viscosity of the oil. Compressed nitrogen has also been employed in electrostatic voltmeters for reducing liability to spark, and the formation of ozone. For very high voltages up to hundreds of thousands of volts, the instruments would become very cumbrous owing to the large distances required to avoid flashing over, but the range of the above instruments may be almost indefinitely extended for A.C. measurement by connecting a condenser in series with the voltmeter as originally proposed by Ayrton and Perry. If the capacity of this condenser is equal to that of the voltmeter, twice the P.D. will be required for the same deflection, or if it is one-ninth of the voltmeter capacity the required P.D. will be multiplied tenfold, and so on, so that an instrument normally reading to 5,000 volts can have its range extended to 50,000 volts or more. This is generally effected by connecting one terminal of the voltmeter to a plate or sphere on an insulating pillar with another plate at an adjustable distance near to it. On the other hand the Snow-Harris attracted disc electrometer (*q.v.*) has been adapted as a high voltage voltmeter by Lord Kelvin in his Volt balance, and by Jona, Siemens and Halske, Grau and others.

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Indicating Instruments: Drysdale and Jolley, *Electrical Measuring Instruments;* Laws (as above); Edgcumbe, *Industrial Electrical Measuring Instruments;* Murdoch and Oschwald, *Electrical Instruments;* Bolton, *Electrical Measuring Instruments;* Jansky, *Electrical Meters.*

Supply Meters: Gerhardi, *Electricity Meters;* Solomon, *Electrical Meters;* Laws (as above); Jansky (as above); Murdoch and Oschwald (as above); Königswerthe, *Elektricitszähler.*

Laboratory Instruments: Laws (as above); Fleming (as above); Hague (as above); Irwin, *Oscillographs.* (C. V. D.)

INSTRUMENTS, MATHEMATICAL: *see* ABACUS, CALCULATING MACHINES, MATHEMATICAL INSTRUMENTS.

INSUBRES, a Celtic people of upper Italy, the most powerful in Gallia Transpadana. Livy states that Bellovesus and his Gauls, having crossed the Alps and defeated the Etruscans near the Ticinus, found themselves in the territory of the Insubres (also the name of a *pagus* of the Aedui). Here they built a city and called it Mediolanum (Milan), after the name of a village in their home in Gallia Transalpina. The name Insubres thus appears applied to the inhabitants (1) of the Aeduan *pagus,* (2) of the territory in Gallia Transpadana occupied by Bellovesus, (3) to the founders of Mediolanum. From 222 to 195 B.C. the Insubres were frequently at war with the Romans. In 222 B.C. they were defeated at Clastidium by M. Claudius Marcellus, who gained the *spolia opima* by slaying with his own hand their king Viridomarus, and in 194 B.C. they were finally subdued by L. Valerius Flaccus.

See H. Nissen, *Italische Landeskunde,* ii. 179 (1902); A. Holder, *Altkeltischer Sprachschatz,* ii. (1904).

INSULATOR, in electricity, is a non-conducting device, or material, used to separate two electrical conductors.

INSULIN. Insulin belongs to the group of substances known as hormones and is secreted into the blood by cells which are situated in or near the pancreas. In the mammalia, in which the pancreas is well defined, the insulin secreting cells lie in scattered groups, called the isles of Langerhans, distributed among the relatively much larger groups, or acini, of pancreatic cells. In certain fishes in which the pancreas does not occur as a definite gland, but is spread out diffusely in the mesentery, *e.g.,* in Lophius and Myoxocephalus, the islet cells form compact encapsulated glands called the principal islets which are often of considerable size and contain no pancreatic (acinar) cells.

Evidence that insulin is present in the pancreas of mammals was originally furnished in 1889 by Mehring and Minkowski. They found that complete extirpation of the gland in dogs immediately caused severe diabetes, and it was not long before the hypothesis was formulated that this must be due to the withdrawal from the body of a hormone having the function of regulating the metabolism of the carbohydrates. The name insulin was suggested (by Sir E. Sharpey Schafer) for this hormone in the belief that it comes from the islets, and many attempts were made to extract it from the pancreas, but with little success. In 1921, however, Banting and Best, working under the direction of J. J. R. Macleod, found that extracts of partially degenerated pancreas contained the hormone. This method was based on the supposition that the powerful digestive ferments of the intact pancreas destroy the insulin during the process of extraction and on the knowledge that the cells which secrete these ferments undergo degeneration more rapidly than those of the islets after the pancreatic ducts have been tied (Schultz and Ssobolew). This observation demonstrated that insulin does exist in the pancreas, and the next step was to devise a method for extracting it in more purified form and in quantity from normal pancreas. Alcohol was found to be a suitable extractive, in that it dissolved the insulin and at the same time inhibited the action of the digestive ferments, and Collip succeeded, in 1922, in sufficiently purifying the alcoholic extracts, by a process of fractional precipitation, so that

they could be injected subcutaneously in man without causing local irritation. Very potent extracts were also prepared from the principal islets of fishes. Further purification of the extracts was effected by precipitating the insulin, either by adjustment of the reaction (isoelectric precipitation) or by means of picric acid followed by treatment with alcoholic hydrochloric acid (insulin hydrochloride). Extracts capable of lowering the blood sugar have also been prepared from other organs than the pancreas, or principal islets, but it is doubtful if their action is really due to insulin. Certain guanidin salts also depress the blood sugar.

The function of insulin is to control those chemical processes of the body which are concerned in the preparation of the foodstuffs for oxidation in the tissues. The material which is immediately oxidized to produce this energy is carbohydrate, a supply of which is always present, as glycogen, in the muscles where it is formed out of the sugar of the blood. This sugar comes from the liver and is derived either from sugar absorbed from the intestine and temporarily stored in this organ as glycogen, or when digestion is not going on, from glycogen which has been manufactured out of protein and fats (gluconeogenesis). Insulin controls the rate of supply of sugar from the liver in proportion to the utilization of glycogen by the muscles.

When insulin is absent from the blood, as after pancreatectomy or when the islets are destroyed by disease (diabetes), sugar production occurs in the liver more rapidly than glycogen formation so that glycogen disappears from this organ, the blood sugar becomes very high (hyperglycaemia) and sugar appears in the urine (glycosuria). At a later stage substances known as the ketone bodies also appear in the blood and urine (ketonuria), being derived from the incomplete oxidation, chiefly of fatty acid but partly also of certain of the amino acids. Death ultimately occurs, either because of starvation caused by the excessive using up of the available foodstuffs of the body, or because of toxic effects for which the ketone bodies are believed to be largely responsible (diabetic coma). Insulin promptly removes all of these symptoms when injected subcutaneously or intravenously, but is inactive when given by mouth, because it is destroyed by the digestive ferments (pepsin) of the stomach. The effect passes off in a few hours, so that the injections must be repeated twice daily. When this is done the symptoms of diabetes remain absent apparently indefinitely, at least two dogs that were depancreatized for over four years were still living in Dec. 1927 and in excellent condition as a result of insulin treatment. In diabetes in man, although the islets are more or less diseased they are never completely destroyed, so that when treatment with insulin is continued for some time the damaged islets may possibly become regenerated.

One of the most significant effects of insulin when given to diabetic animals is that it immediately causes glycogen to be again deposited in the liver and a change occurs in the respiratory metabolism. In a normal animal fed on carbohydrates the ratio between the oxygen absorbed and the carbon dioxide expired, the so-called respiratory quotient, is near to unity, whereas in complete diabetes it never rises above 0·7. When insulin is given the diabetic, the quotient behaves as in the normal animal. Insulin therefore has three fundamental effects in diabetes, it restrains the excessive gluconeogenesis, it stimulates glycogen formation and it raises the respiratory quotient. When insulin is injected into normal animals the blood sugar, which usually stands at about 0·105%, rapidly diminishes and when it reaches a level at between 0·040 and 0·050% curious symptoms supervene. In most laboratory animals these hypoglycaemic symptoms consist at first of nervous hyperexcitability leading to convulsions, and later of coma and fall of temperature. That the symptoms are related to the disappearance of free glucose from the blood is indicated by the fact that they are promptly removed by restoring glucose to the blood, either by giving sugar by mouth or by injecting solutions of glucose subcutaneously or intravenously. Glucose is conspicuously more efficient as an antidote than any other sugar, even than mannose and laevulose which are so closely related to it chemically. The substitution of one hydrogen atom in the glucose molecule by some other radicle such as a methyl (CH_3) group, robs it entirely of its antidoting powers. The mechanism by which excess of insulin causes hypoglycaemia in the normal animal is not clearly understood.

Since insulin can now be prepared in crystalline form (J. J. Abel and Geyling) and a readily dried, solid, compound can be formed with hydrochloric acid—insulin hydrochloride—it may be weighed out for medicinal use, but it is more convenient to use it in liquid form which keeps well in acid reaction. The strength in actual insulin of the liquid is determined by a biological method which depends on the lowering of blood sugar in a normal rabbit. The strength is gauged in units, one unit of insulin being originally defined as that amount which on subcutaneous injection will lower the percentage of blood sugar to the convulsive level, 0·045%, for a period of 5 hours in a fasting rabbit of 2 kg. weight. This original unit was subsequently reduced to one-third. The assay is now carried out by a comparative method in which the hypoglycaemic effect of the solution to be tested is compared with that of a solution containing an accurately weighed amount of insulin hydrochloride. In order to ensure uniformity in the strength of insulin manufactured in different countries the Health Committee of the League of Nations has set aside a sufficient quantity of dried insulin hydrochloride of which 1 mg. contains 8 units. Testing laboratories maintain their own standards, but they can have them checked against the international standard from time to time. By such international uniformity in strength of insulin the diabetic patient is insured against variable dosage and the risk of hypoglycaemic symptoms. (J. J. R. MacL.)

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INSURANCE, ARTICLES ON. The following deal with insurance in its various branches: ACCIDENT INSURANCE, PERSONAL; AGRICULTURAL INSURANCE; CREDIT, INSOLVENCY OR BAD DEBT INSURANCE; ENGINEERING INSURANCE; FIRE INSURANCE; INDUSTRIAL INSURANCE; INSURANCE: *An Introduction;* INSURANCE, MISCELLANEOUS: *Burglary, Drivers' Policies, Fidelity, Guarantee, Plate Glass, Property Owners' Indemnity, Third Party, etc.;* INSURANCE, POST OFFICE FACILITIES; LIFE INSURANCE; MARINE INSURANCE; MOTOR VEHICLES INSURANCE; SOLDIERS' INSURANCE; UNEMPLOYMENT INSURANCE.

Separate articles appear under the headings NATIONAL INSURANCE, HEALTH; NATIONAL INSURANCE, WIDOWS' AND ORPHANS'.

A cognate matter of great importance is the subject of pensions, which will be found under the following headings: INVALIDITY PENSIONS; OLD AGE PENSIONS; PENSIONS, CIVIL SERVICE AND MUNICIPAL; PENSIONS, NAVY, ARMY AND AIR FORCE; PENSIONS, PERPETUAL; PENSIONS, POLITICAL; PENSIONS, IN THE UNITED STATES; SUPERANNUATION; WAR PENSIONS.

A special article on ANNUITY is very important as bearing not only upon insurance schemes, but upon house purchase, hire purchase, etc. Finally, EXPECTATION OF LIFE; GUARANTEE; LIFE TABLES; RE-INSURANCE; TITLE GUARANTEE COMPANIES and WORKMEN'S COMPENSATION are the subjects of special articles under those headings.

INSURANCE, INTRODUCTION TO. Insurance is the practical device by which civilized man protects himself against the contingencies of life. He has for centuries realized the regularity with which the law of average operates when great numbers are involved and has employed his knowledge to provide by insurance against the hazards to which the products of his enterprise and his industry are at all times subject. The principle of insurance was admirably stated by a select committee of the House of Commons who, in reporting (in 1825) on the laws relating to friendly societies, said: "Whenever there is a contingency, the cheapest way of providing against it is by uniting with others, so that each man may subject himself to a small deprivation, in order that no man may be subjected to a great loss. He, upon whom the contingency does not fall, does not get

his money back again, nor does he get for it any visible or tangible benefit; but he obtains security against ruin and consequent peace of mind. He, upon whom the contingency does fall, gets all that those, whom fortune has exempted from it, have lost in hard money, and is thus enabled to sustain an event which would otherwise overwhelm him." It does not detract from the general truth of this pronouncement that a certain part of the premiums paid for insurance is absorbed in the expenses necessarily attendant on the conduct of the business, nor is it a demerit of the system that insurance, since it produces nothing, adds nothing to the wealth of the world. It may, indeed, be claimed to its credit, in this connection, that in practice, with the assessment and modification of premiums with reference to the risks incurred, the system tends, by encouraging the adoption of preventive measures of various kinds, to diminish that waste and loss the fear of which has called it into existence. Due weight being given to the benefits of insurance, both direct and indirect, it must be concluded that its cost to the community, as represented by the maintenance of the great number of persons whose energies it absorbs, and by the profits of those who risk their capital in providing it, is far outweighed by the value of the service which it renders. This, indeed, is as true of insurance on human life, at any rate in its more substantial forms, as it is of insurance against the risk of loss of material things; *e.g.*, by fire or marine disaster.

So far as concerns the trading profits of insurance, which constitute a comparatively minor element in its cost, Great Britain is specially favoured in that the pioneering enterprise of the British insurance companies, and the high reputation which they have long enjoyed, have attracted to them a substantial share in the world's insurance business. The profits on this business cannot readily be computed, but are generally accepted as making a useful contribution to the "invisible surplus" by which the balance of international trade is maintained.

The special position of marine insurance in regard to the commercial prosperity of Great Britain is vividly indicated by Sir Norman Hill in his contribution to *War and Insurance*, one of the series of works on the economic and social history of the World War published on behalf of the Carnegie Endowment for International Peace. Here he sets out shortly the mechanism of the method by which the nation is, in great measure, fed and clothed by supplies from overseas. "By far the greater proportion of the cargoes at any time afloat belong not to the producers, the merchants, or the consumers but to the financial interests who have discounted bills of exchange representing the purchase price of the goods, and who hold as their security the bills of lading and policies of marine insurance. . . . The security against all trading risks is ample because the advance is repaid out of the selling price of the goods on the completion of the voyage, or if the goods be lost, out of the insurance money. Moreover the bills of exchange against which the advances are made afford the most convenient means for the adjustment of international exchange and they therefore pass freely from hand to hand and from country to country in the process of these adjustments. In fact, international finance is in very great measure based on the security afforded by the bill of exchange drawn against goods in transit, and it is to that extent dependent on the security of not only the bill of lading for the goods, but also on adequate insurance against the risks incident to the transit." On a closely related point it may be said that marine insurance has supplied the model for a system of foreign credit insurance which has recently been established at the instance of the Overseas Trade department to stimulate the export trade of the United Kingdom.

Insurance or Assurance.—The terms insurance and assurance are employed somewhat indiscriminately to indicate "the action of insuring or securing the value of property in the event of its being lost, or of securing the payment of a specified sum in the event of a person's death." This quotation is from the *Oxford English dictionary*. Babbage proposed, so long ago as 1826, that the word assurance should be reserved for contracts relating to life, on the ground, in effect, that in this case the event on which the policy depends is a certainty, and that insurance would more appropriately be applied to contracts relating to contingencies. While this convenient distinction has found much favour, it has been challenged in other quarters and is not universally adopted. In the United States the term "insurance" is generally used.

Historical References.—Marine risks were the subject of the earliest form of insurances. Setting aside the attractive but debatable proposition that insurance was recognizable as an element in the maritime commerce of antiquity, there is ample evidence of its use in the middle ages. A "Chamber of Insurance" established in London under a patent granted by Queen Elizabeth in 1574, the object of which was to register all contracts of insurance negotiated and to record their terms for reference in case of dispute, was a comparatively late-comer, similar bodies having been founded in Barcelona (probably in the 13th century) and in Bruges (1310). The first English statute on "assurance" appeared in 1601 and dealt with marine risks. The earliest known life policy, which followed strictly the form of marine insurance, was effected in 1583.

Scope of Insurance.—Insurance was limited, until recent times, to life, marine and fire risks. Modern developments have added other subjects; *e.g.*, the risk of personal accident, sickness, employers' liability, burglary, motoring, aviation and loss of livestock. Insurance under some of these headings includes the wide range of risks involving liability to civil action in respect of loss of life or damage to property.

While commercial insurance of every class expands continuously, in correspondence with the growth of population and with the enlargement of human necessities and desires, the developments of life insurance recently are of special interest. So far as Great Britain is concerned the growth of the business under "ordinary" policies, providing substantial sums for premiums payable annually, half-yearly or quarterly, has somewhat more than kept pace with the increase of population and the change in the value of money. In North America this class of insurance has advanced remarkably, while in various European States the business has exhibited considerable recuperative power in face of the difficulties created by the depreciation or collapse of currencies. Industrial life assurance has made great progress on both sides of the Atlantic; the number of policies of this type in force in Great Britain and Ireland at the end of 1926 was about 72 millions, an average of nearly two policies for every member of the industrial population. The number of such policies in the United States at the end of 1926 is also reported to have been 72 millions, while nearly four million policies were in force in Canada. Industrial assurance is also practised widely in Australia. The latest development of life insurance for industrial workers originated in the United States under the title of "Group insurance," and has lately reached the British Isles. It is stated that some six millions of American work-people are interested in insurances under this plan, by which the employer effects a year-to-year insurance on the life of each person in his employment through the medium of a single policy covering his whole staff. In certain cases the benefits of the plan have been extended, with the aid of contributions from the assenting employees, to cover sickness and accident and to provide pensions on retirement. There is, perhaps, less scope for such extensions in Great Britain, where the ground is largely covered by friendly societies, by State insurance, and, in growing measure, by superannuation or pension funds connected with particular establishments.

Interesting developments in other directions exemplify the methods by which British insurance is adapted to the requirements of the ordinary citizen. For example, the occupier who owns his dwelling, a rapidly increasing class in present conditions, is able through his building society, or other medium by which his purchase has been financed, to couple with his mortgage a policy of a special type whereby the remaining burden of his debt is lifted from the shoulders of his family in the event of his death before his instalments have been completed. Worthy of mention also is the type of policy—under various names—by which the householder may, by a single contract, insure his personal belongings against such diverse misadventures as fire, gas or boiler explo-

sion, burglary, etc., and may cover his risks as an employer in respect of his domestic staff. Generally, it may be said that while the business of the majority of insurance companies is conducted on fairly conventional lines there is practically no type of contingency for which insurance protection cannot be obtained from adventurous underwriters at Lloyd's or elsewhere.

State Insurance.—Insurance has taken a prominent place in the modern conceptions of the functions of the State. The compulsory protection of the worker against the contingencies by which his livelihood was most obviously beset originated in Germany where in the years 1884–86 compulsory schemes of insurance against sickness and accident (including medical treatment) for substantially the whole of the wage-earning community were brought into operation. These were supplemented later by schemes relating to invalidity and old age. That these measures took deep root and met the requirements of the people is sufficiently indicated by the fact that they survived the shock of the loss of reserves on the collapse of the mark in 1923. Austria followed the German empire in the adoption of compulsory State insurance and in 1911 it was introduced into Great Britain and Ireland by the National Insurance Act. Although a modest and experimental scheme of unemployment insurance was incorporated in this act, its principal subjects were sickness and disablement (including, with these, the provision of medical treatment and medicine), and over 15 million workers, of whom nearly one-third were women, were brought within its scope. An enlarged scheme of unemployment insurance, applying to about 11 million wage-earners was introduced in 1920, and in 1925 provision was made for pensions and allowances to widows and orphans and for pensions to the insured and their wives on the attainment of the age of 65. A corresponding Act was passed in the same year by the Parliament of Northern Ireland. The scope of this latest scheme is slightly wider than that of the health insurance measure, and while the number of persons who are insured under the scheme in the United Kingdom approaches 17 millions, the number of persons who are interested as actual or potential beneficiaries is about 31½ millions.

Taking the whole of the schemes together, and bearing in mind the provision made by the Workmen's Compensation Act, which is also, in general, safeguarded by insurance (in this case at the cost of the employer alone), it may be said that the industrial workers of Great Britain and Northern Ireland are more fully protected by the action of the State in respect of the more serious contingencies of life than those of any other country. Developments, however, still proceed elsewhere. The General Conference of the International Labour Organization of the League of Nations (10th Session, 1927) has proposed that the member States should be invited to subscribe to conventions relating to sickness insurance for workers in (1) industry and commerce and domestic service and (2) agriculture, and it is understood that the consideration of other risks is to follow. Save, therefore, in North America, where differences of economic conditions are responsible, at present, for differences of outlook, compulsory State insurance, in relation to a comprehensive range of subjects, seems likely to spread to the whole of the civilized world.

Where State insurance invades a field of effort such as that of the British friendly societies, a measure of controversy is, of course, inevitable. Certain distinctive merits must, however, be conceded to compulsory national schemes, even by those who are most reluctant to concur in the new activities of the State. Looking at the matter as it concerns this country it cannot be denied, on the one hand, that the thousands of registered friendly societies made, and continue to make, a substantial provision against sickness and other contingencies in the case of perhaps four millions of those who come within the national scheme; it has also to be recognized that apart from these bodies, whose operations are on a permanent and fairly stable basis, sickness insurance, though on a lower grade of quality, was very widely practised through unregistered bodies. But, on the other hand, there remained several millions of wage-earners, women especially, whom existing agencies had failed to reach, or at any rate to attract. National insurance, enforced by public authority, succeeded at the point where voluntary agencies had failed, and brought under a measure of protection, moreover, all who from advancing years or inferior health were ineligible for membership of a friendly society Again, by the scheme for pensions at 65 the State was able to enforce protective measures in regard to which private effort, though exercised untiringly over many years, had failed—and that conspicuously—to persuade.

Unemployment insurance as a possible subject of State action presented similar features. Available to many of those engaged in the highly skilled and well organized trades, it made little more than an exceptional appearance in the constitution of the newer trades unions which cater largely for the unskilled classes, while to the millions of unorganized workers it was wholly unattainable. When it is added that where it was practised its finance rested generally on the basis of a single craft, with all the extremes of risk that this implies, it will be realized that the time was ripe for comprehensive action such as the State could certainly take and no other agency had offered to initiate.

Widows' Pensions.—But it is, perhaps, in respect of widows' pensions that compulsion has been of chief value. "Adverse selection" is an element against which insurance on a voluntary basis has constantly to contend, and where the subject is such as pensions to widows and temporary allowances to dependent children this element would operate on a voluntary scheme, dependent on its own resources, with quite paralysing effect. Few with the exception of the married would insure; few, if any, of the insured would keep their policies up when, with the lapse of years, the need of them seemed to disappear. In the result the cost of insurance would be altogether prohibitive. The State, by compulsion applied from early youth to the whole of the wage-earning population, could obviously secure (with or without a subsidy) what private effort dared not attempt. The need for such a scheme, no less than its usefulness in practice, is attested by the fact that in the earliest months of the scheme it relieved the boards of guardians in England and Wales of expenditure at the rate of nearly £2,000,000 a year. This indeed is the lesser relief; the greater is the removal from the ranks of pauperism of scores, if not hundreds, of thousands of fatherless children.

Personnel and Statistics.—The professional interests of the insurance official and the technical education of the junior grades are served by many organizations of which three British bodies may be singled out, both on the ground of seniority and as enjoying the dignity of incorporation under Royal Charter. These are the Institute of Actuaries, the Faculty of Actuaries in Scotland and the Chartered Insurance Institute. The number of those engaged, in all grades, in the practice of insurance at the last census of Great Britain is given as 133,000, of whom one-third were women. Those employees whose remuneration is not more than £250 a year are insurable under the Unemployment Insurance Acts, and in 1927 this class included 86,000 persons.

The statutory returns of the British insurance companies and societies (which do not include the underwriters at Lloyd's) show that in the latest year of account (generally 1926) for which figures are available the total amount received in premiums for business of all kinds was £242,000,000. Of this total £134,000,000 were attributable to insurance contracts other than life, and it is probable that a very substantial part represented business overseas. Claims reached a total of £137,000,000, and reserves of all kinds, of which the funds accumulated under life assurance contracts represented about four-fifths, exceeded the massive aggregate of £1,000,000,000. (A. W. W.)

INSURANCE: MISCELLANEOUS. Under this head are considered various types of insurance which are not dealt with under separate heads (*see* INSURANCE ARTICLES).

Burglary: *Private Dwellings.*—Policies are issued to cover the risks of house-breaking and larceny, although larceny is excluded if plural tenancy exists or, in the case of a flat, if it is not self contained. Premiums are based on the full value of the total contents, an excess premium being charged if valuables, *i.e.*, gold and silver articles, jewellery and furs, exceed one-third of the whole. Damage to the building caused by burglars, for which the insured is responsible, is included in the normal policy.

Business Premises.—The cover is more restricted, the larceny risk always being excluded, whilst frequently only theft following "actual violent and forcible entry to the premises" is insured. The rates vary with the nature of the stock to be insured and the means of protection employed. Insurances are generally effected for the full value of the stock at risk and the condition of average (similar to that used in fire business) is freely used.

Cash Insurances.—Cash may be insured whilst in transit in the custody of an employee of the insured (including the integrity risk) and thereafter whilst contained in an approved safe or strongroom until paid away. The premium is calculated on the estimated carryings, subject to adjustment at the end of the period of insurance. The limit of liability for any one occurrence is the maximum amount stated by the insured to be carried at any one time. Cash is also insured whilst deposited in an approved securely locked safe, but loss following the use of the key, unless obtained by threat or violence, is excluded.

"All Risks" Insurances.—Such cover is frequently sought in respect of jewellery, furs, works of art and other items of value, and insurances may include or exclude the fire risk. The cover is usually comprehensive and excludes only losses due to deterioration, vermin, war and kindred risks. The sum set against each item in the policy is generally agreed to be its value as between insurer and insured when the policy is effected and represents the insurers' liability in the event of total loss.

Fidelity Guarantee.—Commercial guarantees are sought for most responsible officials handling money and are provided by insurers after satisfactory enquiries have been made as regards the antecedents of the applicant. The employer's statement to the insurers forms the basis of the contract and discloses the system of check used, which must not be altered without the consent of the insurers. Policies are issued either for individuals or a collective guarantee may be given for an entire staff. In the latter event each employee is mentioned by name and the sum guaranteed on his behalf is stated.

Plate Glass Insurance.—Essentially an insurance against breakage, the risk of fire is excluded from the plate glass policy. Only glass specified in the policy is insured, and wooden framework and lettering, the latter, unless specially insured, is not covered. Premiums are calculated according to the superficial area and type of the glass to be insured. Stained and other valuable glass, lettering and painting are rated on a percentage of value.

Third-party Insurance.—Indemnities in respect of the legal liability of individuals or corporations to pay compensation to third parties for personal injuries or damage to their property caused by negligence on the part of an employer or his employees, or due to defects in the ways, works, machinery or plant used in the employer's business, are almost universally sought. Policies are issued to cover the insured's entire legal liability, excluding, however, liability to a member of his family or to a person in his service, or liability assumed under contract. Within the limits of indemnity selected the insured is relieved of all monetary responsibility, including law costs incurred in defending claims, fraudulent or otherwise. All claims negotiations are conducted by the insurers who may if they wish relieve themselves of all further liability at any time by paying to the insured the maximum sum for which they are liable in respect of any one accident. The limit of indemnity for any one accident mentioned in the policy is defined as meaning "any one accident or series of accidents arising out of one event." Policies suitably modified are issued to almost every trade and may be obtained to cover most contingencies likely to affect third parties.

Property Owners' Indemnity.—Such policies cover the liability of the insured to pay compensation for personal injuries to and damage to the property of third parties caused by defects in buildings. Claims are commonly due to falling slates, tiles and copings, whilst poorer class properties are subject to falling ceilings, defective railings and staircases and many other causes. Such insurances are similar in operation and conditions to third-party policies, and may be extended to include liability which may be incurred in connection with defective stop-cocks and defective sanitary arrangements. (A. G. M. B.)

Hail Insurance.—Hail Insurance is carried mostly to protect growing crops, policies being written for the principal ones. The coverage is limited to a given maximum amount per acre for each type of crop, and the rates vary with the crop and the territory. In general the liability of the Insurance Company applies only after the crop is in a healthy growing condition.

Earthquake Insurance.—Policies for earthquake insurance protect from all direct loss or damage from earthquake or volcanic eruptions and removal from premises endangered by them. A 10% exemption clause and a 70% coinsurance clause are customary. The policies do not assume liability for fire, wind or tidal waves or loss due to neglect of the insured to diligently protect his property.

Tourist Baggage Insurance.—Personal effects can be insured while in transit within defined geographical limits. Usually the protection covers fire, lightning, cyclone, flood, navigation and transportation risks and theft provided the insured promptly notify the local police authorities. Some policies omit theft or limit the liability to a stipulated per cent of the amount of the policy on furs, musical instruments, jewelry, plate, clothes and watches. The amount of premium is dependent on the size of the policy and the length of time it has to run.

Explosion Insurance.—These policies are designed to cover loss or damage from all explosions except those originating within steam boilers, pipes, flywheels, engines and machinery, as these are covered by Engineering Insurance policies (*q.v.*).

Use and Occupancy Insurance.—Use and occupancy insurance is also known as business interruption indemnity insurance. It is needed particularly by manufacturers of advertised and popular goods, merchants, hotels, laundries, theatres, warehouse and public utilities. The policies protect against losses resulting from interruption or suspension of business that follow a fire or some other calamity. Partial payments are provided for partial interruption of business and it is considered advisable for full protection to be insured for an amount equal to one year's estimated net profit and fixed expenses. Shorter terms are available and are often used on similar policies to protect from loss of rent resulting from the same causes.

For Aviation Insurance: *See* AERIAL LAW; Damage to Machinery Insurance: *See* ENGINEERING INSURANCE; Drivers' Policies: *See* MOTOR VEHICLE INSURANCE; Lightning Insurance: *See* FIRE INSURANCE; Rain Insurance: *See* RAIN INSURANCE; Riot and Civil Commotion Insurance: *See* RIOT AND CIVIL COMMOTION INSURANCE; Soldiers' Insurance: *See* PENSIONS IN THE UNITED STATES; Tornado Insurance: *See* TORNADO INSURANCE.

INSURANCE: POST OFFICE FACILITIES. The grant of Government life insurances in Great Britain through the agency of the Post Office was inaugurated by the Government Annuities Act, 1864. The avowed object of the scheme was to provide facilities for members of the working classes to insure their lives for moderate sums with the advantages of Government security.

The Act empowered the National Debt Commissioners to make ordinary life insurance contracts with any person between the ages of 16 and 60, but not for a greater sum than £100 or for less than £20, and authorized the Postmaster General to direct his officers to receive premiums and pay claims on behalf of the National Debt Commissioners. The rates of premium were to be calculated on the basis of 3% interest, and in such a manner as to form a fund adequate to meet all claims without entailing any charge, whether for claims or expenses, on the Consolidated Fund.

From the outset the amount of business transacted under the scheme was much smaller than had been anticipated, and in 1882 a Select Committee of the House of Commons was appointed to enquire into its operation. An amended scheme on the lines of the committee's recommendations was prepared, and received statutory sanction in the Government Annuities Act, 1882. Revised rates of premium were introduced and new forms of policies were made available, but the most important alteration was the linking up of the insurance system with the Post Office Savings Bank.

The scheme still failed to achieve the success that had been hoped for, and in 1892 it became the subject of an investigation by a departmental committee. The principal result was the adop-

tion of reduced rates of premiums. The new tables were introduced in 1896, and together with the regulations governing the conduct of the business, which were made at the same time, remain in force to-day (1928). The revised scheme was no more successful than its predecessors, and another departmental committee was set up in 1907. Their report, published in 1908, contained a number of recommendations for increasing the usefulness and popularity of the system, but no action was taken until Jan. 1914, when the stamp premium system was instituted.

Under this scheme the premiums are payable by means of ordinary postage stamps to be affixed weekly by the insured person in a premium book. At the end of each 13 weeks the stamped page containing the premiums for the quarter is withdrawn on presentation of the book at a post office. The scheme is available for persons of either sex between the ages of 14 and 50.

The tables show the amounts which are insured at death by the payment until age 60 of premiums varying from 2d. to 1s. per week, and therefore invite comparison with those of industrial insurance companies which show the sums assured by weekly premiums of one penny or multiples thereof payable throughout life. Owing to the shorter period over which premiums are payable, the sums assured under the Post Office scheme, particularly for the smallest premiums which are the most heavily loaded for expenses, are generally less than those quoted by the companies, and it is not improbable that many prospective insurants obtain the impression that the terms offered by the Post Office are less generous than they are in reality.

Under the ordinary scheme of premiums payable by transfer from the insurant's savings bank account the lives of persons of either sex between 14 and 65 years of age may be insured for any amount from £5 up to £100, the lives of children between 8 and 14 years of age may be insured for £5, but children under 8 years of age are not insured. If the amount of the insurance purchased is less than £100 further insurance may be purchased from time to time until the total sum assured is £100. Insurances not exceeding £25 can be effected with or without medical examination.

Meagre Results.—The extent to which advantage has been taken of the Post Office facilities for insurance is indicated by the following table:—

Year ending Dec. 31	No. of policies issued	Amount insured
		£
1911	426	20,040
1916	442	27,258
1921	285	16,153
1927	397	17,994

The total number of contracts in force at the end of 1927 was 10,171, representing sums assured amounting to £511,552.

These meagre results were in marked contrast with the success which since the inception of the scheme has attended the grant of immediate life annuities by the government, both through the National Debt office and through the savings banks. A substantial portion of the total amount of the life annuity business of the United Kingdom has invariably been transacted by the government.

In 1919 a departmental committee was appointed to enquire into the business carried on by Industrial Insurance Companies and Collecting Societies. The committee presented a unanimous report (1920) in which the Post Office system was criticized. Notwithstanding this criticism the scheme remained substantially unaltered.

The Select Committee on Estimates in a report presented to the House of Commons in July 1928, recommended that the Post Office life insurance business should be discontinued.

Subsequently the National Debt Commissioners announced that after December 31 of that year, no further policies would be issued because the volume of business transacted was infinitesimal when compared with that of the big companies, also the energies of the Post Office officials could be more usefully employed in other services. This ruling was put into force in the beginning of 1929.

The country in which Post Office insurance has attained its highest development is Japan, where the undertaking is in effect a national industrial insurance scheme. It is a government monopoly, but it is not compulsory. Postmen act as canvassers and collectors of premiums. The maximum sum assurable is 450 yen and the minimum 20 yen. The premiums are payable monthly either to a post office collector, or at a post office, or by transfer from a savings account. It was inaugurated in 1916, and within 11 years the number of policies in force was over 10 millions and the sums assured amount to about £130 millions. Surpluses have accrued which are being returned to the assured partly in the form of refunds to the policy-holders and partly in establishing and maintaining health and welfare services. (P. G. B.)

INTAGLIO, a term applied to any recessed carving, in which no part projects beyond the original face of the material. In some cases, as in gem cutting, the entire relief is reversed. In others, as in some Egyptian wall carvings, the outline is sufficiently incised so as to allow normal relief. This type is sometimes known as *cavo rilievo* or sunk relief.

INTEGER: *see* NUMBERS.

INTEGRAL CALCULUS: *see* CALCULUS.

INTEGRATION, a physiological term, designating the various processes by which the multifarious activities and functions of the organism are knit together to produce a unified individual. The nervous system (*q.v.*) is by far the most important integrative mechanism. By nerve impulses, organs or tissues in one part of the organism are able to exert a co-operative influence on other distant bodily parts. The nerve impulses, in turn, are themselves integrated into harmoniously functioning patterns by action of their common synapses in the central nervous system. Hormones (*q.v.* and *see* also ENDOCRINOLOGY) are also very important in correlating bodily activities. For integration in mathematics *see* QUADRATURE.

INTEGUMENT, the cell membrane enveloping the protoplasts of plants. It is composed of cellulose together with a number of other substances known as pectic compounds. In biology the term also implies the skin or external covering of an animal. *See* PLANTS.

INTELLECT, the general term for the mind in reference to its capacity for understanding (Lat. *intellectus,* from *intelligere,* to understand). *See* INTELLIGENCE; INTELLECTUALISM.

INTELLECTUAL CO-OPERATION, INTERNATIONAL INSTITUTE OF. In Sept. 1921 the League of Nations, on the proposal of M. Léon Bourgeois, added to its existing technical committees an International Committee on Intellectual Co-operation, made up of distinguished scholars chosen first from 12, afterwards from 14 different countries. Its membership included, among others, Mme. Curie, Prof. Einstein, Prof. Gilbert Murray, M. Jules Destrée and Dr. Millikan. M. Henri Bergson was elected its first chairman. Prof. Gilbert Murray became chairman in July 1928.

The task assigned the committee was that of studying the better organization, through united international effort, of literary, artistic and scientific work. The committee soon became convinced that if it were fully to accomplish its task it must have a permanent administrative organ to prepare its programme and carry out its plans. In 1924 the French Government offered to defray for the League the expenses of such an organ, asking only in return that Paris be its seat. The League accepted the offer; and in Nov. 1925 the International Institute of Intellectual Co-operation opened its offices in Paris, at the Palais Royal.

The Institute is divided into specialized sections which are as follows:

University Relations.—This section organizes annual meetings of the directors of national university offices and of representatives of international students' organizations. It acts as an international university information office and as a link between institutions of higher education in all parts of the world. It organizes vacation courses and other facilities for foreign students; provides for equivalence of degrees, exchange of university professors, national institutes abroad and institutes of foreign studies, and international co-ordination of courses in political science and

international affairs.

Two Sections for Scientific Relations.—A. Science; B. Humanities. These sections deal with specific problems of international scientific organization, such as the co-ordination of libraries, scientific bibliographies, reference books of scientific personalities, etc. Steps are being taken to organize an international special service for libraries attached to the institute. It keeps in touch with the important scientific institutions and learned bodies, and aids them to co-ordinate their efforts. It follows closely the activities of international scientific congresses, and publishes their resolutions and other relevant information about their meetings.

Legal.—This service is chiefly engaged on problems concerning intellectual rights (copyright and scientific property) and, moreover, the legal status of international associations not formed for profit, and in liaison with the International Labour Office the economic position of intellectual workers is being examined.

Literary Relations.—This section is specially interested in the question of translation and of authors' rights, and is actively engaged in preparations for establishing an international office of translation.

Artistic Relations.—This section studies the organization, from an international point of view, of the different aspects of artistic activity. It has established an International Museums' Office which organized the successive exhibitions of engravings from national chalcographies, which was held in different European capitals in 1927, and prepared the first International Congress of Popular Arts held in 1928, in Prague.

Information Section.—This section deals with problems concerning the circulation of books, gives communications to the press and to the public, collects intellectual statistics, publishes an annual list of notable books (since 1924) and, from Jan. 1929, a review *L' Information Intellectuelle.*

Year-Books.—A plan has been drawn up to edit a series of specialized year-books, beginning with an international *Who's Who.*

The Institute has extended hospitality in the Palais Royal to various important international associations which are working in close co-operation in the same field of activity, and has offered its reception-rooms and assistance to several large international congresses.

This organ of the League of Nations is strictly international in character. Its officials belong to about 20 different nations: the director is French, the deputy-director English, the head of the section for University Relations German, that of the Scientific Relations section Dutch, that of the Legal section French, that of the Literary Relations section Swiss and of the Artistic Relations Belgian, while an Italian is head of the Information section.

The Institute does not take the initiative, but attempts to encourage, co-ordinate and assist the countless but diffuse intellectual efforts in each country and to improve the conditions of intellectual work. It aspires to be the rallying-point for intellectuals all over the world who can meet and discuss problems of common interest. (J. L.)

INTELLECTUALISM, a term applied, sometimes in a derogatory sense, to the tendency to emphasize or over-emphasize the importance of thought at the expense of feeling or volition, or even of sensation and intuition. In *moral philosophy* intellectualism tends to identify virtue with knowledge, evil with ignorance. In the *theory of knowledge* intellectualism or rationalism attaches more importance to thought than to sensation or intuition. In *ontology* it conceives the ultimate nature of reality to be some kind of intelligence, or at least regards the universe as intelligible through and through. In *psychology* it treats cognition as the primary mental function, as more fundamental than feeling or volition. In *aesthetics* it stresses the importance of the ideas expressed in, or suggested by, the object of aesthetic appreciation. In the sphere of *religion* intellectualism tends to attach supreme importance to theological doctrine or to religious philosophy rather than to religious sentiment or intuition.

INTELLIGENCE or **UNDERSTANDING** is a term that is still used by psychologists with considerable latitude of meaning. Sometimes it is used as a synonym of "cognition," that is to say, it is applied to any of the numerous processes by which knowledge is built up. Sometimes it is restricted to the conceptional processes, as distinct from processes of sense-perception. And sometimes it is used in the still more restricted sense of the process or function of apprehending relations, or even special kinds of relation. In view of the extensive use of so-called "intelligence tests" (*q.v.*) for all sorts of practical purposes, it would seem to be a matter of some urgency to determine as precisely as possible what is meant by intelligence. But that is not the view of many of the investigators in this branch of applied psychology. Some of them frankly admit that they do not know and do not care what this "intelligence" may be which they are measuring, so long as these measurements can be made use of. Others regard it as denoting the average mental ability of an individual in so far as this can be determined by a series of sample tests. Yet others identify it with some "general" ability which the individual possesses, besides certain "special" or "specific" abilities (*see* ABILITIES), and correlate the former with the general stock of "mental energy," and the latter with various "engines," into which this mental energy may be directed alternatively—whatever these physical metaphors may mean. Others again identify intelligence with the apprehension of relations of all kinds, or only with the function of apprehending connections. Lastly, ordinary everyday usage perhaps tends, on the whole, to emphasize the practical character of intelligence as consisting in the ability to employ the right means in order to achieve the various ends pursued.

The view put forward by the present writer is that the terms "intelligence" and "understanding" should be restricted to the mental function of apprehending connections. Such a conception, it is here maintained, is not only most in accord with ordinary usage, but also helps to explain most of the other uses of these terms. In order to make these points clear, it is necessary, first of all, to explain what is meant by *connections.* This term is used in the sense of causal and rational (or logical) relations, or relations of causal and rational (or logical) interdependence. All connections are relations, but not all relations are connections. Such simple relationships between things as, *e.g.*, their similarity or difference are not connections, although they may afford some sort of evidence concerning their connections. Similarly, relations in space and in time are not connections, though these likewise may furnish evidence concerning their connections. The apprehension of these simpler relations seems to call for no other mental functions than those required for ordinary sense-perception. The same processes which render possible, say, the perception of two patches of colour, also render possible our apprehension of their similarity or difference, of their local contiguity or distance, and of their simultaneity or succession. On the other hand, *connections* cannot as a rule be *perceived,* but must be *conceived.* That will explain why most psychologists restrict "intelligence" and "understanding" to conceptual processes. An example or two of our use of these terms will help to elucidate the view here maintained, and will also show its agreement with ordinary usage.. By looking at the several parts of a puzzle, or of a lock, one can see their similarities and differences, and their spatial relations, also certain time relations it may be. Everybody with normal sight can perceive that much. But not everybody can grasp, or grasp equally quickly or thoroughly, the *connections* between the various parts of the lock or the puzzle. And ordinary usage would associate the term "intelligence" or "understanding" with an insight into these connections, not with the mere perception of the parts as separate items, or even with the perceptions of relations of similarity or difference, of space and time. Similarly, one would not say that anyone *understands* a proposition in geometry when he has merely learned it by heart, or has just ascertained by measurement that certain properties co-exist in a geometrical figure of a certain kind, but does not apprehend the connection between them. Nor again would anybody be said to understand an historical period or a geographical area if he had merely committed to memory a string of facts without any insight into the causes which produced them. This conception of intelligence will explain

also the common association of the term with the practical application of the right means to achieve one's ends. For it is only when one has an idea of the connections between things, that one knows what methods will produce what results. Similarly with "learning from experience," which is frequently regarded as a test of intelligence. It is only when experience has taught one the connections between things that he has really learned from it; and it is only such learning through insight into connections that is the work of intelligence—the mere formation of habits, even the acquisition of skill through mere repetition need have nothing to do with intelligence.

The apprehension of connections is a distinctive conceptual activity marked by greater spontaneity and originality than are other kinds of cognitive processes, such as sensibility, retention, and even imagination. But it depends upon all these functions for the supply of its raw materials. Similarly, though the apprehension of connections is different from, and superior to, the apprehension of other relations, yet it is usually out of the perception of these other relations (of similarity and difference, of space and time) that there emerges the apprehension of connections. The transition may be illustrated, at the lower level of intelligence, from one of W. Köhler's experiments with a chimpanzee called Sultan (see *The Mentality of Apes*, Eng. trans. p. 8 *seq.*). A long string was tied to the handle of a small open basket containing bananas, and pulled through a ring in the wire roof of the animal's playground so that the basket was suspended about 2 metres above the ground; the free end of the string, tied into a wide, open loop, was laid over a tree-branch about 3 metres distant from the basket, and about the same height from the ground. Sultan was then let into the playground. The animal first looked at the basket, then made for the tree, and climbed up to the loop. Watching the basket, he pulled the string till the basket bumped against the ring in the roof, and repeated the action until the basket turned over and a banana fell out. Thereupon he got down and took the banana. It looks as if the monkey, perceiving the spatial continuity between the rope and the bananas, had some dim apprehension of their connection, and acted accordingly. But even at the highest level of human intelligence, it is the perception of the other simpler relations that affords the clues to the apprehension of connections. The so-called methods of induction and the other methods of science are mainly based upon such clues.

Intelligence varies enormously in two respects, namely, in degree and in range, or in intensity and in extensity. As regards degree or intensity there must be innumerable grades between the dawning intelligence of a chimpanzee and the ripe intelligence of a great thinker. In the former case the awareness of a connection between certain things is probably too dim and vague to be described as more than a feeling; in the latter case it is clear and explicit. Intimately connected with these differences, perhaps only another aspect of them, are differences in what may be called degrees of analysis or freedom, that is, differences analogous to those between "tied" and "free" images. At the lower levels of intelligence, the connections are not yet distinguished from the terms connected, but are fused with them in one concrete situation. At the higher levels of intelligence, the connections are distinguished from their terms, and different kinds of connection may be tentatively applied to certain objects or events in order to explain them—as happens in all cases of rival hypotheses. Then, again, there are differences in the range of facts which intelligence colligates. A chimpanzee may only be able to deal with a very few facts at a time, and with these only in so far as they constitute one concrete situation. The great thinkers have attempted to colligate the infinite variety of things in one system or cosmos. And there are obviously innumerable intermediate grades possible. Differences in respect of range of intelligence are no doubt intimately connected with differences in degree or intensity, for a higher degree of intelligence stimulates an interest in a wider range of facts.

In the History of Philosophy, as distinguished from psychology, quite a variety of speculations may be said to have originated in reflections connected with the subject of intelligence. The discovery of orderliness in natural phenomena has often been regarded as evidence of the existence of some kind of pervasive intelligence in Nature. In one form or another, such a view was held by Anaxagoras. Heraclitus and the Stoics, among ancient philosophers, and by Maimon and Schelling in modern times. The whole idealistic movement in ancient and modern philosophy has, no doubt, been influenced to some extent by the thought that cosmic order presumes cosmic intelligence. In addition to these ontological speculations concerning the objective subsistence of intelligence in Nature, there are, of course, also speculations affecting the theory of knowledge. It has been argued that since connections are not *perceived,* but only conceived by the intellect or our intelligence, therefore there is no reason for assuming that there are any real connections among natural phenomena. Science should, therefore, confine itself to mere description, and say nothing about alleged connections. Connectedness or orderliness may be something which the human mind fancifully reads into the phenomena of Nature. Some, indeed, have gone so far as to maintain that the alleged discovery of connection or orderliness among natural phenomena is merely an artistic fancy, a veil of Mayou, by means of which the human intellect at once decorates its environment and veils those brutal features which would make life unbearable. Others, again, would admit that the orderliness of Nature is indeed the work of intelligence, and that we consequently know nothing about things in themselves, though we may entertain certain beliefs about them in so far as the moral life of man seems to presume them. Perhaps the most reasonable philosophical conclusion one may draw from the development and survival of human intelligence is that there really are connections in Nature, otherwise our intelligence could hardly be an instrument of life, such as even the agnostics and the sceptics maintain that it is. It seems more reasonable to suppose that human intelligence discovers useful connections than that it invents useful delusions—however limited its powers may be.

BIBLIOGRAPHY.—*See* articles INTELLIGENCE TESTS; ABILITIES, GENERAL AND SPECIAL; PSYCHOLOGY; papers by H. W. Carr, A. Wolf, and C. Spearman on "The Nature of Intelligence," in *Philosophy and Metaphysics* (Aristotelian Society, supplem. vol. v., 1925); C. Spearman, *The Nature of Intelligence* (1924). (A. Wo.)

INTELLIGENCE, MILITARY. Under this designation may be considered the work of obtaining, collating, interpreting and distributing information, in peace and war, about foreign powers, the countering of foreign powers' efforts to obtain intelligence, and the organization which performs these duties. Information as to actual or potential enemies, allies and theatres of war, has always been required and obtained by governments and commanders in the field; the employment of spies, the questioning of prisoners, date from the earliest times in history, but never have the scope, and what might be termed the technique of military intelligence, reached such a high degree of development as in the World War.

I. INTELLIGENCE IN PEACE TIME

In time of peace, the relative military power of a nation with regard to other foreign Powers, and in particular to its immediate neighbours, necessarily affects its foreign policy. Every government therefore maintains an intelligence system, which generally forms a section of the headquarters staff of its military forces (known in most countries as the general staff), for the purpose of: (*a*) Providing its government with all necessary information regarding the military power of foreign nations; (*b*) Devising means whereby, in case of war, all essential information concerning the enemy, allies and theatre of war may be placed at the disposal of the commander and troops, and the supply of further information continued throughout the campaign; (*c*) Preventing the acquisition of information by the enemy.

Type of Information Required.—The fighting power of a nation can only be gauged when accurate and detailed information is available on certain factors, the most important of which are the organization, strength and power of expansion, armament, tactics and morale of its armed forces, the characteristics of its leaders, its defensive works and fortresses, its com-

munications, such as road, railway, waterway, aerodrome, cable, telegraph and wireless telegraphy systems, its physical and political geography, climatic conditions and economic and industrial resources in relation to military requirements. This information also enables the general staff to prepare, and keep up to date, plans for offensive and defensive operations, together with estimates of the forces required for their execution against any Power or combination of Powers, with which the particular Power, either alone or in co-operation with other Powers, might be brought into conflict.

Sources and Value of Information.—The main sources from which information is derived in peace time are statistics and economic data obtained from foreign government publications, from the Press and technical works, foreign training manuals, military and geographical publications and from information procured by the Secret Service. When war breaks out, this intelligence system provides the commander and troops about to take the field with maps and all available information regarding the theatre of war, the armed forces and military resources of allied and hostile Powers, with their special characteristics; this information forms the basis of the plan of campaign, but requires to be supplemented with information concerning the enemy's mobilization, concentration and order of battle in general. For this purpose preparations must be made beforehand and an intelligence organization provided for the troops in the field; the intelligence section therefore lays down the foundation of the intelligence organization required in war and makes arrangements for expansion by training the personnel required.

II. INTELLIGENCE IN WAR TIME

In war, the greatly increased activities of the home or headquarters intelligence service are mainly directed to areas outside the theatre, or theatres, of operations. In the latter, the armies in the field are provided with intelligence services of their own, who form an additional source of information for the home intelligence service, which is responsible for the further collation and distribution of the information thus received.

Field Organization.—In the field, the intelligence section of the general staff collects and collates all information regarding the enemy's forces and intentions and the theatre of war, supplies to the commander, staffs and fighting troops all information which will assist them in preparing and carrying out plans for the defeat of the enemy and endeavours to prevent the acquisition by the enemy of similar information. To be of practical value, the information supplied must be relevant, furnished in time to be of use and in such form as will admit of its immediate application by those concerned. These conditions require the closest co-operation and mutual understanding between the intelligence and operations sections of the general staff. The developments, technical and otherwise, of modern warfare have placed at the disposal of the intelligence section many resources for collecting information which were not available prior to the 1914–18 campaign. Intelligence in the field has become a large and intricate organization, the varied and complex nature of whose duties necessitates the employment, as assistants to the general staff proper, of a large number of highly trained specialists.

Knowledge of the enemy's intentions is of supreme value to a commander, and the intelligence section should therefore possess throughout the campaign early, accurate and continuous information regarding the enemy's "order of battle," his movements of men and war material, his tactical method, armament and equipment, the organization of his defences and rear services, the topography of the theatre of war. The relative value of these different classes of information varies with circumstances; the character of the operations may change at any moment from open warfare to stabilized warfare, or the reverse; an intelligence service must therefore be elastic both in method and organization. Method, accuracy and speed are essential for the collection, reception, transmission and collation of information, but this work is of no value unless timely deductions can be made from the evidence available. The making of deductions, appreciations and forecasts both as to the probable action of the enemy and the prospect of successful operations undertaken by its own troops is the most important duty of an intelligence section. Its true function, in fact, is to represent the "operations" section of the enemy, for broadly speaking it provides all information concerning the enemy, the allies and the theatre of war, whilst the operations section provides similar information regarding the troops of its own army.

Scope and Nature of Information.—Information regarding the enemy's "order of battle" is of paramount importance. It includes the organization, composition and strength of hostile formations, the direction of their initial concentration and subsequent movements, their distribution, morale and fighting efficiency, the characters of their commanders, methods of recruiting and man-power available to replace wastage. The identification of units is the foundation of all "order of battle" intelligence. Movements of men, supplies and material on a large scale normally portend some important development or a change of the enemy's plans, but as they must take place along organized lines of communication they are difficult to conceal. Detailed knowledge of the enemy's communications system and means of transport is therefore essential; the capacity of railways, quality of roads, navigability of waterways at different seasons, system of aerodromes and auxiliary landing grounds must be carefully studied if reliable conclusions are to be arrived at regarding the size of any movement and the time required for its execution.

Full information regarding the tactics and armament of the enemy at the outbreak of war is usually available by the study of his peace training and organization; but his methods of employing troops and their weapons in the field must be followed very closely in order to discover new developments as early as possible. In the World War full knowledge of each other's pre-war tactics and armament was possessed by the opposing armies, but almost from the beginning of hostilities modifications and new ideas were introduced, which frequently provoked countermeasures. Instances were the employment of poisonous gases, flame and gas projectors, "storm troops," Stokes mortars and tanks. All the economic resources of a State may be required to meet the strain of a prolonged campaign, and accurate knowledge regarding these resources is one of the means of gauging the enemy's staying power.

Sources and Means of Collecting Information.—The main sources of information are prisoners, deserters, local inhabitants, captured documents and material, land reconnaissance and observation, hostile signalling communications, air reconnaissance and photography, the enemy and neutral Press and agents; the principal agencies for its collection are the fighting troops, the signal service, aircraft and secret service. The information, whether positive or negative, acquired by contact with the enemy is that on which every commander mainly relies in making his tactical plan. Hence, to keep the enemy under such close and continuous observation that he can make no movement without being detected is the primary object of all reconnaissance, whether on the ground or from the air.

Ground reconnaissance may be purely topographical, *e.g.*, the acquisition of unmapped information about the ground; it may be tactical, *e.g.*, to discover the enemy's positions, the strength and distribution of his defences, his tactics, movements and intentions; or for the purpose of obtaining "identifications"; *i.e.*, information about the hostile troops in line, their morale, armament and equipment, by the capture of prisoners or documents. These objects are achieved by sending out mobile troops, patrols or raiding parties, or by observation from fixed points. The latter may be visual or instrumental.

Visual observation for intelligence purposes is an organized system for the observation of all enemy activity within the range of vision of its observation posts by trained observers provided with a special equipment of maps, telescopes, periscopes, etc., its elements being generally so placed and co-ordinated that the exact location of the enemy activity recorded can be fixed by intersection, *e.g.*, "flash-spotting." Instrumental observation is mainly automatic, by instruments disposed to receive, transform and transmit impulses from outside; *e.g.*, sound-ranging instal-

lations, electrical listening posts, wireless interception and direction-finding apparatus.

Air Reconnaissance.—Information from the air is derived from balloon observation, aeroplane reconnaissance and air photography. The development of air reconnaissance and photography has to a great extent revolutionized the whole service of military intelligence in the field; not only are aircraft capable of assuming the duty of strategic reconnaissance, but the camera has made it possible to obtain, particularly in position warfare, a far more detailed and exact knowledge of the enemy's system of defence, communication and supply than has ever been possible before. The principal weakness of air reconnaissance and photography lies in their necessary dependence on the weather.

Balloon observation is used principally for the observation of movement by road, railways, and in back areas, of defence works, the location of hostile batteries and the observation of hostile artillery activity. Aeroplane reconnaissance is used at the beginning of a campaign to locate the direction of the enemy's main concentration, to report on the movements and activities of the enemy's troops; and subsequently to supply information on the latter's tactical dispositions, the construction or destruction of bridges, the construction of new defences, etc.

Strategical reconnaissance involves long-distance flights extending frequently to more than 100m.; they are usually carried out by single aeroplanes flying at such an altitude as to minimize the chance of hostile interference; at this height, movements of troops on the ground are unnoticeable, and the information gained is largely confined to reports of railway movements, activity at important junctions, formations of large camps, etc. It is often necessary to fly at medium altitudes and to employ formations of aircraft capable of dealing with air opposition, to obtain more detailed strategical information. Tactical information can only be obtained in sufficient detail by aircraft flying low (close reconnaissance) which can be expected to distinguish troops in the open and artillery in action, and can dive near enough to the ground to clear up a definite point, such as the existence of a machine-gun emplacement or whether a trench system is occupied or not.

Photography forms an essential part of all air reconnaissance. Even in the cases of reconnaissances at high altitudes photographs may be expected to show road movements, tracks, camps, new works, battery positions, dumps, hospitals, light railways, telegraph lines and other signs of military activity, while in the case of close reconnaissance carried out at lesser altitudes, photographs taken in favourable weather enable experts to discover the smallest details of the enemy's defences.

III. THE SECRET SERVICE

The secret service supplies information regarding matters behind the enemy's front and in his home territory, including strength and location of reserves, rear defences and lines of communication, internal conditions in the enemy's country and the state of his resources in man power and material.

Secret Service Methods.—The methods employed in this branch of intelligence work can only be referred to in general terms. Broadly speaking, its duties are:—(1) Offensive, in the acquisition of information by means other than those described in Sections I. and II. above; (2) Defensive, in the prevention of the acquisition by foreign Powers of information regarding the forces of its own country.

The duties of the offensive section, to which alone the name of secret service is popularly applied, are similar in peace and war, but war increases the importance, and with it the difficulties and dangers of the work of secret agents or spies.

Agents work *à poste fixe*, on definite missions or on general roving commissions; they penetrate into enemy territory through the ports, in the guise of peaceful neutrals armed with all the necessary papers, or get there by other means, which in war include penetrating the enemy lines, either in uniform or mufti, during the progress of an action; landing behind them from an aeroplane or free balloon or crossing a frontier guarded by sentries and electrified wire. False papers, disguises, secret ink and all the other tricks beloved of the spy novel may form part of their equipment, but in practice, the most dangerous and efficient spy is the least sensational in his methods; when arrested he invariably has all his papers in order, and is the most plausible person alive. An espionage system in war involves the employment of many thousands of men, women and even children of all grades of society and of all professions: post-boxes, smugglers, guides, train watchers, pigeon men, couriers, runners, etc. All have their part to play, and that part, far from being ignoble, may be, if actuated by patriotism, as noble, as dangerous and as heroic as any played in the armies in the field.

Contre-espionnage.—The duties of the defensive section, popularly described as *contre-espionnage*, are also the same in peace or war, but the machinery and methods vary when carried out in home territory, in occupied enemy or allied territory. The *contre-espionnage* section in home territory commands in peace and war all the assistance of trained police, censorship, port control, hotel registration, the erection of arbitrary barriers such as prohibited areas and of all the preventive measures which are the outcome of years of experience in combating enemy espionage under all conditions. In occupied territory, intelligence in the field equally enjoys these powers, and, in addition, the arbitrary powers of an occupying army, but the whole population is potentially hostile. In allied territory the difficulties are greater, as it is the ally who controls in his own home territory all the real preventive machinery.

The object of *contre-espionnage* is, first and foremost, prevention. Information may be gained by the enemy's agents equally from one's own troops and from the civil population; the former may sell or convey information deliberately, but will more probably convey it to the enemy's agents through indiscretion. "Leakage" may occur in several ways; gossip about impending operations among the troops, especially when on leave and out of the line; indiscreet conversations, messages and misuse of code on field telephones and telegraph; marking of railway trucks, transport and billets, with inscriptions giving identifications of units; indiscretion in correspondence; careless handling of confidential papers and books; taking orders, codes, books, papers of any kind, even private letters into the front line; wearing of badges and numbers, which reveal identifications and in many other analogous ways.

The *contre-espionnage* section is also responsible for the control of the civil population. This involves the control of circulation, of the use of telegraph, telephone and other methods of communication, which might be utilized by enemy agents.

(T. G. G. H.)

INTELLIGENCE IN ANIMALS: *see* ANIMAL BEHAVIOUR; COMPARATIVE PSYCHOLOGY.

INTELLIGENCE TESTS. An intelligence test or intelligence examination is an instrument to measure the amount of intelligence shown by a human being or a lower animal. The instrument consists of a series of questions to be answered, or directions to be followed, or things to be learned, or intellectual tasks of any sort to be performed. Intelligence or intellect may be defined as the ability to perform intellectual tasks; and an intelligence test is a specially instructive sampling of such tasks.

Sample Tests.—The tasks shown below are representative of those used in standard intelligence tests.

"Show me your nose. Put your finger on your nose." Same with eyes, mouth and hair. Three responses out of four must be correct.

What is the difference between: (*a*) Laziness and idleness; (*b*) Evolution and revolution; (*c*) Poverty and misery; (*d*) Character and reputation.

Repeating three digits. After some explanation and practice, the person tested is asked to say 6-4-1, then to say 3-5-2, then to say 8–3–7. The test is passed if one series out of three is repeated without error, after a single hearing.

Repeating six digits reversed. The series used are 4-7-1-9-5-2, 5-8-3-2-9-4 and 7-5-2-6-3-8. The test is passed if one series out of three is repeated without error.

Tom runs faster than Jim. Jack runs slower than Jim. Which is the slowest of the three?

After some explanation and practice, the person tested is asked to "Finish what I say." At night you sleep in . . . Mary has a ring on her . . . You wear gloves on your . . . You wear a . . . on your head.

A person who has been tested in respect of an examination consisting of from 50 to 200 such tasks may be given a score, and so be put in comparison with all others who have been tested with the same collection of tasks.

Intelligence Quotient.—Subject to certain limitations, the score may be expressed in terms of a mental age, that is, the age at which the average child is able to attain it. Thus if John Doe, aged 12·0, scores 118 in the National Intelligence Examination, and if the average child of age 13·1 attains a score of 118 in this examination, John Doe has a mental age of 13·1 years. John Doe's intelligence quotient, or I.Q. is his mental age×100 divided by his chronological age, that is $\frac{13\cdot1\times100}{12\cdot0}$ or 109.

This form of statement is useful for individuals whose scores are not higher than those made by the average child of 14, and whose chronological ages are not over 18. For higher levels and later ages the method is of doubtful value.

The score may also be expressed in terms of the percentage of some defined group who would attain lower scores than it. Thus, if 71% of persons aged 12·0 score lower than 118, and 29% score higher, in the National Intelligence Examination, John Doe may be recorded as in the 71 percentile for his age. This method is especially useful in the case of the higher levels of intelligence and adult ages. A more refined measure of this type expresses any individual's score as a plus or minus deviation from the average for some defined group in terms of the variability of that group as a unit.

Systems in Use.—There are 30 or more such intelligence examinations now in use. Some, like the Pintner-Cunningham Primary Tests, are adapted to measure very young children aged two to five years. The National Intelligence Examination is designed to fit the intellects of the level of ordinary children from 9 to 15. The Terman Group Test is especially suited to measure young people from 14 to 20. Some, like the Thorndike Examination for High-School Graduates, are adapted to measure gifted adults. Some, like the Army Group Examination Alpha, require an ability to read and write; some, like the Binet, are given orally; some, like the Army Beta, are largely independent of language. Some, like the Otis Group Intelligence Scale, measure chiefly intellect as it operates with words and numbers and abstract relations; some are more concerned with information about things and persons. In some, the speed of response counts a great deal in determining the score made; in others, it counts very little, the time allowed being sufficient to permit almost everybody to do almost everything of which he is capable.

Historical Development.—Existing instruments for measuring intelligence developed from three roots: the tests of sensory acuity, memory, attention and the like devised in the early history of psychology; the interview, as of physician with patient or employer with candidate for employment; and the school examination. Galton, Cattell and Binet were pioneers in this field of psychology. Sir F. Galton's *Inquiries into Human Faculty* (1883) presented the general problem of the measurement of individual differences; and he soon thereafter set up in the South Kensington Museum in London a laboratory where any person could be measured in a series of physical and mental traits. Under the influence especially of Cattell, many short examinations or "tests" of special mental powers were devised and rather widely used in the United States from 1890 on. Important work was done by Kraepelin and Ebbinghaus in Germany. An eminent French psychologist, Alfred Binet, using the general form of an interview between physician and patient, enriched by suggestions from psychological tests proper, produced in 1905 what may be called a standardized interview, consisting of 30 questions and tasks, many of which were chosen from the tests of special powers now familiar to all psychologists. This "metric scale of intelligence" was further improved and divided into age levels in 1908, and finally revised in 1911. Many variations of it have been used in different countries.

While Binet was developing a scientific interview and record and score, various psychologists in America were testing children in groups by means of printed collections of tests. The next step was the arrangement of such a collection in a standardized unitary examination, after the general plan of written examinations in school subjects. One of the earliest and by far the most influential of such arrangements was the group examination Alpha prepared in 1917 for measuring recruits in the U.S. Army. This examination was taken by nearly 2,000,000 men, large groups (sometimes over 1,000) being sometimes examined at one time and place.

Modes of Use.—Since then, intelligence examinations have increased rapidly in number, have become diversified in nature, and have been much improved in respect of convenience in giving and scoring. They are widely used, especially in the United States, as an aid in the proper grading and classifying and treatment of school children; and in studies of special groups such as defectives, delinquents and dependents. The methods used in conducting intelligence examinations are also being applied to examinations in school subjects, producing the so-called "new-type" examinations and educational achievement tests. At least 1,000,000 such examinations were made in the case of school children alone in the year 1925. Some of the leading American universities require an intelligence examination as a part of the general admission requirement.

In spite of notable improvements during the last 20 years, existing instruments for measuring intelligence suffer from serious deficiencies. An intelligence examination is still a more or less undefined collection of tasks, its score is still a somewhat arbitrary summation of credits, and the correspondence of the scores to the abilities which they purport to measure is still far from perfect. Psychologists are working to supply these deficiences, seeking to replace the undefined collections of tasks by tasks rigorously defined in nature and graded by a true scale of intellectual difficulty, so that the score may mean the precise height of intellectual difficulty which the person in question can master (*see* EXAMINATIONS).

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(E. L. T.)

INTENDANT, in certain countries an official title having the same general sense as "superintendent" (from Lat. *intendere*, to apply the mind to, watch over). Thus in Germany it is applied to the head of public institutions, *e.g.*, State theatres, and in both France and Germany to certain military offices connected with the *intendance militaire* and *Intendantur* respectively, *i.e.* the equivalents of the British quartermaster-general's and financial departments of the War Office.

In France the name was used in early times to designate a functionary invested by the king with an important and durable commission. The most famous of these functionaries, however, the intendants of provinces (*intendants des provinces*) date from the last thirty years of the 16th century. Originally used to restore order after the civil wars, their functions were at first extraordinary and temporary; but a few were retained as permanent state officials, and in time they came to be fairly generally distributed over the kingdom. The existing territorial divisions were kept, each *intendant* being placed over a *généralité*, save where slight modifications were necessary for administrative purposes. In the 13th and 14th centuries the monarchy had organized a species of inspection (*chevauchée*) over the provincial functionaries, which was performed by the *maîtres des requêtes*. In the 16th century this inspectorate was revived and passed to the *intendant*, who became the resident supervisor of the other functionaries in his district; its connection with the old *chevauchée*

is plainly shown by the fact that the intendants were almost always selected from the *maîtres des requêtes*. The early intendants had naturally been largely concerned with the troops; eventually special military intendants (the only ones that exist in modern French law) were created, but the *intendants des provinces* retained certain military duties.

The early intendants were called indifferently *intendants de justice* or *intendants de finances*. Their powers were fixed by the commission they received from the king, whose direct general representatives they became in each *généralité*, with authority over the other officials, whom they were empowered to censure, suspend, or sometimes even replace. They were in constant touch with the king's council, with which they were connected by their original rights as *maîtres des requêtes*. In the first half of the 17th century they met with some opposition from the governors of provinces, who had formerly been the direct political representatives of the crown, and also from the parlements, which traditionally intervened in the administration, especially by means of *arrêts de règlement* (decisions, from which there was no appeal, regulating questions of procedure, civil law, or custom). The intendants, however, were energetically supported, and so complete was their triumph that in the 18th century governors of provinces could not enter upon their duties without formal *lettres de résidence*.

The intendants had wide powers in the drawing by lot of the militia and in the royal *corvées* for the making and repair of the high roads, and were largely concerned with the administration of the *taille*, in which they effected useful reforms. They were the sole administrators of the principal direct and indirect imposts created in the second half of the 17th century and in the 18th century, and had full powers to settle disputes arising out of these taxes. Owing to the vast size of the districts allotted to the intendants (there were no more than 32 intendants in 1788), they were allowed to delegate their powers to *sub-délégués*, who were, however, not royal officials, but merely mandatories of the intendant. Decisions of the intendant could be carried to the king's council, and those of the *sub-délégué* to the intendant.

See Gabriel Hanotaux, *Origines de l'institution des intendants des provinces* (1884); D'Arbois de Jubainville, *L'Administration des intendants d'après les archives de l'Aube* (1880).

INTENT, in law, the purpose or object with which an act is done. The question of intent is important with reference both to civil and criminal responsibility. Briefly, it may be said that in criminal law the constituent element of an offence is the *mens rea* or the guilty intent. The commission of an act without the intent is not, as a general rule, sufficient to constitute a crime, nor, on the other hand, does the existence of a guilty intent without commission of the act amount to the legal conception of a crime (*see* CRIMINAL LAW). In the case of civil wrongs, in general, the opposite holds good. A wrongful act done to the person or property of another carries with it legal liability, irrespective of the motive with which the act was done (*see* TORT).

(W. DE B. H.)

INTER-ALLIED CONTROL IN WAR: *see* WAR CONTROL; ALLIED MARITIME TRANSPORT COUNCIL.

INTER-ALLIED DEBTS. An examination of the methods by which the Allies financed the cost of the World War (that is to say, the difference between normal pre-war expenditure and actual expenditure for the period 1914–19 inclusive) can only give approximate results, but it is estimated that of the total war expenditure 6% was met by taxation, 77·2% by home borrowing, 14·5% by loans between the Allied Governments themselves and 2·3% by borrowing in other foreign countries. In general the funds placed by the Allies at each other's disposal were utilized, not for internal expenditure by the borrowing country, but for purchase in the lending country of military stores and supplies and, in certain cases, for exchange stabilization and interest payments on pre-war external loans. At one time or another during the war all the Allies employed this means of obtaining funds abroad, but only three of the Allied and Associated Powers acted to any appreciable extent as lenders, namely Great Britain, the United States of America and France, the advances made by Italy being comparatively unimportant. It is extremely difficult to arrive at any accurate estimate of the total sum of these transactions, as the statements published by the various Governments are computed on different bases. In the cases, however, of Great Britain and the United States all the debts have now (March 1928) been funded, with the exception of those due from Russia, so that it is possible to attempt some survey of the whole question. It was only in 1927 that France began to collect the debts due to her and in many cases the amount of these debts is still in dispute.

I. STATEMENT OF LOANS AND FUNDING AGREEMENTS

Great Britain.—For Great Britain the figures in Table II. are taken from the Financial Statement of the Chancellor of the Exchequer, House of Commons report No. 84 of 1925, but the figures in most cases were altered on final adjustment and are only approximate. The Belgian pre-Armistice debt of £110,000,000 is not given, as, under the Treaty of Versailles, this is a charge on German reparations. The figures do not include loans made to the Dominions for war purposes, but do include advances made to certain new and ex-enemy states as well as to Allies, in the period immediately following the war.

Great Britain's only debt to another Allied Government was that of $4,277,000,000 to the United States. As will be seen from the above, her advances to Allies greatly exceeded the amount borrowed from the United States.

United States.—The United States was a creditor only; and after her entry into the war in April 1917 incurred the main responsibility for financing the Allies, among whom Britain was the principal debtor. After the Armistice large sums were provided by the American Government for relief credits in Central Europe and for purchases of war stores. Table I. shows the total loans to the Allies and other Governments as given in the annual statement of the Secretary of the United States Treasury for 1927.

The majority of these loans have since been the subject of funding agreements, as the following official statement shows:—

TABLE I. *Funding Agreements of Certain Countries with the United States*

Country	Date of funding agreement	Total original indebtedness (principal)	Total debt as funded
		$	$
Armenia	..	11,959,917.49	16,627,153*
Austria	..	24,055,708.92	34,159,106†
Belgium	18 8 25	379,087,200.43	417,780,000
Cuba	..	10,000,000.00	Repaid
Czechoslovakia	13 10 25	91,879,671.03	115,000,000
Estonia	28 10 25	13,999,145.60	13,830,000
Finland	1 5 23	8,281,926.17	9,000,000
France	29 4 26	3,404,818,945.01	4,025,000,000
Great Britain	19 6 23	4,277,000,000.00	4,600,000,006*
Greece	..	15,000,000.00	19,659,830
Hungary	25 4 24	1,685,835.61	1,939,000
Italy	14 11 25	1,648,034,050.90	2,042,000,000
Latvia	24 9 25	5,132,287.14	5,775,000
Liberia	..	26,000.00	Repaid
Lithuania	22 9 24	4,981,628.03	6,030,000
Nicaragua	..	431,849.14	299,128*
Poland	14 11 24	159,666,972·39	178,560,000
Rumania	4 12 25	37,922,675.42	44,590,000
Russia	..	192,601,297.37	280,197,301*
Yugoslavia	3 5 26	51,758,486.55	62,850,000
Total	..	10,338,323,597.20	11,872,596,524

*Not funded: debt as on Nov. 15, 1927.

†Time of payment of principal and interest extended to June 1, 1943, by authority of Joint Resolution of Congress approved on April 6, 1922. Debt as on Nov. 15, 1927.

France.—The position of France, which, like Great Britain, was both a borrower and a lender, is more obscure. In the first place, she has not (March 1928) ratified the funding agreements made with either Great Britain, from whom she borrowed £446,226,000, or the United States, from whom she received $3,404,000,000. On the other hand, she advanced considerable sums to Russia and the smaller Allies; here, too, no refunding arrangements have been made, and in many cases the exact amount is in dispute.

TABLE II. 1. *War Debts*

Country	Original Advances*	Debt as funded† (including interest added to capital)	
	£	£	
1. France	446,266,000	600,000,000	
2. Russia	483,321,000	783,000,000	(Debt on March 31, 1927.)
3. Italy	369,824,000	570,000,000	
4. Yugoslavia	22,383,000	25,591,000	
5. Rumania	16,401,000	18,448,000	
6. Portugal	15,611,000	20,134,000	
7. Greece	16,391,000	21,441,000	
8. Belgium: Pre-Armistice	90,084,000	99,133,000	(Pre-Armistice debt as on May 1, 1921, taken over by Germany.)
do. Post-Armistice	6,799,000	..	(Post-Armistice debt repaid in cash.)
	1,467,040,000	2,137,747,000	
2. Loans for Reconstruction and Relief			
	£	£	
1. Belgium	9,000,000	9,000,000	
2. Belgian Congo	3,550,000	3,550,000	
3. Austria	11,578,000	12,727,000	(£2,250,000 repaid in 1923: balance postponed until 1943.)
4. Rumania	1,892,000	2,200,000	
5. Yugoslavia	1,884,000	2,069,000	
6. Poland	3,682,000	4,770,000	
7. Czechoslovakia	461,000	474,000	
8. Estonia	241,000	251,000	
9. Hungary	109,000	109,000	
10. Armenia	88,000	125,000	
11 Lithuania	17,000	..	(Repaid in cash.)
12. Latvia	20,000	..	do.
	32,522,000	35,275,000	
3. Loans for Stores and Repatriation (Post-War)			
	£	£	
1. France	8,226,000	8,226,000	(£5,976,000 repaid by 1927)
2. Latvia	1,303,000	1,303,000	(Interest waived.)
3. Estonia	917,000	917,000	do.
4. Czechoslovakia	827,000	827,000	do.
5. Lithuania	348,000	150,000	do.
6. Poland	174,000	174,000	do.
7. Greece	108,000	108,000	do.
8. Rumania	36,000	36,000	do.
9. Armenia	747,000	1,001,000	do.
	12,686,000	12,940,000	
Total	1,512,248,000	2,185,764,000	

*See Hansard (House of Commons) July 23, 1925, Col. 2445–6. (The figures were in most cases altered on final adjustment and must be regarded as approximate.)

†See published Funding Agreements: the amounts of the gold deposits (viz., France £53,500,000, Russia £60,000,000 and Italy £22,200,000) are deducted.

The Budget Project for 1928 set forth the debts owing to France by various foreign countries, as of Dec. 31, 1926, as follows:—

(1) *Debts in French Currency*	*Francs*
Russia (Tsarist Government)	7,008,928,000
Russia (various local Governments)	416,233,000
Yugoslavia	1,946,042,000
Rumania	1,050,000,000
Greece	812,457,000
Poland	1,047,120,000
Czechoslovakia	474,124,000
Italy	1,145,737,000
Portugal	9,050.000
Lithuania	8,800,000
Hungary	319,000
Austria	379,000
Georgia	200,000
Albania	1,800,000
	fcs. 13,921,189,000

(2) *Debts in Foreign Currencies*		
Russia (various local Governments)	gold roubles	10,533,145
Czechoslovakia	dollars	1,149,000
Italy	lire	16,983,000
do.	£ sterling	18,826
Austria	dollars	16,000,000
do.	lire	35,000,000

Except in the case of the franc debt of Tsarist Russia the figures apparently exclude interest. No account is here taken of counter-claims which are of considerable importance in certain cases.

Italy.—Italy was in the main a borrower, although to some extent she made advances to other Allies. After her entry into the war in May 1915 she borrowed from Britain £369,824,000 and from the United States $1,648,054,050. According to official figures her loans to other Allies were as follows, but certain of the items in the French account are in dispute. Foreign currencies are converted at the rates ruling on April 23, 1926:—

	In thousand lire
Rumania	189,936
France	292,380
Russia	63,000
Yugoslavia	56,000
Greece	5,000
Austria	1,730,000
	2,336,316

Russia.—Russia, on the other hand, was entirely a borrower. Her loans from Allied Governments up to the time of the revolution in 1917 were as follows:—

Great Britain	£483,321,000
United States	$187,729,750
France	fr. 6,023,300,000
Italy	lire 36,045,000

Other Allies.—Belgium was also a borrower, and received considerable sums from the United States, Great Britain and France. As a recognition, however, of the damage done consequent on the violation of the treaty of 1839, Germany undertook in Article 232 of the Treaty of Versailles "to make reimbursement of all sums which Belgium has borrowed from the Allied and Associated Governments up to Nov. 11, 1918, together with interest at the rate of 5% per annum on such sums." At the time of the Peace Conference the representatives of Great Britain, France and the United States agreed, subject to ratification by their Governments, to accept German bonds to the value of the Allied pre-Armistice loans to Belgium thus freeing Belgium from the responsibility of these debts. This was eventually carried out by Great Britain and France. The United States Congress, however, refused to ratify the agreement, and the pre-Armistice debt was the subject of a special arrangement in the subsequent Belgian Debt Funding agreement. For the sake of convenience, the following table gives the advances made by each of the Allies during both periods:—

	Pre-Armistice	*Post-Armistice*
Great Britain	£110,000,000*	£18,500,000
United States of America	$171,780,000	$207,307,200
France	fr. 3,219,474,742*	fr. 241,472,300

*Including interest at 5%.

Of the other Allies, Rumania, Yugoslavia, Greece, Portugal, Armenia, Nicaragua and Liberia were all borrowers, while after the Armistice the new states of Poland, Czechoslovakia, Finland, Lithuania, Latvia and Estonia received advances for various purposes, and Austria and Hungary, of the ex-enemy states, received relief credits. The actual amounts lent can be seen from the preceding tables.

II. HISTORY OF THE LOANS

Any attempt to trace in detail the development of Inter-Allied borrowings, of which the above official figures represent the present position, must be one of great difficulty. For considerable part no authoritative information has been made available as to the dates at which these various obligations were incurred, and the figures given in the following survey must be taken as mere estimates. For the sake of convenience the history of these loans may be divided into three periods:—

First Period: 1914–17.—Up to the end of 1914 the various Allies were able in the main to finance their own foreign purchases. Russia, however, soon found herself in difficulties. Unlike Great Britain and France, her Government was unable to command large funds abroad, while her incapacity to manufacture munitions on a sufficiently large scale necessitated heavy purchases from her Allies. In addition, considerable sums were required for the payment of interest on the existing external debt. As early as Oct. 1914 she had been forced to apply to the British Government for assistance, and a credit of some £11,500,000 was opened on her account at the Bank of England against a shipment of gold to the value of £8,000,000. At the end of the year a further credit was granted, and in Feb. 1915 at a meeting in Paris the British, French and Russian Finance Ministers agreed to unite their financial resources, to share the advances made to Allied Governments, to issue a joint loan and to co-operate in the purchase of supplies abroad. Actually the second proposal was never carried out, but as a result of this and subsequent conferences large funds were raised for Russia in both France and England by the sale of Russian Treasury Bills on the open market and by the extension of governmental credits against a small proportion of gold from the Russian reserve. It is estimated that Russia, during the period 1914–Sept. 1917, borrowed £483,000,000 from the British Government, against a deposit of gold in London of £60,000,000, and 6,000,000,000 fr. from the French Government. She also obtained advances from the United States Government between the months of April and Sept. 1917. In the United States and Japan, moreover, considerable sums were placed at her disposal by the British Government.

The next country to find difficulty in financing its war requirements abroad was France. In Oct. 1914 she had found it advisable to arrange for the issue of Treasury Bills on the London market. By May 1915 some £10,000,000 worth of these bills had been placed, and by the end of that year the figure of open market borrowings had risen to £33,000,000 and to £80,000,000 in 1917. In May 1915 it was agreed that the British Government should grant France substantial credits against shipments of gold in the proportion of three to one. This system lasted until the end of 1916, when the shipment of gold ceased. During the same period France raised considerable sums on the American market, of which the most important was the joint Anglo-French loan for $500,000,000 in Oct. 1915, repaid in 1920. France, during this period, borrowed altogether nearly £200,000,000 from the British Government and dispatched to London some £53,500,000 in gold. To the other Allies the French Government lent approximately 6,500,000,000 francs.

Great Britain during this period loaned to her Allies over £900,000,000. In addition to the above-mentioned advances to France and Russia, £60,000,000 were advanced to Belgium and £27,000,000 to Rumania, Serbia, Greece and Portugal. Up to Oct. 1915 Great Britain had not had occasion to borrow in the United States, but it was found impossible to maintain the American exchange unless funds were available to cover the greatly increased purchases there of war materials. The joint Anglo-French loan was raised on the market without other security than the credit of the two governments, but all moneys subsequently raised in America during this period took the form of credits or secured notes, collateral being deposited in each case. For this purpose the British and French Governments encouraged their nationals either to sell or lend to the Government their holdings of American securities, which were either sold for dollars or employed as collateral.

Italy did not enter the war until May 1915, and from then until the end of this period confined her borrowing to the United Kingdom (with the exception of a small amount raised in Canada). Credits to the extent of some £153,000,000 were granted to her by the British Government, gold to the value of £22,200,000 being deposited in London as security. On the other hand, she herself advanced about 63,000,000 lire to Russia. Her advances to France during this period are in dispute.

The Second Period.—This dates from April 1917, when the United States entered the war, till the Armistice in Nov. 1918. Towards the end of the previous period the Allies were beginning to grow anxious as to their ability to continue the purchase of supplies in America on the then existing scale for an indefinite period. Accordingly, one of the first acts of the United States Government after the declaration of war was to obtain the consent of Congress to a law (Liberty Loan Act) authorizing the extension of credits to Allied Governments up to a total of $3,000,000,000. This limit was subsequently raised three times up to a total of ten thousand million dollars in July 1918. Such credits were granted without any collateral and they were to bear the same rate of interest and be subject to the same conditions as the corresponding bonds to be issued on the United States market in order to raise the sums required. From that time the American Government assumed the responsibility for Allied purchases in the United States. Market borrowings by the Allies ceased with the exception of certain small amounts required for the purpose of refunding existing market loans, some of which, however, were also paid off with the funds obtained from the new credits.

The total advances by the United States Government to the governments of the Allies amounted during this period to some $7,077,000,000, of which Great Britain received approximately $3,696,000,000, France $1,970,000,000, Italy $1,030,000,000 and Belgium $171,780,000. The Provisional Government of Russia (successors to the Tsarist's Government) received $188,000,000 between April and Nov. 1917. Smaller Allies account for the remainder. During the same period the British Government continued to finance the requirements of the Allies in the United Kingdom, and also assisted them by the employment, to a certain

extent, of the credits extended to her in America. These credits were principally employed for the purchase there of raw materials required for the manufacture in the United Kingdom of war supplies for the Allies. For, as the needs of the United States army increased, her ability to meet all the Allied requirements decreased to some extent, and Great Britain endeavoured to take her place. In Aug. 1918, however, it was arranged that each Ally should be debited by America with the cost of the necessary raw materials. In addition, during the early part of 1917 Great Britain advanced funds from her American credits to the Russian Government for interest payments due in America. Total loans by Great Britain to her Allies during these years amounted to over £550,000,000, of which France borrowed nearly £250,000,000, Italy £220,000,000 and Belgium £50,000,000. France, on the other hand, in addition to the advances made by Great Britain, borrowed nearly $2,000,000,000 from the United States, and loaned to her other Allies nearly 7,000,000,000 francs. Italy, Russia, Belgium, Serbia and Rumania were all borrowing nations.

Third Period: Nov. 1918–Sept. 1920.—Although the Armistice was signed on Nov. 11, 1918, nearly two years elapsed before it was possible for the lending Governments to cease making advances to the other Allies for the payment of goods already supplied or ordered. They were also required to enable the Allies to purchase war stores left by the lending Governments in their territories. In addition, the impoverished condition of Europe made it essential, if complete economic chaos were to be avoided, for relief credits for the purchase of foodstuffs and for reconstruction to be granted not only to the poorer Allies but also to certain of the new states created by the peace treaties, and even to some of the enemy countries.

In the United States there was some doubt after the Armistice as to the legality of granting further credits under the Liberty Loan Acts. These Acts limited credits to the period of the war, and Congress had refused to approve any prolongation. On the other hand, the presidential proclamation announcing the official termination of the war was not published until July 2, 1921, and the Administration felt themselves justified in continuing to make advances during the intervening period. The balance of $2,500,000,000 authorized under the Acts was, in this way, advanced to the Allies and utilized by them partly to meet existing contracts in America and partly for the purchase of supplies for the relief of Europe. Moreover, special credits were granted with the approval of Congress to the extent of $740,000,000, of which $600,000,000 were utilized for the sale of war stores to Allied Governments, and $140,000,000 for the sale of flour through the United States Grain Corporation. To this must be added a revolving credit of $100,000,000 opened in favour of the American Relief Administration, of which $84,000,000 was expended for relief supplies furnished on credit.

Relief and reconstruction loans by the British Government amounted during this period to £32,522,000, loans for the purchase of war stores to £12,205,200 and for the repatriation of prisoners to £1,450,000. Similar advances by France amounted to some 1,500,000,000 fr. and by Italy to approximately 600,000,000 lire.

III. THE DEBT SETTLEMENTS

Before even the last inter-Ally loans had been made, it was clear that the problem of repayment would assume an importance in international politics second only to the question of reparations. Soon after the Armistice it became known that the British Government favoured a general cancellation of inter-Ally debts, but the United States was not prepared to agree to such a course. In May 1920 the inter-Ally Conference on Reparations at Hythe declared that it was "important to arrive at a settlement which will embrace the whole body of the international liabilities which have been left as a legacy of the war, and which will at the same time ensure a parallel liquidation of the inter-Ally war debts and of the reparation debts of the Central Empires." This was followed, however, a few days later by a statement by the Chancellor of the Exchequer in the House of Commons to the effect that the question of the United Kingdom debt to the United States of America was being dealt with independently of any question of the part of this country's share of indemnity from Germany. By 1922 the different points of view of the various Allied and Associated Powers on this subject became clearly defined. On Feb. 9 of that year the American Foreign Debt Funding Bill was signed, authorizing the refunding of Allied debts to the extent of $11,000,000,000 into securities with a maximum currency of 25 years, carrying interest at a rate of not less than 4¼%, the negotiations to be carried out by a commission of five members (subsequently increased to eight) under the chairmanship of the Secretary to the Treasury. It was, at the same time, made clear that the United States Government would not consider the remission of debts due to them from the Allies but would look for repayment, though it was recognized that immediate payments would not be possible in every case. This action had a determining effect on the attitude of the Powers concerned towards the whole problem of inter-Ally debts.

The Balfour Note.—Great Britain, which had hitherto made no final pronouncement of policy, was now faced with the necessity of funding her debt to America, and consequently compelled to lay down a principle for dealing with her own debtors. Accordingly, on Aug. 1, 1922, a Note was dispatched to the Governments concerned which has since formed the basis of British policy. In this communication, commonly known as the "Balfour Note," it was stated that, while Great Britain would have been willing to forego all claims for reparations and the repayment of inter-Ally debts if this had formed part of an universal settlement, she must now ask for some measure of repayment. She would, however, be content with a total sum from her Allies and Germany sufficient to cover her own payments to the United States, though this was equivalent to only one quarter of the amount due to her. The French reply in Sept. was inconclusive and unsatisfactory, and the policy of that country was definitely revealed in Oct. at a meeting of the Reparations Commission.

At this meeting certain proposals were submitted by the British delegate for the settlement of the reparations problem, provided that the question of inter-Ally debts was settled at the same time. The French delegate rejected this scheme and put forward a counter-proposal which definitely made the payment of inter-Ally debts dependent on receipts from reparations. At the inter-Allied Conference in London in Dec. 1922 Signor Mussolini, on behalf of Italy, proposed the cancellation of part of Germany's reparation liability if Great Britain would agree to the cancellation of the debts due to her from her Allies. Poincaré elaborated this scheme and offered to hand over forthwith part of the French claim on Germany in payment of her debt to Great Britain and to accept similar terms from her own Allied debtors. Both these proposals were rejected by Bonar Law. The discussion was continued at the Paris Conference on Reparations in Jan. 1923. At this conference the French Government reiterated the principle of the dependence of inter-Ally repayments on German reparations.

The British proposal, which was contingent on the acceptance of their plan for the solution of the reparations question, rested on the basis of the remission of all European Allied debts to the United Kingdom except a small percentage which was to be paid in German obligations, while all German payments over a fixed minimum were to be available for the repayment of European debts to the United States. The failure of the Paris Conference, which was followed by the French occupation of the Ruhr, marked the last attempt to reach any common basis of agreement on this question, although the question was dealt with in the British Note of Aug. 11, 1923 addressed to the French and Belgian Governments regarding the occupation of the Ruhr. In this document the British Government offered as part of a general settlement of the Reparation question to accept in full payment of both reparation and Allied debts a sum equivalent to the amount necessary to cover the funded British debt to the United States, which was estimated on a 5% basis at 14·2 milliards of gold marks. The proposals contained in this Note were not accepted by the Allied Governments concerned.

Anglo-American Funding Agreement.—Meanwhile, the constitution of the United States Funding Commission in Feb. 1922 was immediately followed by preliminary discussions between

the British and American Governments regarding the debt due from the United Kingdom. It was finally arranged that a British delegation, under Sir Robert Horne (the then Chancellor of the Exchequer), should leave for Washington in Oct. with the object of negotiating a settlement. Owing to the change of Government in Great Britain, its departure was postponed, but a payment of $100,000,000 was made on account—the first Allied payment in respect of interest on war debts. The mission finally sailed early in Jan. 1923 under Mr. Baldwin (the new Chancellor of the Exchequer), and returned to England at the end of the month with a proposed settlement which was accepted by the Cabinet on Jan. 31. Under the terms of this agreement the whole principal sum, which after allowing for interest due to Dec. 15, 1922 at 4¼% per annum and for payments already made, was agreed upon at $4,600,000,000, is to be repaid over a period of 62 years in annual instalments increasing from $23,000,000 in the first year to $175,000,000 in the last. Interest is to be paid at the rate of 3% per annum on unpaid balances for the first 10 years and at 3½% for the remainder of the period. The total annual payments on account of interest and principal vary between $160,000,000 and $187,000,000. Britain may rightfully defer half the interest accruing during the first five years, to anticipate payments and to make payments in U.S. Government bonds issued subsequent to April 1917. As these terms were not in accordance with those which the United States Debt Funding Commission was authorized to accept, it became necessary for Congress to approve the agreement, which was done on Feb. 28. On June 15 the first payment under the scheme was made by Great Britain.

Other Funding Agreements.—While the British negotiations were in progress, the United States administration had made their wish to be repaid known to the other countries concerned. The first country to respond was France, which in July 1923 dispatched a mission under M. Parmentier to Washington. No basis of settlement, however, was reached, and negotiations with the Czechoslovak Government led to the same negative result. In Oct. the Administration, hearing that the Rumanian Government contemplated raising a foreign loan, protested against such action before the American Relief Debt was funded. A Rumanian mission subsequently visited the United States, but failed to come to terms. In May 1923 an agreement was reached with Finland for the funding of its debt of $8,000,000 on the same terms as those accorded to Great Britain. No further settlements were reached until 1924, when an agreement was signed in April with Hungary for the refunding of the Relief credits to the extent of $1,939,000 on similar terms to those accorded to Great Britain and Finland. This was followed by settlements with Lithuania and Poland.

In Dec. 1924 the authority of the Debt Funding Commission was extended for another two years and in the following May a *démarche* was made by the United States Government to induce the governments whose debts were still unfunded to negotiate for repayment on the basis of the capacity to pay of the debtor. Consequently, in the latter part of 1925 the majority of the remaining Allies either came to terms or initiated discussions. Thus in Aug. a Belgian delegation arrived at Washington and an agreement was shortly reached by which the debt was divided into two parts. The pre-Armistice debt of $171,780,000 was treated specially, as by the Treaty of Versailles Germany must pay the Belgian war debt as part of her reparations. Belgium undertakes to repay this sum in full over a period of 62 years, but no interest is payable. The post-Armistice debt of $246,000,000 is also to be repaid in full over 62 years, and in addition interest is to be paid at a rate which rises from ⅜ of 1% in the first year to 1% in the tenth year and at the rate of 3½% thereafter.

In Oct. an agreement was reached with the Czechoslovak Government which fixed the debt due at June 1925 as $115,000,000, repayable on terms similar to those reached with Great Britain. Latvia had already signed an agreement in September, and was followed by Estonia in October. In November an Italian delegation signed an agreement which fixed the principal sum due at $2,042 million to be repaid over a period of 62 years. Interest, however, will not be paid during the first 5 years, and thereafter only at a rate rising by 10-year periods from one-eighth of 1% to 2% per annum, or an average of just under 1% per annum for the whole time. This was followed in December by a settlement with Rumania, on the British model.

The French Debt.—Meanwhile, the French Government, which, since the failure of M. Parmentier's mission in 1922, had made no move with regard to the refunding of its debt to the United States Government, dispatched in Sept. 1925 a mission under M. Caillaux (the then Minister of Finance), but the proposals put forward at that time were unacceptable. Better fortune attended the next attempt. On April 29, 1926, an agreement was signed. France agreed to the total at $4,025,000,000 and undertook to pay a total sum of $6,847,674,104 over a period of 62 years, beginning at $30,000,000 for 1926 and rising to $125,000,000 for the seventeenth and subsequent years. No interest is payable until June 15, 1930, after which one per cent will be paid to June 15, 1940, 2% to June 15, 1950, 2½% to June 15, 1958, 3% to 1965 and 3½% thereafter. This agreement has never been ratified by the French parliament, but payments at the rate therein laid down have been regularly made.

All the remaining debtors, including Yugoslavia, Greece, Estonia and Latvia, have since concluded agreements on similar terms, with the exception of Russia, Armenia, Greece and Austria. For the last special arrangements for postponement have been made. If the settlements which have already been made are considered, it will be seen that the terms of the Debt Funding bill with regard to the repayment of capital in full have been carried out in each case, and that, where concessions have been made, they have taken the form of a reduction in the rate of interest. Thus, Great Britain is paying 76% of the 4¼% per annum laid down by the law, while Belgium pays 48% and Italy 25½%. These agreements were ratified by Congress early in 1926.

Debts to Great Britain.—Up to the end of 1924 little or no progress had been made with regard to the repayment of debts due to Great Britain from her Allies. In December of that year the Chancellor of the Exchequer (Winston Churchill) made an official statement to the effect that Great Britain would expect any country making a funding agreement with the United States to come to terms, *pari passu*, with his country. As a result, the French Government took advantage of Churchill's presence in Paris in Jan. 1925, at a financial conference on the Ruhr and the Dawes scheme, to state their intention of opening negotiations and to ask for a definition of the British position. An official reply in February adhered to the principle of the Balfour Note, while no longer supporting the proposals contained in Lord Curzon's Note of Aug. 1923 on the ground that they were out of date. It further proposed that France should pay fixed annual amounts from her own resources, together with a further annuity based on the French share of the Dawes annuities. Direct negotiations were resumed in London in July, when Churchill proposed the payment by France for 62 years of an annuity of £20,000,000, subsequently reduced to £16,000,000 and only a small proportion of which was based on payments to France under the Dawes scheme. Caillaux's counter-proposal of £10,000,000 led eventually to a compromise on a basis of an annual payment for 62 years of £12,500,000. This proposal, which reduced the French debt to Great Britain by nearly two-thirds, was referred by Caillaux to the French Government, which, however, resigned before a final decision had been taken. French opinion was subsequently moved towards the hope of obtaining better conditions by the terms of the Italian agreement with Great Britain and in July 1926, M. Caillaux, who was again Minister of Finance, re-opened negotiations. An agreement was eventually reached by which France agreed to pay a sum of £4,000,000 in 1926–7 which would rise by annual increment of £2,000,000 to £10,000,000 in 1929–30. From 1930–31 to 1956–7 she must pay £12,500,000 annually and from 1957–8 to 1978–9 £14,000,000 annually. She may also postpone half the annual payment for the first three years and by means of a separate letter, reserved to herself the right to ask for a revision of the terms if receipts from Germany did not amount to half the figure laid down in the Dawes scheme. On the other hand, the gold deposit of £53,500,000 was retained by Great Britain (the debt due from France being similarly reduced), until a separate agreement could

be reached. Although the debt agreement has never been ratified in France, the annual payments have so far been punctually made.

By an agreement signed on Jan. 27, 1926, the total amount of the Italian debt at that date was calculated at £610,840,000, and it was agreed that Italy should pay 62 annual payments of £4,500,000 with a partial moratorium for the first seven years. In addition, the Italian gold to the extent of £22,200,000 which had been deposited in the Bank of England as part security for certain loans is to be returned to her by instalments over the same period. It will be seen that, while the total amount to be repaid is not so great in proportion as that which the United States will receive, the value is about the same. Of the remaining debtors Belgium has repaid her post-Armistice debts, and Rumania has reached an agreement on the same basis as that of the offer to France in Aug. 1925, while Yugoslavia, Greece and Portugal have also cóme to terms. Russia alone has made no move. As far as relief credits and credits for stores are concerned, Lithuania and Latvia repaid the amount due on Jan. 1, 1925, while funding agreements for the full amount have been concluded with Poland, Czechoslovakia, Estonia, Hungary, Rumania, Yugoslavia and Greece.

Although it is the declared policy of both Great Britain and the United States to treat the problem of inter-Ally debts as entirely separate from that of reparations, the doctrine of repayment according to capacity, enunciated by the United States, has led to results which are not without interest. Great Britain has advanced to her Allies a total sum of £1,423,132,000, and, on the basis of arrangements already concluded or in course of negotiation, will receive a total sum on account of both principal and interest of £1,147,000,000 in the form of annual payments over a period of 62 years of £18,500,000. On the other hand, she borrowed from the United States approximately £960,000,000, on which she is now paying £30,000,000 and will later have to pay £38,000,000 per annum, so that, in effect, although she lent over 50% more than she borrowed, she will receive from her Allies less than half the amount which she must in her turn pay. Even if she receives her full share of £20,000,000 per annum of German reparation payments under the Dawes scheme (which is a very optimistic estimate), her total receipts on account of inter-Ally debts and reparations combined would only just cover her payments to America. On the other hand, it is interesting to note that the United States should eventually receive on account of loans to her Allies an annual sum equivalent to 65% of that payable annually by Germany in a standard year under the Dawes scheme in respect of reparations. (R. J. S.)

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INTER-ALLY COUNCIL OF WAR PURCHASES AND FINANCE. Before the United States entered the World War, natural, if imperfect, checks on wasteful and unco-ordinated Allied purchases of supplies both in North America and neutral countries were exercised by the limited amount of foreign purchasing power and of shipping available. A certain degree of government control of commodities and of joint purchasing by Allied Governments, destined, as will be mentioned later, to be considerably extended, reinforced these natural checks.

The checks operated with particularly ruthless severity in the case of purchases in America. To a large extent the financial restriction was removed when the United States entered the war, and every spending department, naturally, and indeed, properly, imbued with the conviction that its own requirements were of primary importance for the successful prosecution of the war, prepared an ambitious programme for the future. The United States Government had a double interest in restraining any undue ardour to spend; in the first place it provided on credit a large proportion of the funds required to finance purchases by Allied Governments abroad, and was concerned to be able to satisfy American public opinion that the advances made were expended in the manner best calculated to promote victory; in the second place, it had itself become a large purchaser of war material and equipment, and the first effect of its entrance into the war was to increase the demand more rapidly than the supply. A newcomer had appeared on a restricted market, and it was highly desirable that competition should so far as possible be eliminated and replaced by carefully co-ordinated purchases.

Such were the conditions which induced the Allied Governments in the late summer of 1917 to set up, at the instigation of the United States Government, the Inter-Ally (or Inter-Allied, as it was commonly called in British documents) Council on War Purchases and Finance. In correspondence with the twofold interest of the United States Government described above, the professed objects of the council were firstly to make recommendations as to the supplies and finance required by the various Allies in the United States itself, and secondly to deal, in an advisory capacity, with the problems involved by Allied purchases of all kinds in the world at large.

The council set up two offices, the more important being housed in London in Sunderland House, and the other in Paris. The president was *ex officio* the delegate of the United States Government on the council, and throughout the period of its activity this post was held by Mr. Oscar T. Crosby, who had vacated the post of assistant secretary of the United States Treasury to assume that of special finance commissioner of the United States in Europe. Mr. Paul Cravath assisted him in the capacity of advisory counsel; to his tact it was largely due that the serious friction which the council at times threatened to produce was avoided. The post of secretary-general in London was filled by Mr. H. J. Cook, and that in Paris by Mr. Max Lazard. The British members of the council were Mr. (later Sir) Austen Chamberlain, General Smuts, and Lord Buckmaster. In general the other Allied members were drawn from the representatives of the respective governments on the Commission Internationale du Ravitaillement (*q.v.*).

The Council at Work.—The first object of the council was, as described above, to satisfy public opinion in the United States. That this object was substantially attained may perhaps be inferred from the following reference to the council in the "Annual Report of the Secretary of the (U.S.) Treasury on the State of the Finance for the Fiscal Year ended June 30, 1918": "Valuable information as to the needs of the Governments of the Allies for war purposes, their urgency and the necessity of meeting them from advances by the U.S. has been furnished from Europe by the Inter-Ally Council on War Purchases and Finance and by its president, Oscar T. Crosby." It is proper to add that the required information was given more expeditiously by the special financial representatives appointed by the principal Allied Governments to be in direct touch with the United States Treasury authorities in Washington, and that the value of the council's information was chiefly psychological.

In relation to its second object, the control and co-ordination of the purchase of supplies, the council may have been said to have succeeded by failing. The council's task, as originally conceived, was grandiose and quite unworkable; it represented a Treasury ideal unattainable in practice. The council met every few months and had laid before it imposing sheets, necessarily prepared some time before, which should in principle have set out purchasing programmes of the principal governments for almost every conceivable supply required, not only by the war departments proper but also by civilian departments such as the British ministry of food, which were gradually extending a strict

control over one class of commodity after another. It was inevitable that in the circumstances the figures laid before the council were largely out of date before their preparation was complete. They could hardly be a picture of proposed orders, for the war had to be prosecuted, and needs which altered daily with the war's changing circumstances called for daily control and immediate decision. In fact the figures represented orders in course of fulfilment, commitments long entered into, proposals which might never be proceeded with, and projects, which, even if approved, would have to be abandoned for want of shipping.

This last word reminds us of the real seat of control at this stage of the war. The entry of the United States had relieved the Allies from their financial embarrassment, but it necessarily aggravated the problem of securing sufficient tonnage, which had now to transport not only Allied supplies but American supplies and troops. In consequence, the supply departments found that their freedom to purchase when and where they wished, was, in spite of greater financial ease, more and not less restricted. Shipping was more and more concentrated in the North Atlantic, partly as an economy in its use which to some extent offset the greater demand upon it, and partly the more effectively to combat the submarine menace. The very fact that the United States was a belligerent and that the financing of supplies bought in North America was no longer a major preoccupation permitted the concentration. It thus came about that shipping considerations exercised at this stage of the war a much more effective control over purchasing programmes than the question of finance. Such further control as was possible in reinforcement of Treasury control was provided by the various Allied programme committees which were gradually constituted to deal with government demands for certain commodities, and as the circle of government trading was constantly enlarged these commodities came to cover a very large part of the field of Allied expenditure abroad.

(A. McF.)

INTERAMNA LIRENAS, an ancient town of Italy in the Volscian territory near the modern Pignataro Interamna, 5 m. S.E. of Aquinum; the additional name distinguishes it from Interamna Praetuttianorum (mod. Teramo) and Interamna Nahartium (mod. Terni). It was founded by the Romans as a Latin colony in 312 B.C. as a military base in the war against Samnium, no fewer than 4,000 colonists being sent thither. The city lay on a hill on the northern bank of the Liris, between two of its tributaries, thus lacking natural defences on the north side alone.

INTERBOROUGH RAPID TRANSIT COMPANY was incorporated in 1902 to operate rapid transit lines in the City of New York. Its capitalization consisted of $35,000,000, in common stock. It acquired by assignment the lease of the original so-called subway of the City of New York, which was opened on Oct. 27, 1904, for a distance of twelve miles. On Jan. 1, 1903, it leased (effective April 1, 1903) the elevated railroad lines in the Boroughs of Manhattan and The Bronx, City of New York, from the Manhattan Railway Company, for a period of 999 years.

The company in 1928 operated, under lease from the City of New York, 75.26 route miles of municipally owned rapid transit lines, designated as the Subway division, and 41.39 route miles of privately owned elevated railroad lines, designated as the Manhattan division. During the first full fiscal year of operation the company carried 137,919,632 passengers on the Subway division, and during the same year carried 257,796.754 passengers on the Manhattan division. During the year ended June 30, 1928, it carried 899,238,749 passengers on the Subway division and 349,698,134 passengers on the Manhattan division. Its present outstanding capital stock, bonds and other obligations aggregate approximately $247,600,000. (F. HED.)

INTERCALARY (Lat. *intercalare,* to proclaim), a term applied to a month, day or days inserted between other months or days in order to adjust the reckoning of time, to the revolution of the earth round the sun, the solar year (*see* CALENDAR). From the meaning, "something placed between," intercalary is used for something which comes between two types. In botany, the term is used of growth between the apex and base of an organ, such as the growth in length of an iris leaf, or of the internode of a grass-haulm.

INTERCOLUMNIATION, in architecture, the distance between the columns of a colonnade; usually defined by the number of times in which the bottom diameter of the column is included in the distance between the two closest points on adjacent columns. Thus the distance between the centre lines of two columns is one diameter more than their intercolumniation. The intercolumniation of classic columns was systematized at an early date and the following standard intercolumniations have been listed by Vitruvius and others: (*a*) pycnostyle, equal to one and a half diameters; (*b*) systyle, 2 diameters; (*c*) eustyle, 2 and a quarter diameters, so-called "well-columned," as the one most generally satisfactory; (*d*) diastyle, 3 diameters; (*e*) areostyle, 4 diameters; and (*f*) areosystyle, a complex form in which the columns are arranged in pairs with the distance between the pairs greater than the distance between the columns of each pair, as in the colonnade of the Louvre, Paris (by Claude Perrault, 1665). No such absolute standardization of intercolumniation as Vitruvius' list would suggest exists in classical work; frequently all the intercolumniations of a single colonnade differed, with the widest in the centre. The list must therefore be considered, like the so-called rules for the orders, merely as a summary of the averages.

INTERDICT, in its technical sense as an ecclesiastical term, is a sentence by a competent ecclesiastical authority forbidding all celebration of public worship, the administration of some sacraments (baptism, confirmation and penance are permitted) and ecclesiastical burial. An interdict is a measure which seeks to punish a population or a religious body (*e.g.,* a chapter) for the fault of some only of its members, who cannot be reached separately. It is a penalty directed against society rather than against individuals. In the *Chronicle* of Ademar of Limoges (*ad ann.* 994) it is stated that Bishop Alduin introduced there "a new plan for punishing the wickedness of his people; he ordered the churches and monasteries to cease from divine worship and the people to abstain from divine praise, and this he called excommunication" (*see* Gieseler, *Kirchengesch.* iii. 342, where also the text is given of a proposal to a similar effect made by Odolric, abbot of St. Martial, at the council of Limoges in 1031). It was not until the 11th century that the use of the interdict obtained a recognized place among the means of discipline at the disposal of the Roman hierarchy, which used it, without great success, to bring back the secular authorities to obedience. Important historical instances of the use of the interdict occur in the cases of Scotland under Pope Alexander III. in 1181, of France under Innocent III. in 1200 and of England under the same pope in 1209.

See A. Boudinhon, art. "Interdict" in the *Catholic Encyclopaedia.*

INTERDICTION, in Scots law, a process of restraint applied to prodigals and others who, "from weakness, facility or profusion, are liable to imposition." Its only effect is to prevent the person interdicted from effectively alienating his heritable or real property without the consent of his interdictors. It leaves him competent to dispose of his moveables. Interdiction is either voluntary or judicial. Voluntary interdiction is effected by the prodigal himself, who executes a bond obliging himself to do no deed which may affect his estate without the assent of certain persons called the "interdictors." This may be removed by the court of session, or by the joint act of the interdictors and the interdicted, or by the number of interdictors being reduced below the number constituting a quorum. Judicial interdiction is imposed by order of the court, either moved by an interested party or acting in the exercise of its *nobile officium,* and can only be removed by a similar order. That the interdiction may be effective in questions with third parties it must be published in the appropriate registers.

INTERESSE TERMINI, in law, an executory interest, being the right of entry which the grant of lease confers upon a lessee. Actual entry on the lands by the lessee converts the right into an estate. If the lease, however, has been created by a bargain and sale, which still exist in some colonies, or by any other conveyance under the Statute of Uses, which does not require an entry, the term vests in the lessee at once. This doctrine

was abolished by the Law of Property Act, 1925, S. 149.

INTERFERENCE is the confusion of radio reception due to stray electrical disturbances, undesired signals or other causes. The name interference is also applied to that which produces the confusion.

INTERFERENCE OF LIGHT: *see* LIGHT and INTERFEROMETER.

INTERFEROMETER. An instrument which makes use of the interference of light waves (*see* LIGHT) to measure very small differences in length or very small differences in wave-length. On the one hand, if very homogeneous light (*i.e.*, light which covers an extremely small range of wave-length, often referred to as light of one wave-length) is used, a difference of optical path can be measured by the help of the interference fringes formed: on the other hand, if the light contains two or more separate, but very near, wave-lengths, the component wave lengths can be detected, and their separation measured, by the separation of the fringe systems. (*See* SPECTROSCOPY.) The interferometer has assumed great importance in modern physics, firstly from its use in attempts to measure a difference of optical path due to motion through a hypothetical ether, in experiments of the type initiated by Michelson and Morley (*see* ETHER, RELATIVITY), secondly from its use in the determination of the ultimate standard of length, that is, in measuring the length of the standard metre in terms of wave-lengths of a standard light (*see* SPECTROSCOPY), and thirdly from its use in resolving very close spectral lines, to which reference has just been made.

Separation of Interfering Beams.—The interferometer of Fabry and Perot, in which the interference is produced by repeated reflection of the light between two accurately plane glass plates, is described in the article LIGHT, where reference is also made to another multiple reflection interferometer, the Lummer plate. In both these instruments the reflections lead to what is virtually a large number of sources, with a large path difference, amounting to some tens of thousands of wave lengths, between successive beams. In contrast to such instruments, where the interference is due to the combined effect of a large number of beams produced by the reflections, are instruments in which two beams only, between which interference takes place, are produced from the original beam, the two beams following widely separated paths, so that, for instance, obstacles can be placed in one beam and their retarding effects measured by the consequent displacement of the interference fringes. In the instrument of Jamin the separation is effected by the use of thick plates, the interference from which was first investigated by Brewster. Two similar thick glass plates, with accurately parallel surfaces, are arranged as in fig. 1. The one of the two interfering beams is that which is reflected at the first surface of the first reflector

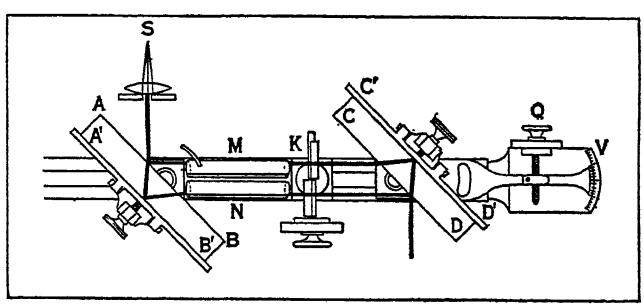


FIG. 1

and at the second surface of the second reflector: the other undergoes reflection at the second surface of the first reflector and at the first surface of the second reflector. If the plates are exactly parallel and exactly equal in thickness the two paths are equal and the two beams should leave the second plate exactly in phase; if there is any lack of parallelism or in homogeneity of the glass interference fringes will be seen. If any substance with a refractive index greater than that of air be introduced in the path of one beam only the retardation produced will cause a shift of the fringes, from which the refractive index can be calculated. To enable the measurements to be made with greater ease a compensator is provided, consisting of two thin glass plates, one in each path, which can be independently tilted to make any desired angle with beam: the greater the inclination the greater the thickness of glass traversed by the beam, so that any desired retardation can be introduced. The instrument has been largely used to measure the refractive indices of gases, for which pur-

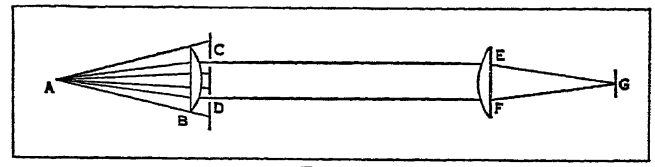


FIG. 2

pose glass-ended tubes are introduced into the path of the beams, one being evacuated, while the gas is slowly introduced into the other, the passage of the fringes being counted. Since the instrument was originally used for this purpose by Jamin it is often known as an interference refractometer. Extensive measurements of gaseous refractive indices have been made with it by C. Cuthbertson.

In the interferometer, also used for the accurate measurement of refractive indices of gases and weak solutions, devised by Lord Rayleigh (3rd Baron), light proceeding from a slit at A, fig. 2, perpendicular to the plane of the paper, falls upon a collimating lens B, which is blocked out by a screen except for two parallel slits at C and D. The parallel beams CE, DF transmitted by these slits are brought to a focus at G by the lens EF, and form interference bands in the focal plane. These bands, which are examined with a high power eye-piece, undergo displacement if any substance which causes relative retardation of the light is introduced into one of the paths. Consider, for example, what happens at the point G itself, which is the image of A. If everything is symmetrical so that the paths ACEG, ABFG are exactly equal, there is brightness, but if, for example, CE be subjected to a relative retardation amounting to half a wave length, we have darkness at G, the band being shifted through half a band interval.

The Michelson Interferometer.—The best known form of interferometer, and the one to which the designation was originally applied, is that devised by Michelson for the Michelson-Morley experiment (*see* ETHER, RELATIVITY, MICHELSON-MORLEY EXPERIMENT), on the effect of the motion of the luminiferous medium on the velocity of light. In this the interfering beams are not only widely separated, but travel, as is required by the experiment, at right angles to one another for the greater part of their path. Light from the source S, which may be an extended luminous surface (a candle, lamp or a lens with an arc light at the focus) falls at 45° on the surface of a plane-parallel glass plate (fig. 3), the surface of which is covered with a film of silver or platinum, of such thickness that the reflected and transmitted pencils are of approximately equal intensity. The transmitted beam falls normally on the mirror C, the reflected

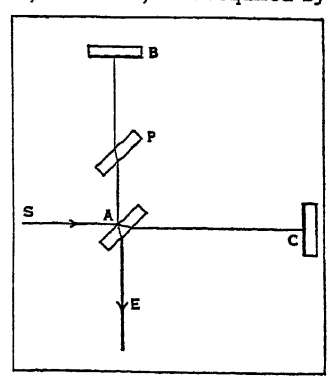


FIG. 3

beam on B, both returning to the separating surface A, whence they both proceed in the direction AE. Since the beam reflected from C has had to pass three times through the plate A, whereas the beam from B only passes once through A, a compensating plate *P'* similar to the plate A, is introduced, which is traversed twice by the beam which goes to B. The resulting interference fringes may be projected on a screen or observed by eye, with or without an observing telescope.

The construction of the instrument is indicated in fig. 4. A heavy casting serves to support the optical parts, and the car-

riage holding the movable mirror C moves on very accurately ground ways. The motion is communicated by means of a screw provided with a worm wheel and a divided circle so that the motion of the carriage may be accurately measured. The stationary mirror D is provided with screws for adjustments about vertical and horizontal axes. The compensating plate B is held by a vertical steel rod, twisting which produces any required small alteration in the path. All of the optical surfaces are very accurately plane, the errors being of the order of a twentieth of a light wave, or less.

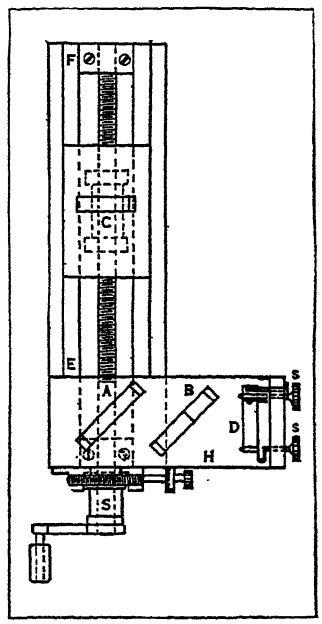


FIG. 4

The adjustment of the instrument is effected as follows. The distances of the mirrors C and B from the half-silvered surface of A are made approximately equal (say, to within a millimeter), and an approximately homogeneous source of light (sodium flame, or better, a Cooper-Hewitt mercury arc) is placed in front of A, as indicated by S. The two images of a needle point placed near S are then brought into coincidence by the adjusting screws of the mirror D, when the interference fringes should appear. They are usually narrow, curved, and not very distinct; but by slowly altering the adjustment of the mirror D they may be given any suitable width, and by diminishing the path difference by turning the screw S the fringes become more distinct. As the path difference approaches zero, the change of inclination of the fringes accompanying a change in position of the eye diminishes; and when this change vanishes, the (coloured) fringes in white light appear, or may be found in a few turns of the worm wheel which gives the slow motion to the screw S. The use of the instrument in the Michelson-Morley experiment is described under RELATIVITY, in measuring the standard metre in terms of lightwaves under SPECTROSCOPY.

THE THEORY OF THE INTERFEROMETER

The arrangement sketched in fig. 5A represents schematically the interferometer in its simplest form. B′ represents the image of the mirror B in the mirror M, A and B′ being supposed to be not quite coincident: it is evident that to the observer at E the effect of the whole combination is the same as that which would be produced by the surfaces A and B′. The light coming to E may then be considered as having come from two nearly coincident sources, which are the image of the source S in the two mirrors. These sources are therefore coherent, but not quite coincident, and the form and visibility of the fringes clearly depend upon the degree of coincidence of the two sources. Exact coincidence would be equivalent to a single source, and consequently there would be no fringes at all in such a case, but exact coincidence is not attained in practice, so that fringes are always visible. When the coincidence is nearly attained the fringes will clearly be broad; when the images are further apart the fringes will be narrow, and usually curved, as mentioned when the adjustment of the instrument was being discussed. The visibility will depend largely upon the aperture, since for good visibility the fringes formed by the two images of one part of the source should be superposed as nearly as possible on those formed by the two images of another part of the source.

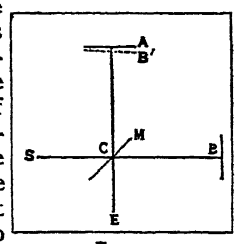


FIG. 5A

As the moving mirror is displaced backwards the two images separate, and the fringes move across the field. Every time the distance between the images increases by a wave length a whole fringe moves past a given fixed point. If the light was perfectly homogeneous the fringes would be visible with any degree of separation of the images, that is, with any difference of path length between the two beams. If, however, the light is not perfectly monochromatic, then clearly with large enough path difference the fringes formed by one component of the light will cancel those formed by a neighbouring component. The fact that even with the most homogeneous source fringes never show with a path length greater than 70 cm. proves that the light consists of trains of about this length.

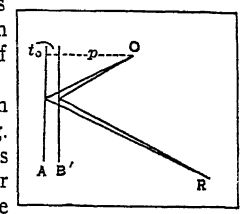


FIG. 5B

Michelson has discussed the formation of the fringes in the following way. In fig. 5B let AB be the two equivalent mirrors shown in fig. 5A, the intersection of their planes being vertical, and consider the effect of the reflection of light from a source R to a point O. Let t be the distance between the mirror surfaces at the point of incidence, ω be the angle of incidence, which may be considered the same for both mirrors, the angle ϕ between them being supposed to be very small (of the order of a second of arc, or less). Further let p be the perpendicular distance from O to the mirrors, t_0 the distance between the mirrors at the foot of this perpendicular, and i the angle between the horizontal projection of the incident ray and the normal. Then the difference in path of the two interfering pencils is seen to be expressed

$$\Delta = 2t\cos\omega$$

and

$$t = t_0 + p\tan i\tan\phi = t_0 + pi\phi$$

since ϕ is very small and so is i, the incidence being very nearly normal.

Hence

$$\Delta = 2(t_0 + pi\phi)\cos\omega$$

The corresponding phase difference is $2\pi\frac{\Delta}{\lambda}$, which with an unlimited aperture may clearly have so large a range of values that all traces of interference vanish. If, however, the cone of rays is limited, either by the pupil of the eye or, in the case of an observing telescope, by a diaphragm, then the range of angles may be small enough to show the phenomenon of interference.

Let us now enquire as to the distance p at which the fringes will be most clearly visible. This must occur when there is no change of Δ with ω, the angle of incidence, that is, when

$$\frac{d\Delta}{d\omega} = 0.$$

Now $\frac{d\Delta}{d\omega} = -2\sin\omega(t_0 + pi\phi) + 2\cos\omega p\phi\frac{di}{d\omega} = 0$, or since ω, i and ϕ are all small, which leads to $\frac{di}{d\omega} = \frac{\omega}{i}$, we have

$$\omega(t_0 + pi\phi) = p\phi\frac{\omega}{i}$$

or

$$p = \frac{it_0}{\phi}.$$

It follows that for an unlimited beam, when i has various values, the different parts of the interference paths are not simultaneously in focus except, firstly, if $t_0 = 0$, when $p = 0$ and the fringes are localised at the surfaces of the mirrors AB, or, secondly, if $\phi = 0$ or the mirrors are parallel, when $p = \infty$ and the fringes are localised at infinity.

If we call Δ_0 the phase difference for normal incidence, $\omega = 0$ and if $\Delta_0 - \Delta = n\lambda$, then

$$2t_0(1 - \cos\omega) - 2pi\phi\cos\omega = n\lambda$$

or, ω being small,

$$t_0\omega^2 - 2pi\phi = n\lambda.$$

Let θ be the angle between the normal and the projection of the ray on the vertical plane containing the normal, and put

$$\frac{n\lambda}{t_0}=\rho^2, \quad \frac{p\phi}{t_0}=h.$$

Then $$\omega^2=i^2+\theta^2=\rho^2+2hi.$$

This represents a circle whose angular semidiameter is

$$\sqrt{\left(\frac{n\lambda}{t_0}+\frac{p^2}{t_0}\right)}$$

and whose centre is displaced through an angle $h=\frac{p\phi}{t_0}$, and so we see fringes which are circular arcs. If the separation t_0 is small, the equation reduces to

$n\lambda=-2p\phi i=2\phi x$ where $x=-pi$ is the horizontal separation between the fringes, which is constant. Disregarding sign, $x=\frac{n\lambda}{2\phi}$. The fringes are straight, and parallel to the intersection of the mirrors A, B′. The distance between consecutive fringes is clearly

$$b=\frac{x}{n}=\frac{\lambda}{2\phi}.$$

The visibility V of the fringes is defined by Michelson as

$$V=\frac{I_1-I_2}{I_1+I^2}$$

where I_1 and I_2 are the maximum and minimum intensities respectively. Michelson has shown that we can deduce the formula

$$V=\frac{\sin kp\phi(i_2-i_1)}{kp\phi(i_2-i_1)} \qquad \text{where } k=2\pi/\lambda$$

and i_1, i_2 are the limiting values of i for the incident beam. This shows that if $p=0$, which, as we have already seen, involves $t=0$ if all parts of the interference patterns are to be simultaneously in focus, then $V=1$, which is independent of the aperture. For moderate aperture the visibility is independent of the aperture. This is also true if $\phi=0$.

An idea of the order of magnitude of the angular aperture permissible may be obtained in an elementary way as follows. If the differences in phase between the central and marginal rays be λ the discordances will be considerable. In the case where $\phi=0$, and the mirrors are truly parallel, if β is the angular aperture of the objective, then

$$\text{difference in phase}=2t(1-\cos\beta/2)=\lambda$$

whence $\beta^2=\lambda/t$ as a first approximation. Thus if $t=25\lambda$, then $\beta=\frac{1}{5}$, and the angular aperture of the lens should certainly be less than $\frac{1}{5}$.

Comparative Place of Interferometer as an Optical Instrument.—It had been pointed out by Michelson that the interferometer can be regarded as a modification of the ordinary instrument, telescope or microscope, consisting of lenses or mirrors, and that prisms and gratings as well have their analogies in interferometers. We will consider first the case of a converging lens, of supposedly perfect optical construction, that is, for which the optical distance from point to point is equal for all paths. Such a lens, considered as an optical instrument, may be employed to form an accurate image of the object, as in an astronomical observing telescope, but it may also be used for accurate measurement of a displacement, or angle, where a representation of the object is not necessary, so long as there is some recognizable feature of the image on which a setting can be made. It is well known that the image of a luminous point formed by a lens is a diffraction pattern consisting of a bright spot, surrounded by rings, and that the resolving power of the instrument depends upon the extent of the overlapping of the diffraction rings due to two close object-points. (*See* LIGHT, section on Resolving Power.) The size of the diffraction pattern is inversely proportional to the angular aperture of the lens, and the definition and the resolving power both increase as this aperture is increased. With a given aperture, however, the indistinctness of the image becomes more and more pronounced with increasing magnification, since all the imperfections of the image are subject to the same enlargement as the size itself, while the brightness diminishes. The interference fringes of the diffraction pattern, however, are more accurately measurable if the pattern is magnified, since, generally speaking, setting a cross-wire is possible to within a fixed fraction of the fringe width.

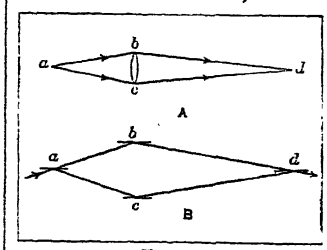


FIG. 6

For the purpose of accurate measurement of position or angle we may therefore block out the central portion of the lens altogether, leaving merely a circular annulus which will produce sharp rings, or, better still, we can merely isolate two small portions of the lens at opposite ends of a diameter. We shall in this way obtain an exceedingly bad image of the luminous object, but we shall have interference fringes which can be increased in size up to practically any limit without affecting the amount of light. The result is exactly the same, as far as measuring position is concerned, as could be obtained with a perfect microscope of infinitely great magnifying power with an infinitely bright source. This device of isolating two small strips of lens at the opposite end of a diameter is, in fact, that adopted in Rayleigh's interferometer, already described. Regarding the lens as an optical instrument we sacrifice resolution and definition, with a gain of accuracy of measurement. We may then say that, since all optical phenomena ultimately depend upon interference in its most general conception, there is no fundamental difference between the interferometer and ordinary lens system. The analogies will now be considered in a little more detail.

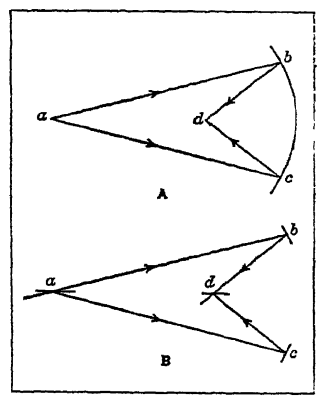


FIG. 7

The Rayleigh interferometer has already been considered. The close analogy between the optically perfect convex lens and an interferometer consisting of four mirrors is illustrated in fig. 6. Thus in fig. 6A the image of a source (a slit A, or a fine line ruled by a diamond on a smooth glass or metal surface) is formed at D (the result of the "combination" of all the rays which fall on the lens BC), where it may be observed, as in the telescope or the microscope, by an eyepiece. In fig. 6B the source is replaced by the surface A, whence two of the pencils (one transmitted and the other reflected) are bent by the prisms (or mirrors) at B and C so that they meet at the surface D, proceeding thence to the eye or the observing telescope. In fig. 7 the same analogy is illustrated when the lens is replaced by a mirror.

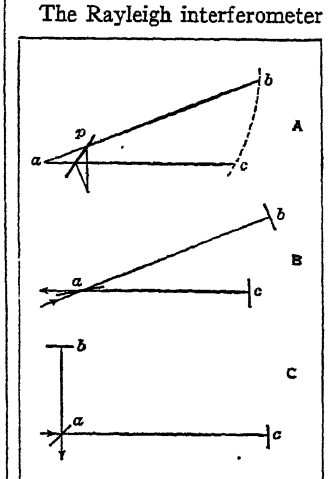


FIG. 8

Thus it appears that the essential difference between lenses or mirrors, on the one hand, and the interferometer, on the other, is that in the former all the rays from the source which fall on the lens unite in the focal plane to form an image; whereas in the interferometer of the type in question there are only two interfering pencils. The advantage of this has already been

pointed out. In the illustrations just given, the microscope or telescope, and the analogous forms of interferometers. may be applied to the measurement of distances or of angles

But prisms and gratings are employed in what seems at first sight to involve different principles, and for a different purpose, namely, the analysis of light into its component constituents. The analogy still holds, however, as is shown in fig. 8A and B Thus in figure 8A, *A* represents the slit source of light and *BC* a grating which diffracts the light back to *A* (part being thrown on one side by the plane-parallel plate *P* for observation or for photography) while in figures 8B and 8C, the interferometer shows a similar light-path, but only for the two limiting pencils of light, 8C being produced from 8B by a slight rearrangement of the mirrors.

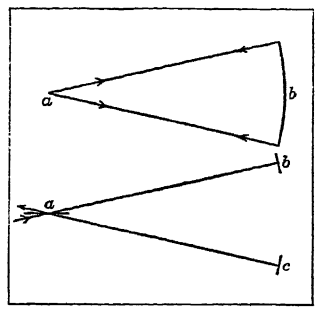


FIG. 9A

If in this arrangement one of the mirrors, say *C*, is movable, and the incident light monochromatic of wave-length and if *n* is the number of maxima (or minima) corresponding to *d*, the measured difference in path, then the wave-length is given by $\lambda = d/n$; and, as is described under *Spectroscopy*, this can be measured with far greater accuracy than is possible by the use of prisms or gratings.

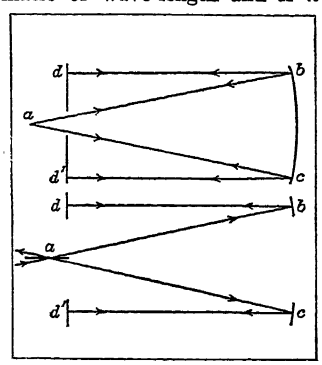


FIG. 9B

Any arrangement of mirrors and lenses has its analogue in a possible interferometer. Fig. 9 shows three different dispositions of optical apparatus and three corresponding interferometers. The diagrams are self-explanatory, A being a concave mirror with the source at the centre of curvature, and hence a single plane mirror in place of the two mirrors of fig. 7: C a double convex lens with equidistant object and image, a variation on fig. 6; and B a concave mirror and two plane mirrors with the source at the focus of the mirror. The interferometer diagrammatically represented in Ciii. is a slight variation on that of Cii. obtained if the mirrors *B* and *C* are separated until *AB* and *AC* are at right angles.

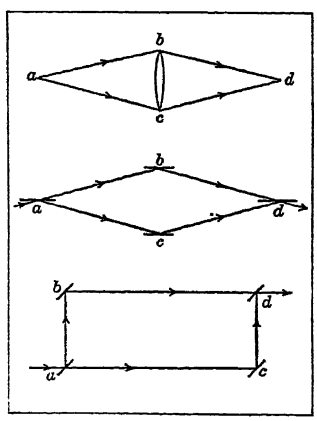


FIG. 9C

Measurement of the Standard Metre in Terms of Light Waves.—The standard metre is defined as the distance between two fine lines on a particular iridio-platinum bar kept at Paris. It is, however, clearly desirable to have some absolute standard of length, not depending upon a particular piece of material, since not only are secular changes possible in the material which will produce minute changes in length, but also, in the remote chance of an accident to the bar, it should be possible to replace it. Long ago two proposals were made to fill this need, the first being to adopt as a standard the length of a pendulum which swings once a second at Paris. It was found on trial that the error of measurement was considerably greater than expected. The second proposal was to use the earth's circumference as a standard, and, in fact, the original metre was intended to be one forty-millionth of this length. As a result of several of the very costly investigations of the measurement of a given arc of the meridian it proved, however, that this measurement was too inaccurate to serve. The interferometer with large differences of light paths enables us to measure a length of many centimetres in terms of the wave length of a specified light, and so gives us a standard which can be easily reproduced at any time or place. The International Committee on Weights and Measures decided, in fact, in 1923 on the adoption of such a standard, so that the measurement of the standard metre in terms of a wave length is of the highest importance.

If a wave length is to be a standard length it is, of course, essential that the light should be very homogeneous; among the hundreds of radiations examined none answered the requirements so well as the red line of cadmium vapour. With this light interference fringes are still measurable with a path difference of 22 cm., which distance contains about 350,000 waves, or, say, 700,000 fringes. The optical error of measurement will depend somewhat on the visibility of the fringes, but an estimate of one-tenth of a fringe width is quite conservative, and thus indicates the possibility of making such a measurement to an order of accuracy of one in ten million. The general principle of the method is simply to move the mirror of the interferometer through a distance given by the standard, and to count the number of fringes, but to make sure that the mirror has actually been moved through the standard distance, and to extend the measurements to a length of a metre a number of special devices are necessary.

Since fringes cannot be obtained with a path difference of one metre, and even distances of several centimetres are troublesome, as they involve the counting of some hundred thousand fringes, a standard decimetre and a series of substandards were prepared. The standard decimetre was afterwards compared with the metre in a way which will be described. The intermediate standards, by the help of which the number of fringes was reduced to a countable one, consisted of a 5 cm. one, a 2·5 cm. one, and so on, each successive standard being half the length of the previous one, the ninth and last being ·39 mm., which contains only 600 red light waves, or 1,200 fringes in the doubled distance between the parallel surfaces which constitute the standard. This number of fringes can readily be counted without fear of error. The construction of those intermediate standards is made clear by the example shown in fig. 10. It consists of two plane-parallel glasses A, A shown on the front surfaces, and held in contact with three brass pins, which are filed and polished until the two surfaces are as nearly parallel as required. The distance between the planes of the front surfaces of these mirrors, one of which stands, as will be seen, higher than the other, constitutes the standard length.

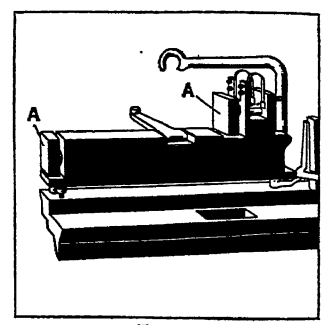


FIG. 10

The first task is to determine the exact number of wave lengths in the smallest standard, which we will call standard I. Fig. 11 represents the interferometer set up for this purpose: *d* is the moveable mirror, *m m'* are the two mirrors of the standard (the distance between them being exaggregated in the diagram) and *n* is a stationary auxiliary mirror. This mirror is used for the purpose of counting the fringes that pass when *d* is displaced, that is, for measuring the displacement of *d* in wave lengths. To start, the front surface of *m* is made to fall in line with the image of the reference plane *d*, making, however, a very small horizontal angle with it, so that with white light a series of vertical interference bands is formed, the central band being achromatic and therefore readily distinguishable. The mirror *d* is now steadily moved back, and the succession of circular fringes formed by the *cadmium* light on *n* is counted. The

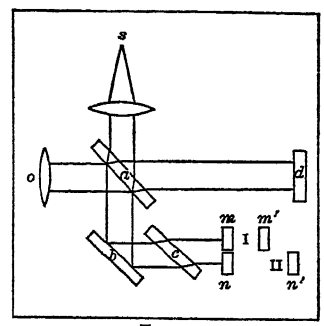


FIG. 11

motion is continued until d coincides with the rear surface m', a coincidence detected once more by the *white* light fringes, the achromatic band being brought to the same position on m' as it had before on m. The motion of d is thus measured in terms of wave lengths of cadmium light, and the limits of its motion, given by the distance between m and m', determined by the use of white light fringes to establish coincidence.

The next step is to compare standard II. with the one already measured. Now n represents the front mirror of standard II., n' the rear mirror. The two mirrors m and n are brought into the same plane with the help of white light fringes. The mirror d is now moved to coincide with m', and standard I. is moved until fringes reappear on m, so that m' and n' are now very nearly in the same plane. The small distance between m' and n' in this position is determined in fractions of a fringe of cadmium light by moving d, so that the correction to be applied to standard II. is determined. Standard III. is checked against II. in the same way, and so on, until the decimetre is reached.

The table gives the results of three independent measurements of the number of light waves in the (doubled) length of standard IX., the decimetre. The fact that these measurements were made. at different times, months apart, and by different individuals, and still give the same result to a few hundredths of a light wave, gives confidence in the accuracy of the result. Besides the red line of cadmium, the green and the blue line were used, as recorded.

Series	Red	Green	Blue
I. . . .	310,678·48	393,307·92	416,735·86
II. . . .	310,678·65	393,308·10	416,736·07
III. . . .	310,678·68	393,308·09	416,736·02

The final operation is the comparison of the decimetre with the standard metre. For this purpose an auxiliary metre X. was provided with two diamond scratches at a distance apart very nearly equal to a metre. An arm extending at right angles from the decimetre has a similar mark which is placed as nearly as possible in coincidence with one of the metre marks. The standard decimetre is then "stepped off" ten times by the help of the interferometer fringes. The resulting error is, however, multiplied by ten, instead of by two as in the comparison of the smaller standards. It is estimated that the error of separate determinations of the metre may be of the order of one-half of a light wave, but the mean of all measurements is doubtless much less. To this error must, however, be added the errors of the micrometric measurements of the "coincidences" at both ends of the metre bar, and finally the error of the comparison of the auxiliary metre with the standard.

The final results are as follows:

Number of Light Waves of the Three Principal Cadmium Radiations in the Standard Metre

Red	1,553,163·5
Green	1,966,249·7
Blue	2,083,372·1

The metre rod is in air at 15° C and 760 mm. of mercury pressure. It is estimated that these results are correct to about one part in two million.

Measurement of Stellar Diameters.—Most of the applications of the interferometer have been mentioned at one part or another of this article. The chief of them are:—the measurement of standard wave length, or, differently put, the measurement of the meter in terms of the light wave; the measurement of the maximum distance over which interference can be produced, or the coherence of a wave train: the measurement of refractive indices of gases and weak solutions: and the resolution of close spectral lines. Reference must also be made to the recent application of interferometric methods for the measurement of stellar diameters. Suppose we consider the whole of the lens of a telescope stopped out, except for two slits at opposite ends of a diameter, as in the Rayleigh interferometer. A single luminous point will produce a pattern of interference fringes. A second close luminous point will likewise produce a pattern of fringes overlapping the first pattern. If we consider the two points as originally coincident, and then gradually separate them, the superposed pattern will give a certain pattern of fluctuating intensities depending upon the separation, but ultimately a separation will be reached such that the darkest parts of one pattern fall exactly upon the brightest parts of the other pattern, and we shall have uniform illumination. The argument can be extended to an uniformly illuminated disc, for which it can be proved that the fringes vanish when

$$\alpha = \frac{1{\cdot}22\lambda}{s}$$

where S is the separation of the two slits, λ the wave length of the light used, and α the angle subtended at the telescope by the diameter of the disc.

This principle has been applied by Michelson to the measurement of stellar diameters. It is not feasible to make a lens of large enough diameter to hope for vanishing with the extremely small α provided by a star disc, but Michelson gets over the difficulty by receiving the light from the star on two mirrors set at 45°, from which it passes to two other 45° mirrors which throw the light in two pencils at opposite ends of a diameter of the lens or the mirror of the telescope. The general arrangement of the mirrors on the great reflecting telescope at Mount Wilson is shown in fig. 12. The separation of the first two mirrors, which, with the second two, are mounted on an arm set normally across the telescope at the aperture and, is limited only by mechanical considerations, and, in Michelson's first instrument, was variable and could be made as great as 20 ft. The method of mounting of the mirrors is indicated in fig. 13. With the red star Betelgeuse a vanishing of the fringes was obtained with a separation of about 10 feet (306 cm.), which, taking the effective λ as $5{\cdot}75\times10^{-5}$ cm., gives the angular diameter α to be ·047 seconds of arc. Using a parallax of ·018 we obtain an estimate of 240 million miles for the linear diameter of this star. The diameters of a few other stars have been measured by this method. In 1928 an interferometer of the pattern in question is under construction at Mount Wilson which will allow a 50 foot separation of the mirrors. (*See* STAR.)

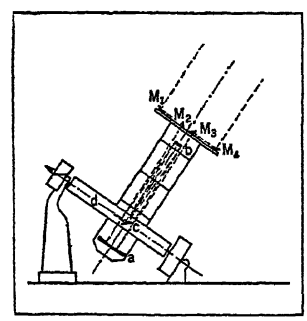


FIG. 12

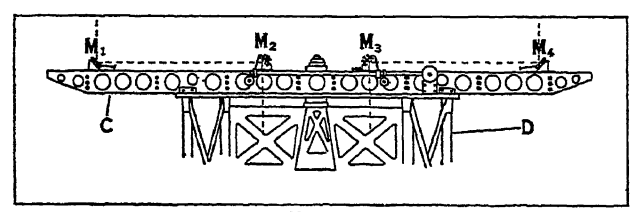


FIG. 13

BIBLIOGRAPHY.—The principles of interferometers are described in the standard text-books on Optics, cited in the bibliography to Light, to which may be added Lummer's volume on Light in Müller-Pouillet's *Handbuch der Physik*. A general account of Michelson's work is given in Michelson's *Light Waves and their Uses* and *Studies in Optics*. The analogy between interferometers and other optical instruments was first pointed out by Michelson in the American Journal of Science 39, 115, 1890. (A. A. M.; E. N. DA C. A.)

INTERGLACIAL STAGES, a series of comparatively warm and mild intervals, each lasting several thousand years, between the equally prolonged times of extreme cold in the Pleistocene glacial period (*q.v.*). For the stages of extreme cold the geologist Albrecht Penck chose names from representative districts in the Alps: Günz, Mindel, Riss and Würm; of these, the Günz stage is the earliest, the Würm stage is the most recent. Penck chose these names because their order in

the alphabet corresponds to the chronological order of the four stages, while space is left between them for additional names, should additional stages of cold be defined.

The same names are conveniently used to indicate the intervening warmer stages. Thus the first mild interglacial stage is called the Günz-Mindel stage; the second, the Mindel-Riss stage; the third, the Riss-Würm. This cyclic alternation of climate through the Pleistocene period is accompanied by alternating Arctic and temperate fauna and flora, while there is a further change, particularly of the fauna, due to the steady evolution of forms throughout the Pleistocene period. Thus in Europe during the colder stages the woolly mammoth and reindeer reached the south of France, while one of the interglacial stages was so warm that the lion and hippopotamus flourished in England.

In North America there was a similar cyclic alternation of climatic conditions throughout the Pleistocene glacial period, but there are difficulties in the way of drawing definite parallels between the Old World and the American stages. It is likely, however, that the earliest glacial stage in North America, which includes the pre-Kansan, Nebraskan and Albertan drifts, and which is called sub-Aftonian by American geologists, coincided with the Günz of Penck. The earliest, or Aftonian, interglacial stage of North America would thus correspond with Penck's Günz-Mindel interval. In North America, the Aftonian interglacial stage was marked by the presence of mastodons, three species of elephants, six species of horses, and the sabre-toothed tiger.

The second, or Kansan glacial stage in North America, corresponding to the Mindel of Europe, saw the extinction of some American camels and horses. It was followed by the Yarmouth interglacial stage, parallel to Penck's Mindel-Riss, when the fauna included mastodons, mammoths, horses, tapirs, bison, deer and sabre-toothed tigers.

The third, or Illinoian, glacial stage in North America, corresponds to Penck's Riss. It was followed by the Sangamon interglacial stage; this was in its turn fourth, or Iowan, glacial stage, the record of which is not well defined. The fourth, or Peorian, interglacial stage followed; it presents similar difficulties.

The fifth, or Wisconsin, glacial stage appears to correspond to the European Würm. It was followed by the post-glacial stage, which gradually merges into the present time. Elephants, mastodons, horses and the great sloths disappeared, the exact cause of their disappearance being unknown.

In the earlier or pre-glacial stage, Pleistocene vegetation was characterized by a commingling of warm temperate and cool temperate forms. During the alternating interglacial periods the record of plant life in the more northern regions indicates a succession of forest, barren ground, steppe, tundra and arctic types with each increase of glaciation. Upon the retreat of the glaciers this succession of plant types recurred but in reversed order. In some interglacial periods the climate was milder for the same latitudes than at the present time, so that numerous trees, for example, extended some hundreds of miles north of their present range. In the post-glacial or late Pleistocene stage, which blends into the Recent, plant life assumed substantially the present status and distribution. Many arguments may be advanced supporting the view that the post-glacial and recent constitute a part of an interglacial stage, as the time that has elapsed since the disappearance of the last great ice-sheets from Europe and north-eastern North America is less than the duration of some of the former interglacial stages.

The effect of glaciation upon the vegetation of Europe and North America, especially the former, was profound, not only with reference to the present distribution of the flora, but also as regards the extinction of old and the evolution of new types. In Europe the high mountain chains, which extend in an east-and-west direction, together with the Mediterranean, Black and Caspian seas, prevented the migration of the flora southward. In consequence an immense number of plants formerly components of the European flora, particularly that north of the Alps, was obliterated by glaciation. Numerous types of trees now found only in North America and Asia were abundant in Europe in pre-Pleistocene and part of Pleistocene times. Among these were such important trees as the black walnut, butternut, hickory, magnolia, bald cypress and sassafras (*qq.v.*).

In North America the back-and-forth movement of plant life was not impeded, as in Europe, by high mountains and inland seas. The presence of the larch (*Larix laricina*) in Georgia, of the black spruce (*Picea mariana*) in Kansas and of the white spruce (*Picea glauca*) in Iowa, all far south of their present range, has been demonstrated. Likewise, the presence during a mild interglacial stage of a fig in fruit in British Columbia, and of the redbud (*Cercis*), the Osage orange (*Maclura*), the papaw (*Asimina triloba*) and other warm temperate types as far north as Toronto, Ont., has been proved.

INTERIM (Lat. *interim*, in the meantime), a word specially applied to certain edicts passed by imperial diets during the reformation in Germany with the object of *temporarily* settling controversial points of doctrine and ecclesiastical practice until they could be decided finally by a general council. The interim of Regensburg (Ratisbon) was promulgated in 1541; but the most famous example of such a *modus vivendi* was the interim of Augsburg (1548). This, drawn up at the bidding of Charles V. by Michael Helding, Julius von Pflug and Johannes Agricola, who represented orthodox catholic, Erasmian, and moderate Lutheran opinions respectively, was an ambiguous compromise, accepting on the one hand transubstantiation, the seven sacraments, adoration of the Virgin and saints, and papal headship, but admitting on the other justification by faith, marriage of priests, and lay communion in both kinds. The variation permitted to Maurice of Saxony within his dominions was called the Leipzig interim, and was signed on Dec. 22, 1548.

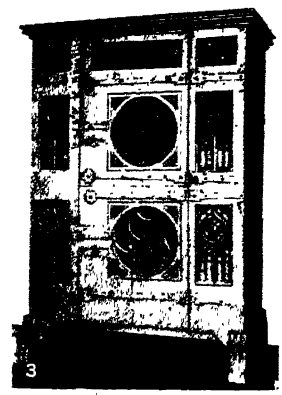
INTERIOR DECORATION, the art of furnishing and decorating the interior of a building, generally a residence. Furniture, rugs, lamps, wall-coverings, curtains, wall paper, as well as fixtures, bric-a-brac, etc. are the principal materials involved in the art of interior decoration. This article will treat historically the various styles of furniture, etc., under the following heads: EUROPEAN; EARLY ENGLISH; EARLY AMERICAN; CHINESE; JAPANESE; MODERN WOOD FINISHES, PAINTS AND VARNISHES.

EUROPEAN

Early Middle Ages.—In the earliest middle ages domestic life, such as we understand it, can hardly be said to have existed at all. Furniture and equipments had to be of a kind convenient for transport from one place to another. They were solid and strong, and in number they were kept down to the indispensable minimum. Military equipment formed a large part of the travelling baggage. There was no question of a separate furnishing of each temporary abode. Above all, it was necessary for the owner to be able to hold what he had. His habitation was rather a stronghold than a dwelling-house. The principal living apartment was a large hall with bare walls, open-beamed roof, narrow windows (probably unglazed) and floor paved with stone slabs or tiles. It contained very few pieces of furniture, and mostly such as could be brought by the occupants and carried away again when they went elsewhere. Window curtains, if used, were strung on hinged rods swung away from the window in day-time. The doorway might have some similar contrivance. A large hooded chimney maintained a log fire. Metal braziers on wheels, for local heating, were added during the later middle ages. Warming-pans were probably a still later innovation. A massive table would be fixed to the floor at one end of the hall. Upon it entertainers would mount, to divert the company between or after the courses. Long trestle-tables, easily movable for dancing or displays, were in general use. The seats were mostly plain benches or stools without backs. If a fixed bench ran along one of the walls, there might be panelling at the back against the coldness of the stone behind, and a cushion or two. There were a few folding chairs, generally of metal, light and easily portable, and perhaps a chair of state. Sitting upon the floor, on cushions or rugs, was long customary. The coffer with hinged lid was the chief provision for storage. It served as a packing case during transit, and afterwards as a general repository. It also formed a supplementary bench or table. There was a





















BY COURTESY OF (3) THE DIRECTOR OF THE VICTORIA AND ALBERT MUSEUM, (4) THE SPANISH ART GALLERY, LONDON, (6, 7) THE DIRECTOR OF THE HISTORICAL MUSEUM, BASLE, (8) THE METROPOLITAN MUSEUM OF ART, NEW YORK, (9, 10) DR. FOIRER, "SPATGOTISCHE WANDMALEREIN UND WOHNRAUME"; PHOTOGRAPHS, (1) BROGI, (2) GIRAUDON, (5) KUNSTANSTALT STENGEL AND COMPANY G.M.B.H.

EUROPEAN FURNITURE AND INTERIORS OF THE MIDDLE AGES AND RENAISSANCE

1. Room in the Royal Palace, Palermo, Sicily, known as the apartment of King Roger II.; an interior of the Norman period (12th century) showing the influence of the Saracenic period which directly preceded it. The room, though small, has an effect of great splendour. The walls are lined with marble, with hunting scenes above in gold and coloured mosaics
2. "King René seated at table," from an illuminated manuscript, showing a French interior of the first half of the 15th century. The wall is decorated with tapestry, and rush matting covers the floor. A screen of rushes is placed between the king's seat and the fireplace behind it
3. German oak cupboard with Gothic tracery, iron locks and hinges, 15th century
4. Spanish sideboard carved with Gothic tracery, 15th century
5. Bedroom with walls and ceiling of wood, from the Landesfürstliche Burg at Meran, South Tirol. A Swiss interior of the 15th century
6. Room from the Spiezhof, Switzerland, about 1580, re-erected in the Historical Museum at Basle
7. Room from the "House of the Cardinal," 1540, re-erected in the Historical Museum at Basle. A chandelier hangs from the rafters and on the left is a table with the hinged top open, revealing the space used for storing writing implements or toilet articles
8. Room with wood floor and carved and panelled walls and ceiling, from a house in Flims, Switzerland, 17th century
9. Courtyard entrance of the castle of Issogne, Val d'Aosta, north Italy; wall bench, linen-fold panelling, and frescoes below the vaulting, 15th century
10. Kitchen of the Castle of Issogne, Val d'Aosta; the floor is stone, and the ceiling is vaulted

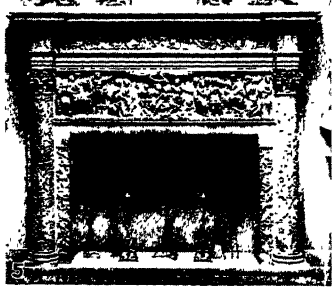
INTERIOR DECORATION





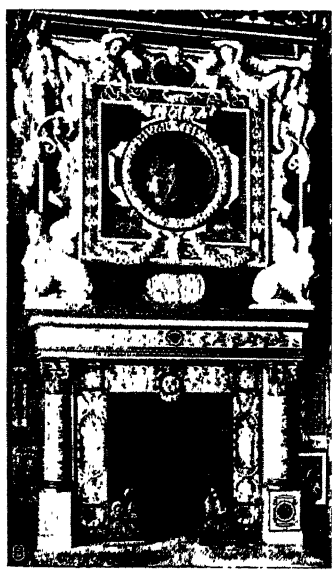


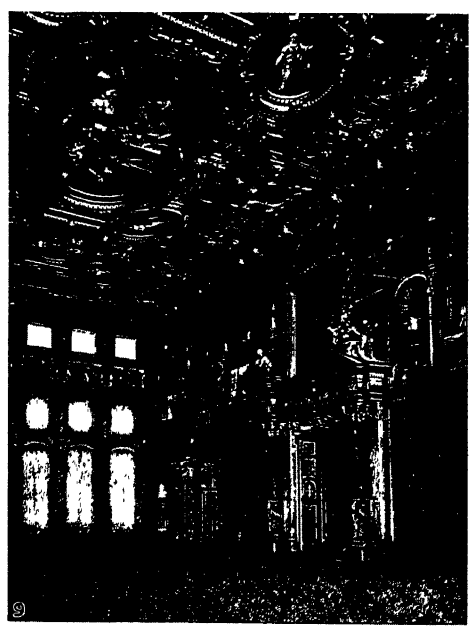










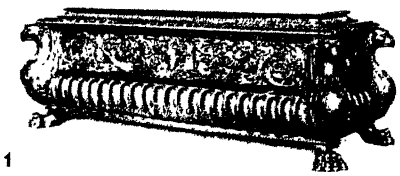


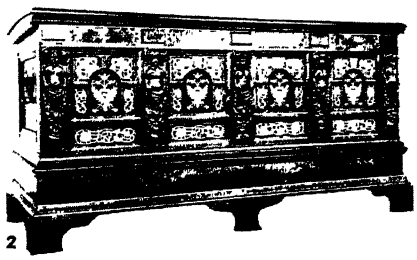


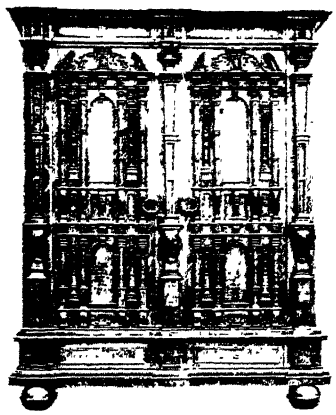
BY COURTESY OF (2, 9) THE GERMAN RAILROADS INFORMATION OFFICE, (7) THE METROPOLITAN MUSEUM OF ART, NEW YORK; PHOTOGRAPHS, (1, 4, 5) ANDERSON, (3, 6) ALINARI, (8) LEVY AND NEURDEIN

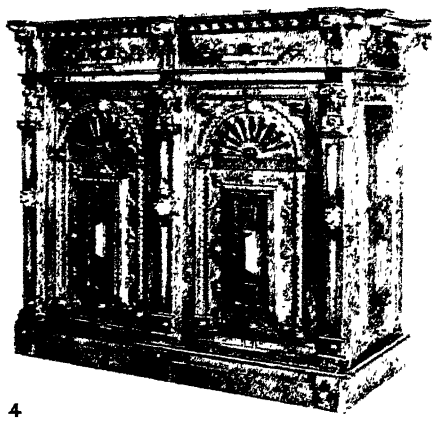
EUROPEAN INTERIOR DECORATION OF THE RENAISSANCE

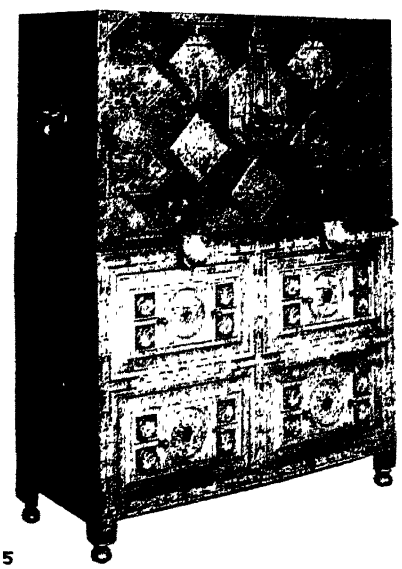
1. "St. Ursula's dream," by Vitt. Carpaccio (1455–1526), a painting showing an Italian interior of the late 15th century. The bed is uncurtained; the windows are ornamented with leaded glass lunettes. In the Academy, Venice
2. Fireplace in the large hall of Weikersheim Castle, Germany. Early 18th century
3. The Hall of Exchange in the Collegio del Cambio (Bankers' Guild), Perugia, panelled and frescoed after the Italian manner of the 15th century. In the right foreground is a desk of carved and inlaid walnut. The frescoes are by Perugino (1446–1523)
4. A room in the Borgia apartments of the Vatican, known as "Sala del Credo." In the lunettes are paintings of the Apostles, with sentences from the creed. The walls are painted, and benches of coloured marble fill the window embrasures. 15th century
5. Fireplace by Benedetto da Rovezzano (1474–1552), Italian. Now in the National Museum, Florence
6. A room in the Davanzati Palace, Florence. The lower section of the walls is painted in imitation of hangings. The furniture dates from the 15th and 16th centuries
7. Bedroom from Palazzo Sagredo, Venice, *c.* 1718. The bedstead is carved and gilded. The ceiling is attributed to Gasparo Diziani. Now in the Metropolitan Museum of Art, New York
8. Mantel-piece in Fontainebleau. Period of Francis I. (1494–1547)
9. The "Golden Hall" in the famous Renaissance Town Hall of Augsburg, built 1616–20 by Elias Holl. It is 113 feet long, 59 feet broad and 53 feet high. It is decorated with paintings and is profusely gilded

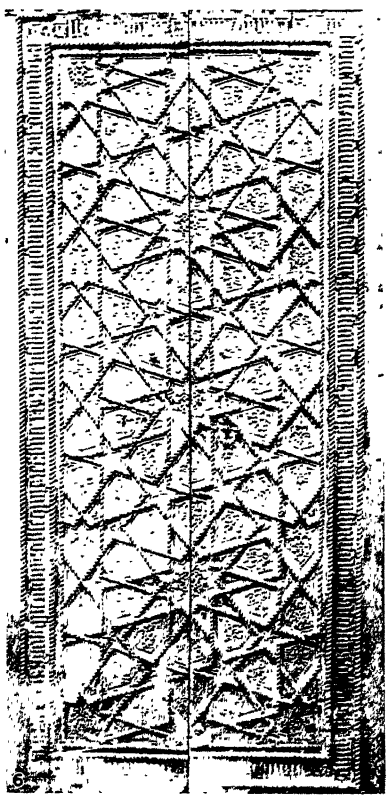

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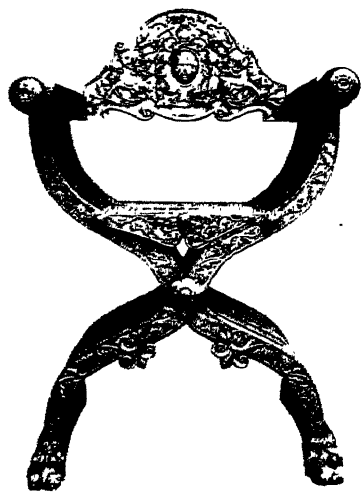

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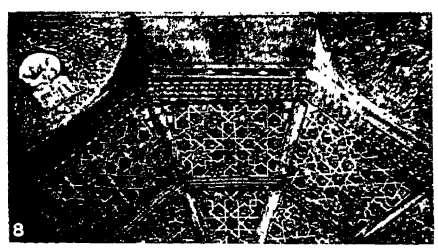

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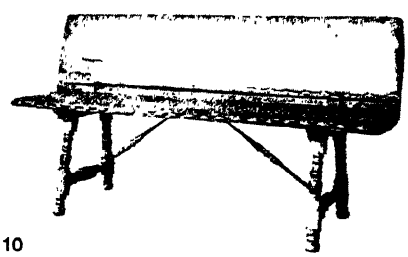

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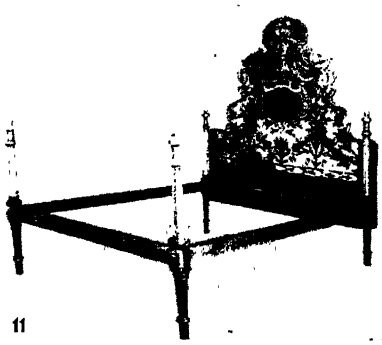

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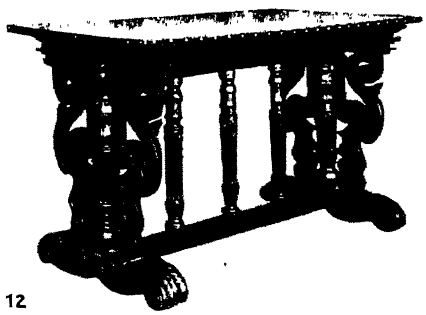

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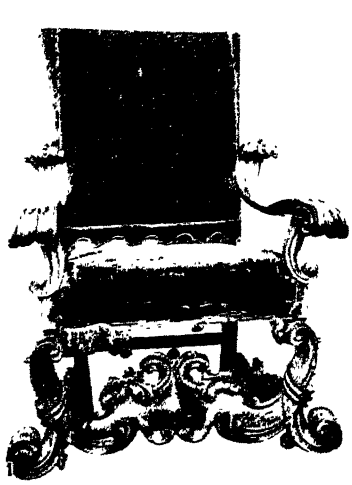

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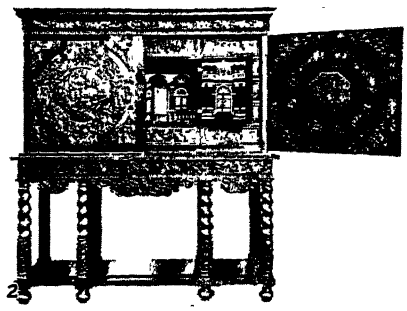
BY COURTESY OF (1-4, 7, 8) THE DIRECTOR OF THE VICTORIA AND ALBERT MUSEUM, (5, 6, 9-12) THE SPANISH ART GALLERY, LONDON

EUROPEAN FURNITURE OF THE RENAISSANCE

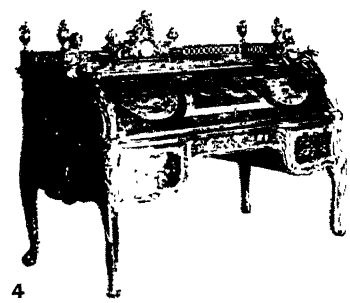
1. Marriage coffer (*cassone*) of carved walnut. Italian, 16th century. 2. Coffer of carved oak. North German, early 17th century. 3. Oak cabinet. South German, 17th century. 4. Carved oak cabinet. Flemish, late 16th century. 5. Cabinet. Spanish, 16th century. 6. Pair of wood doors, gilt. Hispano-Moresque, 14th or 15th century. 7. Folding armchair. Italian, 16th century. 8. Portion of ceiling from the palace at Torrijos. Hispano-Moresque, late 15th century. 9. Iron-mounted wooden coffer. Spanish, 15th century. 10. Walnut bench braced with iron. Spanish, 16th century. 11. Wooden bedstead. Spanish, 18th century. 12. Carved wood table. Spanish, late 16th century

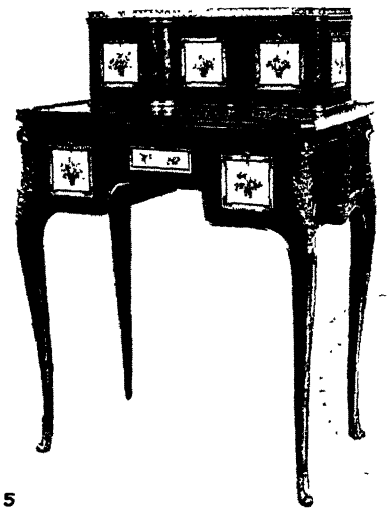
INTERIOR DECORATION

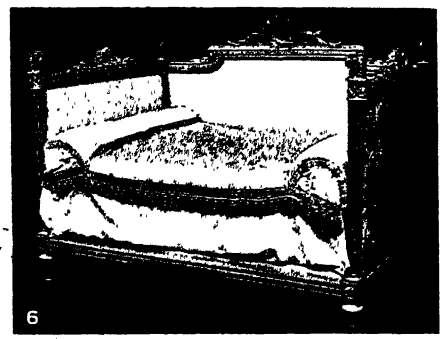






















BY COURTESY OF (1, 2, 5, 6, 7, 9) THE DIRECTOR OF THE VICTORIA AND ALBERT MUSEUM, (3, 10) THE KEEPER OF THE WALLACE COLLECTION, PHOTOGRAPHS, (4) COLLECTION ARCHIVES PHOTOGRAPHIQUES, PARIS, (8) BURTON HOLMES FROM EWING GALLOWAY, (11) EWING GALLOWAY

EUROPEAN FURNITURE AND INTERIORS OF THE 17TH TO THE 19TH CENTURY

1. Venetian chair of carved walnut upholstered in velvet. 17th century.
2. Dutch ebony cabinet on ebony stand. The doors and drawer fronts are carved with mythological and other subjects and edged with wavy mouldings. The architectural ornament of the interior is inlaid ivory and coloured woods. Middle of the 17th century
3. French ebony cabinet with marquetry of tortoise shell and brass, marble top and gilt bronze mounting. Probably after a design by Berain. Late 17th or 18th century
4. "Bureau du Roi" made for Louis XV. of France by Oeben and Riesener between 1760 and 1769. It is made of marquetry of various woods adorned with mouldings, statuettes vases and gilt bronze plaques
5. French writing table in sycamore wood with gilt bronze mounts, marble top and inlay of plaques of Sèvres porcelain. Period of Louis XV.
6. Bedstead of carved and gilt wood with coverings of blue silk damask. French. Period of Louis XVI.
7. Panelled room of painted and gilded oak erected between 1682 and 1694 by Alexandre Sévin in the Château de la Tournerie near Alençon
8. Salle du Conseil at Fontainebleau, built under Charles IX. and decorated under Louis XIV. and Louis XV. The walls and ceilings are painted by F. Boucher and the settees and chairs covered with Beauvais tapestry of a Louis XVI. design
9. Boudoir (re-erected) constructed for Madame de Sérilly, lady-of-honour to Queen Marie Antoinette. Late 18th century
10. Commode with marquetry of coloured woods, marble top and gilt bronze mounts by J. Caffieri. From the room of Louis XV., Versailles
11. Interior of Herrenchiemsee castle, a magnificant building in Louis XIV. style erected on the Chiemsee, Bavaria, by Louis II., 1878–85

simple form of dresser, for the preparation of food, with shelves above for utensils.

One or more spaces in the hall were curtained off by movable hangings, suspended from the rafters or from iron rods projecting from the walls. Separate apartments were thus temporarily provided. Low movable beds were placed within, covered with blankets or skins. Mattresses and pillows were stuffed with peapods or straw; feathers did not come into general use before the 15th century. The wealthy also had travelling beds, of palanquin form, borne behind and before by horses or men. If recesses in the hall were curtained off, a nearer approach to separate sleeping-rooms was provided. The cabinets or bowers for women's work and recreation were formed in this way.

The kitchen was a low apartment with a depression in the middle of the floor for the fire, provided with a great iron grid, which was slid over for cooking upon. In some cases there were one or two private rooms, perhaps on an upper floor. Guests were accommodated in the large hall, where movable beds could be set up in case of need. Sometimes strangers had separate apartments, with an entrance from outside. In the greater houses there was a chapel, where daily prayers were read.

Later Middle Ages.—Such conditions, varied according to local circumstance, were generally prevalent in western Europe down to the close of the 12th century. Where Eastern habits of life had already penetrated, as in Sicily or Spain, magnificent buildings were erected. A room in the palace at Palermo, Sicily, is still known as that of the Norman king, Roger II. The walls are lined with marble, and the lunettes and ceiling above are encrusted with elaborate mosaics. Changes were gradual and progressive, but a definite step forward was made about the 12th century. Most of the military leaders in France (and many in neighbouring lands) had by then taken part in the Crusades, and they had learned something of a more luxurious mode of living. The accumulation of possessions now began, and women took a more prominent share in the regulation of the household and the provision of daily needs. Curtains brought from the East would be of thinner texture, and they were drawn back in folds rather than swung away from the windows. The better store of hangings enabled the bareness of the walls to be relieved. The wooden ceilings were coffered, and sometimes painted in bright colours and gold. Where folding shutters were provided for the windows, the need of glazing would be obviated. The high table was placed across the end of the hall, where the floor was raised. Long massive tables at right angles accommodated the household and retainers. Tables of horse-shoe form might still be used, as in early times, for convenience in serving. Tables for the dishes were at the lower end of the hall. A small "credence" table, for tasting wine and liquors, was set against a side wall. Wooden cradles for infants were made to rock on the floor, or to swing between end-supports. Seats with upright wood backs, and, perhaps, a carved hood above, would replace the plainer benches for the chief personages. The coffer, or chest with hinged lid—that perennial and indispensable article of furniture—had its drawbacks. Everything set upon it had to be removed before it could be opened. Hinged doors were therefore set in front, perhaps with a nest of drawers behind, and a long drawer below. From this the armoire and the varieties of presses and cupboards would take shape. Beds became fixtures, though not yet relegated to separate sleeping-rooms. They were of panelled wood, sometimes taking the form of a huge cupboard with open front. The mattress raised above the floor was often of ample dimensions, affording space for a whole family in case of need. It was generally set in the corner of the room, and at the free angle the curtain was looped up during the daytime in a kind of rolled bundle, still exemplified in Dutch pictures as late as the 17th century. Sometimes there was a narrow space between the bed and the wall for dressing and undressing. This was screened off by the bed-curtains.

In the later middle ages the wardrobe was a separate room, with deep presses lining the walls, having cupboards above and lockers below. Here were stored the hangings, floor-coverings, curtains, tapestries and linen of the establishment, besides the garments and materials for a large household. With the lack of shops this was the place to replenish supplies. It was also the workroom of the establishment, with tables and other provision for tailors, repairers and needlewomen.

As the middle ages went forward, the hall continued to serve many purposes; but gradually the dwelling became divided into ante-chamber, hall and withdrawing-chamber. There might be also a state bedroom, where guests could be received. A *lit de parade* was sometimes provided solely for this purpose. The "bed of justice," of which we hear from mediaeval times onwards, was at first a couch or low seat for reclining upon, where the French sovereign met his parliament.

The kitchen was now provided with vast low arched recesses in the walls, where the fire could be better regulated than in the middle of the floor. Rotating spits, in stages, for roasting, had dripping pans below, and there were hooks for suspending cooking-pots over the fire.

The floor (of stone or earthenware tiles in large houses, of the bare earth in others) was covered with sawdust, as it is even to-day in great kitchens. In course of time it became usual to spread the floor with rushes and fragrant herbs. It was not till the later middle ages that the rushes were plaited into mats. Plain woollen cloth or furs were sometimes laid down. For ceremonial, rich stuffs were spread before the royal throne. Oriental pile carpets were not used before the 15th century, and they were rare in western Europe before the 17th century.

Torches at first provided the principal lighting, and the fire served to give light as well as heat. There might be a few sconces fixed to the walls, with prickets for candles. A small hanging lamp with floating wick was more convenient than the candle for the light, which was usually kept burning all night within the bed-curtains, as much to scare away spirits as corporeal beings. Standing candelabra of iron for many candles came into use, as well as small portable pricket candlesticks, and occasionally chandeliers or "lustres" hung from the rafters.

As the women of the household took more and more to the management of domestic affairs, furniture tended to accumulate. The use of ornaments and various articles of luxury grew during the times of the Crusades, increasing as commercial relations with the Near East became closer in subsequent centuries. Indoor provision for washing and bathing must also be included among luxuries. A long trough with a row of taps in a courtyard served for most of the household. At times there was a tank or cistern with water continually running. A metal bowl, flat-sided, was sometimes fixed to the wall of a living room, with a swinging ewer or a small cistern with tap over it, and a towel upon a hinged rod near by. Provision for reading was made by a portable lectern with sloping top. The top might revolve to facilitate reference to different books, or it would work up and down for convenience. Sometimes it had a recess for the storage of books. A sloping board for writing upon could be adjusted to the arms of a seat, or it could rest on a table. Sometimes a shallow box, with inkhole, was set on the writer's knees.

Small convex mirrors were hung to the walls as early as the 15th century, but hand mirrors of polished metal or glass were the only mirrors in general use before that time.

An illustration in the celebrated manuscript in the Museum at Chantilly, the "très riches Heures du Duc de Berri," represents King René seated at table. Behind him is a fire in a hooded chimney. He is protected from its heat by a circular screen of plaited rushes. The wall is covered by a tapestry hung upon hooks. Rush matting is on the floor. The table is covered with a white cloth, and courtiers and servants are busy around. It forms a striking picture of seigniorial life in the first half of the 15th century.

A German oak cupboard of the 15th century, carved with Gothic tracery and provided with iron hinges, is here shown in Pl. I., fig. 3. An oak sideboard, from Spain, is also reproduced. (Pl. I., fig. 4.)

The amount of mediaeval domestic furniture which has come down to the present day is relatively small, but the general characteristics need to be borne in mind, for the middle ages were the cradle of later times, and much that came afterwards is explained by reference to them. Indeed, in backward countries, or in remote districts little affected by change of fashion, the

mediaeval tradition has been carried down to our own times. Besides eastern Europe, parts of Switzerland and Scandinavia may be cited as examples. The wooden chair (*see* WOODCARVING), from Tyldalen church, in Oesterdalen, Norway, is attributed to the 10th century.

Alpine Lands.—The mediaeval furniture of the lowlands was principally of oak and hard woods, but in mountainous districts, such as Switzerland, the Tyrol and south Germany, the use of fir, pine and the softer woods at hand determined the form and ornamentation of the furniture made from them. Such woods were often the only available building materials as well, and floor, walls and ceiling alike would be entirely of wood, as they often are to-day. The bedroom from the Landesfürstliche Burg at Meran, South Tyrol (Pl. I., fig. 5) is a remarkably complete and well-preserved example of an interior in a house of some standing in the latter half of the 15th century. The old Swiss furnished interiors shown in Pl. I., fig. 6, though only in one case dating back to the mediaeval period, illustrate much that has been said about earlier times. Most of them belong to a series in the Historical museum at Basle, carefully removed from old houses, chiefly in the town. There are others in the museums of Berne and Zurich, covering the period from the 15th to the 17th century. Floors are of wood, walls and ceilings are moulded and panelled. Sometimes there is inlay or veneering of harder and more ornamental woods. The mouldings are bold, but any carving is usually in slight relief, owing to the nature of the wood, and the inlay is generally simple and geometrical. Tables have legs of trestle form, and the tops are hinged so as to lift up and reveal a spacious receptacle for writing implements or articles of the toilet. Chairs are primitive, with solid wooden seats and splayed legs. Benches are fitted along the wall. Panelled beds of ample size are in the living-room. Coffers tend to be high, with a wider base containing one or two drawers. The walls being of wood, the construction of corner cupboards is simple. Flat carving may be in a style recalling fret-work. Bands of foliage and other ornament following the Gothic tradition, and suited to the coarse grain and softness of the wood, are very effective. These decorative parts were painted in bright colours, and entire pieces of furniture were sometimes painted over with figure-ornament or other motives.

Italy.—The Castello d'Issogne, in the Val d'Aosta, in northern Italy, is remarkable among surviving examples of the adaptation of the mediaeval domestic interior to the mild climate south of the Alps. It was built about the year 1490 by a member of the Challant family, who held the post of governor of the Val d'Aosta. Though mediaeval in structure and appearance, it is not a stronghold, but a summer retreat. It is built in a square with a tower at each corner. There is an inner courtyard, along one side of which is a kind of vaulted portico supported by pillars and open to the courtyard. This is used as a hall, with wooden linen-fold panelling and a fixed bench running along the wall. The lunettes above the panelling are filled with fresco paintings of scenes in daily life—the shops of a provision merchant, an apothecary, and a tailor and draper, an outdoor market, and soldiers in a guard-room. There is also a dining-room with credence, tables and stools, an armoury, a kitchen, servants' hall and chapel. The coffered ceilings are carved and painted (*see* Plate I., figs. 9 and 10).

During the middle ages furniture in Italy differed but little from that of neighbouring countries. Any deviation was likely to be due to the use of walnut, a more tractable wood than oak, and to the outdoor life which rendered an accumulation of furniture superfluous. The Gothic style never took firm hold in Italy, though occasionally Gothic tracery is found in the furniture of Venice and Tuscany.

RENAISSANCE

The Renaissance, which originated in Italy in the early years of the 15th century, gradually brought about a complete change in the domestic furniture of that country and of Europe. The classical tradition had never been entirely lost in Italy. Traces of Roman greatness were to be seen in many places, though excavation was only undertaken with the aim of obtaining building materials from the ancient ruins. When a deliberate return to old models was made, furniture gained an importance that it had not known hitherto. Columns, capitals, entablatures, pediments and other architectural features provided the skeleton of the structure, and the purpose of the cabinet or table, or whatever it might be, was subordinated to its form. The joiner borrowed from the architect. The furniture of the early Italian renaissance is often very restrained and beautiful. For the more elaborate kind of work, sculpture in low relief and stucco modelled in intricate patterns were much used. The stucco was usually gilt all over and picked out in colours. Such pieces became elaborate and costly works of art, though it must be admitted that they were a by-product of the furniture-maker's craft. Carpaccio's painting of St. Ursula's dream, in the Academy at Venice, gives a most attractive idea, though in some measure fanciful and exaggerated, of an Italian interior in the last of the 15th century (Pl. II., fig. 1). The bed is of a form allied to the great panelled bed of northern Europe, but the heavy curtains are not required in a room flooded by the light and warmth of the early morning sun. There is a bench along one wall, an arm-chair, a stool and a low table. A cupboard is let into the wall, and a smaller cupboard holds books and other articles. The ceiling is panelled and the windows are shuttered, with leaded glass lunettes above.

There was no class of furniture on which the wood-carver's and stucco-modeller's skill was more exercised than on the cassone or marriage-coffer, provided and filled for the bride. In addition to the elaborate relief-work and gilding, these coffers were often painted on the front and sides, and occasionally inside the lid as well, with appropriate scenes executed by some of the chief artists of the day. The cassone of the 16th century illustrated (Pl. III., fig. 1) is carved walnut. At times these chests imitate the forms of the ancient Roman stone sarcophagi. Walnut, a common wood in Italy, was an admirable material for delicate carving. The panelling of rooms was sometimes finely carved and inlaid. The Hall of Exchange at Perugia (Pl. II., fig. 3) shows the panelling, with pilasters and cornice, and a fixed bench along the wall. A large writing desk is built out into the hall. Italy did not need the heavy draperies of colder regions, and the dry climate rendered fresco-painting durable on the walls. The fixed writing desk here seen is the forerunner of the writing bureau, which became an indispensable article of furniture as the practice of writing became general. A type of chair much favoured in Italy, and often richly carved and gilded, was evolved out of a simple joiner's contrivance of mediaeval times. The seat was a small wooden slab, generally octagonal. It was supported at front and back by two solid boards cut into an ornamental shape. Another piece of wood, in the shape of a half-opened fan, formed the back. The tables were generally oblong, supported by columns, consoles or terminal figures, with a long stretcher running from end to end.

In Italy the domestic arts were not relegated to a place inferior to those which it has been customary, since the 18th century, to designate as the "fine arts." The amazing versatility of the great artists of Italy is largely accounted for by this circumstance. The influence of the Italian furniture of the renaissance soon spread into neighbouring countries, revolutionizing the furniture-making of Europe.

Austria and Germany.—Italian models were followed in the Austrian provinces to the north. The cabinet makers of Augsburg and south Germany evolved an elaborate type of work based on the example of Italy. Cabinets had doors in front, which revealed an arrangement of drawers and compartments inside. They were covered with veneering and inlay of tinted woods, and details were delicately carved. Rooms were panelled in harmony with the furniture. The inlaid writing desk of Christoff Müller, of Augsburg, made in 1555, now in the Berlin museum, is shaped at the end like the façade of a mansion of the Renaissance. The cabinet shown (Pl. III., fig. 3) is of oak, with veneering of Hungarian oak and other woods, and mounts of tinned iron. An oak coffer, with inlay of sycamore and oak, is a representative example of north German furniture in the earlier part of the 17th century. It bears the arms of the city of Lübeck.

France.—The French monarchs of the 16th century invited Italian artists to the court. They were employed in extensive undertakings, and the forms they introduced were generally fol-

lowed. Italian models in furniture were closely imitated. The carved walnut furniture of France in the 16th century is remarkable for gracefulness and delicacy. Sometimes it is relieved with inlay of small plaques of figured marbles and semi-precious stones. Elaborately-carved oblong tables were supported by consoles or fluted columns, connected by a stretcher surmounted by an arched colonnade. Cabinets and chairs followed Italian shapes. As in other countries where a tradition has been imported from outside, the influence was largely restricted to the capital and to districts under the influence of the court. Older local traditions lingered in the remoter regions. In France, for example, the distinctive furniture of Brittany and Normandy has retained its local characteristics down to the present day.

Spain.—In Spain the alien influence came at an earlier time and from remoter parts. With the invasion and occupation of the south by Arabs and North Africans, in the 8th century, the greater part of the peninsula became virtually an oriental country, and so it remained for seven centuries. After the expulsion of the last Arab ruler, at the end of the 15th century, many "Moriscos" still remained in the country, and the intelligent and industrious craftsmen among them still worked for the Christian rulers of the land in their own traditional styles. The vaulted, coffered ceiling in pine wood, elaborately carved and painted, reproduced in fig. 14 comes from the palace at Torrijos, near Toledo. It was built at the end of the 15th century for Gutierraz de Cardenas and his wife. Several types of these oriental panelled or coffered wood ceilings are found in Spain. The fine pair of carved and gilt wood doors reproduced (Plate III., fig. 6) recalls the Saracenic work of Egypt, but, nevertheless, it is typical of southern Spain in the 14th century. The Latin inscription in Gothic lettering will be noticed. A type of cabinet known as the vargueño is typically a Spanish production—a medley of European and oriental elements. The upper part is a chest, generally elaborately mounted in wrought iron, with a massive iron lock to the drop-front. When the front is lowered, an elaborate arrangement of drawers and recesses is revealed, often with ivory inlay, gilding and brilliant colouring. Sometimes the base is another chest with cupboards. Later examples have supports with baluster legs and arcading elaborated from French or Italian models. The chest itself is sometimes decorated under the same influence. Mediaeval Spanish furniture has various foreign elements. The buffet already referred to recalls French work. The iron-mounted coffer, originally painted all over, and bearing shields of arms is a Spanish adaptation of the Italian cassone. Folding chairs of X-shape, with mosaic inlay of ivory and coloured woods, were much in use in the 16th century. There is a tendency for Italian models to be followed in the furniture of the 16th and 17th centuries. In a country so renowned for its iron-workers, it is not surprising to see that bracing-irons of fanciful workmanship are often attached for strength to tables and benches. A Catalan bedstead of the 18th century with painted back is reproduced.

Low Countries.—Perhaps the Italian renaissance found its most characteristic expression outside Italy in the Low Countries. The Gothic furniture of earlier times was solid and strong, with linen-fold pattern and intricate tracery. Its use is exemplified in the work of the contemporary oil painters, whose work gives so convincing a picture of the prosperous and comfortable domestic life of those industrious provinces in the middle ages. Rooms were lofty and spacious. The walls were wainscoted in oak or covered with embossed and painted leather. Windows were partly enclosed by glass panes, often embellished with heraldic and figure ornament, and partly by inside shutters of oak, studded with nails. When the shutters were thrown back, light and air were provided at the same time, for numerous Dutch pictures show that in many cases there was no glass behind them. Chimney pieces, with overmantels carried up to the ceiling, were embellished with marble columns and elaborate carving, and similar architectural ornament flanked the doorways. Heavy oak tables (sometimes "draw tables," which could be extended to twice the length) had massive bulbous legs and solid stretchers. The beds in the corners of the living rooms were heavily draped. Folding wooden chairs and low stools with more or less elaborate turnery, were still used, besides a new type with baluster formed or twisted legs, arms, and straight backs heightening as the 17th century went forward. The leather upholstery of seat and back were replaced by caning in the latter half of the century, when the high back had a narrow panel flanked by balusters or columns resembling the legs. Low chairs with back, arms and ears in one solid piece, were stuffed and padded, and upholstered with tapestry, embroidery, velvet or other material, showing that the limit of domestic comfort had by that time been reached. Large folding screens with leather panels, or others of lacquer-work imported from the East, kept out the draught. Lacquered furniture was also imported from China and Japan, and travellers learned the secret of this specifically oriental craft, so that imitations were made in Holland, as well as in France, north Italy and elsewhere. The great tapestries for which the Netherlands had long been famous afforded additional protection from the cold air, and oriental pile carpets were used as table-cloths, for it was not yet customary to spread them on the floor, where they would have accorded ill with the habits of domestic life.

Scandinavia.—In Scandinavian countries much domestic architecture continued to be of wood, and the furniture remained simple and primitive. Relief was afforded by painted linen hangings, sometimes representing biblical scenes, with the figures in contemporary peasant costume, and by brightly-coloured cushions in embroidery or tapestry. Houses of the well-to-do contained furniture from north Germany or the Low Countries, providing models which the local carpenters might copy.

The Baroque.—During the 17th century the baroque (*see* BAROQUE ART), had a drastic effect upon furniture design. Large wardrobes and cupboards had twisted columns, broken pediments and heavy mouldings. The Venetian chair of the later years of the 17th century, reproduced (Pl. IV., fig. 1), is an admirable illustration of the tendencies of the time. It is of carved walnut, upholstered in red velvet.

The baroque style owed much to the oriental influence which swept over Europe in the 17th century, when several of the European maritime countries established regular trading relations by sea with India and the Far East. Besides the furniture and domestic goods imported from the East, the oriental craftsmen worked, for export, in a pseudo-European style, from designs supplied by the traders. Heavy tropical woods were also brought to Europe, and from these furniture was made which borrowed much from the prevailing taste for oriental elaboration. Ebony cabinets with waved mouldings, intricate carvings in low relief, and profuse inlay in tinted ivory and coloured woods, were made in Italy, Germany and the Low Countries. The ébéniste then acquired his name. A Dutch cabinet of the 17th century, in carved ebony, inlaid in ivory and coloured woods, is illustrated (Pl. IV., fig. 2).

Later French.—In France, the Italian influence of the 16th century was gradually assimilated, and a national style of furnishing was evolved which soon spread its influence into neighbouring countries. The "styles" of Louis XIV., the Regency, Louis XV., Louis XVI., the Empire and so forth, have passed into the phraseology of Europe generally, and their influence has operated wherever the terms have been used.

The reign of Louis XIII., covering most of the first half of the 17th century, was a time of transition. The fame of his son and successor, Louis XIV., the great monarch, might suggest that the outlook of a great nation was then modified and enlarged by the force of a single personality, but it was the national spirit which created Louis XIV., and his times. Expansion in Asia and America, and the growth in the national wealth, were the causes which led to the building of Versailles and the *Galerie d'Apollon* of the Louvre. The great "Salon" now came into being, and the number of separate apartments was multiplied. A suite would comprise a vestibule, ante-chamber, dining-room, salon, state bedroom, study and gallery. Stately and spacious staircases were provided. The interior economy of the modern house dates back to this time.

The Gobelins factory, which still remains a national establishment, was founded under Louis XIV. for the production of *meu-*

bles de luxe and furnishings for the royal palaces and the national buildings. Charles Le Brun was appointed the first director of the Gobelins. Furniture was veneered with tortoiseshell or foreign woods, inlaid with brass and ivory, or heavily gilt all over. At times it was even completely overlaid with silver. The name of André Charles Boulle (*q.v.*) is particularly associated with this tendency. His cabinets and tables were completely covered by sheets of tortoiseshell and brass cut into intricate patterns so as to fit into one another, the tortoiseshell alternately forming the pattern and the ground. (*See* INLAYING.) The light fanciful "grotesques" of Bérain were much used for this work. Heavy gilt bronze mounts protected the corners and other parts from friction and rough handling. An example of this work, of a later period, in the Wallace collection, London, is shown in Plate IV., fig. 3. In ancient times, folding chairs might be of iron or bronze, and iron hinges and mountings have, of course, been used at all times where strength was required. The massiveness and elaboration of the furniture under Louis XIV. was followed by the rococo style of the regency in the first half of the 18th century. This style owes more to the influence of Chinese art than any other. The famous writing-table of Louis XV. (Pl. IV., fig. 4), exhibited in the Louvre, was the work of the celebrated furniture makers, Riesener and Oeben. It is said to have taken nine years to make. Furniture under Louis XVI. showed some return to classical models. Curved surfaces were replaced by severer design, and straight, tapering legs succeeded the cabriole. A limit of elegance unknown before was reached. Plaques of the delicate porcelain of Sèvres, with ornament painted in brilliant colours on a dazzling white ground, were freely employed upon tables and cabinets (*see* Pl. IV., fig. 5). The graceful tapestries of the Gobelins and Beauvais replaced the heavy velvets of the 17th and early 18th centuries for upholstering chairs and settees and for window hangings. The bedstead shown (Pl. IV., fig. 6) is of carved and gilt wood, with coverings and canopy of pale blue silk. The French furniture of the 18th century set the standard of elegance and refinement for the whole of Europe.

Rooms were rebuilt or remodelled in accordance with the taste of the day. Elaborate parquet flooring was introduced before the close of the 17th century. Walls were enriched with relief work and gilding. Tall glass mirrors, reaching from floor to cornice, were set between the windows and protected by console tables. Ceilings were painted by some of the chief masters of the time. Later, when more restrained types of furniture were made, walls were painted white, with mouldings picked out in gold. The plain whitewashed ceiling did not come into favour before the 18th century was well advanced.

Two French domestic interiors here reproduced are separated by a century of time, but the contrast is greater than that involved in this circumstance. The earlier is provincial work, and it differs materially from the work then being done for the court of Louis XIV. The other is from Paris, showing in a marked degree the refinement and delicate workmanship of the period of Louis XVI. The panelled room from the Château de la Tournerie, near Alençon (Pl. IV., fig. 7), is of oak, painted and gilt, and embellished with embossed leather panels enriched with painting and gilding. The château dates mainly from the 16th century, but the panelling was erected between the years 1682 and 1694 by Alexandre Sévin. It bears his crest and initials with those of his wife. The boudoir (Pl. IV., fig. 9) is from a house in the rue Vieille du Temple, in Paris. The room is said to have been erected under the personal supervision of Queen Marie Antoinette and Madame de Sérilly, her friend and lady of honour.

Later Styles.—Towards the end of the 18th century the influence of the discoveries that had been going on at Pompeii penetrated into Germany and Austria, and interiors were decorated in the light and fanciful style exemplified in the wall-frescoes of the Pompeian houses. About this time a vogue arose for draping interiors into the resemblance of a tent. The draperies completely covering the walls were sometimes pleated, and if the ceiling was high enough it would be concealed by a kind of sloping velarium. A bed would be enclosed by festoons of drapery.

The influence of the well known cabinet-makers of England in the second half of the 18th century, was reflected in the work of the furniture-makers of north Germany and Denmark.

The Napoleonic régime hastened the changes then in progress in European furniture-making. The example of Roman majesty was continually in the emperor's mind, and the "Empire" style aped the uninspired decorative formalities of Roman imperial times. Furniture with outcurving legs was copied from representations in Roman reliefs. Griffins and sphinxes were freely used as decorative motives or supports. Beds with rolled ends and stuffed backs, sometimes with drapery above like a gable roof, were the forerunners of the sofa of the later years of the century. The rest of Europe adopted the "Empire" style, of which the chief merit was a return to more sober models after the exaggerated fancifulness of previous styles.

Towards 1825 the reaction came. Earlier fashions were again reverted to, for a time, in a half-hearted manner. The new wealth of industrial and trading communities gave rise to new ideas of material well-being. The comfortable "Biedermeier" style arose in Germany. Furniture was luxuriously cushioned and padded. Thick curtains, festooned draperies, table-covers, antimacassars, tassels and fringes were seen everywhere. The time when these began to be curtailed or to fall into disuse is within the memory of the older generation to-day.

The subsequent tendency to revert to imitations of the furniture of the 17th and 18th centuries is not altogether praiseworthy. It is easier to stifle originality than to revive it when the inevitable need arises. Moreover, there were contributory causes for most of the changes which have been here briefly reviewed, and to copy a type of chair or table when the circumstances which originally gave rise to it are no longer operative is not in harmony with the soundest principles. (*See* also the various short articles on pieces of furniture, such as BED, CHAIR, CHEST, TABLE, etc.; also the different styles and periods, such as ROCOCO, BAROQUE, GEORGIAN, etc.

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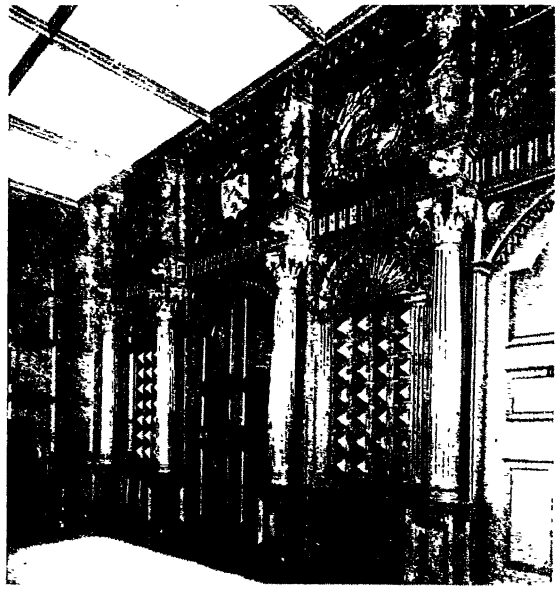
ENGLISH

Henry III.—A notable early specialist in house decoration in England was Henry III., who gave us Westminster Abbey. The Liberate Rolls of his reign preserve for us all the orders he gave for the adornment of his various castles and manor houses. Larger windows, and, especially, rose windows were built in halls, their painted glass adding to the rich colour decoration that the king loved and obtained at other times by painting "histories" on his walls, as in his Great Chamber at Westminster. His queen had a figure of winter painted over her fire-place there, and spring-like flowers painted on the white-wash of her room at the Tower. Walls were frescoed with histories, including scenes both biblical and classic, and below them often was wainscoting with painted and decorated boarding. Wrought roofs or painted ceilings completed a rich domestic treatment, which was very rare in 13th century England, when walls were bare and hangings were the usual means of decoration resorted to by nobles or rich burghers.

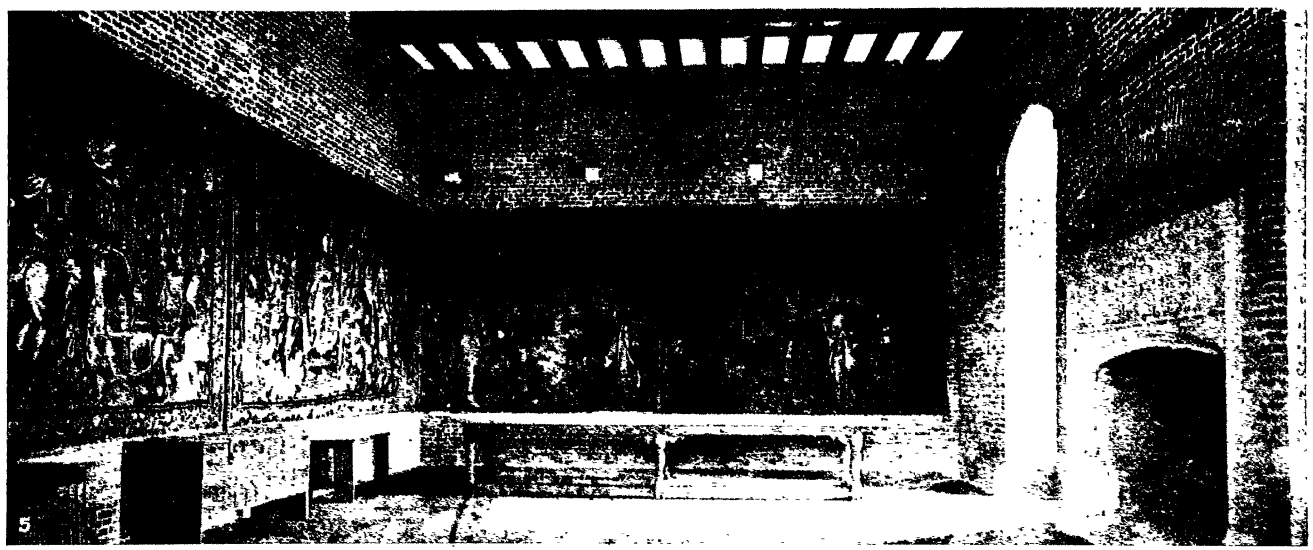
Flanders tapestries, known by the generic name of "arras," were the most favoured material. Solidly woven, they resisted the wear and tear of the movings of great men who had various estates but little gear. Tapestries were hung curtain-wise from wood-quartering set with tenterhooks, and such have recently been renovated at Tattershall castle, where, except for such hangings, the brick structure of the walls was visible, as is seen also











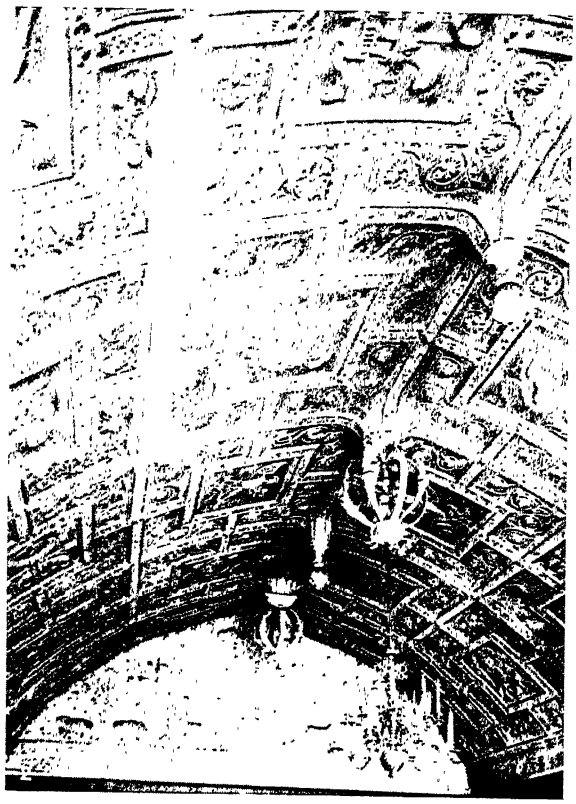
BY COURTESY OF COUNTRY LIFE, LONDON, FROM TIPPING, "ENGLISH HOMES"

ENGLISH INTERIORS OF THE 15TH AND 16TH CENTURIES

1. "Richard II. Feasting," from *Les Chroniques d'Angleterre*, an illuminated manuscript of about 1475; showing architectural treatments and decoration of the period
2. Marble chimney piece in the gallery at Cobham, executed by Giles de Whitt of the Low Countries, 1599
3. Hall screen of single storey height at Cuckfield, Sussex. Early Renaissance style. About 1581
4. Gallery door at the Vyne, Hampshire; carved in Gothic linen fold with various heraldic devices. About 1515
5. A room (restored) in Tattershall Castle, Lincolnshire, built about 1438 by Baron Cromwell, Lord High Treasurer to Henry VI.; refurnished with tapestries, Gothic chests and table of the late 16th century

INTERIOR DECORATION









BY COURTESY OF COUNTRY LIFE, LONDON, FROM TIPPING, "ENGLISH HOMES"

ELIZABETHAN AND JACOBEAN INTERIORS

1. The hall at Plas Mawr, Conway, Carnarvonshire, an admirable example of an Elizabethan interior. The patterned ceiling is a product of the school of plasterwork that flourished during the last quarter of the 16th century; the upper part of the chimney-piece is also plaster
2. Ceiling in the great chamber at Herringston, Dorchester, dating from about 1615. It is barrel-shaped and worked in the late Jacobean style with an elaborate pattern of floral scrolls, heraldry, beasts and birds. The pendentals are a feature of the period
3. Stone hall screen at Wollaton Hall, Nottinghamshire, a residence erected in 1580 by Sir Francis Willoughby. Elizabethan
4. The large or north drawing room at Levens Hall, Westmorland, showing 3 decker chimney piece, plaster work ceiling, and north window with roundels of painted glass. The family heraldry is carved in the compartment above the fire arch, Queen Elizabeth's arms in the centre panel of the second compartment, and the date 1595 in that to the right



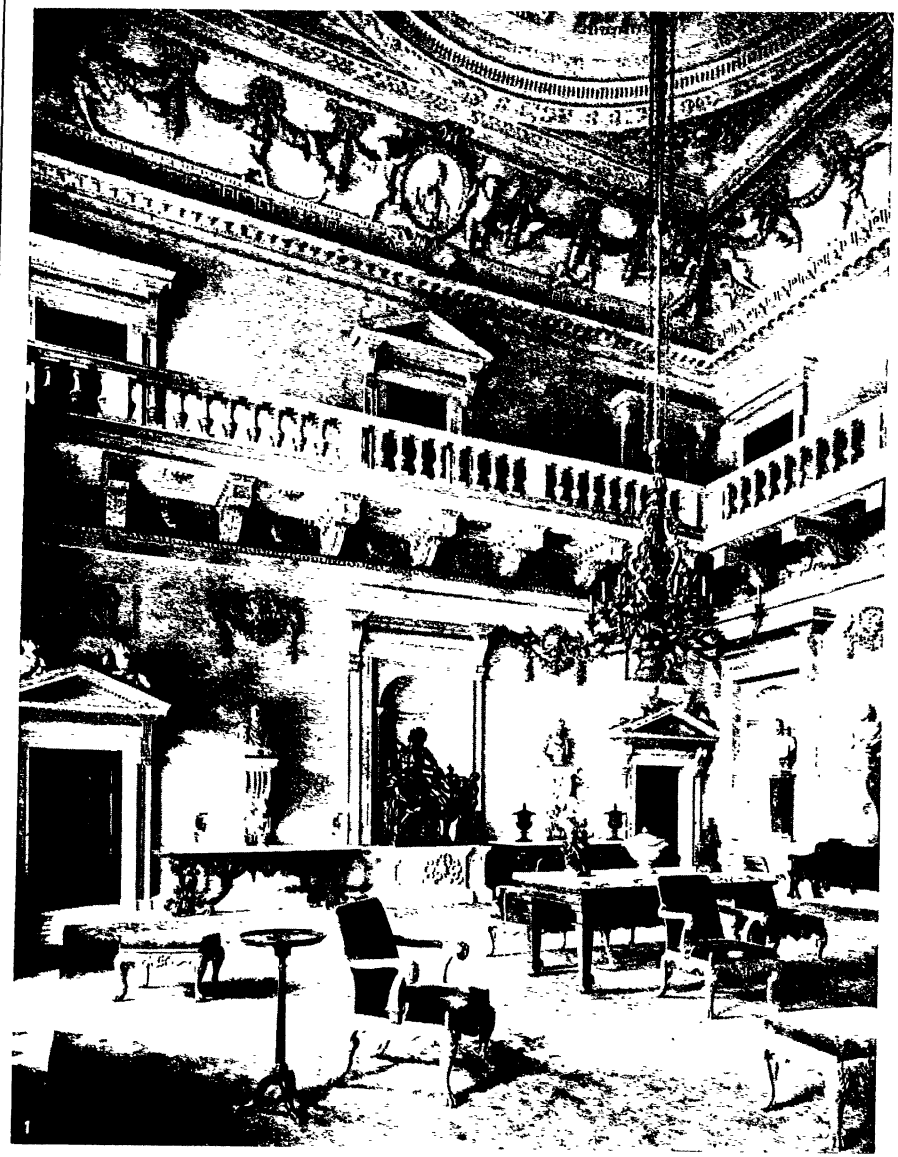


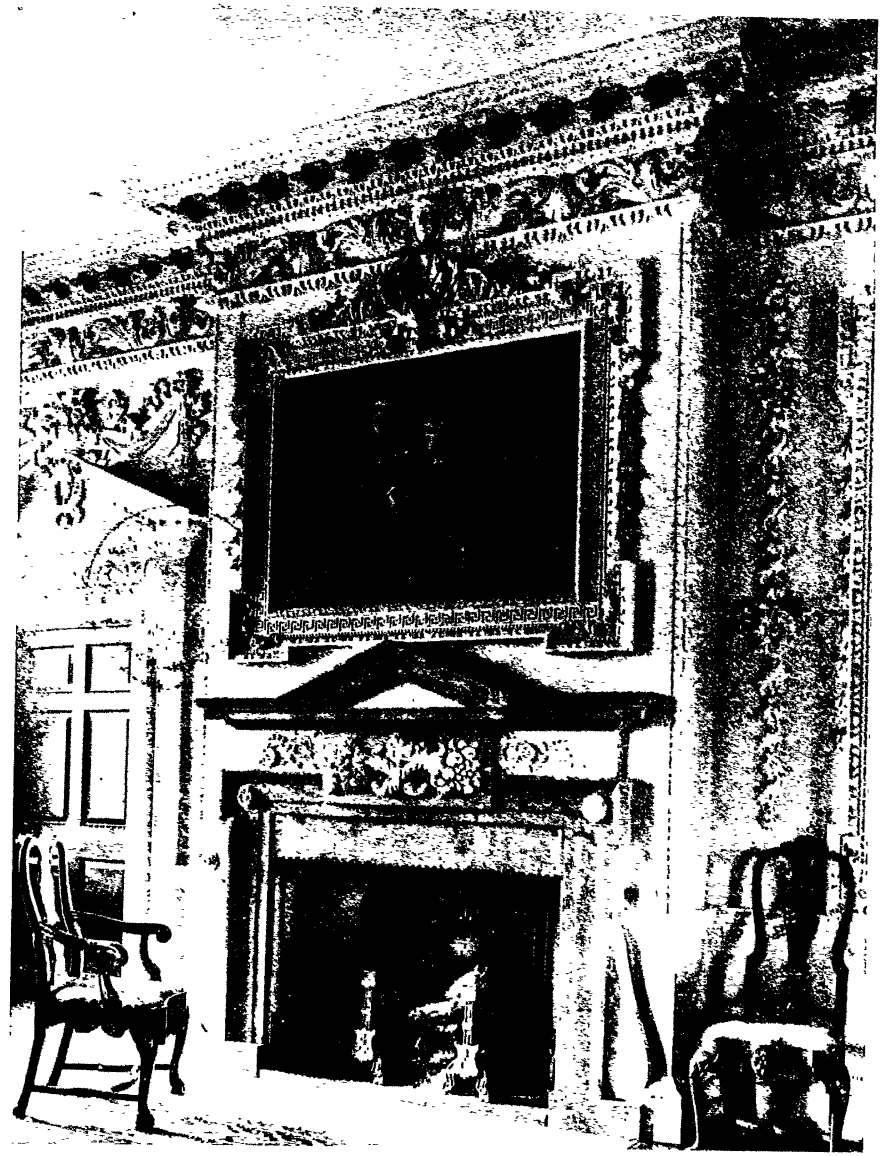
BY COURTESY OF COUNTRY LIFE, LONDON, FROM TIPPING, "ENGLISH HOMES"

ENGLISH INTERIORS—SYON HOUSE AND CHATSWORTH

1. View of the great dining room at Syon House, Middlesex, looking east, showing the niche system (introduced to add to the sense of width), the columned apse and the painted ceiling. The chimney piece is of white marble, and the room is painted yellow with gilded enrichments. Executed about 1762 by Robert Adam.

2. The great chamber at Chatsworth, Derbyshire. It is wainscoted from floor to ceiling, and the more important panels are decorated with carvings sometimes attributed, probably erroneously, to Gibbons. The ceiling was painted by Verrio, the famous contemporary Italian





BY COURTESY OF COUNTRY LIFE, LONDON, FROM TIPPING, "ENGLISH HOMES"

EARLY GEORGIAN INTERIORS

1. South side of the stone hall at Houghton, Norfolk. *c.* 1725. The room, surrounded on three sides by a gallery, is of white Whitby stone, with stucco ceiling and dark mahogany windows and doors

2. Chimney piece of dark veined marble with frieze and sculptured ornament of Carrara marble, at Godmersham Park, Kent. *c.* 1732. Design of the picture frame conforms with that of the window cases

in a picture from an illuminated manuscript produced in Flanders for Edward IV. (*c.* 1475) of Richard II. feasting (Pl. V., fig. 1). There is no arras, but the king sits under a rich textile canopy, similar material also hanging in front of the musicians' stand. It was not as yet customary to have walls lined with oak, but it was used, and used richly, by the highly expert carpenters of the day for such structural purposes as hall screens and room partitions. They had not, however, taken in hand the chimney-piece, which remained in the domain of the mason who in the 15th century bestowed pains upon its adornment, as we see in the great heraldically carved chimney-pieces at Tattershall, dating from about 1438.

The Development of Panels.—It was not, however, until the days of Elizabeth that this feature became monumental, often reaching from floor to ceiling by the use of superposed classic columns. By that time framed wood linings had become usual, and to them gradually became applied the word "wainscote," which had originally merely meant foreign oak. Such panelling, although only common under Elizabeth, occurred under Henry VIII., the finest and amplest surviving example being probably that in the Gallery of the Vyne, in Hampshire, where the linen-fold carving is enriched by various heraldic badges that enable us to date it from between 1515, when Wolsey was made a cardinal, and 1530, when Catherine of Aragon fell into disfavour (Pl. V., fig. 4).

The same treatment, extending also to ceiling beams and panels, we may still see in such Essex houses as Paycocke's, in Coggeshall, the Granby inn at Colchester or the manor house at Tolleshunt Darcy.

Frescoing walls still continued, but most of it has perished. Some late 15th century representations of Bible scenes have recently been found under whitewash at Cothay, in Somerset, while of Elizabeth's reign a very good example has come to light at the White Swan inn at Stratford-on-Avon, depicting scenes from the story of Tobit.

Hangings, however, still held the premier place as wall coverings. In the early part of the 16th century, the number of sets belonging to kings and great men was almost countless, and a Vyne inventory of 1541 gives sets in almost every room of the house, including the chambers of dependents. A somewhat similar effect was reached by cheaper means, and there was a great output of *tempera*—painted or "stained" cloths, using the same subjects as tapestry—histories from biblical or classic sources, verdure of woods and fields with beasts and birds and decorative subjects passing from Gothic to Renaissance *motifs*. Nearly all this "counterfeit arras" has perished, but a set displaying the Acts of the Apostles survives at Hardwick hall in Derbyshire.

Leather, embossed, painted and gilt, was less used in England than on the Continent, but such woven fabrics as velvets and damasks for the wealthy, and "sayes and bayes" for modest folk, found a place on the walls as well as for bed and window hangings.

The Elizabethan joiner, when his employer's purse permitted, enriched his wainscotings with carvings and inlay and completed the circuit of the room with elaborate oak door-cases and chimney-pieces, using for them classic orders and Renaissance *motifs*. For the most part their work shows an uncultured vivacity rather than a trained head and hand, a knowledge of the anatomy of the human form being very rarely displayed. Typical of the English craftsmen of the day is the great drawing-room at Levens in Westmorland. The chimney-piece, dated 1595 (Pl. VI., fig. 4), is of three-storeys, Doric, Ionic and Corinthian orders being piled one upon the other. Elaborately framed wainscotings, enriched door-cases, plaster-work ceiling and roundels of painted glass in the windows complete the picture.

Screens continued to be used in halls even when they were of single-storey height, as at Cuckfield in Sussex, dated 1581 (fig. 5). The vast majority were of oak, but in important houses, stone was sometimes used, as at Wollaston (Pl. VI., fig. 3) and Montacute. Stone and even marble were used for chimney-pieces, especially in James I.'s reign when Max. Colt, "carver in wood and stone of all his majesty's works," provided three marble chimney-pieces for Hatfield; and we find similar ones at Knole and Bramshill. One example, however, there is of the previous reign; a noble chimney-piece in the Gallery at Cobham, wrought in 1599 by Giles de Whitt (Pl. V., fig. 2).

Plaster Ceilings.—Although wainscotings became the normal wall treatment under Elizabeth and her immediate successors, yet there was still scope for tapestry, and also for enriched plaster ceilings consisting of narrow interlaced ribs forming geometrical patterns. There are interesting examples at Plas Mawr in Conway, where the same material forms the upper part of chimney-pieces, the royal arms indicating a date in Elizabeth's reign (Pl. VI., fig. 1). Such treatment of ceilings was often very elaborate in those distinctive Elizabethan rooms, the long gallery and the great chamber, which were often upstairs; and greater height was obtained by using the roof space and forming a barrel-shaped ceiling. They exhibited not only the narrow ribbing of Elizabeth's time, but also the broad bands with enriched soffits that came in under James I., one of the finest examples of which is at Herringston, near Dorchester, dating from about 1615 (Pl. VI., fig. 2).

The Staircase also reached its final development in this reign. In mediaeval times, the winding newel form, sometimes of wood but more often of stone and never very wide or easy in gradient, had prevailed. But under Elizabeth it had begun to be placed round an ampler open space, and its decorative possibilities being recognized, enriched newel posts, balusters and strings were given to it. The idea was developed under her successor, and one of the finest, both in planning and execution, is the great stair at Hatfield, dating from 1610. The newel posts are richly carved and surmounted with figures so skilfully sculptured in wood that they may well be the work of Colt himself. Here, and at Audley End, the halls, which still rise to the roof, are fitted with great screens embodying all that is best and finest of the native design and workmanship of the time.

Jones and Webb.—A feeling for classic reserve was now spreading and the Late Renaissance period might well have begun under Charles I. but for the political difficulties that checked the zest for fine building. Returning from Italy in 1615, Inigo Jones introduced the new style in the Whitehall banqueting house and the Queen's house at Greenwich, and, despite English conservatism at first and the Civil War and the Commonwealth afterwards, we find his hand and that of his kinsman and associate, John Webb, at Wilton, Forde abbey and Thorpe, all houses altered or built by men on the winning, or Parliamentary, side. Also built under the Commonwealth is Coleshill, the earliest and one of the best of English country seats where classic form and Italian tendencies prevail.

Wood was less used than stone and stucco by the Italians for wall linings, and Inigo Jones favoured their materials as well as their manner. Webb, however, and other Englishmen were more northern in taste and native in training, so that wood held its own in England till the end of the century. But it had to conform to the new taste. Wainscotings must no longer be framed sheets of small panels in the nature of movable linings, but must simulate wall structure. They become architecture, not furniture. Vast panels thrust forward from their stiles by bolection mouldings are made up of two or more boards skilfully chosen and worked to hide the joint, even where they are left unpainted, as by Grinling Gibbons, the amazing delicacy of whose carving in lime is obscured by paint but stands out excellently against an oak background.

The Age of Wren is characterized by an architectural treatment as of stone but with the natural surface showing, as exemplified by the admirably designed and executed joinery not only in churches and public buildings, but in houses, such as Belton and Chatsworth (Pl. VII., fig. 2). The passage from the early to the late Renaissance period is a change not only of style but of spirit. During the former, the craftsmen retained much of the independence of action of mediaeval times, and the work was free and forceful but not fine. But perfection, reached through discipline, is the essence of the classic spirit. The design becomes more learned and includes detail which it was the business of the executant to follow obediently but skilfully. The field of individuality was closing for the craftsman, but that of dex-

terity was opening wide. Thus mastery of technique is a distinguishing feature of men like Gibbons and Hopson, Strong and Tijou,—natives and foreigners who combined to give finish to the decorative output of the later Stuarts.

The Georges.—Even during the last years of that dynasty, and still more under the Georges, the wood-workers found their domain contracting. Italy exerted more and more influence, stone and stucco became more used. Vanbrugh began and the Burlingtonian school continued the stucco, stone or marble halls of the new Whig palaces, such as Castle Howard and Blenheim under Anne, Houghton and Holkham under George II., Syon and Heveningham under George III. Stone treads and iron balustrading, moreover, were introduced for staircases, although in this feature the joiner long retained the lead. Under Charles II. the work is solid with massive balusters or open panels elaborately carved under a broad hand-rail, as at Wolseley or Sudbury. But with the 18th century it becomes lighter and more delicate, although equally finished and rich, as at Beningbrough in Yorkshire where, in 1716, we find the joiner still supreme, and are enchanted with the quality and quantity of the wood-work as it appears there and in so many doorways and chimney-pieces, shutterings and framings in George II. houses, like Godmersham in Kent (Pl. VIII., fig. 2).

Elsewhere, however, it is the Italian stuccoist who holds sway and riots in the exuberant ornament that was so wonderfully reached by experts in *il stuc,* and of which we find outstanding examples at Mereworth and Houghton (Pl. VIII., fig. 1), Moor Park and Clandon.

Textiles.—But it was not only stone and plaster that was driving the joiner from walls of rooms. Textiles became increasingly popular. For them as for wood the late Renaissance demanded a more architectural handling and they were no longer hung but stretched on frames fixed above a dado. Not only tapestry but cut velvets and damasks were favoured, and a single order for these given by the duchess of Marlborough in 1707 was for over 3,000 yards. Indian calicos and other lighter and less expensive textiles were also fashionable, but the most serious, because still cheaper, competitor to wainscoting was paper, which, from being a 17th century rarity became a prevalent feature as the 18th century progressed. During George III.'s reign we notice an increasing lapse from classic restraint and Palladian purity. French rococo joined Italian baroque and was sprinkled with vagaries that passed for Chinese and Gothic. Ceilings, chimney-pieces, door-cases were apt to be so treated, the most astonishing being perhaps those at Clayden in Buckinghamshire.

Adam.—Reserve rather than excess, however, was the English characteristic, so that baroque and rococo gave way to the choice delicacy and clean lines that were the basis of the style of Robert Adam, who commenced his London practice in 1759. With him the despotism of the architect over the craftsman was complete. No detail of decoration or furnishing escaped him: his rapid and precise draughtsmanship covered the whole ground. The executant must not depart one hairbreadth from the drawing supplied, but he must have reached exquisiteness of technique. This spirit, joined to that of severity and restraint in design, makes the perfection reached during the last decade of the 18th century a little chilling and inanimate, implying a ceremonious rather than a domestic life.

Adam's clients, however, were for the most part the Italy-loving leaders of an aristocratic and artificial age, who affected a palatial and ultra-architectural treatment of interiors, as shown by the painted wall surfaces broken by pedimented door-cases, the columned apses and the scooped-out niches that we find in the hall at Kedleston, the dining-room at Syon (Pl. VII., fig. 1) and the saloon at Heveningham. In smaller and more domestic rooms, if the materials differed, the same practice obtained. Even carpets were made to reflect the ceiling design. Wood was never left unpainted, and although the joinery is still admirable, the enrichment is often in composition or in pewter. We find specially designed temple-fronted book-cases, and specially painted pictures set in specially designed frames fixed and painted to form an integral part of the wall structure.

"Gothic."—So much logical completeness, such wholly unemotional perfection, was bound to stir up opposition, especially at a time when a new romantic school was forming and the cult of the picturesque was gathering strength. Although architecture and decoration—indeed, life itself—were treated much as playthings by Horace Walpole, and Strawberry Hill was a mere confectioner's romance, yet his influence was large and helped to turn James Wyatt from the classic manner, which he had practised as successfully as Adam, to pseudo-Gothic. For decoration it was a singularly unfortunate introduction. What in the mediaeval interior was not movable was truly structural, and not imitative of it; so that not only did flimsy wood, plaster and paper decorations entirely miss the Gothic spirit, but they were introduced as the trappings of houses designed to meet entirely different habits of life. Thus, when the 19th century was reached, a plan that, in the disposition of parts, the shape of rooms, the height of ceilings, suited the habits and views of the day, might be decked out by the architect in what he was pleased to think was Gothic or Tudor, Roman or Greek, French or Italian, Egyptian or Indian.

The last half-century has been largely a struggle to get free from this welter of confused aims and misunderstood styles, but with all this there is too great a reliance on the past, on the halcyon days of the Renaissance styles, early and late. The best craftsmen are employed on mere copying, on the production of "Period rooms," so that among decorative styles we cannot include one of to-day.

See ARCHITECTURE; FURNITURE; LAMPS; LIGHTING; METAL WORK; RUGS; TAPESTRY; TEXTILES; WALL-PAPER.

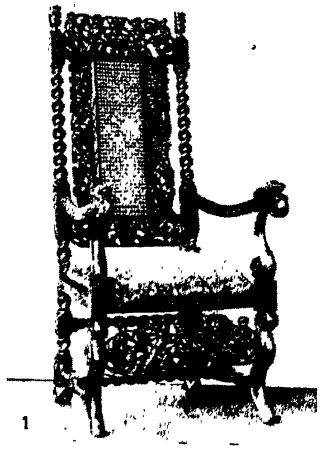
BIBLIOGRAPHY.—Sir R. Blomfield, *History of Renaissance Architecture in England, 1500–1800* (1897); J. A. Gotch, *Early Renaissance Architecture in England* (1914); H. A. Tipping, *Grinling Gibbons and the Woodwork of his Age, 1648–1720* (1914), and *English Homes, 1066–1820* (1920–28); A. Bolton, *The Architecture of Robert and James Adam, 1758–1794* (1922); M. Jourdain, *English Decoration and Furniture, 1760–1820* (1922), and *English Decoration and Furniture, 1500–1650* (1926); L. Turner, *Decorative Plasterwork in Great Britain* (1927).

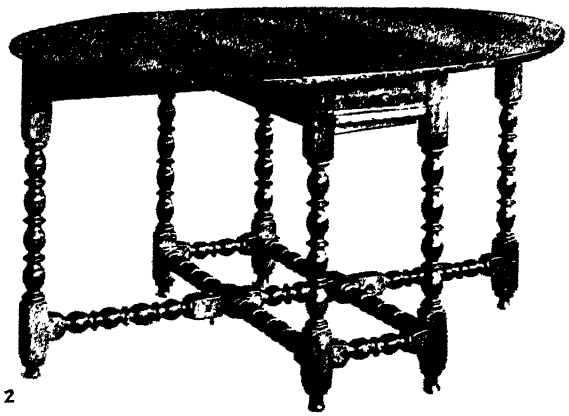
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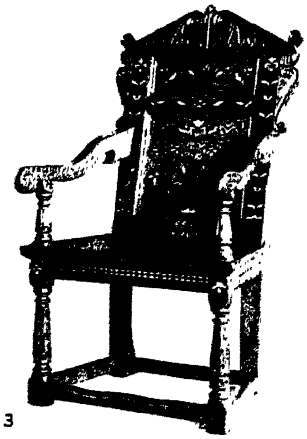
ENGLISH FURNITURE

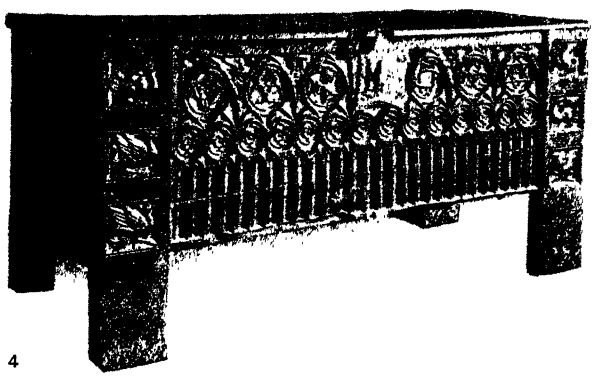
English furniture has developed in the course of many years from a few primitive types to highly specialized varieties; it has evolved gradually with the progress of civilization. So little survives from mediaeval times that information must be sought in contemporary references, supplemented by representations in illuminated manuscripts. Most of these miniatures are of foreign origin; but they are reliable evidence, for the governing classes were Continental in their habits and the equipment of their homes. The furniture made for them was strongly influenced in form and detail by Gothic architecture, and was freely embellished with colour and gilding. English oak was the chief material, but softer woods were also used.

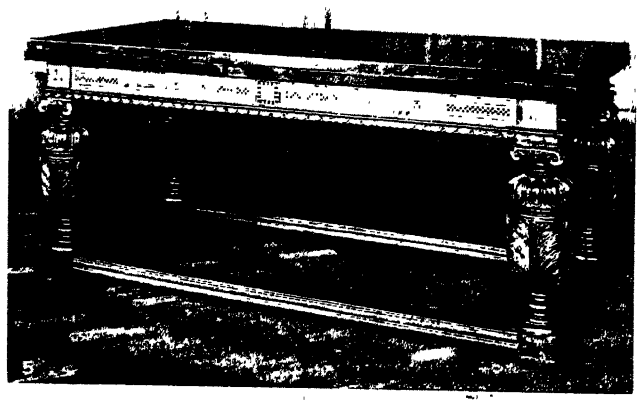
The furniture usually found in important houses consisted of beds, chests, cupboards, tables and stools. These objects are the basic types from which the whole evolution can be traced. Wills and inventories prove that draped bedsteads were treasured possessions of mediaeval householders, prized not for the rough framework but for their magnificent woven and embroidered hangings. These draperies consisted of a celure (back), tester (canopy), curtains and valances, and on them were worked scenes from the chase and many fanciful devices. Such beds were placed in the principal living rooms, and served as couches in the daytime. Chests were almost the only receptacles for valuables. They survive in large numbers, many 13th century examples being preserved in churches. The fronts, formed of stout planks, are pegged into wide uprights, plain, or carved with grotesque monsters. Later specimens are sometimes carved with arcades of Gothic tracery, scriptural incidents or mythological subjects. Large travelling chests, called "standards," were bound with iron and covered with leather. At the ends were iron handles through which ropes could be passed to facilitate transport. The guild of cofferers already existed in Edward III.'s reign, but could not prevent the

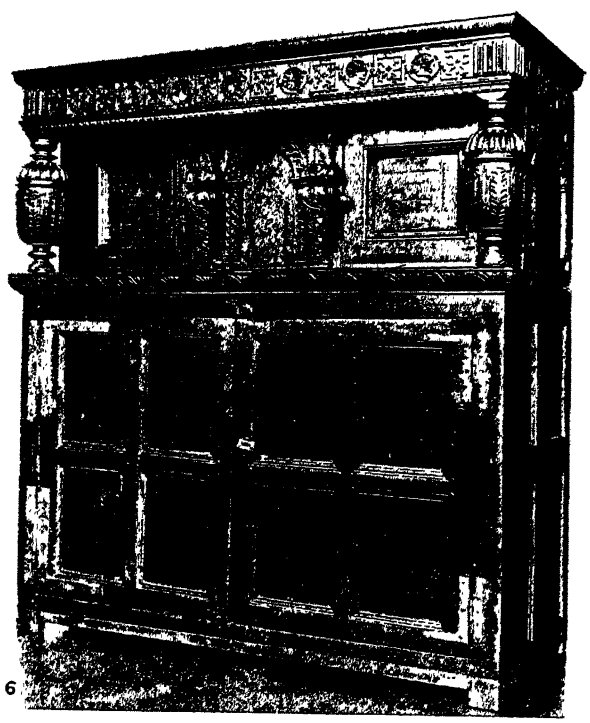

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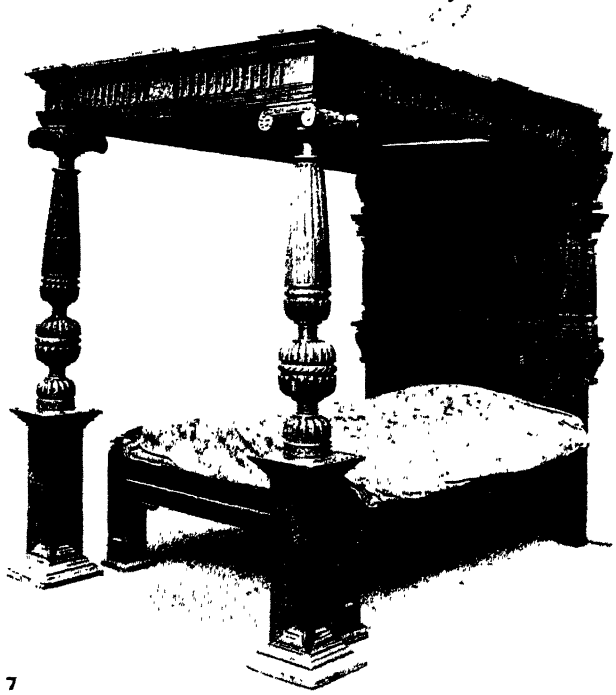

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ENGLISH FURNITURE OF THE 14TH, 16TH, AND 17TH CENTURIES

1. Armchair of carved walnut; about 1680. 2. Gate-leg table of turned oak, the legs having wooden hinges, 2 ft. 4½ in. in height; about 1660. From Capt. N. R. Colville. 3. Armchair of oak inlaid with various woods; about 1600. 4. Carved oak chest of the late 14th century; from Ockwells Manor, Berkshire. 5. Draw-table of oak, with inlaid frieze and carved legs; about 1600. 6. Court cupboard of carved and inlaid oak; dated 1610. 7. Bedstead of carved walnut with inlaid frieze; 1593

INTERIOR DECORATION

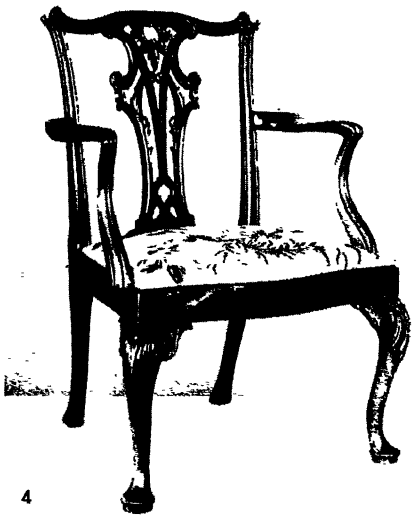




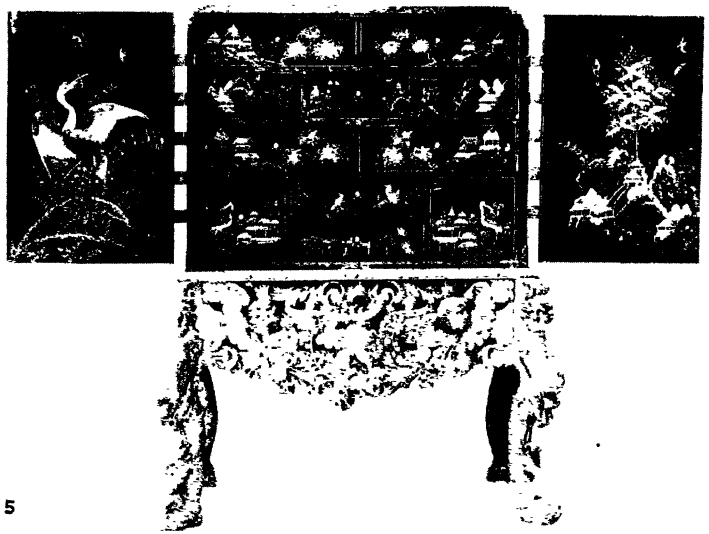
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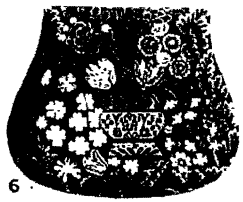
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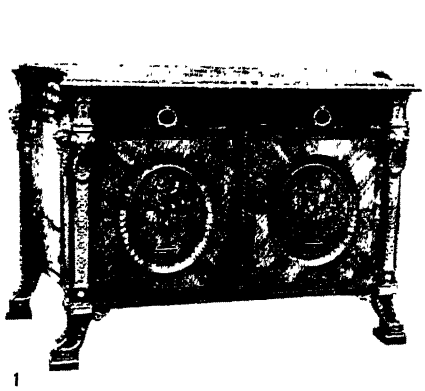


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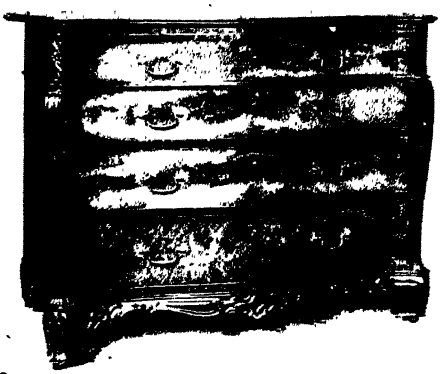
BY COURTESY OF (1, 3) COPR., WALTER BOURKE, BY GRACIOUS PERMISSION OF HIS MAJESTY THE KING, (2, 4, 5) THE DIRECTOR OF THE VICTORIA AND ALBERT MUSEUM, (6, 7) P. D. GRIFFITHS

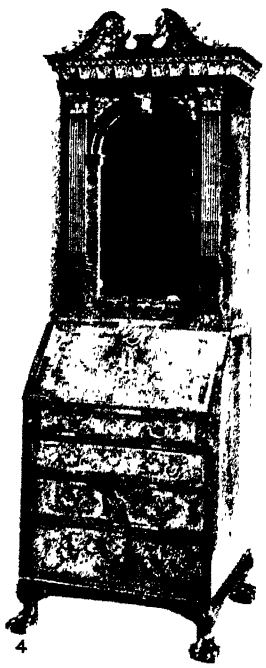
ENGLISH FURNITURE OF THE 17TH, 18TH AND 19TH CENTURIES

1. Long-case clock, the case veneered with walnut. Enrichments of chased and gilded brass. Movement by Daniel Quare, about 1705
2. Cabinet designed and painted by William Morris, mounted on a turned stand; about 1862
3. State bed with hangings of rose damask, made for George, Prince of Wales, in 1715
4. Mahogany armchair, one of a set, in the style of Chippendale; 1755
5. Cabinet lacquered in gold and colours, on a black ground, the stand carved and silvered; about 1675
6. The seat of the chair seen in fig. 7, showing detail of *petit-point* needlework
7. Hoopback chair veneered with burr walnut and finely carved; about 1720

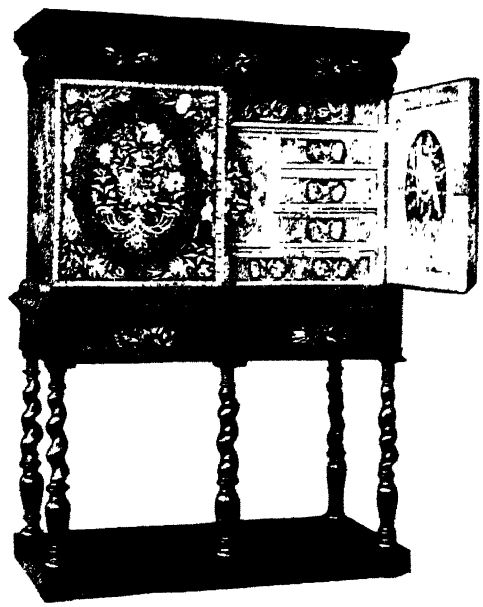

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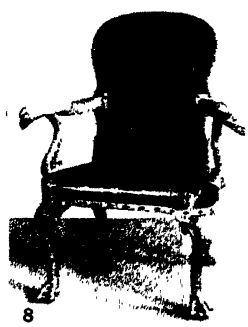

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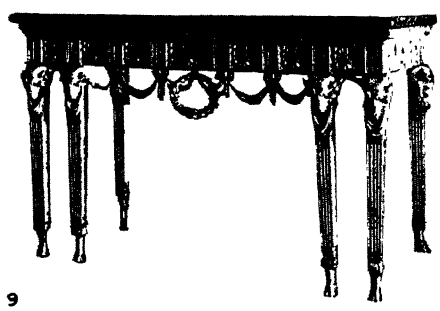

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ENGLISH FURNITURE OF THE 18TH CENTURY

1. Commode veneered with satin wood and decorated with marquetry. About 1770
2. Bookcase of carved mahogany. About 1745. From Mr. J. Thursby Pelham
3. Commode chest of drawers. Carved mahogany. About 1760
4. Bureau bookcase veneered with burr walnut, gilt carved. About 1730
5. Mirror in frame of wood, carved and gilt in the rococo style. Probably by Chippendale. About 1755
6. Cabinet on stand; walnut decorated with floral marquetry. About 1685
7. Side table with marble top, carved and gilt. In centre is figure of a child seated on a shell. Designed by William Kent. About 1730. Houghton Hall
8. Armchair of carved walnut, upholstered in red velvet. About 1720
9. Side table with classic decoration; carved and gilt. Designed by Robert Adam about 1770. From 20, St. James's Square, London

importation of Danzig chests and others of overseas work. On a dresser in the hall flagons and cups were displayed. It was an open framework of shelves with a projecting lower portion, sometimes enclosed by doors. Side-tables, used for serving meals, were in the form of a chest mounted on legs, the panels pierced with Gothic tracery. What are now termed cupboards were known as ambries. Existing specimens are of massive construction with cross divisions and foliated iron hinges. Until the close of the middle ages chairs were lofty, throne-like structures, few in number and regarded as symbols of authority. The ordinary seats were chests and stools with benches sometimes fixed to the walls. Mediaeval dining tables were of trestle construction, boards of oak or elm resting on a series of central supports. They had removable tops and could be stored away after meals. Two examples still remain at Penshurst Place, the tops, nearly 30ft. long, being supported on carved trestles with cruciform feet. Towards the end of the 15th century panelled framing, or joinery with mortice and tenon, replaced the primitive method of construction in which planks split or sawn from the log were roughly put together with pegs. At this period panels were often carved with the linen-fold pattern, so called from its resemblance to linen arranged in upright folds.

Tudor.—In the Tudor period the character of domestic furniture was gradually transformed by Renaissance influence, carved profile heads, dolphins and foliated scrolls appearing on structures which at first remained Gothic in design. Henry VIII. employed Italian craftsmen for the equipment of his new palaces, and their works were imitated by native craftsmen with less delicacy and finish. Walnut, more readily carved than oak, was extensively used, and, though much of this furniture was imported, there are undoubted English examples. Under Elizabeth inlay consisting of arabesque or chequer patterns in coloured woods came into vogue as decoration. There was a notable increase in domestic comfort. Harrison about 1587 reported that costly furniture had descended "even unto the inferior artificers and manie farmers." By this time the style had emerged from foreign tutelage and assumed a character distinctively English. It is coarse and vigorous, prodigal of material and floridly enriched. The round arch figures prominently with corbels and grotesque terminals; foliated strap-work fills the decorative areas, while nothing is more characteristic of Elizabethan furniture than vase and melon-shaped supports of prodigious girth profusely carved. In the matter of new types there was little innovation, but capacious presses were provided for clothes and mirrors of glass in highly decorated frames were becoming known at court. Chairs were more abundant. They had panelled backs and joined frames and could be readily moved; in some the woodwork was hidden by rich fabrics. Beds were now constructed of wood throughout, a panelled back and posts supporting a ponderous tester. Joined tables with "draw," or extending, tops ousted the trestle variety; while court cupboards and buffets laden with plate adorned every well-appointed hall.

The Stuart Period.—This increase in domestic comfort continued until the outbreak of the Civil War. From James I.'s reign padded and upholstered seats survive, and at Knole may be seen chairs of X pattern covered with silks and embroidered velvets. A very remarkable specimen, in which Charles I. is said to have sat during his trial, has lately been acquired by the Victoria and Albert museum. Such chairs show Continental influence, but the main output was insular and traditional. The style gradually lost its rude vigour. Structural members dwindle in scale, and fanciful carving degenerates into stock patterns, eked out with applied bosses and spindles. The furniture of the Protectorate is, for the most part, severe and angular.

After the Restoration there was a striking change. The exiled court on its return introduced French fashions, and austerity gave place to lavish display. Furniture became lighter, more highly finished, and better adapted to varying needs. Walnut was the favourite material. Joinery developed into accomplished craftsmanship and new processes appeared, notably veneering wide surfaces with thin sheets of wood into which floral patterns in marquetry could be inserted. The passion for colour found an even better outlet in lacquer decoration. The importation of works of art from the East had begun in Tudor times, but was of small account until after the Restoration. Then the taste became widespread, Evelyn and other observers reporting their friends' houses to be furnished with Indian screens or panelled in the finest Japan—descriptions implying oriental lacquer. Such things came from China and were soon imitated in England, the art of covering furniture with successive coats of coloured varnish being known as "Japanning." New forms of decoration coincided with a multiplication of types. Day-beds, a form of couch with an adjustable end, and winged arm-chairs served for repose. A little later, sofas with back and arms carried comfort a stage further, patterned velvets mainly of Venetian origin and damasks woven at Spitalfields being the usual coverings. Bureaux with an enclosed desk were produced towards the end of the century, and chests of drawers came into general use. Mirrors were no longer rarities after the duke of Buckingham had established his famous glass-works at Vauxhall, the frames being carved, lacquered or inlaid. Charles, says Evelyn, "brought in a politer way of living which passed to luxury and intolerable expense." An example of this extravagance is afforded by the tables, mirrors and stands covered with embossed silver with which the king's mistresses furnished their apartments. Fashions succeeded each other with great rapidity. Chairs show these changes most clearly, developing in a brief period from mere seats into movable decoration. They had floridly carved crestings and stretchers, while for the structural members many varieties of turning were employed. Scrolled legs were general under Charles II., being succeeded by taper and baluster forms a few years after his death. In beds of this period, the tester, back and posts are covered with material pasted on to the wood and matching the hangings. They were of enormous height with elaborately moulded cornices, and had ostrich plumes or vase-shaped finials at the corners of the tester. The ornate stands and side tables of this age demand special notice, for, profusely carved and often gilt, they are among its most striking productions.

The 18th Century.—At the beginning of the 18th century a new style arose. It was simple and dignified, based upon curved lines and entirely admirable in its insistence upon form. The cabriole-shaped support with claw-and-ball or paw feet was a salient feature, and early in the development stretchers were eliminated. This style depended largely upon finely figured walnut veneers, and made but a sparing use of carved ornament. Chairs changed their character completely. They had hooped uprights and vase or fiddle-shaped splats curved to support the back, beauty and comfort being combined in the design. Tallboys, or double chests of drawers, cabinets fitted with shelves, and bureaux in two stages met the demand for greater convenience, while the types already known were much improved. About 1720 mahogany began to supersede walnut as the fashionable material, its consumption increasing with the repeal of the heavy import duties. The furniture which had prevailed during Anne's reign no longer satisfied the governing class, whose taste inclined to ostentatious magnificence. They demanded something grandiose and cumbrous, suited to the great Palladian houses for which it was destined. Inspired by the contents of French and Italian palaces, such furniture was largely the production of architects, William Kent, the most celebrated, having travelled in Italy before starting practice. The basis of design was classical, the manner baroque. Columns, architraves and entablatures are prominent with terminal figures and heavy scrolled supports, masks and acanthus scrolls being favourite ornaments. The carving was bold and often masterly, gilding, freely used, enhancing the effect. At Houghton, Holkham, Rousham and elsewhere, Kent's furniture may be seen in its proper environment, gilt mirrors and side tables with sets of chairs and settees covered with patterned velvets recalling the vanished splendours of that opulent age.

About the middle of the century a fresh wave of French fashions produced an Anglicized version of the rococo style. It was romantic in conception, fantastic and capricious in the manner of its working out. It banished the straight line and made asymmetry a cult, while it sought its ornament in conventionalized

renderings of natural forms—shells, foliage and flowers. With it flourished the Gothic and Chinese "tastes," the one a travesty of a forgotten art, the other an attempt to exploit the furniture of an unknown land. Architects with a hold upon tradition were now challenged by cabinet-makers who produced their own designs. Chippendale, Ince and Mayhew, Johnson, Manwaring and many others published illustrated trade catalogues to advertise their wares. Of these works Thomas Chippendale's *Director* is the most important. It affords an apt summary of contemporary tendencies, and is at once eclectic and original. Chippendale borrowed his rococo from Meissonier, but depended much on his own fancy for what he deemed Gothic or Chinese. It was an age of specialization, and many varieties of furniture are represented, ranging from extravagant side-tables for saloons to ingeniously contrived little objects for bedrooms. In the explanatory notes mahogany is generally recommended, but many of the designs are to be japanned or finished in burnished gold. The contents of such houses as Nostell and Harewood (where the original bills are preserved) show Chippendale to have been a craftsman of genius; though he had many rivals scarcely less gifted. His name affords a convenient label for furniture of the middle of the 18th century—mostly the work of other hands. The classical reaction, which set in shortly after 1760, swept away tortuous forms and terminated licence in design. Robert Adam, whose name is inseparably associated with this movement, had, like earlier architects, studied in Italy. His fastidious taste rejected the art of the later Renaissance, and sought inspiration in the remains of antiquity. When he was given a free hand, furniture and decoration were included in his architectural schemes. What he could achieve when "the subject was great and the expense unlimited" Syon and Nostell remain to show. They are brilliant essays in the "antique style" with the contents carefully thought out in relation to their surroundings. This furniture makes a learned use of classical ornament, but paterae, husks, rams' heads and urns are less eloquent of the change than the symmetrical structural lines. At this time commodes and other objects intended for display were often of satinwood with marquetry or painted decoration, the latter copied from designs by leading artists. The style as Adam conceived it was too severe and scholarly to be widely appreciated. It was modified by contemporary cabinet-makers, and may be seen translated into popular terms in Hepplewhite's *Guide* (1788). In the process the furniture has lost its ceremonial character, and become simple, homely and graceful. It retains, for the most part, symmetry of form and excellence of proportion. Heart and shield-shaped backs on chairs and settees with tapered and fluted supports are noticeable features, while feathers, wheat ears and shells are prominent in the painted or inlaid decoration. The movement was towards lightness and elegance, and furniture of a distinctly feminine kind is found represented in Sheraton's *Drawing Book* (1791). This period saw the highest technical accomplishments, and a degree of specialization hitherto unapproached. Sheraton's designs for fitted washing-stands, dressing- and work-tables are triumphs of ingenuity and eminently practical.

At the end of the century a strange archaeological revival, based upon a closer study of Greek, Roman and Egyptian remains produced the Empire style and that modified version of it which became current in England. The chief English exponent was Thomas Hope, an amateur designer with some antiquarian knowledge; but when the fashion was taken up by cabinet-makers the results were often woefully incongruous. They essayed the production of Roman bookcases and sideboards undeterred by the lack of classical precedents, and to what depths of incongruity they descended may be seen in Sheraton's later publications and in George Smith's *Household Furniture*. Rosewood was used with bronzed or gilt ornament and metal inlay, sphinxes and animal terminals being favoured as supports. With the last phase of this style, prolonged into the reign of George IV. and growing ever more grotesque, the making of furniture ceased to be an art. The introduction of machinery ended the craftsman's direct responsibility and robbed him of pride in his work. The old tradition of sound craftsmanship lingered, and may be detected even in the cumbrous productions of the Victorian age, devoid though they be of any aesthetic interest. It may confidently be said that the domestic arts were never at lower ebb than during this period.

The Pre-Raphaelites and Modern Movements.—Early in the '60s the complacent acceptance of mass embellished with ungainly ornament was challenged by the movement inaugurated by William Morris and a group of pre-Raphaelite artists. They sought to rehabilitate craftsmanship, and with this end in view their sympathies were naturally drawn to the middle ages when craftsmanship was in its prime. Their work is distinguished from the earlier Gothic revival by greater understanding and a regard for modern needs. That it can wholly escape the charge of being "sham mediaeval" cannot be maintained, but it was sincere in intention and provocative of thought. Morris realized part of his ambition, for he trained a company of enthusiastic and highly skilled craftsmen. The propaganda spread in spite of the prevailing Philistinism, and a marked improvement in taste was the result. For an appreciative few Morris furniture continued to be made, and, among the inheritors of his traditions, Ernest Gimson deserves honourable mention. The movement was, however, too typical of a time when the arts had become disastrously divorced from life. It found its chief supporters among a cultured minority with exclusive standards and a somewhat superior attitude; in consequence there was more than a hint of the "precious" and artificial about the furniture made for them. A notable result of pre-Raphaelite activities was to direct attention to the striking merits of furniture which had been banished by the Victorians. It was rescued from obscurity and the collecting habit spread, rapidly producing a huge crop of "fakes" and reproductions. This habit has undoubtedly determined the character of English furniture for nearly 50 years. It has stifled originality and degenerated too often into an unintelligent craze, while it must be held responsible for the cheap and horrible travesties of historic styles, which under the label "period" have done so much to degrade public taste. In the last decade there have been unmistakable signs of a renaissance, and something of the Continental enthusiasm for modern furniture has spread to England. In the productions of this new school fitness for purpose is again considered and great attention is bestowed on the material, many beautiful, exotic woods being used with striking effect. Ornament is unobtrusive (excepting in the more fantastic examples), and even mouldings are kept in subordination. The forms are often eccentric, reflecting the latest aberrations of fashion; attempts to produce jazz or cubist furniture are not unknown. At the present day the opportunities are quite severely limited by the inevitably high cost and also by lack of patronage. The outlook is promising, both on account of the genuine originality sometimes displayed by designers with a firm hold upon tradition, and because fine craftsmanship is again highly prized. The 20th century will possess a distinctive style when a few gifted designers emerge to consolidate the gains already won. (*See* ENGLISH FURNITURE; LACQUER; TUDOR PERIOD; STUART PERIOD.)

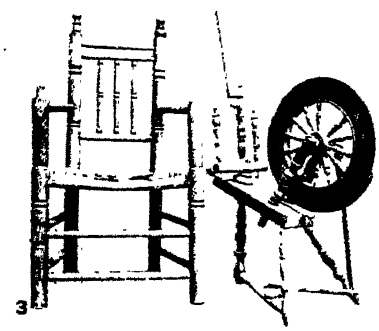
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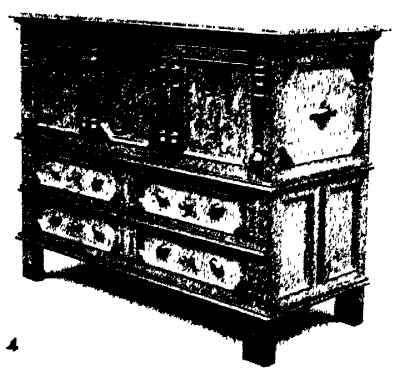
EARLY AMERICAN PERIOD

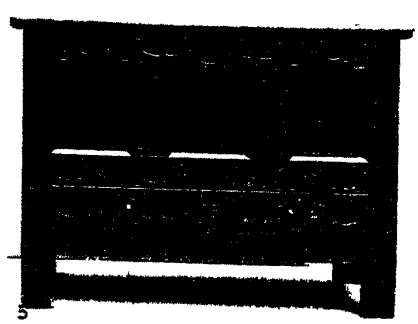
The heritage of the American colonists on their first arrival in the New World was the household art of the countries from which they came: English in Virginia and New England, Dutch and











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EARLY AMERICAN INTERIORS AND FURNISHINGS

1. Reproduction of the Capen house kitchen, Topsfield, Mass., 1683, an example of the earliest type of American architecture. The fireplace opening, with a round brick oven at one end, extends over half the length of one wall. The clock near the chest is of the 17th century type and is run with weights. The chair seats are covered with coloured linen. 2. Kitchen from Millbach house, Lebanon county, Pennsylvania. 1752. 3. Armchair of Governor John Carver, and early spinning wheel. Plymouth. 4. A "Connecticut chest" with carved tulip decoration. The drawers are of oak, and the top, bottom and back of pine. 1675–1700. 5. "Hadley chest"









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AMERICAN INTERIORS OF THE 18TH CENTURY

1. The stairs at Westover, Virginia 2. Drawing room from the Powel house, Philadelphia 3. Drawing room of Miles Brewton house, Charleston 4. The west parlour of Mount Vernon, Virginia

Swedish at first on the Hudson and the Delaware and German as well as British in Pennsylvania. Even among the leaders few represented courtly fashion. Hence, the earliest household decoration and furnishing, after the period of primitive makeshifts, reflected rather the character of the common houses of the small towns and rural districts abroad. In these the fundamental element deep into the 17th century, in Germany even into the 18th, was a survival of the art of the middle ages, with its structural emphasis, its simple forms derived from materials, tools and use.

Thus in New England in the 17th century we find the clay-filled walls, the timber houses roughly plastered and whitewashed, or perhaps wainscoted with wide moulded boards, which, standing vertically, served as the partitions. The joists of the ceiling were exposed, supported on heavy moulded summer-beams; the great fireplace was likewise spanned with a huge beam, and was devoid at first of any moulded frame. The effect was one of homely solidity, achieved by the frank revelation and elaboration of every element of the construction.

Into such houses in New England and Virginia went furniture of Jacobean oak, a few pieces doubtless brought over by the leaders, but the vast majority made in America after remembered models, from the abundant supply of native woods, chiefly American oak and pine. They included chests, court and press cupboards, trestled tables and forms and, at first, but a few chairs of the turned or wainscot types. One variety of armchair with turned spindles has acquired in America the name of Carver chair from the familiar example belonging to John Carver, still preserved at Plymouth. Other characteristically American types are two forms of chests found in the Connecticut valley: the "Connecticut chest" of the lower valley, with Jacobean spindles and the panels carved with a tulip decoration; the "Hadley chest" further up the valley, of which the frame likewise has incised carving. In the English colonies the furniture, as well as the woodwork, was generally left without paint or other finish. Inventories of the better 17th-century houses reveal that they contained much in the way of hangings, including tapestries and needlework, as well as treasures of plate made by the American silversmiths of the time, and pewter by local pewterers.

Similar in their generally mediaeval character were the interiors of the Pennsylvania-German houses, where, however, there was a rich colour, in the painted decoration of the chests with motives of birds, tulips and other traditional elements, the illuminated texts, birth and marriage certificates which hung upon the walls. It was the German colonists also who first made any high development of pottery, as in the Pennsylvania slip ware, with similar decorations, and in glass-making, as in the wares of Stiegel and Wistar. The familiar hand-woven coverlets, chiefly of blue and white, were likewise derived from patterns brought in by the German weavers.

Following the evolution of style in England, under the Commonwealth and the Restoration, there appeared in America chairs of the Cromwellian and Carolean types, with spiral turnings and baroque scrolls, with seats and backs upholstered in needlework or with panels of cane. The chest with a drawer or drawers then made its appearance. The founding of Philadelphia by William Penn in 1682 brought to America for the first time the decoration of the period of Wren, which had appeared in London after the great fire and had been developed by Wren and Daniel Marot in the reign of William and Mary. Its influence only became wide in the colonies with the opening of the 18th century. The construction disappeared beneath a formal interior finish. Panelling took the place of sheathing, the fireplace was surrounded by classic mouldings, at first boldly projecting, to produce the chimney-piece. The doors and windows, too, were surrounded by classic frames, and the wall might even be divided, in the finest houses, by pilasters. In the staircase the open string, with carved brackets at the end of the steps, was adopted; the balusters and newels, more slender, were richly turned, often in varied spirals.

Walnut became the favourite wood in furniture, until superseded by mahogany in the middle of the century. The style of William and Mary, with its trumpet turnings in legs of chairs, dressing tables and chests of drawers (now elevated on frames to constitute "highboys"), its high curved chair-backs; and that of Queen Anne, with its cabriole legs, succeeded one another some score of years after the advent of these monarchs in England. To this time we may refer the first creation of the American types of Windsor chairs, many of them so different from the English Windsors and owing more to the roundabout chairs. In hickory the Americans found an admirable wood for the bows and spindles. The early Georgian style was adopted in America simultaneously with the use of mahogany, so that mahogany pieces are to be found in the colonies of types which in England were disused before the advent of this wood. Certain types were also created in America, most notably the "block front" secretaries and dressing tables made by John Goddard of Newport about 1763, with alternate projections and recesses crowned by carved shells.

The heyday of the colonial style came in the fifteen years before the Revolution and coincided broadly with the Chippendale influence. Chiefly with the publications of Abraham Swan the forms of the French *rocaille*, with its characteristic pierced shell work, reached America and were used in the adornment of the great mansions of Annapolis and Philadelphia, and such fine houses as that of Jeremiah Lee in Marblehead and Miles Brewton in Charleston, or the Philipse Manor in Yonkers. The delicate carving of the overmantels, with their scroll tops, was matched in the airy relief work of the plaster ceilings. This was the period of the great Philadelphia cabinet and chair makers, such as William Savery, whose earlier work is of a simpler character, Benjamin Randolph, James Gillingham and Jonathan Gostelowe, whose workmanship compares with that of the London craftsmen. The most characteristic pieces, distinctively American, are the highboys and lowboys of mahogany, their tops and skirtings carved with delicate shell ornament. The trade of the upholsterer now also flourished; the craft of the silversmith in the hands of such men as Philip Syng and Revere the elder excelled in adaptations of fine Georgian models.

On the eve of the Revolutionary War the influence of the Adam style began to be seen, as in the garlanded ceilings at Kenmore and those executed for Washington after the outbreak of hostilities. The war postponed any widespread effect until after the resumption of relations in 1783. In the following year John Penn, of London, in building his little box, Solitude, on the banks of the Schuylkill, gave the first complete example, and others were furnished in the great Philadelphia mansion of the Binghams and the country seat of William Hamilton, the Woodlands, nearby. The style was introduced in New England by Charles Bulfinch who found an apt follower in the Salem carver, Samuel McIntire. Mantels and doorways were adorned with delicate composition ornaments, at first imported from London, later made also by American craftsmen like Robert Wellford of Philadelphia. Ingenious adaptations of the Adam motives, made with gouge and auger, were widely employed about 1800. Owing to war but little characteristic Adam furniture was made in America, but the developments of Heppelwhite and Sheraton were early and eagerly adopted. The later Georgian models also gave inspiration to silversmiths like the patriot Paul Revere, in Boston, and Joseph Richardson in Philadelphia. Through the new relations with France not a little fine French furniture of the Louis XVI. style was imported to America, as, for instance, by Washington and by such residents in Paris as Jefferson, when American minister, and James Swan of Boston. Both Sheraton and Directoire models were adapted by the gifted cabinet-maker in New York, Duncan Phyfe, whose lyre tables and sofas are among the most refined of American furniture designs. Of this general character must have been the original furnishings of the White House under Jefferson, destroyed by the British in 1814. In the refurnishing of the White House under Monroe, about 1817, it was furniture of the French empire and Restoration which was imported. The heavy mahogany of this classic style with its gilt mountings filled the high, chaste interiors of the American houses of the Greek revival and persisted until the advent of Victorianism.

See WALL-PAPER; TEXTILES; RUGS; METAL WORK; LAMPS; LIGHTING; TAPESTRY. (F. KL.)

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CHINESE

The Chinese mode of living is quite different from that of the Japanese, though in art and culture the two peoples have many points in common. The difference in the diet and the difference in the style of their dress, manifest themselves in their houses and in their mode of living. Unlike the Japanese, the Chinese house interior is profusely decorated and furnished with chairs, tables, beds, stands, cabinets, screens, etc.

In an ordinary Chinese house the guest room, which opens to the courtyard, has a bare tiled floor, and is furnished with tables and usually 8 chairs. The place of honour in the room is marked by the long table, *kew tai* (bridge table) placed at the middle against the back wall where hangs a painting or a pair of hanging scrolls bearing quotations from the Classics or both. Upon the long table are placed vases of flowers and objects of art. Directly in front of it one invariably finds a square table named, for good luck, *Pa Hsien Tai* (table for the eight Taoist immortals). On either side of it is placed a square stool or an arm chair for the honoured guests. The back wall is often formed of a screen partition, *bing mun,* behind which there generally is another room with a sacred shelf, *sun low,* where deities and the spirit of the ancestors are enshrined high up near the ceiling; and below on the floor a place is provided for the god of the earth, *te chu sun.* In homes of the common people, the sacred shelf constitutes the main feature of decoration in the house, usually occupying the most prominent place above the bridge table in the guest room. In the houses of the upper class, there is more than one guest room or parlour. There is an entrance room, through which the guests pass into the courtyard and into the *cha tai,* a small room where the visitors may change their street attire into a proper dress before appearing in one of the guest halls, *ka dong.*

By removing the *chang chou* (the long windows), the latticed panels between the pillars, the guest hall is thrown open to the courtyard for the entire length. Some homes are provided with another guest hall, *kwa tai* (flower parlour), which may be used for the banquet as well. Whenever possible, the screen partitions (not sliding screens like the Japanese ones) are employed so that two or more rooms may be used as one big room when a large party is entertained. The main wall, as well as the side ones, are generally covered with many paintings or scrolls mounted as the Japanese *kakemono,* which are changed periodically so as to keep them in harmony with the season. In some houses tapestries take their places. The parlour generally has a tiled floor and the bedroom a wooden floor, rugs or carpets being very seldom in evidence even in the wealthy homes, though the country has long been famous for the production of splendid rugs.

The cabinet, tall and dignified, with shelves and chest of drawers inside the swinging doors, occupies an important position in the living rooms of the Chinese house. No less significant is the bedstead, which is often a work of art in its design and embellishment with carvings and paintings. The bedstead usually combines a small compartment to contain a chair and a table. Sometimes the bed is enclosed in a large portable structure with a ceiling, the wooden parts being decorated with beautiful carvings, generally lacquered over. The curtains for the bed, during winter, are of double satin, and in summer either of white taffeta or of very fine gauze, both of which are open enough to permit the air to pass through and close enough to keep out mosquitoes and other insects. The structure is a room in itself, being provided with a door and generally so large that it is fitted with shelves and contains, not only the bed of ample size, but a table. chairs and a cupboard. The usual furniture is in the dark, heavy, precious hardwood. *tzu-tan.* The chairs with seats of the same material, and backs with an inset of *tai-lee-sek,* marble from Yunnang province which has natural pictorial marking like the paintings after the "southern school," have their simple dignity. Little square stands used for serving tea are often topped with *wan-sek,* the ordinary marble.

Both tables and chairs are often inlaid with mother-of-pearl in floral and bird designs, but the best wood is preferred to be admired in its natural state. Some pieces are lacquered in various colours, while others are lacquered and carved or incised, many of them presenting impelling dignity by their shape, size and tasteful decoration; some of the best examples may be seen at the Victoria and Albert museum. With the massive furniture, heavy carved beams on the wooden ceiling, and panels of latticework that shut off the glare of the courtyard, the room is restful. Superb workmanship in decorative art, with inlay of ivory, coloured horns, mother-of-pearl, etc., on a lacquered ground is shown on the tall folding screens used as partitions in the room. A single-panelled screen, *ping-mun,* also called a devil screen, is placed at the entrance to the house to act as a buffer. While it prevents a view of the interior from outside, it serves to deflect, or ward off, according to the Chinese superstition, the evil spirit which is believed to travel through the air in straight lines.

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JAPANESE

The refinement of simplicity, which finds its aesthetic ideal in the natural beauty of materials and is compatible with the austerity of architectural form, is a keynote of a Japanese house-interior.

The Walls.—Rooms of various sizes are made by the use of *fusuma* (sliding partitions of wood), patterned or painted paper or silk-covered screens, running in grooves, which usually measure some 6 ft. in height and 2¼ to 4½ ft. in width. *Shōji,* the equivalent of windows, consist of light lattice-work to which is pasted white translucent paper, and also slide-in grooves. The grooves run between squared wooden posts, and allow both kinds of screens to pass one another, rendering hinged doors unnecessary, and permit of the screens being lifted out altogether, thus throwing a series of rooms into one great apartment. The "filling" (varying in height from 2 to 4½ ft.) between the beam over the screens and the ceiling, is generally, in good class houses, of latticed wood or bamboo or of pierced woodwork called *ramma.* The carving of the *ramma,* often elaborate in palaces and mansions, should be in harmony with the character of the room. Those in certain palaces and temples in Kyoto are exquisitely carved, some having intricate designs in pierced work carved from a single piece of wood, showing flowers and birds on one side and trees and animals on the other, and, in one instance, a flight of wild geese over swaying pampas grass so carved that a painting of the silver moon on the upper wall of the next room may be seen through the openings in the carved *ramma,* beyond the dark silhouette of the carved flying birds.

The Floors.—The floor boards are completely overlaid by *tatami,* straw mats some 2 in. thick and measuring about 3 by 6 ft., each one covered by finely woven grass matting. The size of the room is computed in mats, according to whether it needs 4½, 6, 8, 10, 12 or 12½ mats to cover the floor. In ordinary dwelling houses a room is seldom larger than 15 mats. The spotless matting of closely-woven fresh reeds, bound on the long sides of each mat with a narrow strip of dark linen, together with their pale green colour neutralized by light filtering through the paper screens, and their fresh fragrance, appeal strongly to natives of Japan, and those who can afford it continue to preserve this freshness by reversing and changing the top matting from time to time.

The Ceiling.—The ceiling is equally simple. In an ordinary dwelling house it is about 9 ft. from the floor and formed of thin, slightly overlapping panels of unpainted wood about 12 to 18 in.

wide, whose monotony is broken by parallel strips some 18 in. apart running across the ceiling, and invisibly nailed from above. Since the grain of the wood forms part of the decorative scheme in the interior, the boards are cut from a single tree to insure uniformity. The panels, 6 ft. in length, must be so laid as to suggest continuity of the grain across the room, and must be carefully planed by the carpenter, for they are to be admired in their natural state and no flaw in human handicraft must be allowed to spoil their intrinsic beauty. All the woodwork of the interior must in the same way be left virgin, unspoiled by colour-stain or paint, with occasional exception of the narrow framework of the *fusuma,* and the *tokobuchi*—a piece of wood several inches in width and thickness running along in front of the *tokonoma* (*see* below) to its full extent—both of which may be lacquered in harmony with *tatami* borders or the *tokonoma* post. This is often made from a tree having some special tint or texture, or else made to conform to its natural curve of growth. A portion of its bark or the worm-eaten marks beneath it, or the stump of a branch or some other witness of nature, is preserved, thus focussing on the *tokonoma*—the most important feature of a Japanese interior—the significance of the design of the room.

The Tokonoma.—This slightly raised recess or alcove, usually built into the wall at right angles to the verandah, is commonly from 2 to 3 ft. deep and 4½, 6 or 9 ft. wide proportionately to the size of the room. In it are displayed the only independent decorations in the room. A painting or a set of two or three *kakemono* (scroll-paintings mounted on rollers) occupies the back wall of the alcove, and a vase holding the *ike-bana* or flower arrangement (*q.v.*), an incense burner or a wood-carving, or some other art object, is placed on its floor. They must each be in harmony with the season or with any special occasion which may befall, and are chosen with a view to give pleasure to an expected guest. There may be many *kakemono* put away, especially in old families, but only one is shown in the *tokonoma,* selected to do honour to the guest. If he is likely to enter other rooms having a *tokonoma,* a distinctive atmosphere must be created in each, while emphasizing some central harmonizing idea. The flower arrangement and other decorative art objects must be complementary to the painting. Thus a *kakemono* of the moon may be accompanied by a few sprays of autumn flowers, artistically arranged in a bamboo basket, and a small bronze censor in the shape of a cottage, thus suggesting a fishing hamlet on a tranquil evening of autumn. Or a painting of a waterfall may hang in the *tokonoma,* while on its floor is placed a rectangular bronze vessel well filled with water and with a few water-lilies appropriately arranged in it. In a small room the same atmosphere may be achieved by showing a narrow *kakemono* of a waterfall in a roughly-executed black monochromatic style and placing on the floor a single white blossom of *Hibiscus mutabilis,* half-concealed among its freshly moistened leaves, displayed in a slender bronze vase with very cold water so that the moisture collects outside and trails down over the beautiful patina, creating the suggestion of a miniature pool on the round flat lacquered board of liquid black upon which the vase stands.

Thus the guest is brought to feel the very spray from the waterfall, transforming the confined room into a fitting place in which to entertain visitors on the hottest of summer days. An alternative to the painting is a couple of lines of poetry on which the guest may meditate on his entrance into the room. His attention may next be led to a *bon-seki* (*q.v.*), a tiny landscape contrived with natural stones and sand, on a black lacquered tray at the foot of the *kakemono.* It may call to mind some familiar scene—a rocky promontory with an island near by, and beyond the moonlit sea the dim contours of undulating hills. The poem on the *kakemono* (for calligraphy is also treated as a pictorial art) thus quickens with new meaning for him and he can share the poet's inspiration.

Other Decorations.—In a companion recess adjoining the *tokonoma* are *chigai-dana*—shelves arranged stepwise—for additional art objects and there is usually a small cupboard with appropriately decorated sliding doors either above or below the shelves. There may also be a low writing-place built at the side from which the light comes, in front of the *tokonoma,* where lacquered boxes for paper and other writing paraphernalia can be placed, further decorating the room. What articles, and how and where they are to be arranged in these places to conform to the general scheme and to afford the maximum of decorative value and aesthetic pleasure, has been an aesthetic study for centuries. In the time of the Shōgun Yoshimasa (1436–90) a set of systematic rules of decoration had already been formulated, and is still followed by some of the "tea-men." There may also be placed by the low writing-table in the master's room, a portable lacquered set of shelves or a cabinet carrying a few objects of art for his delectation in moments of leisure.

Thus simplicity of display is fully compatible with wealth of possessions. The same object is rarely seen twice in a dozen visits. Hundreds of beautiful things may be stored in the treasure-house. Guided by his knowledge of the character and temperament of his guest, his recollection of the impression made by the things on view on former occasions, a Japanese host will select from his store, always aiming at giving pleasure and a delightful surprise to his guest.

Sometimes a skirting of strong white or grey paper about a foot high as a protection against the broom is seen on a Japanese wall, but it is never papered or covered up by a number of paintings, although a *gaku,* consisting of a few written characters expressing or suggesting a poetical sentiment or a truth may be framed above the *fusuma.* Plastered earth and sand, variously coloured, and mixed with boiled *funori* (*Gliopeltis furcata*) to give solidity, is used for the interior surfaces of the lath and plaster walls, and the pounded shell of little fresh-water bivalves or iron filings is sometimes mixed with the sand for their decorative value. Plaster in tint of smoke, mist or cloud, often has a hard and resistant surface.

Furniture.—In the Japanese house the furniture is conspicuous by its absence. There is neither table nor chairs such as are used in China or in the West. Everybody removes his or her shoes, sandals or clogs upon entering the house, and even slippers or house sandals are left outside in the wooden corridor. People sit, or rather kneel and sit back on their heels, on the *tatami* on flat square cushions. Each person is provided with a *tabako-bon* (smoking set) in summer and a *hibachi* (charcoal brazier) in winter. In some houses to-day gas or electric stoves are fitted, but the brazier is the characteristic means of warming a Japanese interior. It may be of bronze, porcelain or wood decorated with lacquer, and is furnished with a pair of small tastefully designed and ornamented fire-irons like chopsticks. Braziers are usually small and portable.

Beds may be arranged on the floor in any room at night by piling up wadded quilts, which are folded and packed away in the closet, after airing in the sun, in the morning, leaving the room clear for other uses during the day. A *tansu,* a chest-of-drawers in plain paulownia wood, may betray the sleeping apartment, but this, too, is often placed in the closet, shut off by *fusuma,* so as not to be seen. A clothes-horse is as a rule also placed out of sight behind a screen. *Byobu,* ornamental folding screens of 2, 4 or 6 panels decorated with writing or painting, or carried out in plain gold, serve many a convenient purpose, warding off draughts or hiding an undesired view. A single-panelled screen called *tsuitate* is usually placed in the entrance-room, to allow of the front *shōji* being pushed open without exhibiting the interior of the house to a caller. Even the dining-room is without any sign of its use, a collapsible low table being brought in for family use at mealtime, or food being carried in and served to each individual on small low lacquer tables called *o-zen,* kept in the kitchen cupboard when not in use.

In the summer heat the ordinary *fusuma* and *shōji* are frequently removed and replaced by others specially made of rushes or split bamboo to permit the passage of any breath of wind that may happen to stray into the house. The floor, too, may be covered over with rattan matting, to impart coolness; and *misu* or blinds made of split bamboo or rushes, may be suspended from the eaves to give shade and privacy.

Simplicity the Keynote.—Japanese rooms are thus extremely

simple, though neither barren nor cheerless, since every detail of form and colour is studied and harmoniously combined, even the joinery being so perfect that not a trace of a nail can be seen anywhere, with the result that, at least for beauty, the empty room is sufficient in itself. There is a sense of relief in this absence of furniture. These neat and airy rooms, so restful and so spacious, may be opened at will for their entire width onto a tiny landscape over which the eyes delight to wander. Or they may be closed up completely, leaving the occupant alone with an iron kettle (an object of art in itself) gently boiling on the charcoal fire, overlooked from no window, but companioned by the silhouettes of bamboo or pine branch in the garden forming countless attractive patterns on the creamy paper of the *shōji*. In such a room may be admired an ancient tree of stately form, growing in a pot placed in the *tokonoma*, and still retaining its dignity in its miniature form. Freed from the distraction of furniture, the men and women in the room recapture their dignity and significance. In the simple form in which the exigencies of construction determine the refined and reserved quality of the decoration, and the furnishings are reduced to the essentials, while the subtly blended colouring and the constant variety of the view on which it can be made to open build up a composition of delicate lines and graceful forms, the Japanese interior well fulfils its main and consciously recognized functions: it supplies an appropriate setting for clean and simple living. (*See* JAPANESE ARCHITECTURE; JAPANESE SCULPTURE; WOOD CARVING: *Far Eastern;* BON-SEKI; BON-SAI.)

BIBLIOGRAPHY.—E. S. Morse, *Japanese Homes and Their Surroundings;* R. A. Cram, *Impressions of Japanese Architecture and the Applied Arts.* (J. HAR.)

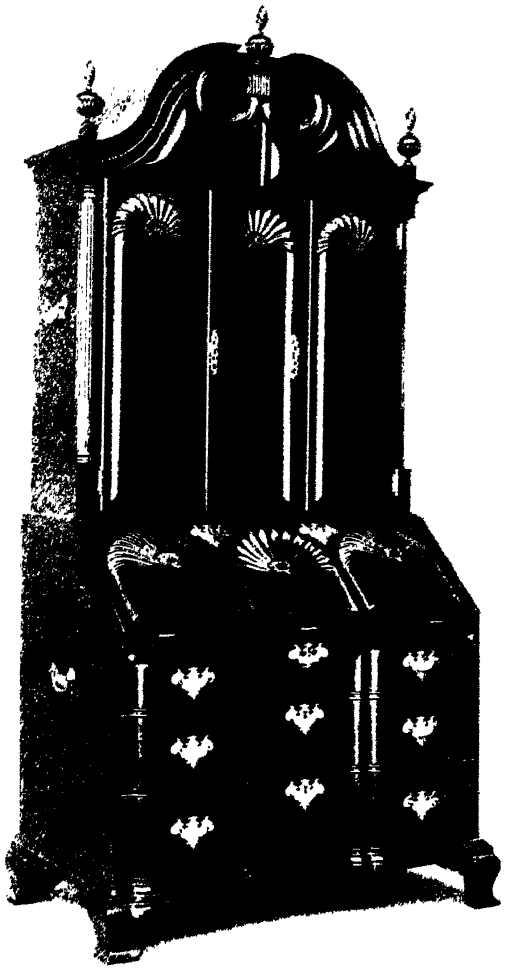
MODERN

Any consideration of the principles of interior decoration as determined by modern needs should contain a comparison between the work of past periods and that of our own. Sound development does not lie in a mere production of novelties; the whole circumstances of the age must lead in a natural line to the new form. We know that the mentality of our ancestors up to the beginning of the 19th century was unblushingly feudal and that comfort itself was sacrificed to the ideal of magnificence. Anybody with any pretensions had to be magnificently dressed, and his personal status was indicated by a suitable uniform, with abundance of gold, long tassels and richly-chased arms. Obviously the rooms in which these men lived had to be equally magnificent. Tradition, assured culture and discipline, combined with great naivety, made this possible. We can still imagine to-day that the craftsman found salvation only in producing work of the best possible quality; but unfortunately we have no conception left of how it was possible to make him so happy that he produced one new form after another, with amazing power, and how he was able, without any serious friction, to carry all his contemporaries with him and, lacking all the enormous modern facilities, yet to spread his ideas throughout the whole civilized world. The age which followed gave the bourgeois its chance, and simplified everything; the form aimed at was more severe, but despite this limitation there was an increase of refinement, and a great and sometimes fantastic, but suggestive multiplicity of design appeared. This phase ended in Europe about the middle of the 19th century, and was succeeded by a dreary, generally mistaken imitation of earlier styles, intolerant of all else, and fatal to all genuine tradition; corrupting work and making it superficial, and leading at the best to falsification. Although the modern man is changing completely in externals, concentrating increasingly on practical matters, and would certainly not dream of appearing in the street dressed up as a knight, in the decoration of his home he thinks it necessary to copy some form of decoration belonging to the past: In this way he loses all feeling for real development and, through his art studies which are generally superficial, loses all touch with living art. Work is mostly performed by machinery. The engineer is preoccupied with his constructive, calculating methods; nothing is sacred to him; he can make anything to order; and the products inflicted on us, the cast-iron stoves, benches and furniture, the first motor-cars, the pots and pans and small artistic products with a superfluity of decoration in every style, the Gothic not excepted, have accustomed the great, ever uncritical majority to buy the most hideous objects with indifference, and to lose all sense of natural beauty and of individual form. This process has been carried so far that business men have made serious good work impossible through their so-called "cheap goods." People with taste draw back from all this and collect antiques and generally end by forgetting that it is their duty as it was formerly the duty of the court, the nobles, the Church, and later, of the educated classes, to foster a high standard of art and craftsmanship. The modern movement has begun by realizing this and by searching for a way out. Ruskin and Morris both sought to awaken humanity to the beauty of good craftsmanship and genuine material, and gradually introduced old techniques and methods of work. As a result of their teaching wonderful works in metal, leather, ceramics and textiles were produced, but were often created in bygone styles, although freely adapted. Ashbie, in 1885, went farther, and produced in the Guild of Handcraft excellent modern silver work—although again in antique form; the development of the art of the Scot Mackintosh into a wholly new, original style is amazing. His rooms in pale grey wood and violet strutts and embroidery adorned with rose-red flowers, his original lighting and glass, his heating apparatus, indeed every detail, were remarkable and full of promise. Innumerable forces bestirred themselves, seeking to evoke, in England first, then in Holland, Germany, Austria, France and the Scandinavian countries, a great, genuine and creative artistic movement, to help the world to reach again a unity of culture. At first there was no radical transformation. The business interests were alarmed, disconcerted, and, without established precedents to guide them, were quite bewildered. The public also was wholly bewildered, in part enthusiastic, in part misunderstanding and prone to severe criticism.

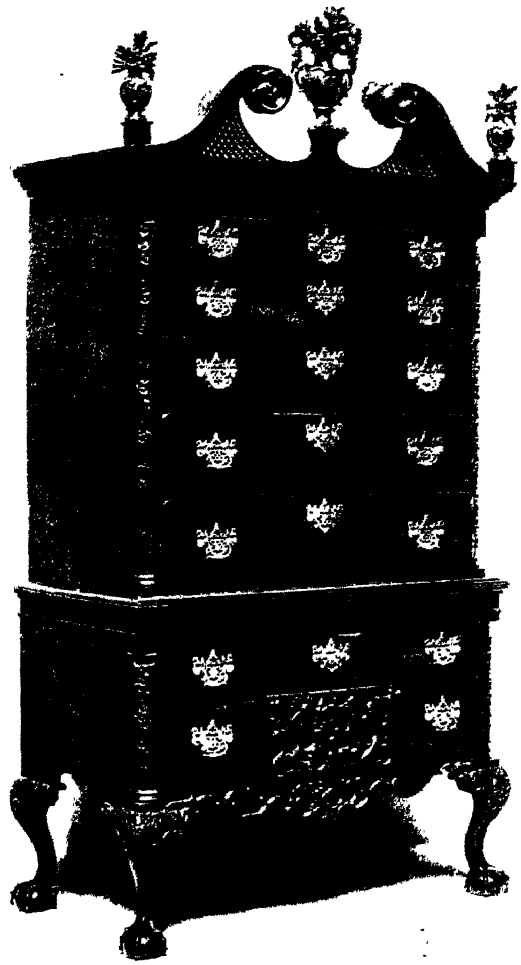
Yet the movement, which ended with the beginning of the war in 1914, succeeded in making itself felt everywhere. To-day we are confronted by a movement which is even stronger and obviously more radical than before, which has learnt in the hard school of war and poverty which followed it many a lesson which the great public needed and was bound to receive.

In modern interior decoration, now that it is recognized that decoration alone, even new forms of decoration, admittedly does not create style, the great need is to have a complete apprehension of the task in all its essentials. We no longer think in terms of pillars, window-frames and decorations of one type or another; we create the room to be the environment of some particular human occupation, adapted for that purpose, simple and concise in form, and constructed in the best and most suitable materials. Manifold needs give birth to equally manifold expressions and we are beginning to construct with comparative certainty, without the risk of committing blunders. A city of to-day looks quite different from the city of a hundred years ago. With the help of new technical contrivances we can achieve quite unprecedented effects, because our first care is to apply all the methods of sanitation, to preserve correct proportions in design and to consider the needs of every class of society. In a modern house bacilli lead a sorry existence; light and air flow through every corner and cranny. Glass, manufactured in every possible way, set in metal, to economize space on the frames, is replacing white walls. We attach the chief importance not to the lighting apparatus but to the light, and similarly we care more for the heat than for the heating apparatus.

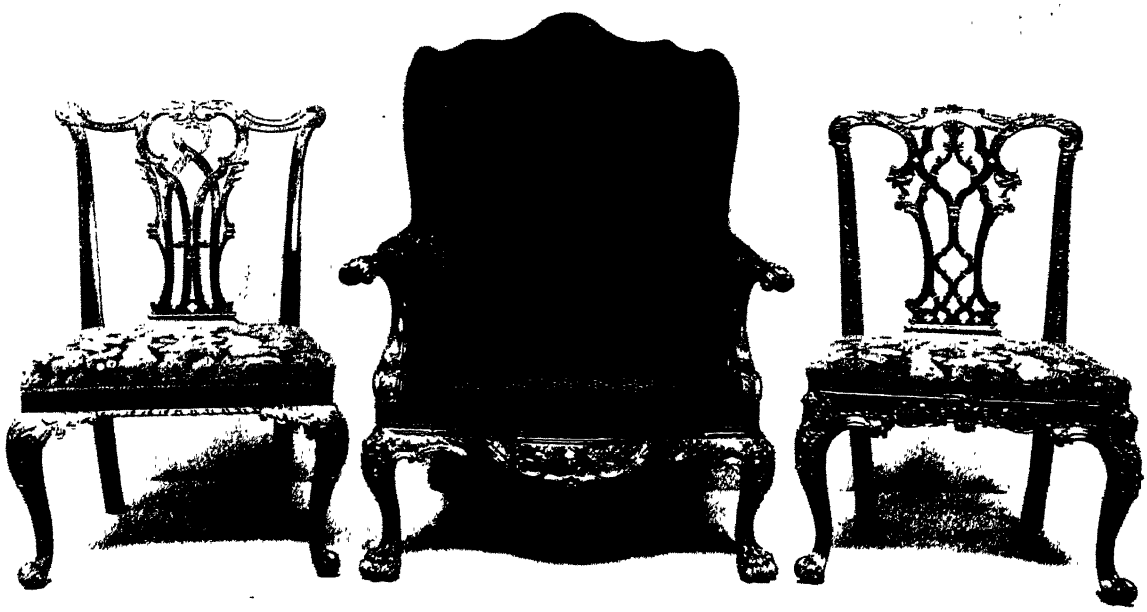
First consider the living rooms. The size and height must partly depend on circumstances; the height must not be less than 7 ft. 6 in. to 8 ft. 6 in. One wall—facing east, south or west should be glass from ceiling to floor; many rooms, such as the breakfast-room, winter garden, living rooms and day nurseries may have two or even three sides of glass. Double glass, reaching to the floor and lined with water-tight material, may provide a space for flowers, plants and perhaps statuary. Besides having a door in the inner glass wall there could be a second door in the outer glass leading on to a balcony or a terrace. There should be no pernickity curtains, blinds, etc., but some suitable means of protection against excessive sun. In first class work the actual wall surfaces are sometimes left without further treatment with fine effect. In rooms already built and wall surfaces already treated, it is



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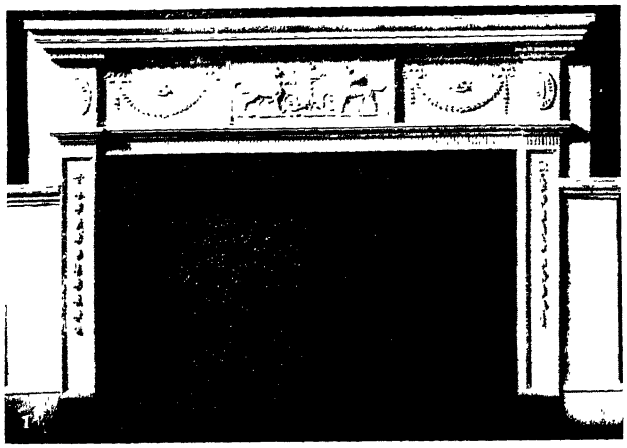
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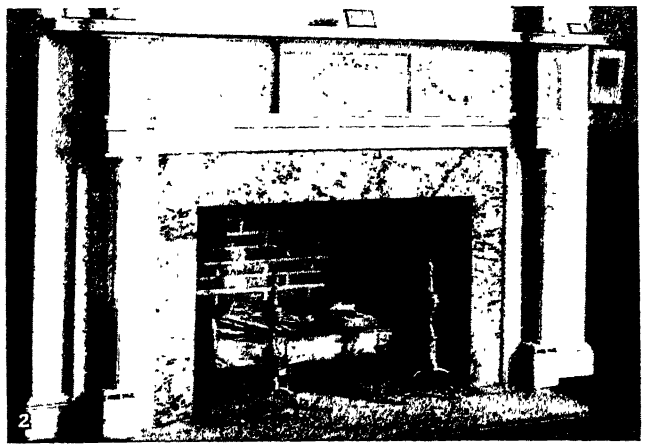
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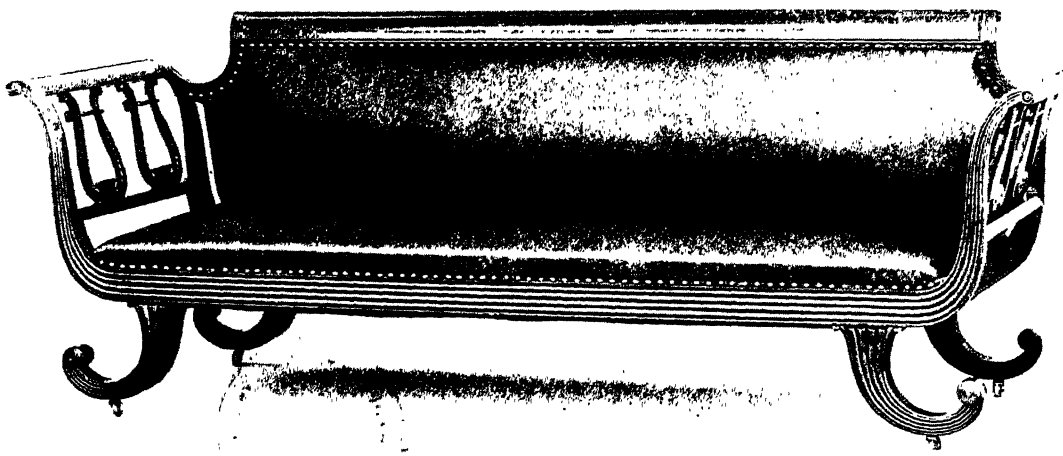
AMERICAN FURNITURE OF THE COLONIAL PERIOD

1. Mahogany block front secretary desk with carved shell ornament and bracket feet, an example of the style developed by John Goddard, Newport. About 1763
2. Carved mahogany highboy with cabriole legs and scrolled pediment, Philadelphia, about 1770
3. Sample chairs in the Chippendale style, made by Benjamin Randolph, Philadelphia, about 1770

INTERIOR DECORATION







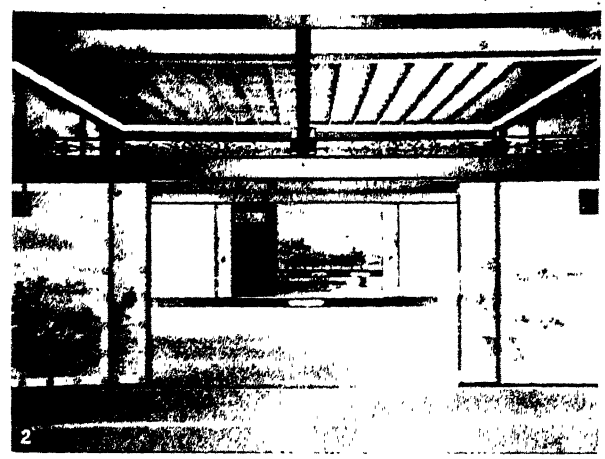


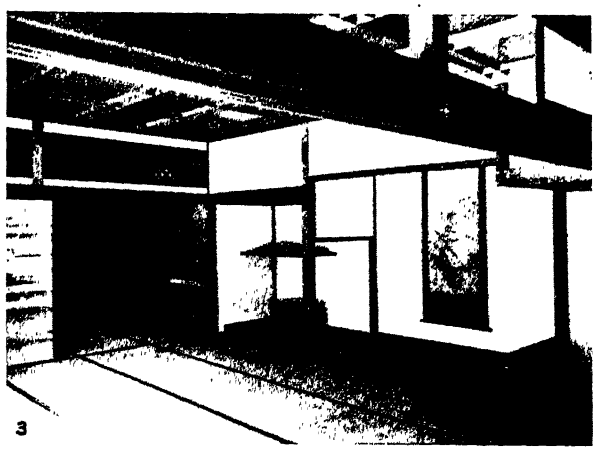
BY COURTESY OF (1) MISS N. D. TUPPER, (2, 3) THE METROPOLITAN MUSEUM OF ART, NEW YORK; PHOTOGRAPH, (4) CHARLES WHITENECK

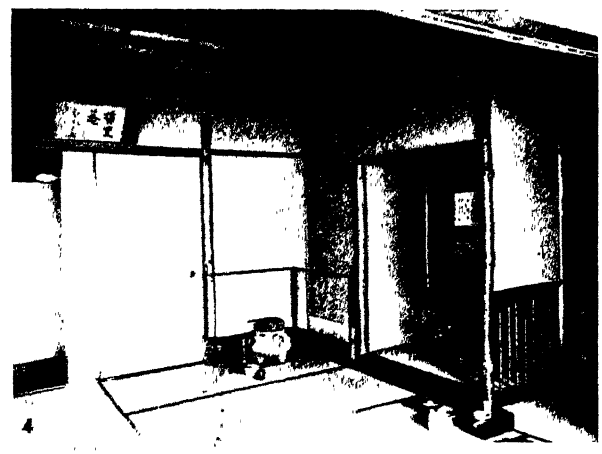
AMERICAN FURNISHINGS EARLY IN THE 19TH CENTURY

1. Mantel from the Gore House, Waltham. About 1799 to 1804
2. Mantel by Robert Wellford, with the Battle of Lake Erie as the decorative motif. Adam style, about 1815
3. Mahogany sofa with lyre ends by Duncan Phyfe. New York, about 1800
4. The oval drawing room at Lemon Hill, Philadelphia, 1798. An interior in the Adam style

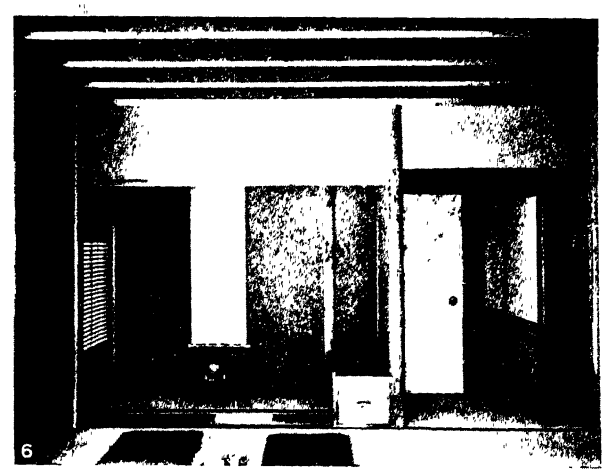

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JAPANESE HOUSE INTERIORS

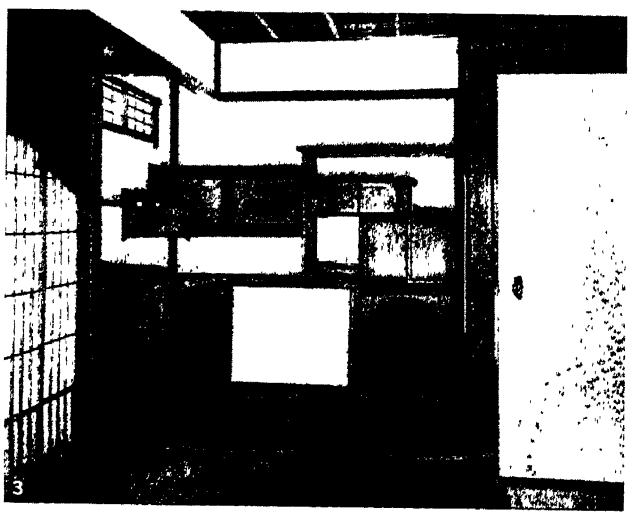
1. The Prince's room in Niunaji, Kyoto, enclosed by painted sliding partitions
2. Shinden of the Temple Niunaji, Kyoto, showing a series of painted partitions slid back
3. Interior in the home of Mr. Tomita at Nagoya, showing the *tokonoma* (slightly raised recess or alcove) and the *ramma* of lattice work between the partitions and the ceiling
4. Tea room in the house of Mr. Miyazaki, Nagoya. The post of the *tokonoma* is in the natural shape of the growing tree
5. Room in the house of Hirai, Kyoto, showing *tokonoma* and modern lighting fixtures (above)
6. *Tokonoma* in the house of Mr. Ichida, Kyoto. The ceiling, of unpainted wood cut from a single tree, crossed by parallel strips about 18 in. apart, is a characteristic feature. On the floor, in the foreground, are two *tatami*, the flat square cushions used in place of chairs

INTERIOR DECORATION





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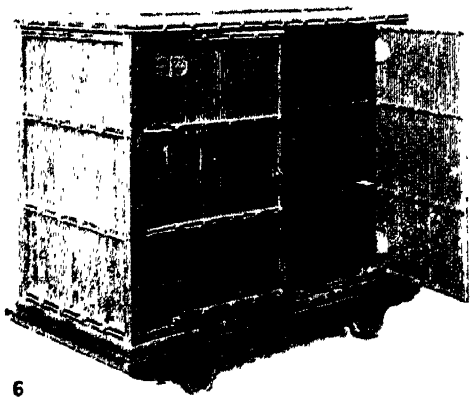
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BY COURTESY OF JIRO HARADA

JAPANESE INTERIORS AND FURNISHINGS

1. Interior of the Keiun-tei in the garden of Mr. Tomita at Nagoya
2. A room in the house of Mr. Nishimura, Kyoto, showing *tokonoma* (raised alcove) and adjoining recess with shelves
3. Shelves and cupboards in a room in the Katsura detached palace
4. Guest rooms in the Temple Hokyoji
5. Pierced screen of paulownia wood, carved by Kobayashi Jodei. In the Imperial Household Museum
6. Small bamboo cabinet of the 8th century. In the Imperial Household Museum
7. *Tokonoma* in the home of Mr. Hatton, Nagoya. The *kakemono* (scroll-painting) of Fujiyama is complemented by a few sprays of red-berried *nandin* in a bronze basin, and by *bon seki* (a miniature landscape made with stones and sand)

necessary to treat the wall aright, making it either washable or porous, according to how the room is to be used. As room space is usually scanty, we cannot have walls which will be too easily damaged or stained during occupancy. The whole wall treatment, up to the ceiling, should be uniform. Above all, there should be no wainscots. Wood panelling is highly effective—choice woods, beautifully grained, the doors not unnecessarily large, and unframed, and simply cut out of the wood. In small rooms the ceiling also may be executed simply in wood, a treatment which gives a good, severe, solid effect. Parquet floors, covered with self-coloured linoleum or with loose carpets are often desirable; carpets are needed where the occupants are likely to spend long hours comfortably seated at ease. The carpets might be self-coloured and of good material; if they have broad or narrow stripes of dark colour marking the border, they look well and will certainly never be thought tasteless. Whatever cupboards are required in such a room should be built into the wall, and writing-tables, etc., should be made to tilt up and disappear into the wall. Collectors will perhaps add glass cases, reaching to the ceiling, to these walls, and may even keep pictures in this way; for to use valuable pictures or statues as wall decorations is dangerous to occupants and the safety of the pictures or objects.

Heating and Lighting.—The approved method of heating to-day is by hot-water pipes, which give a fairly certain and regular warmth. As they require large radiating surfaces, on account of the not excessive warmth they impart, they might also be built into the lower parts of the wall—suitably isolated, of course. Light is best admitted through the window, hence this should be well lit up in the evenings also—perhaps by ceiling lights between the double glazing. This form of illumination will usually suffice, but a number of contact points at carefully chosen places, including some in the floor for standing lamps, etc., of the most varied types, will prove serviceable. The age of pompous lamps and chandeliers, etc., hung from the ceiling, is past; they break up the space and blind the eye. It is important to note that candle-light burns upwards, and does not dazzle if the brilliance is not excessive. It was natural and necessary, in an age of magnificence, to assemble countless candles in a cluster; the flickering light, surrounded with polished crystals of glass, was capable of producing great effects. The form of illumination produced by imitation candles of frosted glass and electric lamps in the shape of flames—a lifeless copy—is one of the most incredible blunders in taste. Gaslight, as an open flame, or better, with mantle, also burns upward. Its characteristic mark is the supply of the fuel by means of pipes. The pipes must therefore be given special prominence. Electric light is used in incandescent wires; its characteristic note is that it hangs downward, and on a cable. This is the proper position of an incandescent lamp, and it is an abuse to place it sticking upward, for the sake of some favourite lamp. The modern age of incandescent lamps offers the most varied and original combinations and will prove particularly serviceable in public localities and large apartments. The candle continues and will continue to be employed as a table illumination at meal-times, on account of its comfortable, and at the same time decorative effect. (*See* LIGHTING PRACTICE.)

Colour Treatment of Walls, etc.—In deciding on the wall treatment of a room the governing factor is always its purpose or use, which should determine its form. In many rooms which are only meant to be occupied for short periods, and are made of masonry, the colour of the paint, in particular, can work wonders. A beautiful bright cinnabar red, pale yellow or green have a cheerful effect. A deep red will certainly have a solemnizing, pale blue and grey a tranquillizing, effect. Very light brown, pink or pale violet are generally suitable for ladies' rooms. Blue is a very good colour for resting rooms and bedrooms. A white wall, as such, in a beautiful, natural material, will always remain in favour, and will invariably prove a good convenient background for furniture and stuffs. In considering any other colour, the chief point is whether a warm tone (yellow, brown, red) or a cold one is required. This is where most mistakes are made; a very strong sense of colour is necessary if the whole effect is not to be spoiled by woods and stuffs which do not harmonize in colour. A new idea, which conforms with our feeling for space, is to put slashes of the colour of wall and ceiling on to the window wall. If we put in any exceptional piece of furniture, part of the wall, against which it stands, can be coloured to suit. It will sometimes be admirable to cover walls and ceiling altogether with stuff, giving an effect of warmth. It is preferable to do this first with stuffs in a single colour.

Disposition of Furniture.—We shall, then, need less and less furniture in our living-rooms, since everything put there merely for show, or, worse still, for symmetry, must vanish. The fireplace, burning wood or coal, should be retained on account of the ventilation which it affords, of the beauty of the open flames, and of its warmth in autumn and spring. The inmates of the house will love to gather round it of an evening, or in chilly weather, and this is the chief place in which seating accommodation, of varying size and shapes, is to be placed. A low occasional table, always placed beside a chair, never in front of it, and electric lamp, and perhaps a small moveable stand for books, newspapers, and possibly light refreshments, will meet all needs. As most, if possible, all articles of furniture should be fitted into the walls, we hardly need any more furniture in the living-rooms beyond chairs and tables, except perhaps a flower-pot for a beautiful, large indoor plant. The latter should preferably be a lime or an oak, rather than a palm or anything else alien to native flora. Cut flowers in a beautiful glass or a good piece of pottery, set in the right place, give great pleasure. The first law of the decorative artist is to make life cheerful and full of joy by the simplest possible means. The time is gone when human beings were supposed to find pleasure in dark, cellar-like rooms with heavy carpets and festal plush curtains, innumerable ugly knick-knacks such as balustrades, candelabra without lights, flowers with artificial dust to imitate the genuine, wardrobes and chests of drawers.

Bedrooms and Bathrooms.—The bedroom must be light, again with one wall all windows, the beds on simple steads of wood or metal, not unnecessarily large. The light must be behind the head, so that one can read easily, lying on either side. A roomy easy chair with a small table beside it, a footstool, small, light tables on either side of the bed on which to place books, medicines or a glass of water, will be sufficient furniture, if we have made arrangements for everything else in the bathroom and dressing-room.

The bathroom has become increasingly important. It is impossible to do without it, and for various reasons it is desirable to allow it ample space. It is used, not only for washing and bathing, but for gymnastics and massage and all sorts of exercises. It must allow of quick and thorough cleansing; both walls, floor and ceiling should therefore be tiled. Furniture, if any, should be of enamelled metal glazes, as in the operation room of a hospital. The walls and ceiling may, of course, also consist of enamelled metal glazes, and the colour, besides white, a very pale grey, or, for a lady, even a pale pink shade. The dressing-room may have cupboards for all purposes around three walls, with one wall wholly mirror, in front of which should be a small table for toilet articles and the like and a low, wide chair, painted in dull oil or varnished. The lighting should be built into the mirror wall on either side, the floor covered with heavy mats or carpets, as it will often be trodden by bare feet. It should be possible to see that the floor of the bathroom is warm, not ice-cold, without employing bath-mats. In small houses, however poor, at least a sheltered table-nook must be arranged.

Attics, Kitchen and Pantry.—The attics, kitchen and pantry, the latter next to the dining-room, should also be clean, easy to wash, and in every way practical in their arrangements. No machines or implements whose shapes are in any way decorative or ornate should be used. The stands for kitchen utensils should be open, the lighting from the ceiling, which, like the walls, should be covered with simple white, undecorated tiles. The floor should be paved with plain slabs, preferably in pale grey or black. Pans, jam pots, etc., are better put away in a separate niche than in a refrigerator.

Assistants must be trained to look on themselves not as servants but as colleagues. They must be lodged in a nice, cheerful room

in Paris, is an example of this type of work. Similarly, ceramics has developed greatly, and plays an important part in fireplaces, wall-decoration and above all in frescoes. The free painting of walls, particularly in restaurants, cafés and similar localities is also much in use, but fresco-painting is also often successfully employed. (*See* also RUGS AND CARPETS; WALL-PAPER; LIGHTING IN PRACTICE.) (J. Ho.)

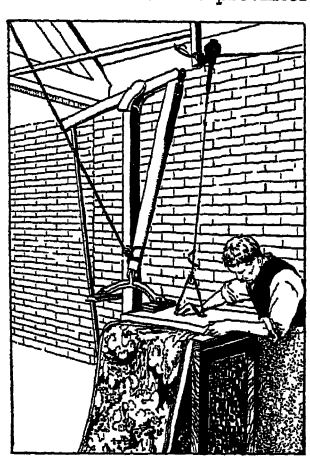
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WALL-PAPER

Paper wall-hangings were first invented as inexpensive substitutes for the costly and sumptuous hangings of brocade, brocatelle, tapestry, stamped leather and Genoese velvet, used in the palaces and the great houses of Europe in the 16th and 17th centuries.

The earliest beginnings of this art are still in some obscurity. It is evident, however, that printed wall-papers were not made until after the discovery that type could be cut on wood-blocks and printed. Apparently some of the earliest paper wall-coverings were produced by the letter-press printers themselves. This fact is substantiated by a discovery made in 1911, during restorations to the entrance hall of Christ's college, Cambridge. On the original beams of the ceiling, in the entrance hall and dining room, was found the oldest block-printed wall-paper known to be in existence. The design is in black and white, done on the reverse of the proclamation of the accession of Henry VIII. Scarcity of good stock evidently led to this economic use of both sides of the paper. The pattern is that of a contemporary velvet or brocade. It is signed with "a great H and a goose," the mark or rebus of the master-printer, Hugo Goes, who was living and working in Steengate, York, in 1509.

Domino Papers.—But the real development of the wall-paper idea is due to the *dominotiers* of France, a group of men working in the 16th century in Rouen and other cities of the provinces to make domino papers and marbled papers, which were eagerly bought by the peasants as a decoration for their fireplaces. Undoubtedly this inspiration came from the decorative Italian papers used to line boxes and books. The Frenchmen, however, were the first to put such papers to general use as wall-hangings.



BY COURTESY OF JOHN LINE & SONS
AN EXPERT AT WORK ON THE PRODUCTION OF A HAND-MADE DESIGN

Domino papers were printed with little geometrical figures, designs in compartments, or grotesques. Marbled papers required no printing, but were made by floating off the colours from the surface of water, after "combing" them into various marble designs. Both domino papers and marbled papers were also used in France for end-covers of books, and for covering or lining boxes. Special marbled papers in black and white were made for funeral prayer-books and other mortuary requirements.

By permission of the king, the *dominotiers* merged with certain wood-engravers in 1586, and formed a corporation or guild of *"dominotiers, tapissiers et imagiers."*

Small sheets of paper like those used for the *Images d'Épinal* (*c.* 12×16 in.) were employed for these paper-hangings, which were sold by the quire or by the ream. The outline of the design, engraved on wood-blocks, was printed by means of a simple press. The design was then coloured by hand, by means of stencils, using distemper colours mixed with glue. The French name of *papier peint* for wall-paper is a descriptive relic of this early process. No attempt was made in these earliest wall-papers to arrange designs in such a fashion that they would match when the small sheets were put together on the wall. It was not until the master *dominotier*, Jean Papillon (1661–1723), invented continuous matching designs about 1688, that people were relieved of the casual effects created up to that time whenever wall-paper was used.

Jacques Chauvau, who was a pupil of Papillon, improved on his master's ideas by printing all the colours from successively applied wood-blocks instead of stencilling them by hand. He had great success from his initiative; his method was quickly taken up by Boulard in Paris; and papers of the same sort were soon printed in Chartres and in Orléans. During Papillon's time the popularity of wall-paper increased. Savage opened a factory in Reims; Le Tourmy and Rabier-Boulard had wall-paper factories in Orleans; Isnard of Strasbourg, Descouteaux of Chaumont, Vautrain of Nancy, and Roche of Lyons became well-known for their work in engraving and printing paper-hangings. The new technique of printing in colour was not universally substituted for the old. Until the end of the 18th century, there were still small ateliers that remained faithful to "illuminated" papers. Nevertheless the process was widely used.

Both paper-printers and paper-hangers had been greatly handicapped up to this time by the fact that they were obliged to work with small-sized sheets of paper. In 1760 Fournier, a merchant on the rue Carré St. Martin, Paris, made the first attempt to produce paper in long strips by pasting the small sheets together before printing, thus forming a roll. An edict of Louis XVI. in 1778 decreed that each such "roll" should contain 24 sheets of paper, pasted end to end, making the length about 34 feet. The name and address of the maker was obligatory on the two end sheets. This was the standard size for a roll of wall-paper until the metric system was adopted.

Flock Papers.—The discovery was made in 1620 that chopped wool could be used to produce wall-paper which resembled velvet and tapestry so closely as to deceive both the eye and the fingers. This new invention, especially suited to contemporary fashions in house-decoration, was launched by Le François of Rouen. His process was very simple. Instead of the ink or distemper colours used by the *dominotiers* for printing their wood-blocks, he employed a mordant or greasy varnish. Before it dried he shook or blew over it, by means of small bellows, very finely chopped wool in different colours. This substance adhered to the varnish and covered the design. The superfluous wool was then shaken off, and a perfect imitation of brocaded velvet was obtained.

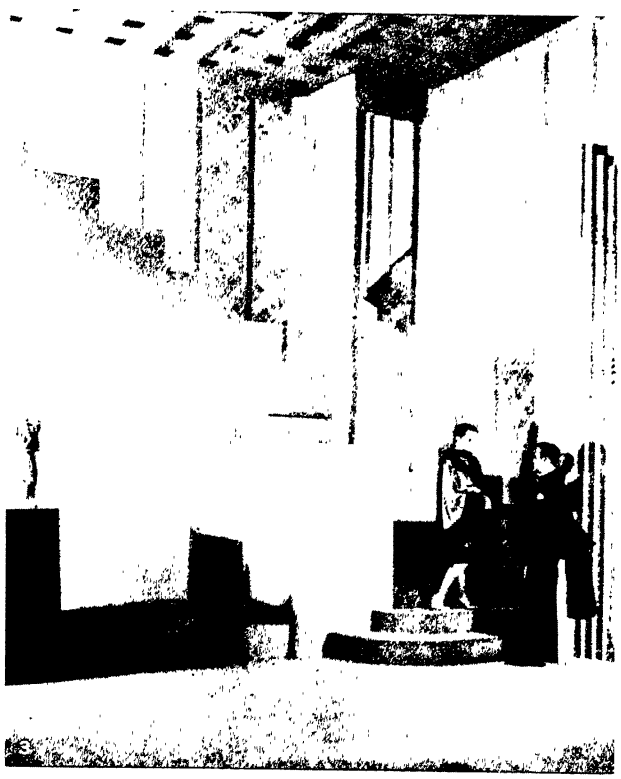
The cost of flock papers was small, in comparison with the sumptuous stuffs imitated, and their effect was so impressive that they attracted great attention and made the name of Le François famous in all the countries of Europe. Jerome Lanyer, of England, was inspired to attempt the same process under a grant made by Charles I. in 1634, giving him the exclusive right to manufacture flock hangings which he called "Londriniana." For this privilege he paid the sum of £10 a year to the crown. Lanyer's flocks were made, however, on "linnen, cloath, silke, cotton, leather and other substances," probably because there was not at the time any English-made paper strong enough to use for the purpose.

Fifty years later Dunbar of Aldermanbury was advertising an amazingly large assortment of flock papers, "some after the manner of real tapestry, others in imitation of Irish stitch, flowered damasks, sprigs and branches; others yard wide in imitation of marble and other coloured wainscots, others in yard wide embossed work, and a curious sort of flock work in imitation of Cassaws and other hangings of curious figures and colours."

In France the first generation of flock papers died out before they were in general use, to be succeeded by the illuminated papers of the school of Papillon. In England, on the contrary, flock papers took root and flourished. The process was perfected







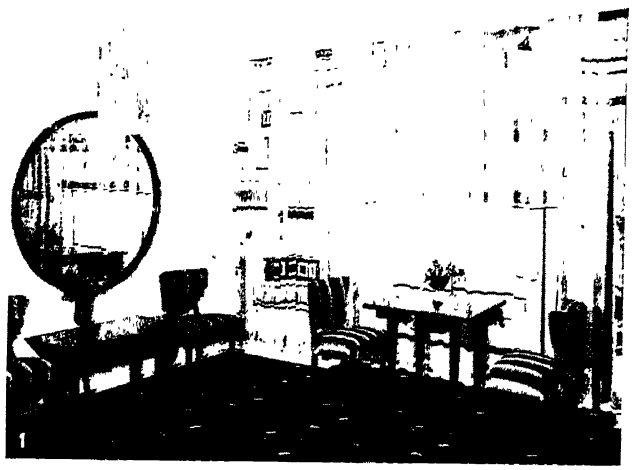


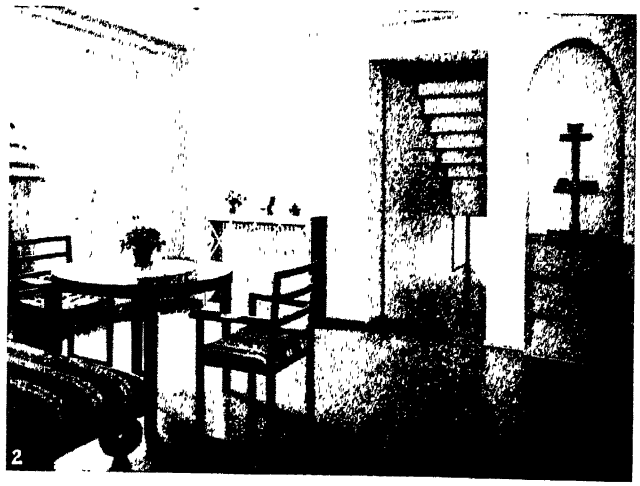
BY COURTESY OF (3) LORD AND TAYLOR, (4) KAUFMANN'S DEPARTMENT STORE; PHOTOGRAPH, (2) BONNEY

MODERN HOME AND EXHIBITION INTERIORS

1. Withdrawing room by Josef Hoffmann shown at the Art Exhibition, Vienna, 1927
2. Interior in the Paris home of Robert Mallet-Stevens, modernist architect. The walls are white stucco and the floor is tiled in a geometric pattern in black, brown and grey. Aluminium is used in finishing the bases of the easy chairs, and in the end tables, radiator covers and staircase railing. The balcony on the right forms the upper landing of the staircase. The furniture is upholstered in Hélène Henry fabric
3. Exhibition room for Decorative Accessories at the Exposition of Modern French Decorative Art, February 1928. Designed by Eli Jacques Kahn
4. Modernist interior arranged by Eugene Schoen. The living room is decorated in mauve and silver and the bedroom, seen through the arch, in tan and rose. Illumination is by means of table lamps and wall and ceiling light both direct and concealed

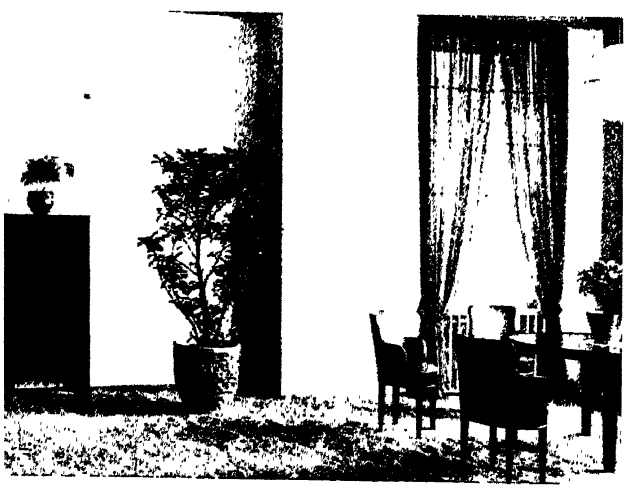
INTERIOR DECORATION

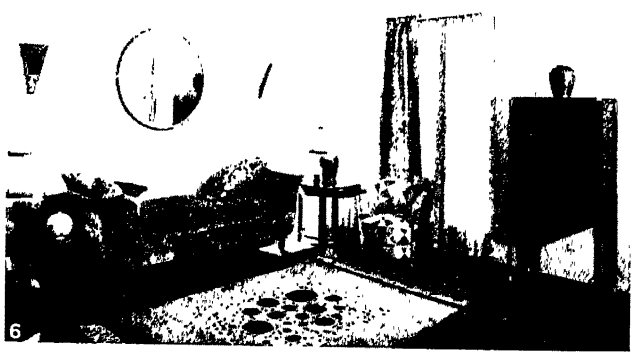












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MODERN INTERIORS OF EUROPE AND AMERICA

1. Bedroom in the house of E. Bauer, Vienna. Designed by Josef Hoffmann. Wall paintings by Frau Likasz Strauss
2. Breakfast room in the country house of B. E. Ast, Velden-on-Worthersen. Designed by Josef Hoffmann
3. Interior showing arrangement of tables, bookcase, sideboards, etc.
4. A French interior designed by Jacques Ruhlmann at the time of the International Exposition of Decorative Arts, Paris, 1925. The furniture is of ebony and other precious woods, inlaid with ivory and silver-bronze. The chairs are upholstered with Beauvais tapestry. Above the mantel is a decorative panel by Jean Dupas
5. Room in white stucco with sand colour curtains and a velvet carpet in grey and black. The block oak furniture is upholstered in tomato red leather. The ceiling moulding is of gold, yellow and red. Designed by Josef Hoffmann
6. Living room. The sofa is by Jacques Ruhlmann, the commode and chair covered in a Rodier fabric are by Lelan

and improved in this country, and in 1750 England suddenly began to ship flock papers back to France. The greatest success was the brocaded paper done on blue or gold grounds, which quickly became the rage in Paris. Madame de Pompadour commanded it to be hung in her dressing room at Versailles and in her bathroom at the Château des Champs. Ladies of the court sent their Gobelin tapestries to storage, in order to put "English blue paper" in their place. The charming designs of Papillon were forgotten or depreciated in devotion to this new fashion.

An English paper-stainer named Lancake went so far as to get permission to establish a factory at Carrières, near Paris, for the production of flock papers, and French manufacturers were driven to defend themselves against the English invasion. They knew the secret process and had no difficulty in adapting themselves to the taste of the day. To prove their superiority they used chopped silk instead of chopped wool, imitating the finest silks that came from the looms of Lyons.

It is interesting to observe how these papers were applied to the wall. Early papers in England were nailed on with flat-headed nails. Later papers, both in France and England, were applied with paste—but flock papers were treated with as much courtesy as if they had been the actual stuffs of which they were imitations. They were mounted on a chassis, or stretcher, which was first nailed to the wall and covered with stout linen, tightly stretched. Over this brown paper was pasted as a lining paper; the flock paper was applied when this was dry.

Paper Imitating Painted Panels.—The second half of the 18th century was marked by a new development in paper hangings, due largely to the genius of Reveillon, a Paris manufacturer, who took his inspiration from painted room-decorations executed by the artists of the day. Reveillon determined to make paper panels of such a character that they might be used in wood-panelled rooms in place of decorations painted on canvas or on wood, and to employ the best artists as his designers. The panels created for him by Huet, Cietti, J. B. Fay, Prieur and Lavallée-Poussin, executed with Reveillon's amazing knowledge of technique, are undoubtedly the most beautiful wall-papers that have ever been made. (Several panels by Prieur will be found in the Musée des Arts Décoratifs in Paris.)

In Reveillon's opinion, no paper stock existed that was fine enough to be worthy of these designs. He reports in his Mémoires that he saw a piece of vellum paper brought to France by Benjamin Franklin—paper that was used in England by Baskerville in printing fine books—and that he greatly desired to reproduce it. In 1770 he purchased a paper-mill at Courtalin-en-Brie, and began there the fabrication of the paper for which in 1786 he was awarded the Prize for the Encouragement of Useful Arts.

His wall-paper factory in Paris employed about 300 workmen. It received from Louis XVI. in 1784 the title of "royal manufactory," which gave Reveillon among other privileges the right to add to his sign the crown and the three fleurs-de-lys. The establishment met disaster in the riot of April 28, 1789, at the beginning of the French Revolution. Incited by jealous competitors, and roused by the rumour that their wages were to be cut, his band of employees pillaged the factory, leaving destruction and ruin in their wake. Unable to find and murder Reveillon himself, they burned him in effigy. The guards, ordered out to quell the disturbance, fired on the mob. Many persons were killed and several were sent to prison.

Reveillon fled to refuge, and from his retreat sent a despairing letter to Necker; in reply he was offered by the king a sum of 30,000 francs to offset his loss and was assured of protection and continuance of royal favour if he would resume his work. Discouraged and broken in health and spirit, however, he emigrated to England where he died a few years later, leaving his factory in the hands of Jacquemart and Bénard, who proved to be worthy successors. Although chiefly noted for panel-decorations designed by eminent artists, Reveillon also made all the various sorts of papers that expressed the taste of his day; to these he gave a distinction of design and colouring that endowed them with a special sense of refinement and grace.

Similar developments in the printing of paper panels occurred in England around 1754 under the direction of John Baptist Jackson, who is the most interesting and prominent character in the history of English wall-paper. Jackson published a book on the "Invention of Engraving and Printing in Chiaro obscuro . . . and the application of it to the Making of Paper Hangings of Taste, Duration and Elegance." The book is written largely about himself, styled "Author of that Paper Manufactory now carrying on at Battersea." It was here that Jackson produced the famous series of Venetian prints ordered by Horace Walpole for Strawberry Hill, and also the large landscape-panels and medallions which are a curious mixture of Pillement and Piranesi.

Jackson's papers were printed in oil on a rolling press of his own invention. He guaranteed that "the colour will never fly off—no water or damp can have the least effect on it." Engravings made by him in Rome and in Venice, copies of Canaletto, Rembrandt, Titian and other old masters, were used as subjects of these panels. He also reproduced statues like the Belvedere Apollo, the Dying Gladiator, and the Venus de' Medici, so that "the person who cannot purchase the statues themselves may have these prints in their places." The latter part of the 18th century in England was also notable for the work of Francis Frederick and George Eckhardt, who established a factory in Chelsea in 1786 and executed some remarkable papers with needlework designs, and others with printing in silver-leaf.

In 1712, under Queen Anne, a tax of one penny a square yard was assessed on English paper-hangings. In 1714 this tax was increased one-half. No change in duty was made thereafter for nearly a century. Wall-paper was exempted from duty in 1825, the same year in which prohibition of importation of this manufactured article was removed.

Paper in continuous rolls was invented by Nicholas Louis Robert, of Essônes in 1799, and the English patents, "to make paper without seam or join," were obtained in London in 1801 by John Gamble and Didot St. Leger. The use of paper of continuous lengths was not, however, permitted in England before 1830, because of the important revenue derived from the tax stamps on the small sheets. France, meanwhile, made use of the new invention after 1810.

Scenic Papers.—The attempts made by Reveillon and Jackson to produce paper which represented paintings in panels had a natural development in wall-paper history. They were followed by the epoch of scenic papers—panoramas that covered the entire room with a landscape or a story without repetition.

Late in the 18th century, after the papers of the Revolution with their liberty caps and tricolor cockades and fasces, their pyramids and palms, had come and gone, the makers of wall-paper took up this new idea and carried it out with infinite detail. Robert, whose partner, Arthur, died on the guillotine, produced a Directoire paper with designs of Bosio. Jacquemart and Bénard printed the "Hunt" at Compiègne, of which there is a set in the Metropolitan Museum of Art in New York and also in the Victoria and Albert Museum, London. But the two specially prominent names in the realm of scenic papers are those of Zuber and Dufour.

Zuber's factory, founded in 1790 and still in operation, is at Rixheim in Alsace. In 1804 this paper factory issued the "Vues de Suisse," which, although crude in colour and style, roused great interest because of their decorative possibilities. In 1825 appeared "Paysage des Lointains," and in 1830, "Paysage de Brezil," designed by Rugendas. In 1831 Zuber printed the Paysage à Chasse. "Scenic America" was first edited in 1834, designed by Zipelius and Ehrmann. With its colourful views of West Point, Niagara Falls, New York Bay, Boston Harbour, the Natural Bridge in Virginia, and the Dance of the Winnebago Indians, it has proved to be one of the most popular of all the scenic papers, and new editions are still being issued each year.

In 1838 came the "Courses des Chevaux" in grisaille, with chariot racing in Rome, obstacle racing in France and flat racing at Newmarket. In the same year, Zuber issued "The War of Independence," which was printed with the background of Scenic America, but with Continental soldiers, Washington's triumphal entry into Boston, and the surrender of Cornwallis at Yorktown in

place of the figures in the foreground. This paper, of which no editions were printed for more than 60 years, has recently been re-edited. "Isola Belle" was brought out by Zuber in 1843, and "Eldorado" appeared in 1848. Zuber was the only manufacturer in the provinces who rivalled the scenic papers produced by the Parisian makers, and is the only one, except Desfossé, whose papers are still published today, using the old blocks. The Zuber factory printed the first continuous rolls in colour in 1829, and obtained from Manchester in 1850 the first cylinder colour-press to come into France.

At the head of the distinguished Parisian group making fine scenic papers in the early 19th century, stood Joseph Dufour, who made his reputation with the Captain Cook wall-paper printed in Mâcon in 1804–1805 (anno XIII.). This picture-paper represented a number of scenes from Captain Cook's voyages in the islands of the Pacific ocean; it is very rich in colouring, and tapestry-like.

It was the usual custom to publish a descriptive booklet with each scenic paper, giving careful instructions for matching and putting the strips together, whenever a new design appeared. Many of these papers were sent to America, wrapped in tin-foil tubes to protect them against dampness. They were put on the walls with the aid of a numbered chart, after the fashion of children's picture-puzzles. Their success in France and America was not repeated in England, where they were little known.

In 1808, Dufour presented to his public twelve panels representing the Twelve Months of the Year, designed by Fragonard fils; and in 1814, a classic paper in grisaille, with all the gods and goddesses, known as the "Galerie Mythologique." But his masterpiece was the "Cupid and Psyche" paper, which appeared in 1816. The designs for this paper were made by Louis Lafitte, who exhibited them in the Salon in 1817. Two of Dufour's papers, especially popular in America, were "The Bay of Naples" and "The Monuments of Paris" (1815). They may still be found in many old New England houses. Other notable scenic papers from Dufour's ateliers were "Paul and Virginia" (1820, designed by Brock); "Olympic Fêtes" (1824, designed by Mader père); "The Voyages of Antenor"; "The French in Egypt" (1814); "Telemachus in the Island of Calypso" (1825); "The Banks of the Bosphorus" (1816); "Views of Hindustan," and "Views of Turkey." Other famous makers of scenic papers were Jourdan-Villars, who issued the "Battle of Austerlitz" in 1806; Delicourt, producer of "The Great Hunt" in 1851; and Cler and Margéridon, who edited the "Fêtes Louis XIII."

The operations of making scenic papers were common to all fabricants. Small sheets were first glued together to form a "roll," the paper was then sized, and spread out to its full length on long tables, where it received the background colour, put on by a workman with a brush in each hand. After the rolls had been hung up to dry, they were polished on the back. They were then ready for the printer and his wood-blocks. Tempera colours, mixed with hot glue, were used for printing, and a different block was used for each colour, which necessitated as many blocks as there were colours or shades in the design. One colour was printed at a time throughout each roll, and left to dry before proceeding with another. The printing of such papers in this fashion to-day is not a commercial possibility, because of lack of workmen sufficiently skilled in the art, the high cost of labour, and the length of time required to complete a set.

Scenic papers of a date later than the discovery of continuous paper were still printed on small sheets, the economical manufacturers having a supply of the old paper in stock, and finding that it was of better quality than machine-made paper. It may be noted that the 19th century scenic papers still in existence owe their long life to the durability of the material of which they were made. Panoramic decorations of wall-paper commenced to fall into disfavor about the middle of the century. The advent of the printing machine in 1849 discouraged any further attempts of this magnitude, and, since then, the old order of hand-printers has almost passed away.

Early American Wall-papers.—The first wall-papers used in America were naturally imported from England or from France. They were sold by book-sellers and stationers in quires and reams, as they were sold abroad. For the convenience of housewives, they were also peddled about from door to door. "Painted paper" is found in the inventory of Michael Perry in Boston in 1700; Daniel Henchman of the same city records the sales of quires of painted paper between 1712 and 1714. "Stampt paper in rolls for to paper rooms" is first advertised by John Phillips in the *New England Journal* in 1730.

Plunket Fleeson of Philadelphia founded the first American manufactory in 1739, and sold his papers in the shop with his other wares, which included "bedticks, live geese feathers, blankets and sacking bottoms." In 1769 he advertised "American paper-hangings, made in Philadelphia, of all kinds and colors, not inferior to those generally imported, and as low in price." He suggested also that "every one among us who wishes prosperity to America will give preference to our own manufacture, especially on the above proposition, if equally good and cheap."

Wall-paper was not yet important enough to induce merchants to devote their whole time to it; so it was often sold by the upholsterers and undertakers, as well as by the ironmongers and those who furnished army equipment. James White, arriving from London in 1754, announced "paper-hangings, put up so as not to be affected by the hottest weather, also funerals furnished and shrouds, either pinked in London or plain and pleated, and sheets."

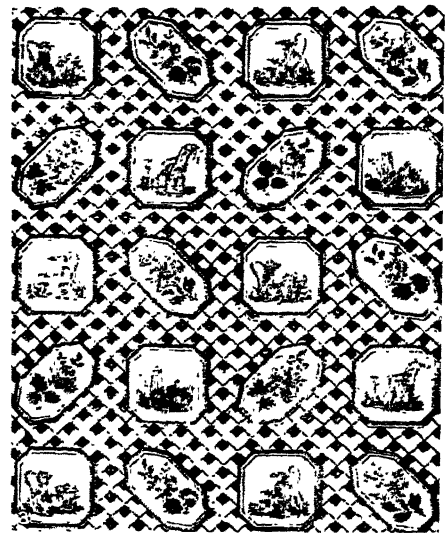
Between the years of 1740 and the outbreak of the Revolution, there were constant importations of paper-hangings, arriving from London and Paris by every ship. It is to be supposed that American manufacturers kept pace as best they could with foreign fashions. In Philadelphia, Ryves and Fletcher, Joseph Dickinson, Burrill and Edward Carnes, and William Poyntell were importers and manufacturers. In Boston, Jerathmeel Pierce, John Welsh, Jr., Moses Grant, Joseph Hovey, and Prentiss and May made paper-hangings "equal to any on the continent." In New York State were John Rugar and John Howell and Son. In Springfield, New Jersey, was the important firm of Mackay and Dixey. An event in the history of American wall-paper was the printing of the "Washington Memorial" paper in 1800 by Ebenezer Clough of Boston.

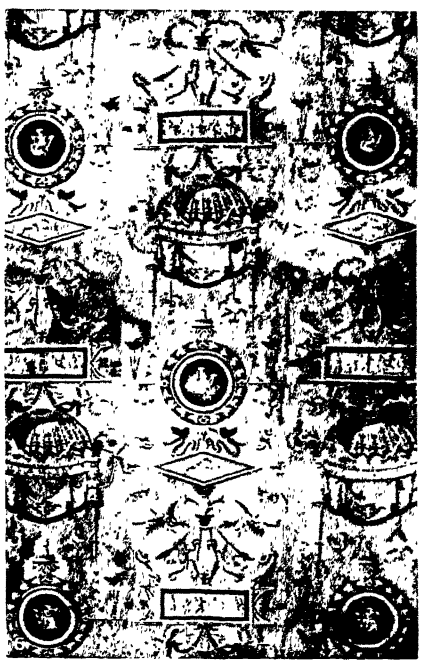
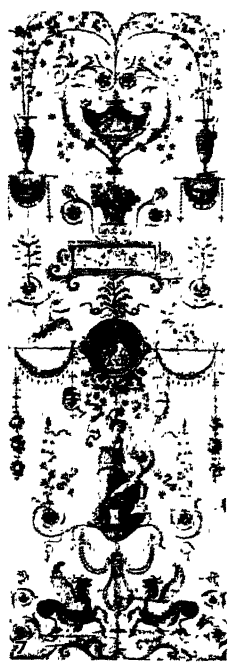
Brissot de Warville reported to France in 1795 that paper-hangings were "universal in the United States. No other decoration is known there; almost all houses are neat and decent." The rage for scenic papers possessed New England by 1817. Many of them were brought across the ocean as wedding gifts, or birthday or anniversary presents, in special charge of the sea-captains. Wall-paper establishments soon followed the new fashion, and imported many sets of these "varieties of views." In 1844 John Howell brought from England the first colour-printing machine, and wall-paper entered on a great era of development which continued until the close of the Victorian age.

Chinese Wall-papers.—With the founding of the Dutch East India Company in 1597, the English East India Company in 1600, and the French Company in 1660, Europe was inundated with a flood of Oriental stuffs, and *objets d'art*. In the ships with these goods came wall-papers that were different from anything the Occident had yet seen. They were painted by hand with birds and flowers, forming delightful backgrounds for the lacquer and Oriental porcelains that were fashionable. The first of these papers to arrive in the western world were presented by the great Hongs, or merchants, to their important customers to take home as gifts after the consummation of some important sale.

Such gifts were the objects of great admiration and curiosity, and many friends desired similar sets. Orders for them went back on the next ship and soon a regular commerce in Chinese papers was established. Shipments were made with the tea-boxes; Mincing lane in London became the centre for their distribution. To avoid the long delay caused by ordering paper specially painted in China, attempts were made to imitate them, both in France and in England, thus creating what are known as Anglo-Chinese and Franco-Chinese wall-papers. As such designs were looked on favourably by Badminton and Versailles, both the original Chinese papers and their imitations were stamped with royal approval.








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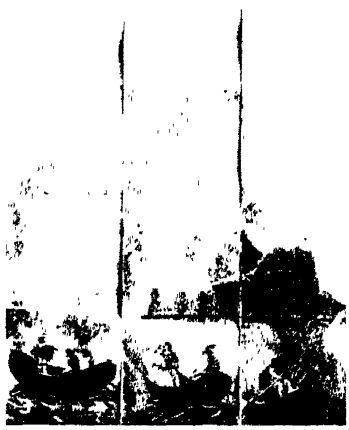
ENGLISH AND FRENCH WALL-PAPERS, 16TH–19TH CENTURY

1. English wall-paper, 16th century; Elizabethan era (1558–1603). Woodblock print in black and white. 2. English wall-paper, 18th century, with Chinese design of birds and foliage, a favourite *motif* up to 1750. 3. Domino wall-paper, France, late 18th century. This example (1795–1800) clearly shows the *Directoire* style in the medallions containing furniture and pottery. The colours are red-brown, green-grey and tan. Domino papers were printed with designs in compartments, geometrical figures, or grotesques. 4. French wall-paper, early 19th century. in sepia, black and white. These scenic papers were very popular in France and America. 5. Overdoor wall-paper by J. B. Reveillon, France, 2d half of 18th century. Reveillon manufactured paper panels designed by artists; this one was in the room with the Cietti paper shown in fig. 6. 6. Wall-paper designed by Cietti, Italy, and printed by J. B. Reveillon between 1780 and 1789. Cietti here uses a Pompeiian design and colours, precursors of the less delicate Pompeiian styles popular during the Directory (1795–99). 7. French wall-paper, 18th century panel designed by Prieur, manufactured by J. B. Reveillon; now in the Musée des Arts Decoratifs, Paris. 8. "Renaud and Armide," printed by Leroy, France, 1828. Here Renaud, the Crusader, is shown with the enchantress, Armide, in her pleasure-gardens. (*See* Plate II., fig. 7.) 9 and 10. Classic wall-paper, "La Galerie Mythologique" (1814), by Joseph Dufour, Paris. This paper, in *grisaille*

INTERIOR DECORATION















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FRENCH WALL-PAPERS, 18TH AND 19TH CENTURIES

1. Wall-paper, France, *Directoire* period (1795–99), issued by Nicholas Louis Robert, of Essones. The colours are blue, green and *grisaille*
2. "The French in Egypt" (1814), a notable paper with scenic representation of Napoleon's Egyptian Campaign, by Joseph Dufour, Paris
3 and 4. Wall-paper in grey and sepia, printed by Jean Zuber of Rixheim, Alsace, *c.* 1830, representing scenes from Scott's "Lady of the Lake"

   Fig. 3 (Part I): "Each boatman, bending to his oar,
   With measured sweep the burthen bore"

   Fig. 4 (Part II): "Then like a sunbeam, swift and bright,
   She darted to her shallop light"

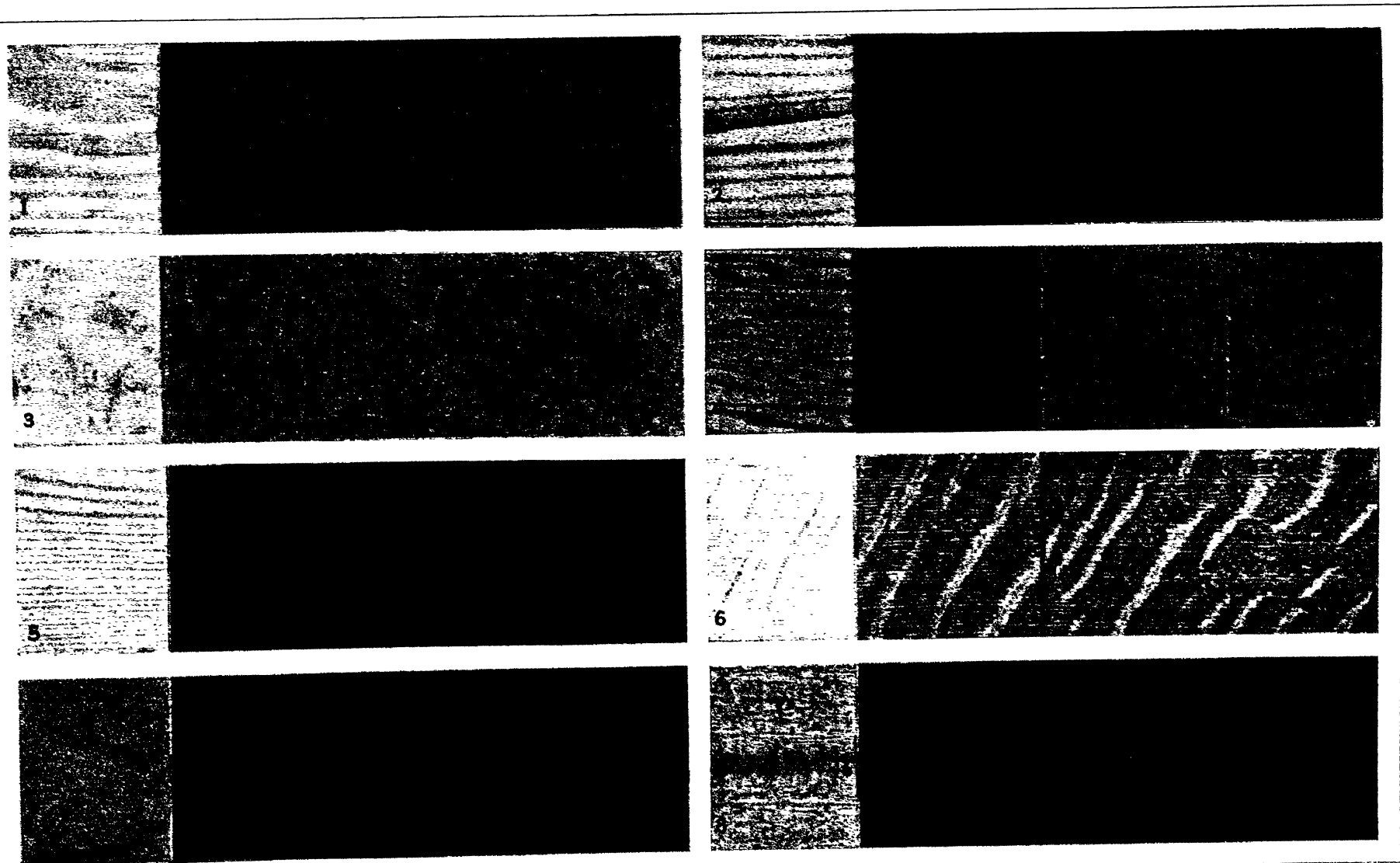
5. "The Bay of Naples" paper, printed by Joseph Dufour, Paris, between 1815 and 1820. The views show the Bay of Naples, ships, Vesuvius in eruption, Tivoli, Amalfi. This paper was very popular in America
6. "Cupid and Psyche" ("Les Amours de Psyche") paper (1816), Joseph Dufour's masterpiece designed by Louis Laffitte, designer to the king. The scene here shows Psyche at the bath. The set has 26 strips, in *grisaille* and sepia
7. "Renaud and Armide," printed by Leroy, France, 1828. In this scene Renaud, the Christian knight and Crusader, vanquishes the demons of the enchantress, Armide, with his magic sword. (*See* Plate XX., fig. 8)



BY COURTESY OF (1, 3) THE ESSEX INSTITUTE, (2) THE SOCIETY FOR THE PRESERVATION OF NEW ENGLAND ANTIQUITIES, (4, 5) NANCY MCCLELLAND, INC., (6) HENRY D SLEEPER, (7) MRS. HENRY R. REA, (8) MRS. E. BRUCE MERRIMAN

WALL-PAPERS, 18TH AND 19TH CENTURIES

1. "The Banks of the Bosphorus" ("Les Rives du Bosphore") paper, printed by Joseph Dufour, Paris, 1816. The complete set, consisting of 26 strips in colour, represents landscapes with river and *caïques*
2. Hall of Hamilton House, South Berwick, Maine; paper with repeated arches
3. "Views of Hindustan" ("Paysage Indien") paper, printed by Joseph Dufour, Paris, 1815. The set consists of 20 strips in colour. A set still exists in the Putnam-Hanson house, 94 Boston St., Salem, Mass.
4. Blue wall-paper, one of three panels, from designs by Boilly (1761–1845), France
5. "Paul and Virginia" paper, illustrating the story by Bernardin de Saint-Pierre, designed by Brock (1820), printed by Joseph Dufour, Paris
6. Old Canton wall-paper, 18th century, showing *The Making of Porcelain*, now at Beauport, Gloucester, Mass. This fine Chinese paper, treating also the subjects *The Cultivation of Tea* and *The Raising of Rice*, was imported to America shortly after 1770, by Robert Morris. The complete set consists of 40 strips, each 12 ft. x 4 ft. To-day half of the paper is in Mr. Henry D. Sleeper's house, Gloucester, the remainder at Providence, R.I. (*see* fig. 8)
7. Mrs. Henry Rea's hall, with painted paper panels, formerly belonging to George Sand
8. Old Canton wall-paper, 18th century, now in the ball-room of Mrs. E. Bruce Merriman, Providence, R.I. (*see* fig. 6)



BY COURTESY OF G. A. LA VALLEE, THE MARIETTA PAINT AND COLOR CO.

PANELS SHOWING PROGRESSIVE STEPS IN WOOD FINISHING

1. Pine. Cherry stain (one coat); one binding coat; special varnish (two coats)
2. Gum. Mahogany stain (one coat); one binding coat; gloss varnish (two coats)
3. Birds-eye maple. Silver gray acid stain (one coat); color developer (one coat); gloss varnish (two coats)
4. California redwood. Black acid stain (one coat); filler (one coat); color developer (one coat); dull varnish (one coat)
5. Birch. Mahogany stain (one coat); one binding coat; gloss varnish (two coats)
6. Quartered oak. Combination oak filler (one coat); gloss varnish (two coats)
7. Walnut. Circassian walnut stain (one coat); walnut filler (one coat); gloss varnish (two coats)
8. Mahogany. Mahogany stain (one coat); mahogany filler (one coat); one binding coat; gloss varnish (two coats)

Interesting examples of some Anglo-Chinese designs exist in the Victoria and Albert Museum, London. The average height of Chinese papers was 12 feet. The favourite designs up to the middle of the 18th century were birds and flowers; after 1750 these were largely superseded by landscapes with figures.

Occasionally Anglo-Chinese papers were ordered for American homes, as for example the one executed in London for Thomas Hancock in 1793 in accordance with his command to make "a great variety of different Sorts of Birds, Peacocks, Macoys, Squirril, Monkys, Fruit and Flowers."

The English Gothic Revival.—Notable in the last half of the 19th century in England was the Gothic revival in paper-hangings. In 1843 Augustus Welby Pugin made for the new Parliament Buildings the papers in Gothic patterns that are an admirable expression of the spirit of the architecture. The Daisy pattern of William Morris, the first of a long series, including the Trellis, the Pomegranate and the Acanthus, was published in 1862. All of these papers were an attempt in colour and pattern to revive something from the old Gothic tapestries. They gave inspiration in their turn to Owen Jones and later Gothicists. Since then, no great achievements are to be noted in the history of English paper-hangings.

Wall-paper in Modern Decoration.—The reaction against the over-decorated Victorian era, and the lack of good designs in machine-made wall-papers resulted after 1900 in a temporary disuse of this practical wall-decoration, which had filled a need for three centuries. In its place for twenty years or so have been monotonous putty-coloured walls, panelled with picture mouldings.

Wall-paper, however, has recently come back into its own. A definite attempt to revive the old designs of the 18th century and the old processes of printing has resulted in great benefit to this humble art. With this revival of old designs, much study has been made of the fashions of hanging wall-papers a century ago. In many early houses only three walls of a room were covered with design; the fourth, usually the fireplace wall, was panelled with wood. This idea is being repeated in many country houses to-day.

Modern lovers of wall-paper have also discovered that a partially-papered wall is sometimes more successful than a wholly-papered wall. Hence the use of wall-paper in panels, outlined either with wood mouldings or with paper borders such as were used in olden times to complete a room. These panels are carefully designed to fit the architecture of the room, and the painting of intervening wall-spaces and door and window-trims is carefully studied to complement the colours of the paper.

An enthusiastic revival of the use of scenic papers may also be noted, which has resulted in the pillaging of many houses that contain original examples of Dufour's and Zuber's work. Such papers as the "Bay of Naples," the "Monuments of Paris," and "Captain Cook" are eagerly sought for use in entrance halls and dining-rooms, where there are few high pieces of furniture to hide the panorama. To protect these papers, and assure the possibility of their safe removal, it is customary to line the walls with canvas before the paper is applied. Canvas and paper may be removed with great facility. The decorated bathroom is a new development of the day, and here again wall-paper has lent its aid. Gay designs, given a coat of waterproof varnish, make bathrooms into places of colour and beauty, and provide a durable decoration.

In rooms where plain walls are a requirement, a wall-paper cornice is sometimes used, with a border above the chair-rail, in a fashion that recalls the old stencilled rooms of early days, where each member of the family took part in stencilling a frieze. Paper panels are again being set into wood rooms, as Reveillon desired, making a pleasant contrast between the panel-decorations and the natural colour of the wood.

Modern manufacturers are producing many good "background papers" for those who have pictures to hang on their walls, and also many papers that are an adequate decoration in themselves. There are glazed papers for the kitchen, marbled papers for the hall, and an imitation of wood-graining that gives the effect of pine.

Papers that represent stuffs, such as toile de Jouy, chintzes and damasks; papers that represent paintings; and papers that are good imitations of the Chinese are relied on to give decorative effects and variety in modern homes.

Present-day schemes of modernist decoration include, beside the textures of wood and glass and metal, many gold and silver wall-papers, and others done in brilliant colours and daring designs. These are used by the modernists in a curious fashion, four or five different papers being combined in the same room—a frieze of one color and pattern at the ceiling line, another paper on the dado, and two or more different papers with their borders on the field of the wall. Many examples of this type of room were seen in the 1926 Paris exhibition of *Arts decoratifs*.

Wall-paper has also been found useful for enlivening the small decorative objects of the household. Wall-paper screens give a note of colour and interest to a room, and have become practical since the discovery of a method of making them puncture-proof. Wall-paper desk-boxes, blotters, and scrap-baskets, with a coat of shellac, are quite as decorative as leather. Wall-paper lamp-shades in bedrooms and country houses are amusing and gay. Wall-paper shelf-borders decorate a closet at small expense, while bandboxes and dress-boxes of wall-paper on the shelves make uniform and colourful dust-protectors.

See PAINTING; PAPER.

See Kate A. Sanborn, *Old-Time Wall-Papers* (New York, 1905); George Leland Hunter, *Decorative Textiles* (1918); *Captain Cook Wall-Paper* (Bulletin of the Pennsylvania Museum, May, 1921). *See* also P. Ackerman, *Wall-paper, its History, Design and Use* (1923); N. McClelland, *Historic Wall-paper* (with full bibliog., 1924); A. V. Sugden and J. L. Edmondson, *A History of English Wall-paper* (1926).

(N. V. McC.)

WOOD FINISHES, PAINTS AND VARNISHES

Wood, which is both the most available and the most easily workable of structural materials in the majority of the habitable regions of the globe, has from the earliest times been extensively utilized. When, in the course of cultural development, the sense for beauty was awakened, the art of wood finishing had its beginning. In ancient Egypt the embellishment of wood structures by painting and gilding reached a comparatively high state of development, and it was diffused thence, slowly, eastward and westward throughout the settled regions of the world. Each country receiving the tradition, modified and adapted it in conformity with the nature of the native woods, the materials available and the cultural genius of its people.

In the Far East, and especially in China, a highly specialized art developed under the early dynasties, and was carried thence to Japan where it reached its highest state of development. The treatment familiar on Chinese and Japanese articles of vertu and known as lacquer is based on the sap of a tree extensively cultivated in both countries solely for this use, the *Rhus vernicifera*, which is closely related to the *Rhus toxicodendron* of the West, and similarly poisonous. Various grades of lacquer or varnish are made by treatment and selection of its sap or juice, and the lacquer, coloured with selected dyes or pigments is applied in successive coats (in the finer pieces as many as 16) each laboriously ground down with emery flour or other abrasives and as laboriously polished with different substances, the final polish being given with pulverized deer's horn. Each coat must be dried in the dark and in a moist atmosphere. Inlay work and other decorative materials are applied to the lacquer while it is still moist and imbedded therein by the application of subsequent coats.

In Europe during the middle ages and later, besides gilding and similar processes, the decoration of wood consisted principally in staining with a vegetable dye, such as a decoction of log wood, or a chemical agent, such as tannic acid, and the subsequent application of a drying oil or a spirit varnish, consisting of a gum resin (*sandarach elemi, damar*, etc.) dissolved in a volatile solvent, or East Indian lac dissolved in alcohol. Wax was also a favourite material for finishing such work.

The French artisans early developed a finishing process of unique quality which is still popular under the name "French Polish." The process is simple though somewhat tedious. After

the surface has been properly prepared a very dilute solution of shellac in alcohol is applied with a pad made of stocking material. As soon as this coat is dry another is applied over it. This is repeated until the required lustre is obtained. Then, using the same pad, the surface is polished with a very little linseed oil, and after standing over night the polishing with oil is repeated. The soft sheen obtained in this way cannot be duplicated.

The varieties of woods used in construction at the present time differ widely in physical characteristics as well as in their chemical reactions. As a consequence different methods of initial treatment or preparation are required. Wood finishers classify them as "soft" or "hard," connoting generally their relative absorbent properties; "open" or "close" grain, indicating the relative solidity of the surface offered for finishing; resinous or non-resinous, the former class including woods such as cypress, which contain juices that are not really resins; and "plain" or "figured," these terms connoting the visual prominence of the wood structure.

All open grain woods require "filling" as a preliminary to the decorative treatment. This so-called grain consists of the sap-ducts which have been laid open in cutting the lumber, and becomes apparent in those woods having large sap-ducts. These are chiefly the woods classified also as "hard woods." The principal types encountered are butternut, walnut and the *juglans* family in general; oak, of all varieties; ash, elm, mahogany, rosewood, and chestnut. The following, classified as close grain woods, are, with the exception of maple, birch, cherry, gum and yellow pine, also classified as soft: bass, beech, birch, cedar, cherry, cotton wood, cypress, fir, gum, hemlock, holly, maple, the pines, poplar, redwood, spruce, sycamore and tulip. The preliminary treatment in all cases includes stopping of cracks and nail holes with putty coloured to match the finish to be applied, sandpapering with fine sandpaper to a smooth surface, removal of blemishes if the finish is to be transparent, and thorough dusting off.

Transparent Finish in the Natural Colour.—The woods suited to this treatment are those possessed of natural beauty due to their colour or configuration of grain. Those ordinarily selected for this treatment are the hard woods in general, sometimes including close grained woods like the hard pines, the maples, some of the cedars, cherry, cypress and some types of birch. The natural beauty of certain of these woods, especially oak, is often enhanced by "quarter sawing" in which the boards are cut diagonally across the log.

The more open grain woods are "filled" with paste wood-filler, of which the best grades consist of finely powdered quartz ground to a rather stiff paste in a special varnish. The filler may be coloured or uncoloured. In the latter case, being transparent, it merely provides a smooth surface for varnishing. In the former, the grain is more clearly defined and very beautiful effects may be obtained by the addition of colour, aluminium bronze or white pigment. The paste filler is applied across the grain with a stiff brush, and after it has "set," but before it becomes hard, the surplus is wiped off, again across the grain, with excelsior, burlap or similar material. After the remaining filler has become completely hard, the entire surface is sandpapered with fine sandpaper and carefully dusted off. The first coat of varnish is then applied, using a flat varnish brush. The grade of varnish used depends upon the finish desired. If the work is to be rubbed or polished, the varnish selected is a rubbing and polishing grade; if not, a softer and more elastic grade of interior varnish is usually preferred. In either case three or more successive coats are applied if a good finish is desired. Sufficient time is allowed for the complete drying of each coat—from 24 to 48 hours, depending upon the character of the varnish. However, quick drying varnishes made from synthetic resins, in which the drying time has been reduced to a few hours, have recently been introduced.

If the more beautiful finish produced by rubbing is desired, each coat of varnish after thorough drying, is rubbed with powdered pumice stone and water or pumice stone and oil to produce a perfectly smooth surface. If a dull or low lustre finish is desired, the final coat is rubbed only. If a lustrous finish is required the rubbing of the final coat is followed by polishing with rottenstone and oil. For both rubbing and polishing a pad made by fastening felt to a flat block is most serviceable, and for sandpapering a similar pad is serviceable, the sandpaper being laid over the felt.

Staining.—The modern tendency in wood finishing is to colour the wood before applying the finish. In fact, it has long been the practice to stain many of the choicer woods, such as mahogany, walnut, rosewood, oak, etc. The natural colour of mahogany is a very pale yellow, but staining of this wood has been so long in vogue that the very name suggests red, though in recent years brown has become the more popular colour. Certain woods are also stained to imitate rarer varieties, as, for instance, birch and maple to simulate mahogany, or birch in imitation of cherry.

The older craftsmen employed a variety of vegetable dyes and various chemicals to produce the effects they required, but with the invention of coal-tar dyes, in their great variety and beauty, the older art has largely fallen into disuse. Many of these so-called "aniline dyes" are now sold as powders under the names of the woods on which they are supposed to be used, as, for example, mahogany brown, mahogany red, walnut brown, oak stain, etc. Most of the stains used in ordinary finishing, however, are purchased ready for use from the manufacturers, who furnish them in endless variety.

Stains are of five types, selected according to the woods on which they are to be used—water stains, oil stains, spirit stains, acid stains, and penetrating stains, the last including alkaline stains. The water stains are usually prepared by the user by dissolving the dye in water, though they can be purchased in solution; the rest are obtained ready for use from the manufacturer. The oil stains are generally preferable to the water stains, since they do not "raise the grain" of the wood like the latter, which necessitate sand-papering. The water stains nevertheless are preferred for the light coloured soft, absorbent woods, because oil has a tendency to darken these. Where lacquer is the finishing material, water stains are usually preferred, because of the better adhesion of the finish after their use. Many stains are also made with the same insoluble pigments that are used in the manufacture of paint; and finally, varnish stains are procurable for first coating in which the stain and the first coat of varnish are applied in one operation. Acetic acid is usually added to some stains to increase the solubility of the dyes not readily soluble in water; and oil or spirit—usually turpentine or an alcohol—is substituted for water in other stains for similar reasons.

With water or spirit stain the procedure is to apply the stain with a soft brush. Skill is required here to obtain evenness of distribution. A coat of dilute shellac varnish is then applied. This serves to stiffen the wood fibres that have been "raised" by the stain, so that they may be easily cut. The surface is then lightly sand-papered with fine sand-paper. The transparent wood-filler is next applied if required, followed by a second application of stain, if required, and a second light sand-papering. The varnishing follows—two, three, or more coats, either rubbed or unrubbed, according to the finish desired.

The term enamel, originally applied to fused vitreous coatings on metals, is now also used for opaque pigmented varnish coatings. Such finishes were formerly produced with spirit varnishes (principally dammar) but are now commonly produced with prepared enamels. As found in the market, the better grades of these consist of zinc oxide or the best quality of lithopone ground in a special rubbing varnish.

In producing the finish the wood is first filled, if necessary. One or two coats of flat drying oil paint are then applied, followed by two or more coats of the enamel, according to the quality of finish desired. These coats may be rubbed, as in clear varnish finishing, and the final coat polished; or they may be applied successively without further treatment.

Graining.—This type of finish, once universal, is now rarely used, except where necessary to match old work. Its purpose is to imitate with cheaper woods the colour and figuration of more expensive woods. Expert grainers of the old school can so closely simulate rare and costly woods that it is almost impossible for the eye alone to distinguish between them. Woods usually selected for the purpose are the common soft close grained woods, such as

pine, poplar, soft maple, etc. A "ground colour" closely resembling the prevailing colour of the wood to be imitated is first applied, two or more coats being necessary. These colours may be bought ready for use. Specially prepared graining colours to match the deeper shades of the wood to be imitated are then applied evenly with a soft flat brush. This process is called "rubbing in," from the fact that paste colours formerly used, necessitated rubbing to spread them. A comb of steel or hard rubber is then passed over the portions of the work that are to be left plain. For imitating the less open grain hard woods, such as walnut, cypress, yellow pine, cherry, etc., the steel comb is covered with a rag. Rags are also used for wiping out "heart-grains." Then by the use of combs and wiping rags the expert grainer can closely imitate the grain pattern of any wood. The finishing touch is added by "overgraining," to soften and blend the work, with water colour, to which a little beer or vinegar has been added. For commercial work machines, stencils and transfers are available which fairly imitate the grains of various woods. The chief objection to them is that the pattern is monotonously duplicated. The most successful of these is perhaps the "graining wheel," consisting essentially of a printer's ink roller bearing the grain pattern in relief. A more recent invention consists of a steel roller which stamps the grain pattern into the substance of the wood, which is then filled, stained and treated exactly like the wood imitated. The completed work is preserved by varnishing.

WAX FINISH AND PAINTING

Instead of varnish, wax is often used for finishing natural or stained wood surfaces. This is one of the oldest methods of wood finishing. The material used was formerly beeswax dissolved, with the aid of heat, in turpentine, or simply the plain powdered wax, spread with the aid of weighted brushes. Both methods are still used, especially in the finishing of hardwood floors, but the commoner modern practice is to use prepared waxes, consisting of several kinds of wax with a small proportion of a volatile solvent. This treatment produces a dull finish, which becomes lustrous with rubbing. The usual undercoat for wax is shellac varnish. No special skill is required to produce this finish, vigorous rubbing being the chief essential. The same effect is produced in more permanent form by the so-called "hard wax finishes," containing carnauba or other hard waxes.

While not usually classified as a method of wood-finishing, painting is more commonly practised than any other method. In the methods just considered the purpose is to enhance the natural beauty of the wood itself, whereas paint is applied for the purpose of concealing the wood. Other types of finishing require that the wood shall be uniform in colour and free from defects and blemishes, but as paint (like enamel, already considered) permanently hides the surface, no selection is necessary.

Preparation for painting is essentially the same as for the types of finishing already discussed. The surface is sandpapered; open grain woods are filled with paste filler coloured with the paint to be used; nail holes, cracks, etc., are stopped with putty similarly coloured; the surface is again sandpapered; and finally all resinous spots and knots are coated with a shellac varnish. The first or "priming" coat is then applied. This coat usually contains somewhat more oil and more volatile "thinner" (turpentine or mineral spirit) than the succeeding coats, to facilitate penetration and assure firm adhesion. The second coat contains less oil and less volatile "thinner" than the priming coat; and the third, which is usually the finishing coat, less "thinner" than the second coat.

The methods of decoration with paint are of infinite variety, depending upon the taste, skill and ingenuity of the craftsman, since the hues, tints and shades at his disposal are practically unlimited and the possible combinations countless.

Lacquer and Other Special Finishes.—The oriental lacquer produced from the *Rhus vernicifera* has already been described. Another type of finish, long used in the West for preserving the lustre of polished metal surfaces and called by the same name, consists simply of spirit varnish—resins dissolved in alcohol or other volatile solvent. This type was largely superseded for the purpose by another form of "lacquer" consisting of nitrated cellulose dissolved in amyl acetate or other volatile solvent with the addition of various "plasticizers," such as castor oil. These were similar in general composition to collodion (nitro-cellulose dissolved in sulphuric ether) or celluloid, in which the plasticizer is camphor. The technical study of nitro-cellulose, stimulated by its importance in explosives, photography, moving pictures, the manufacture of artificial silk and of celluloid products, naturally led to a consideration of its possibilities as a decorative and protective coating. Research and experiment quickly led to the production of a nitro-cellulose, or "pyroxylin," which contained less nitrogen and was therefore more stable than the earlier types, and at the present time many industrial products requiring a finish are coated with pyroxylin lacquer.

Various chemicals which in reacting with the chemical components of the various woods produce colour changes of greater or less intensity are occasionally used by wood finishers, though to a less extent than formerly. The most popular of these is the treatment known as "fuming." It consisted formerly of prolonged exposure of the wood—chiefly oak or mahogany—to the fumes evolved from strong ammonia. It is now commonly brushed on the surface, but the older process yields more uniform effects. Other chemical stains with which varied effects may be produced on different woods are tannic, pyrogallic, chromic, picric, acetic, nitric, hydrochloric and sulphuric acids, the alkalis, potassium bichromate, potassium permanganate, copper sulphate (blue vitriol), ferrous sulphate (green vitriol), ferric chloride, chrome alum and manganese sulphate. These chemical agents all have the advantage of producing permanent coloration, in contradistinction to many of the commonly used dyes. Wood treated in this way is finished as with ordinary stains.

Various effects are produced by first applying ground coats of flat paint or enamel, and after this foundation is dry applying a coat of transparent glaze of a different colour and while still wet stippling, wiping with a rag in various patterns, imitating graining with brushes and a whisk broom, etc. The effect known as "antiquing" is produced in a similar manner, by applying over the flat ground coats a semi-transparent glaze coat of somewhat darker tone. Raw umber or a mixture of raw and burnt umber is commonly used. While the glaze is still wet it is wiped off with a soft rag. Sufficient colour remains to give the "antique" effect desired. The "old ivory" effect is produced by adding to white paint a little raw sienna and burnt umber for the ground coats and after these are dry glazing with a thin mixture of the raw sienna and burnt umber. Ebony is simulated by painting first with vermilion (Japan colour) and finishing with two or three coats of black tinted with Chinese blue. All these special finishes should be protected with one or two coats of varnish.

Spray Machine Finishing.—The spray painting machine was used to an unimportant extent from 1870 to 1923, but it was only with the introduction of pyroxylin lacquer into the furniture and automobile finishing field, in 1923, that it found extensive application. Since that date the improvement of the device has progressed rapidly and its adaptation to other fields has steadily spread. But for this machine the industrial lacquers, which dry too rapidly for application by brushing, could not have been utilized. With slight modifications it was found equally serviceable for the application of paint and varnish, and its use with these has rapidly expanded. With it many decorative effects, such as mottling, spatter finishes in one or several colours, glazing, colour misting, etc., can be produced rapidly and at comparatively slight expense. Modern pyroxylin lacquers are of three types: (1) clear, quick-drying, unpigmented lacquers, applied by the spray-gun; (2) quick-drying pigmented lacquers also applied by the spray-gun; (3) slower drying pigmented lacquers applied with a brush.

The first type, used to replace varnish in the finishing of furniture and similar industrial products, is applied to surfaces already stained, filled and otherwise prepared in practically the same way as for finishing with varnish. The lacquer coating hardens within a few minutes. Two or three coats are usually applied, the final coat being rubbed as in finishing with varnish. Pigmented spraying lacquers are most largely used for finishing automobiles, railway coaches and similar products. The rate of drying is somewhat

slower than that of the clear lacquer, but still quite rapid. Two or more coats are applied, with or without rubbing according to the finish desired.

Brushing lacquers were devised for domestic use. They are pigmented, like the coloured spraying lacquers, but the speed of drying has been retarded so as to permit application with a brush. They are, nevertheless, completely hard within about 30 minutes. They are "flowed" from the brush and cannot be worked over like varnish. The technique is different, but easy to acquire, and the results are novel and both beautiful and enduring.

Still more recently, to meet the competition of lacquer and to overcome some of its disadvantages, the quick-drying oil varnishes known as "four hour varnishes" have been developed. They are, to all intents and purposes, oil varnishes in which certain synthetic resins have been substituted for the fossil resins commonly employed.

See PAINTS, CHEMISTRY OF; VARNISH; GILDING; ENAMELLING; WAXING; LACQUER; DECORATION; INTERIOR DECORATION.

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INTERIOR, DEPARTMENT OF: *see* GOVERNMENT DEPARTMENTS.

INTERLACED ARCHES. Arches which span twice the width of the space between the piers of an arcade, so that each arch crosses two others. In some cases the arches interlace, their mouldings crossing alternately over and under those of the other arches; in some cases the whole is on one plane and the arches merely intersect. Interlacing arches are common in Romanesque work (*see* BYZANTINE AND ROMANESQUE ARCHITECTURE), especially Norman, and also in English Gothic (*see* Gothic Architecture), and are also occasionally used in Moorish work, as in the great mosque at Córdova (8th century). For illustrations *see* ARCADE.

INTERLAKEN, a Swiss town (1,864 ft.) in the canton of Berne, situated on the flat plain (*Bödeli*) between the lakes of Brienz (E.) and of Thun (W.), and connected by steamer, as well as by railway (17½ m.) with the town of Thun. It is built on the left bank of the Aar, and grew up around the religious house of Austin Canons, founded about 1130 and suppressed in 1528. In the surviving buildings of the convent religious services (Anglican, Scottish Presbyterian and French Protestant) are now held, while the more modern castle is occupied by offices of the Cantonal Government. The fine and well-shaded avenue called the *Höheweg* runs through the main portion of the town, and is lined on the north side by a succession of huge hotels and the large Kursaal. Interlaken is much frequented in summer, partly because of the glorious view of the Jungfrau (13,669 ft.) which it commands to the south, and partly because it is the best starting-point for many excursions, as to Schynige Platte, Lauterbrunnen, Grindelwald, Mürren and Jungfraujoch. The lines serving these places all start from the eastern railway station (that from Thun reaches the western or main railway station), whence steamers depart for the Giessbach Falls, Brienz and Meiringen, on the way to Lucerne or to the Grimsel Pass. In 1920 the population of Interlaken was 3,261 (mainly Protestant and German-speaking). Opposite Interlaken, and on the right bank of the Aar is Unterseen (in 1900, 2,607 inhabitants), which was built in 1280 by Berthold von Eschenbach.

See *Fontes rerum Bernensium* (original documents up to 1366) (8 vols., Berne, 1883–1903); *Die Regesten des Klosters zu Interlaken* (Coire, 1849); E. Tatarinoff, *Die Entwickelung der Probstei Interlaken im XIII. Jahrhundert* (Schaffhausen, 1892).

INTERLOPER, one who interferes in affairs in which he has no concern. This word, with the verbal form "to interlope," first appears at the end of the 16th and beginning of the 17th century in connection with the interference of unauthorized persons in the trade monopoly of the Russia Company and later of the East India Company. The *New English Dictionary* quotes from H. Lane (1590), *Haklyt's Voyages*, "From those parts the Muscovites were furnished out of Dutchland by enterlopers with all arts and artificers and had few or none by us," and also from the *Minutes of the Court of the East India Company*, 22nd of February 1615, "to examine all suspected personnes that intend interlopinge into the East Indies or Muscovy." Edward Philips (*New World of Words*, 1658) defines interlopers at common law as those "that without legal authority intercept the trade of a company, as it were Interleapers." The word appears to be of English origin, for the Dutch *enterlooper*, smuggler, often given as the source, was taken from English, as was the French *interlope*. The word is a compound of *inter*, between, and *lope*, a dialectal variant of "leap." A common word for a vagrant, or "straggler," as it is defined, was till 1580 "landloper," and the combination of "straggler" and "interloper" is found in *Horsey's Travels* (Hakluyt Soc.), 1603–1627, "all interlopers and straglyng Englishmene lyving in that country."

INTERMEZZO. An interlude or entr'acte of a light and pleasing character serving as a contrast between the acts of a more serious drama or tragedy, and, in its developed form, continuing as an independent piece in this manner throughout the whole work, two entirely independent works, one serious and one light, being thus presented in alternate instalments. Pergolesi's famous *La serva Padrona* was such an intermezzo as originally produced. Nowadays the term is more generally applied to a short piece introduced between the larger movements of a symphony or sonata or to an independent short composition.

INTERNAL COMBUSTION ENGINES. An internal combustion engine is one in which energy is directly translated into mechanical power by causing an explosion to take place behind a piston. Professor Andrade has epigrammatically described this as "putting the furnace into the cylinder."

An explosion is an event of so sudden and violent a character that it might well seem impossible for man effectively to bring under his complete control so destructive and apparently unruly an agent; yet many billions of perfectly regulated gaseous explosions now minister daily to our needs in internal combustion engines of all kinds throughout the world.

Genghis Khan, in China, is recorded as having first used gunpowder in cannon about A.D. 1234 and King Edward III. in western Europe about A.D. 1327; the earliest proposal to utilize explosions (of gunpowder) to obtain *continuous* motive power was probably made by Christian Huygens in 1680, and Papin and the Abbé Hautefeuille later endeavoured to develop his proposal, but without success; it has now long been agreed that gunpowder is an entirely unsuitable substance for employment in any internal combustion engine.

R. Street, in 1794, proposed an engine driven by a flame-ignited explosive mixture of vapourized spirits of turpentine and air, and Sir Dugald Clerk regards this as the first real gas engine described in Britain. In 1820 W. Cecil at Cambridge described to the Cambridge Philosophical Society his engine operated by the explosions of a hydrogen-air mixture used to create a partial vacuum below a piston, the atmospheric pressure then producing the working stroke, much as in the earliest steam engines; he describes such an engine and states that at 60 revolutions per minute the explosions were perfectly regular; this is considered to have been the first actually working gas engine in the world.

With this brief introduction, we pass to the consideration of the various forms in which the internal combustion engine is used. These may be divided as follows:

I. Gas Engines
II. Heavy Oil Engines
III. Light Oil (or Petrol) Engines
IV. Special Engines

Separate articles are devoted to DIESEL ENGINE and AERO-ENGINE.

GAS ENGINES

The commercial career of the gas engine began with Samuel Brown (1823 onwards), whose design operated on the atmospheric-vacuum principle; actual Brown "gas-vacuum" engines were made and sold, and in 1832 were in regular service at Croydon, Soham, and Old Brompton; Brown engines were also fitted in a road

vehicle in 1826, and in a 36-foot boat in 1827.

Progress after this became more rapid; Wright in 1833 described an engine working with an inflammable mixture of gas and air much as in a normal double-acting high-pressure steam engine; followed William Barnett (1838) to whom the gas engine owes important advances, as he first realized the importance of compressing the explosive charge before ignition; he invented also the well known Barnett igniting cock which remained in general use up to as late as 1892. The next noteworthy advance was due to Barsanti and Matteucci who in 1859 produced a singular design known as the "free-piston" engine, subsequently improved in practical details by Otto & Langen; these inventors, at the 1867 Paris exhibition, first showed an actual example of their later well-known and widely used "free-piston" engine. In this the cylinder was vertical, of considerable height, and open at the top; it contained a heavy piston, below which, when in its lowest position, the explosive charge of gas and air was fired electrically; the piston was quite free in its ascent, and was fired upwards by the explosion, like a projectile; its ascent continued until the pressure below fell sufficiently for the atmospheric pressure and its friction, to bring it momentarily to rest; immediately thereafter the atmospheric pressure, its weight and the partial vacuum beneath it caused its rapid descent, during which a rack attached to the piston engaged with, and drove, a pinion, thus turning a shaft carrying a heavy fly-wheel; near the end of its descent the burnt gases were allowed to escape into the atmosphere. The engine was excessively noisy in operation and mechanically an outrage, but it possessed three advantages:

(1) The exploded mixture was very rapidly expanded.
(2) The expansion ratio obtained was considerable—often as much as 6:1.
(3) The partial vacuum produced below the piston was utilized in its operation.

Hence, for the period, its gas consumption was quite economical, amounting to only about 44 cu.ft. per B.H.P. hour; to this comparative economy much of its commercial success was due.

Lenoir, in 1860, had commenced building his gas engines which were worked exactly like, and closely resembled in appearance, a double-acting steam engine of normal horizontal pattern; he introduced an uncompressed mixture of gas and air into his cylinder during the first part of the stroke; cut off and ignition then simultaneously took place, and the remaining (*i.e.*, the working) portion of the stroke was then performed by the pressure and expansion of the exploded charge. A great many Lenoir engines were built, and worked with great regularity, smoothness and quietness; but they were very wasteful, the gas consumption being commonly roundly 100 cu.ft. per B.H.P. hour; mainly on this account the Lenoir engine was in due course entirely superseded by the mechanically much inferior Otto and Langen "free piston" engine above described.

By 1860 the necessity of pre-compressing the working charge before ignition was clearly recognised by several investigators; as early as 1799 Lebon, in France, had referred to compression, but the real originator of the practice was Barnett; in 1861 G. Schmidt stated definitely to the Society of German Engineers that explosion engines would work more economically, if the mixture were compressed to three atmospheres before ignition as in this way "a great expansion and heat transformation is possible."

The Beau de Rochas Cycle.—But it was in 1862 that the essential requirements, and the means of satisfying them, were first explicitly stated by Beau de Rochas in Paris, who then laid down the following four essential conditions for the greatest economy in working: (1) A maximum cylinder volume with a minimum cooling surface. (2) A maximum rapidity of expansion (3) A maximum ratio of expansion. (4) A maximum initial pressure of the ignited charge.

And he stated further that these conditions can be practically realized by the adoption of the following sequence of operations: (1) Suction during the first out-stroke of the piston. (2) Compression of the mixture during the following instroke. (3) Ignition of the compressed charge at the dead point, and subsequent expansion of the exploded gases during the next out-stroke; this is the "working stroke." (4) Expulsion of the burnt and expanded gases during the next in-stroke.

This is the celebrated Beau de Rochas cycle now universally employed in all "four-stroke" cycle internal combustion engines.

The Otto Gas Engine.—Another 14 years elapsed, however, before de Rochas' suggestions were embodied in an actual engine; but in 1876 Otto produced the world-famous "Otto silent gas engine," in which the "de Rochas" or "four-stroke" or "Otto" cycle, as it is variously termed, was strictly followed; and the Otto silent gas engine at last launched the internal combustion engine upon its amazing commercial career.

A single-acting four-stroke internal combustion engine of the simplest possible type is shown diagrammatically in fig. 1. A cylinder, open at one end, is fitted with a closely fitting piston which drives a crankshaft through the medium of the connecting rod indicated; when the piston is in its uppermost position there is still a portion of the cylinder volume above it, and this is termed the "combustion chamber"; forming part of this chamber is the valve-pocket containing an inlet valve A (here shown as of the simplest "automatic" type—as used in early engines), and an exhaust valve B which is operated by means of a cam C and "tappet-rod" D. The cam C is borne on a shaft gear-driven at half-speed from the

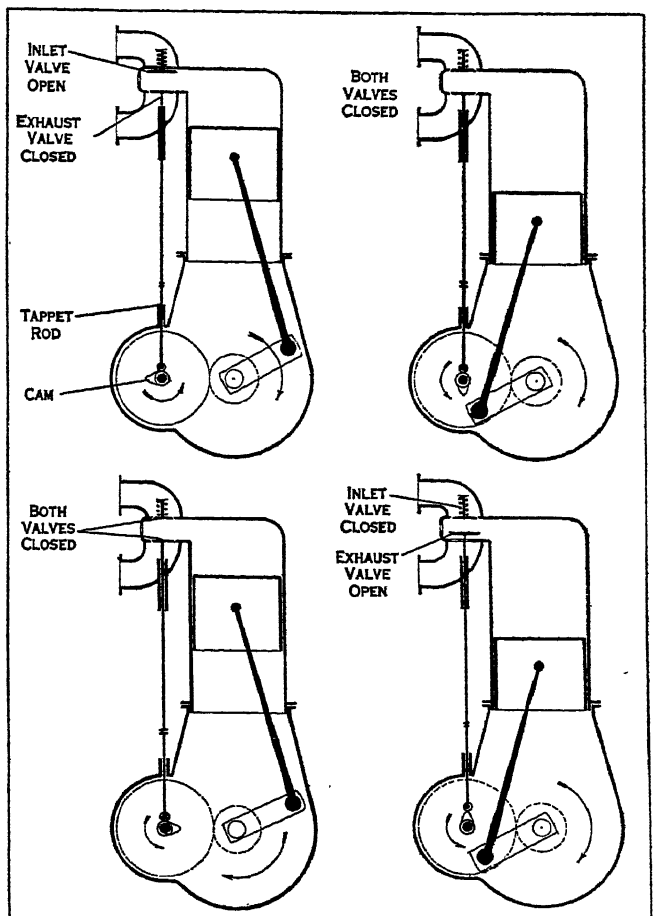
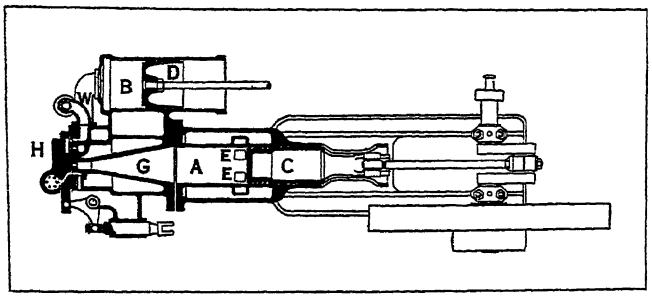


FIG. 1.—DIAGRAM SHOWING VALVE AND CAM OPERATIONS OF 4-STROKE CYCLE INTERNAL COMBUSTION ENGINE

crankshaft as indicated by the dotted circles; this is termed the "cam-shaft" or "half-time shaft" or "timing shaft." The action is as follows:—Suppose that by some means the engine has been set in motion. On the first down-stroke of the piston the partial vacuum produced above it causes the automatic inlet valve A to open, and a mixture of gas and air to rush in, filling the combustion chamber and volume swept out by the piston; this is the *suction stroke*. On the succeeding up-stroke the automatic inlet valve at once closes, and the charge of gas and air is compressed by the ascending piston into the combustion chamber; this is the *compression stroke*. At the upper dead point the compressed charge is

ignited by some suitable means, explosion instantly takes place, a great rise of pressure occurs, and the piston is driven forcibly downwards by the inflamed mixture whose pressure and temperature rapidly fall during the expansion; this is the *working stroke.* At the end of this stroke the exhaust valve B is lifted by its cam and held open throughout the succeeding up-stroke, causing the expanded and burned gases to be discharged into the atmosphere;



FROM GIBSON AND CHORLTON, "MODERN MECHANICAL ENGINEERING" (BLACKIE & SONS)

FIG. 2.—CLERK 2-STROKE CYCLE INTERNAL COMBUSTION ENGINE

this is the *exhaust stroke.* This cycle is now repeated indefinitely and the crankshaft rotates continuously, the crank-pin thus receiving *one* working impulse in each *two* revolutions. In all modern gas engines the inlet valve A is also cam-operated from a half-speed shaft.

In the four-stroke cycle engine the utilization of the same cylinder alternately as a charging pump and as a power cylinder though very convenient as a simplification in construction involves the serious drawback of only one working impulse in every four piston strokes, and accordingly in single-cylindered or few-cylindered gas engines the crankshaft rotation can only be kept at a tolerable degree of uniformity by providing one, or frequently two, massive fly-wheels which by their great angular momentum maintain the rotation rate only slightly impaired during the exhaust, suction and compression periods.

The Clerk Cycle.—Attention was in consequence soon concentrated upon providing some means of increasing the frequency of the working impulses in gas engines, without sacrifice of economy, and as early as 1878 Sir D. Clerk had produced his first *two*-stroke, or "Clerk cycle" engine, of which an improved example was shown at the Paris Electrical Exhibition of 1881. The operation of this engine (fig. 2) was as follows:—The engine comprises two cylinders, *viz.*, a power cylinder A and pump cylinder B, each containing a piston as shown. The power cylinder A has at its outer end a ring of exhaust ports EE′ which are overrun by the piston C when near the end of its out-stroke. The piston D of the pump cylinder B is driven by a crank set of about 90° in advance of the power crank and on its out-stroke sucks into B a charge of mixed gas and air through a sliding valve H and pipe W. At the commencement of D's in-stroke, H being closed, compression of the charge in B begins, and as soon as the pressure rises above that in the power cylinder A, it is delivered into the combustion chamber G of the power cylinder through an automatic inlet valve, the power piston C being then at the end of its out-stroke, as shown. On its in-stroke C first masks the ports EE′ and next,—the automatic inlet immediately closing,—compresses the thus entrapped fresh charge into the combustion chamber G. At the inner dead point the compressed mixture is exploded and the piston is driven forcibly downwards, thus performing the working stroke; the expanded and burnt gases rush out into the atmosphere immediately the piston uncovers the ring of ports EE′. It is clear, then, that in this engine every out-stroke of C is a working stroke, and thus the design provides one impulse in every revolution, and so has double the impulse-frequency of the four-stroke cycle

An ideal two-stroke, or Clerk, cycle engine accordingly should develop twice as much power as a four-stroke engine of the same size and speed. In practice, however, the two-stroke cycle possesses certain features which prevent the ideal performance being attained; these are:—(1) In the four-stroke engine the inlet valve is opened just before the end of the piston in-stroke and remains open throughout the whole of the suction stroke and usually for a short period thereafter, so that cylinder-charging continues during about 220° of crank-shaft revolution. But in the two-stroke cycle engine the charging period is only the short interval elapsing between the un-covering and re-covering of the ports EE′ by the piston, which usually occurs during some 80° of crank shaft revolution. Hence in the two-stroke engine it is in general impossible to get so large a charge as in the four-stroke.

(2) In the four-stroke engine, discharge continues throughout the whole of the exhaust stroke (and in practice even longer), and thus the residual burnt gases are definitely expelled by the piston during its exhaust in-stroke so that, finally, only the combustion chamber remains filled with residual burnt gas, and this often at somewhat less than atmospheric pressure. But in the two-stroke engine the whole cylinder remains filled with hot residual exhaust gases which, while assisted in their exit by the incoming cool fresh charge, *heat* this fresh charge, so expanding it and thus reducing its density and so further diminishing the "volumetric efficiency" of the engine.

(3) Loss of fresh charge frequently occurs by "short circuiting" through the exhaust ports, and many small two-stroke cycle engines suffer some loss of unburned gas from this cause. Clerk cycle engines have been practically superseded in small sizes by the Day engine next described, though a modern example of a small Clerk cycle design appears in the "Dolphin" petrol engine, an account of which is given in *The Gas, Petrol & Oil Engine,* vol. ii. But in the largest types of two-stroke gas engines the Clerk cycle prevails, with some modifications, as in the well-known Koerting and Oechelhauser designs referred to later.

The Day Engine.—A valuable simplification of the Clerk cycle engine was made in 1891 by Day who ingeniously dispensed altogether with the charging pump B (fig. 2) by adapting the crank chamber to perform its service; the Day engine is illustrated in fig. 3 in two forms, that on the left showing the "two-port" type as used in the well-known "Bolinders" marine oil engine, while that on the right illustrates the "three-port" type as universally employed in the small high-speed two-stroke engines of motor bicycles, launches, etc.

In each of these the crank-chamber is completely enclosed so as to be air-tight. In the two-port type the ascending piston creates a partial vacuum in the crank-chamber and the charge of fresh mixture at once enters through an automatic valve as indicated. On the down-stroke this valve at once closes and the mixture is compressed in the crank-chamber to a few lb. per sq.in. pressure; when near the bottom of its stroke the piston first over-runs the exhaust port (on right), the expanded and burnt gases above it at once rushing out through the exhaust, and immediately afterwards over-runs an inlet port (on left) communicating with the crank-chamber, thus permitting a charge of fresh mixture to enter the cylinder. A "hump" on the piston deflects the stream of entering fresh mixture upwards and so minimizes loss by short-circuiting through the exhaust port. The piston, rising, first cuts off the inlet and exhaust ports and next compresses the entrapped charge into the combustion chamber where it is fired, and the working stroke next follows as usual. The two-port engine thus requires one valve, but the three-port engine is valveless, and is the simplest form of internal combustion engine possible, the only moving parts being the piston, connecting-rod and crankshaft. Referring to the right-hand diagram of fig. 3, the third port is shown below the exhaust port. When the piston rises the inlet port is closed, and, as before, a partial vacuum is created in the crank chamber; when near the top of its stroke the *lower* edge of the piston over-runs the third port and fresh charge immediately rushes into the crank-chamber. The subsequent descent of the piston first cuts off the charging port and next compresses the fresh charge in the crank-chamber; the remainder of the cycle is as in the two-port type.

These two-stroke engines will obviously run equally well in whichever direction the crankshaft may be started; this property renders their reversal easy—a valuable feature in marine applications.

Simple Theory.—The working substance is usually, for sim-

plicity, regarded as air, conforming strictly to the equation:—

$$pv = cT \qquad (1)$$

where p is pressure, estimated in lb./sq.ft.; v is the volume of 1 lb. in c.ft.; c is a constant, having the value of about 53·3; and T is "absolute temperature" in °F and is equal to the ordinary °F plus 460. The action is further imagined as taking place with the same mass of air always within the cylinder, and the

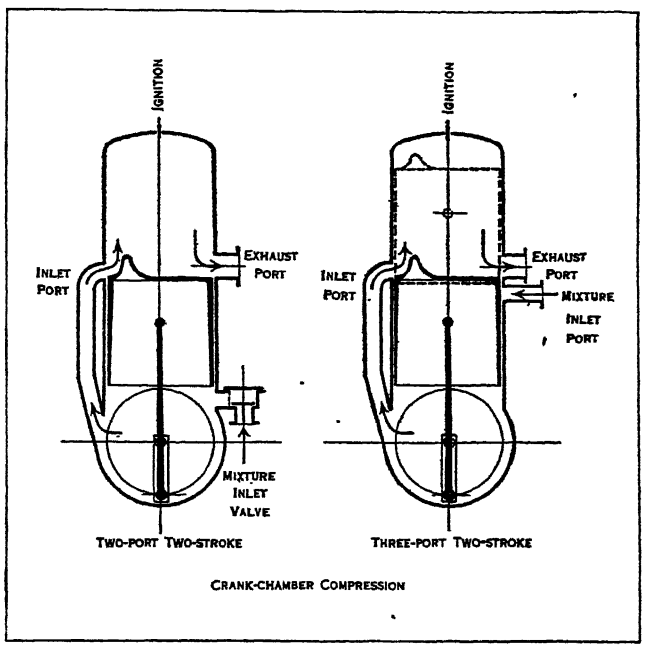


FIG. 3.—DIAGRAMS SHOWING 2-PORT AND 3-PORT 2-STROKE INTERNAL COMBUSTION ENGINES WITH CRANK-CHAMBER COMPRESSION

compression and expansion are regarded as "adiabatic," *i.e.*, no gain or loss of heat to the cylinder walls is contemplated. Fig. 4 exhibits the ideal indicator diagram of a four-stroke cycle engine with these simplifying assumptions.

Imagine the piston as at the top of its stroke with the combustion chamber volume filled with air; this is represented by the point O on the diagram, the combustion chamber volume being v_0 and the atmospheric pressure p_0. The piston next performs the suction stroke and the corresponding line 01 is traced on the diagram; at 1 the whole cylinder volume, v_1, is filled with air at atmospheric pressure (p_1). The return of the piston next compresses the air into the combustion chamber, the rise of pressure with diminution of volume being represented by the (adiabatic) compression curve 1–2. At the end of the compression in-stroke the mixture is exploded and an instantaneous rise of pressure occurs from T_2 to T_3; next follows the working out-stroke and the exploded gases expand (again adiabatically) as indicated by 3–4. At the end of the working stroke the exhaust opens suddenly and the burnt charge rushes out, the pressure falling instantly to that of the atmosphere, as indicated by 4–1. Then during the return exhaust in-stroke of the piston the line 10 is traced. This cycle is then repeated indefinitely.

In theory the working air is regarded as receiving a sudden accession of heat at 2 which causes its temperature (absolute) to rise from T_2 to T_3, and a sudden withdrawal of heat at 4, whereby its temperature is reduced from T_4 to T_1. During the periods of adiabatic compression and expansion no loss or gain of heat is considered to occur. Thus the only heat *given* to the working air per cycle is during the explosion 2–3, and the only heat *subtracted* is that during the "exhaust drop" 4–1. The difference between the heat given and the heat subtracted, or "rejected," is the (heat equivalent) of the mechanical work done by the piston per cycle. Accordingly as both heat exchanges take place at constant volume, if K_v denote the specific heat of the working air at constant volume we have:—

Heat given per cycle $= H = K_v(T_3 - T_2)$. B.Th.U.
Heat rejected do. $= R = K_v(T_4 - T_1)$. B.Th.U.

Work done per cycle $= H - R = K_v(T_3 - T_2) - K_v(T_4 - T_1)$. (B.Th.U.= British Thermal Unit, the heat required to raise 1 lb. of water 1°F.) and thus:— (2)

The Thermodynamic Efficiency $= \dfrac{H-R}{H} = 1 - \dfrac{R}{H} = 1 - \dfrac{T_4 - T_1}{T_3 - T_2}$.

This equation expresses the efficiency in terms of the absolute temperatures at the four corners of the diagram; it is much simplified in the following manner:— The ratio $\dfrac{v_1}{v_2}$, termed the adiabatic compression ratio, is always known, and is denoted by r; then $r = \dfrac{v_1}{v_2}$, and it will also be observed that in the four-stroke engine r is also equal to $\dfrac{v_4}{v_3}$,—the ratio of adiabatic expansion. Now it is easily shown in thermodynamics that along an adiabatic curve of a perfect gas the product $Tv^{\gamma-1}$ is constant where γ is the ratio of the specific heat of the gas at constant pressure to the specific heat at constant volume. So that, from fig. 4 in this case:—

$$T_2 v_2^{\gamma-1} = T_1 v_1^{\gamma-1}. \quad \therefore \quad T_2 = T_1 \left(\frac{v_1}{v_2}\right)^{\gamma-1} = T_1 r^{\gamma-1}.$$

$$T_3 v_3^{\gamma-1} = T_4 v_4^{\gamma-1}. \quad \therefore \quad T_3 = T_4 \left(\frac{v_4}{v_3}\right)^{\gamma-1} = T_4 r^{\gamma-1}.$$

Substituting these values for T_2 and T_3 in (2) gives:—

$$\text{Thermodynamic Efficiency } 1 - \frac{T_4 - T_1}{T_4 r^{\gamma-1} T_1 r^{\gamma-1}} = 1 - \left(\frac{1}{r}\right)^{\gamma-1}.$$

and accordingly the expression takes the very simple form:—

$$\text{Thermodynamic Air Efficiency} = 1 - \left(\frac{1}{r}\right)^{0.4} \qquad (3)$$

as for air $\gamma = 1.4$ roundly, in the simple theory here set out.

A committee of the British Institute of Civil Engineers in 1905 recommended the adoption of this expression to indicate the ideal maximum thermodynamic efficiency of the four-stroke engine; it is known as the 1905 Air Standard, and has been very extensively

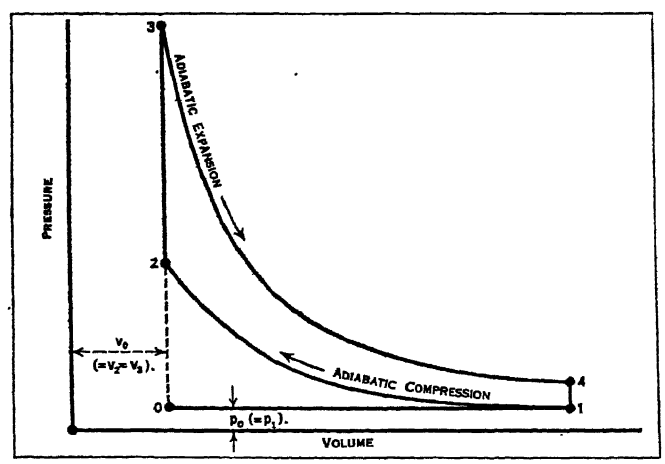


FIG. 4.—IDEAL "OTTO" OR 4-STROKE CYCLE DIAGRAM

employed. It makes the ideal maximum efficiency increase with the compression ratio, as is shown by the following figures:—

For r =	4	6	8	10	12	14
The air std.=	·426	·512	·565	·602	·630	·652

In spite of the simplifying assumptions involved it has very well served its purpose; thus, after very extended experience Ricardo, *The Automobile Engineer*, 1928, observed, "As we raise the compression ratio of an engine we improve both the power output and the efficiency very nearly in proportion to the increase in the Air cycle efficiency."

Estimation of Horse-power.—The smaller-powered quicker

running classes of gas engine are usually tested for power by some form of brake dynamometer by which the "brake" or "effective" horse power is directly determined. With larger engines indicator diagrams (*see* fig. 4) may be taken from the working cylinder; the average height of the figure 1234, measured by the scale of pressures of the diagram, gives the mean effective pressure on the piston in lb./sq.in. during the working stroke; this is usually denoted by p.

Now let d denote the piston diameter in inches, s its stroke in inches, and n the number of revolutions of the crankshaft per minute. Then the piston area is $\cdot 7854\ d^2$ square inches, and therefore the mean effective piston load during the working stroke is $\cdot 7854\ d^2p$ lb. weight.

This load works through $\frac{s}{12}$ feet; and accordingly the "indicated work" performed per working stroke is $\cdot 7854 d^2p \times \frac{s}{12}$ foot-lb. In one hour $60 \times \frac{n}{2}$ working strokes are made and, assuming them all exactly alike, the total indicated work per hour is thus $\cdot 7854\ d^2p \times \frac{s}{12} \times 60 \times \frac{n}{2}$ foot-lb.

But a horse-power is, by definition, a rate of working of 33,000 foot-lb. per minute, or $60 \times 33{,}000$ foot-lb. per hour; finally, therefore the indicated horsepower of a single-cylindered single-acting four-stroke cycle internal combustion engine is expressed by: $\frac{\cdot 7854 d^2psn \times 60}{12 \times 2 \times 60 \times 33{,}000}$; and this reduces by ordinary arithmetic to:—

$$\text{Indicated H.P.} = 99_2 d^2psn \times 10^{-9}. \qquad (4)$$

If the engine have N cylinders, the total I.H.P. is obviously N times as great as (4).

Suppose that by test both the I.H.P. and B.H.P. of an engine have been ascertained. Then their difference, viz., I.H.P. − B.H.P. is the horse-power absorbed in engine friction and in doing any other work incidental to the performance of the cycle of the engine. Their ratio, viz., $\frac{\text{B.H.P.}}{\text{I.H.P.}}$ is termed the "mechanical efficiency" of the engine and is usually denoted by η; thus:—

$$\text{Mechanical Efficiency} = \eta = \frac{\text{B.H.P.}}{\text{I.H.P.}}. \qquad (5)$$

The product ηp, *i.e.*, mechanical efficiency multiplied by indicated mean effective pressure, is termed the "brake mean effective pressure."

The mechanical equivalent of one B.Th.U. is 778 ft.-lb. of work; and accordingly the heat equivalent of one horse-power-hour is $\frac{33{,}000 \times 60}{778} = 2{,}545$ B.Th.U. Suppose, for example, trial of a gas engine to show that 15 cu. ft. of coal gas was consumed per I.H.P. hour, the gas having a heat value of 500 B.Th.U. per cu. ft. Then $15 \times 500 = 7{,}500$ B.Th.U. of heat are expended in obtaining 2,545 B.Th.U. of indicated work; and thus the absolute indicated thermal efficiency $= \frac{2{,}545}{7{,}500} \times 100 = 33{\cdot}9\%$.

If the mechanical efficiency of the engine has been found to be 85%, so that $\eta = 0{\cdot}85$, then the brake thermal efficiency would be $33{\cdot}9 \times 0{\cdot}85 = 28{\cdot}8\%$. If the ratio of compression, r, of the engine were 6, the corresponding ideal air standard efficiency would be 51·2%. And accordingly the relative indicated thermal efficiency $= \frac{33{\cdot}9}{51{\cdot}2} \times 100 = 66{\cdot}2\%$. Similarly the relative brake thermal efficiency $= \frac{28{\cdot}8}{51{\cdot}2} \times 100 = 56{\cdot}25\%$. These figures are from actual test results from a well-designed 100 B.H.P. gas engine in 1923. The small gas engine is rarely as efficient as the large one, contrary to the steam engine.

GAS ENGINE PROGRESS

Fuels Used by Gas Engines.—The principal are:—(1) Town's gas; often styled "coal gas." (2) Producer gas. (3) Coke oven gas. (4) Blast furnace gas. (5) Natural gas.

For a description of these, *see* FUEL; GAS MANUFACTURE; NATURAL GAS.

The table following gives some average values of these fuels and data relating to their employment for power purposes in gas engines:—

TABLE I. *Gas Engine Fuels; average heat values*

Fuel	Heat value in B.Th.U. per c.ft. at 1 Atm and 60° F.	Minimum vol. of air, c.ft. required per c.ft. of fuel	Maximum heat evolved on combustion of 1 c.ft. of mixture B.Th.U.
Town's gas	500	5·5	77
Coke-oven gas	400	4·0	80
Producer gas (from anthracite or coke)	130	1·0	65
Blast-furnace gas	100	0·75	57
Natural gas	950	9·5	90

To avoid overheating the engine it is in practice found necessary to provide a considerable *excess* of air in order to reduce the heat evolved per cu.ft. of mixture used to form 50 B.Th.U. in the smaller types to 35 B.Th.U. in the largest. This practical limitation prevents advantage being taken of the high heat-evolution per cu.ft. of Town's gas, coke-oven gas and natural gas, and furnishes the reason for the suitability of so poor a gaseous fuel as blast-furnace gas.

Ignition.—The ignition of the charge in gas engines with certainty and regularity proved for long a difficult problem first successfully solved by the Barnett (flame) igniting cock (1838), already mentioned, which continued in use up to about 1892. A method very widely used up to about 1923, particularly in small-powered gas engines, was that known as "hot-tube" ignition; it was first employed in the Stockport gas engine in 1883 and in its simplest form it consisted merely of a metal tube, usually of iron or nickel, a few inches long, closed at its outer end, screwed into the end of the engine cylinder, its open inner end being in constant communication with the contents of the combustion chamber ("open-tube" ignition). The tube was continuously heated during working by an external Bunsen-flame lamp, and explosion of the engine charge occurred as soon as the compressed fresh mixture reached its red-hot portion. Tube ignition proved quite satisfactory for engines of up to about 20 horse-power.

Modern gas engines are almost universally fitted with electrical

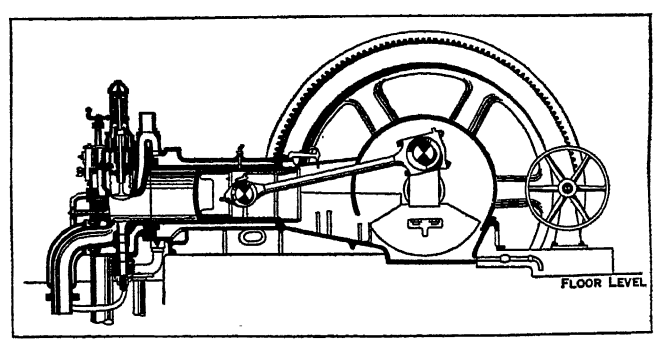


FIG. 5.—CROSSLEY HORIZONTAL GAS ENGINE; SECTIONAL VIEW

ignition, commonly of the low tension magneto type wherein a magneto with a rocking armature provides current to a low-tension make-and-break ignition plug fitted to the combustion chamber of the cylinder. High tension magneto ignition, substantially as used in all petrol engines,—though of robuster type,—is also becoming more general; thus in 1922 the gas engines of, *inter alia*, the National, Campbell, and Browett-Lindley companies were fitted with H.T. ignition.

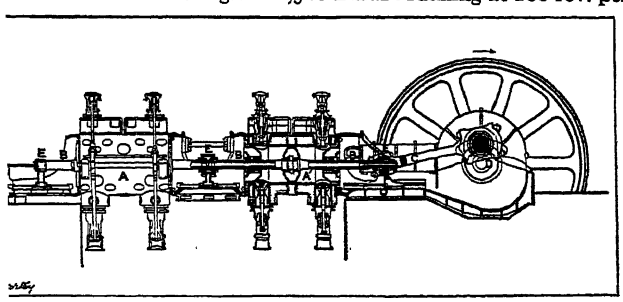
Starting of Gas Engines.—For engines of less than about 30 H.P. no special starting apparatus is usually needed; having

arded the ignition, and turned on the gas supply, the fly-eel is turned by hand as quickly as possible and the engine thus rted.

Many gas engines of 30–200 H.P. are started by aid of a small mp fitted to the engine by which an initial charge of gas and is delivered by hand-power into the combustion chamber, and ited by "flicking over" the L.T. magneto by hand; many wheels are furnished with a ring of holes round the rim for ertion of a crow-bar, by which the engine may be "barred" nd so as to get the crank-pin in a favourable position for rting, *i.e.*, about 20° beyond the inner dead centre on the ng stroke. Large gas engines are started by compressed air red in cylindrical steel reservoirs at a pressure of 100–300 lb. in. The air compressor is sometimes belt-driven from the en-e, but in very large engines is a separate unit driven by a small iliary engine. A special air-starting valve is fitted to the com-stion chamber of the cylinder, and on admission of the com-ssed air through this the engine commences to turn, and takes its working cycle after a few revolutions.

Modern Gas Engines.—In gas engines of less than about 400 P. but little essential change has occurred since 1910; there is teady output by many builders of repute of a nearly standard ie of horizontal four-stroke cycle single-acting one- or two-indered engine using Town's gas or producer gas as fuel. A mal engine of this type, by Crossley Bros. is shown in fig. 5, nprising a water-jacketed cast iron cylinder fitted with a gas-it cast-iron piston driving a crankshaft in the usual manner by ans of a connecting rod. The very massive flywheel will be ed; in this case it is formed with an internally-toothed ring l by means of the hand-wheel and enmeshed pinion shown rring" round before starting is effected. At the closed end or eech end" of the cylinder is the combustion chamber con-ning at the top the mixture inlet valve and at the bottom the aust valve both, of course, cam-operated from the half-speed ft. Ignition is by low-tension (L.T.) magneto. The engine ed is regulated by a governor which varies the lift of the inlet ve.

Vertical Gas Engines.—The considerable bulk and weight of horizontal slow-running larger gas engine has caused attention be given to faster-running multiple-cylindered inverted-verti-designs, occupying much less floor area, and of diminished and weight. Prominent among British builders of this type is National Gas Engine Co. whose designs range from a four-inder, two-crank, single acting four-stroke inverted vertical dem engine of 300 B.H.P. at 300 rev. per minute, to a 12-cylin-six-crank similar design of 1,500 B.H.P. running at 200 rev. per



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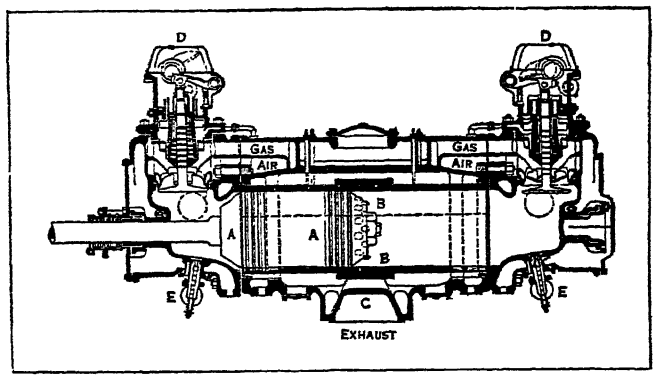
G. 6.—LARGE HORIZONTAL GAS ENGINE. A 2-CYLINDER, DOUBLE-:TING, 4-STROKE, SINGLE-CRANK NUREMBERG ENGINE

ute. One "National" installation of this type aggregates 11,-horse power.

Large Gas Engines.—From about 1910 improvement in the gest types of gas engine have been mainly in matters of detail *e.g.*, in the more extended use of refuse material as fuel for gas producers: in the employment of high tension electrical ition: and in better cooling and governing arrangements.

The large horizontal slow-speed engine is typified by the four-ke double-acting tandem design as developed by the Nurem-g (M.A.N.), Ehrhardt, Deutz, and Haniel companies in rope, and built also in Great Britain by the Lilleshall Co., kers and Galloways.

The *tandem double*-acting four-stroke engine possesses the important advantage that every stroke is a working stroke. A view of a 2,500 Horse-power M.A.N. engine, in part section, is shown in fig. 6. The two liberally water-cooled cylinders A,A′, are in line with their water-cooled pistons mounted on a common piston-rod (also water-cooled), to one end of which is attached the connecting-rod C driving a single-throw crankshaft D. The



FROM GIBSON AND CHORLTON, "MODERN MECHANICAL ENGINEERING" (BLACKIE & SONS)

FIG. 7.—SECTION OF 600 B.H.P. KOERTING ENGINE CYLINDER

three crossheads EEE are adjusted to carry the weight of the piston rod and also of the two heavy pistons, so that these "float" in the cylinders, thus greatly reducing engine friction and consequent wear. The inlet valves will be noted at the top, and the exhausts at the bottom, of each cylinder. To illustrate performance:—Eight engines of this type by Vickers had each a cylinder bore of 43·3 in., a stroke of 47·3 in. and, using blast furnace gas, developed roundly 1,800 B.H.P. at a speed of 100 rev. per minute. One of the largest installations of M.A.N. engines is a 65,000 horse-power plant at Bruckhausen. The type is very reliable and economical; a 2,000 H.P. engine using blast furnace gas has run, day and night, during 19 months. In 13,870 consecutive hours the engine actually ran during 13,687 hours, *i.e.*, 98·6% of the whole time possible; and the stoppages were due to the blast furnace, and not to the engine.

Large Two-stroke Gas Engines.—The large two-stroke Clerk cycle engine has proved very successful, particularly in the horizontal designs of Koerting & Oechelhauser.

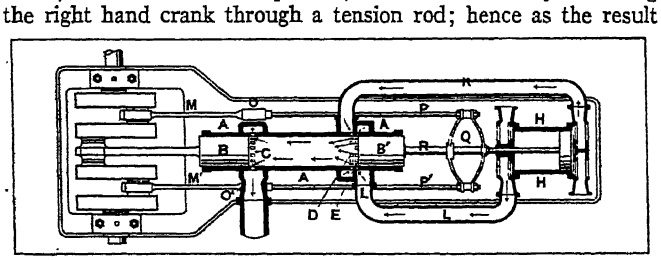
The Koerting is a single-cylindered double-acting horizontal two-stroke engine, and the piston thus receives a working impulse in every stroke. A sectional view of a Koerting cylinder appears in fig. 7. The engine is characterized by the long water-cooled piston AA,—of length fully half that of the cylinder; in its extreme right and left positions the piston over-runs a central belt of exhaust ports BB, and so permits the escape of the burnt gases into the exhaust branch C. At each end of the cylinder is a mechanically operated inlet valve D, D^1. The illustration shows the contents of the right-hand end of the cylinder exhausting through BB; simultaneously the inlet D^1 is opened admitting firstly *air* only, and immediately afterwards the working charge of mixed gas and air. The preliminary air is a scavenging charge; the working charge is delivered to the inlet valve boxes by separate double-acting pumps driven by the engine and no mixture of gas and air occurs until they jointly enter the working cylinder; this is an important point in relation to large gas engines. The piston now moving towards the right first cuts off the exhaust ports BB and next compresses the mixture into the combustion chamber where it is fired (by L.T. magneto) as usual, the resulting explosion driving the piston towards the left. The same cycle of operations is performed in the left-hand end of the cylinder, and thus *every stroke* of the piston is a working stroke. Starting is effected by compressed air stored at 150–300 lb./sq.in.; the air starting valves are shown at EE in fig. 7.

The Siegener Co. have built Koerting engines giving 2,000 horse-power from a single cylinder of 42 in. bore and 55 in. stroke, running normally at 80–90 revs. per minute. The inlet valves of these very large engines were 19·7 in. in diameter, with a lift of 3·14 in. The American de la Vergne Co. have installed at Buffalo

Koerting-type engines aggregating 40,000 B.H.P. Upwards of 250,000 B.H.P. of Koerting engines had been constructed in 1923.

The Oechelhauser Engine.—This successful large two-stroke gas engine works on a modified Clerk cycle; a diagrammatic view appears in fig. 8. The engine is of the horizontal single-acting type having a cylinder AA open at *both* ends, containing two pistons BB^1 working in opposite directions, and driving a common three-throw crankshaft. B drives the central crank through an ordinary connecting rod, while B^1 is fitted with a short piston rod R terminating in a crosshead Q fitted with side rods PP^1 and return connecting rods MM^1 driving the two side cranks. The combined gas and air pump HH is also driven from the crosshead Q as indicated. Just before it reaches its extreme "out" position piston B over-runs the ring of exhaust ports C; at the same time piston B^1 over-runs firstly the ring of *air* inlet ports D and immediately thereafter a second ring of *gas* ports E. The exhaust gases at once escape through C, assisted by the scavenging charge of air under slight pressure entering through D. This fresh air also cools any residual exhaust gas, so minimizing risk of pre-ignition, and preventing loss of fresh fuel through the exhaust when the gas ports E open. The pistons next approach one another and compress the entrapped fresh charge between them; at the end of the "in," *i.e.*, compression stroke, the mixture is fired electrically and the working out-stroke then follows. The engine thus furnishes one impulse per revolution. The double-acting pump H is an air-pump on one side of its piston and a gas-pump on the other; gas and air are pumped separately into the reservoirs L and K respectively, in which a pressure of 5–6 lb./sq.in. is maintained. It will be noted that the gas and air are only mingled actually within the working cylinder. Oechelhauser engines to Messrs. Beardmore's designs range from 400 horse power at 130 rev. per min., with cylinder 24 in. bore and stroke of 30 in., to 2,500 horse power at 80 rev. per min., with cylinder bore of 48 in., and stroke of 60 in.

The Fullagar Engine.—A valuable advance in the double-piston Oechelhauser type of engine was made by H. F. Fullagar about 1912. By associating together *two* open-ended cylinders he dispensed with the somewhat cumbrous side-rods and return connecting-rods of the Oechelhauser design, and also was able to use a normal flat *two*-throw crankshaft. In this way weight and cost were saved and a very compact engine, giving two impulses per revolution, resulted. The essential feature of the Fullagar power unit is a pair of side-by-side open-ended cylinders with their pistons connected across by special diagonal tension rods; the obliquity of these rods is not great, and the side-thrusts arising therefrom are borne by crossheads and (water-cooled) guides. The compressed power charge between, say, pistons A and B being fired, B is driven downwards thus actuating the left-hand crank, while A is driven upwards, thus simultaneously actuating the right hand crank through a tension rod; hence as the result



FROM GLAZEBROOK, "DICTIONARY OF APPLIED PHYSICS" (MACMILLAN & CO.)

FIG. 8.—DIAGRAM OF THE 2-STROKE DOUBLE-PISTON OECHELHAUSER ENGINE

of each working impulse the crankshaft experiences a nearly simple "torque"; moreover, the cylinders being open-ended, no stresses are set up in the engine-framing during running; thus the Fullagar engine may be built somewhat light for its power output. As described here, the charges of gas and air are as if supplied by pumps formed by boxing in the top crossheads; the charge is delivered at a pressure of about 3 lb./sq.in. As with other two-stroke cycle engines, the Fullagar may be run in either direction by giving it the necessary initial motion, and suitably timing the ignition.

An early experimental engine of 550 B.H.P. by Allen of Bedford comprised *two* Fullagar units with cylinders of 12 in. bore, and each piston with a stroke of 18 in.; normal speed 250 rev. per min. A 30-hour trial of this engine showed an absolute thermal indicated efficiency of 37·6%; the weight of the engine was only 87·5 lb. per B.H.P. which is small for a stationary design. A 2,000 horse-power engine by Belliss and Morcom in 1918 comprised *three* Fullagar units, with 18 in. cylinders and 27 in. stroke, running at 170 rev. per minute. This engine used as fuel coke-oven gas having a net calorific value of 440 B.Th.U. per c.ft. and tests showed a full-load consumption of roundly 22¼ c.ft. of gas per B.H.P. hour, corresponding to an absolute brake thermal efficiency of 26%. The Fullagar engine also uses oil fuel in the Diesel manner, and marine Fullagar-Diesel engines are constructed by Cammell Laird and others in sets of 3,000 B.H.P. and over.

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HEAVY OIL ENGINES

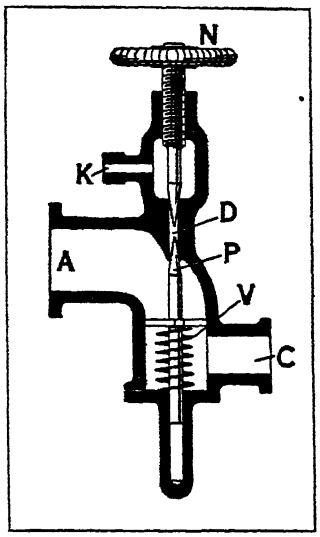
The success of the Otto and Langen engine, described above, and the final establishment of internal combustion engines on a commercial basis by the Otto silent gas engine of 1876, directed the close attention of many engineers to improving further such engines particularly in relation to the fuels employable. Town's gas was an expensive fuel, and available only in large centres of population. The increasingly wide distribution of petroleum oils, particularly the paraffin oils, lamp-oils, or kerosenes, no doubt suggested that if such oils could be rendered available as fuel a much wider area of usefulness would be opened to the internal combustion engine. The earliest of such engines to achieve a considerable measure of success was the Priestman Oil engine introduced in 1885.

Heavy Oils.—This is a general name for inflammable liquid hydrocarbons, particularly petroleums, of flash point exceeding about 75° F and ranging in specific gravity from 0·78 to 1·0; with such liquids a considerable preliminary heating is necessary to obtain an explosive mixture of their vapour with air, and the earliest heavy oil engines were accordingly of the vapourizing class, and used as fuel American and Russian kerosenes, Scotch paraffin and shale oils, and even crude and residual petroleum oils.

The Early Priestman Oil Engine.—This engine was built (1885) in four-stroke cycle single-cylindered types up to 11 horse power, and gave best results when using as fuel kerosenes of 0·8 sp.gr. and flash point about 100° F. The oil fuel was delivered by air pressure through a minute orifice, in the form of a very fine spray or mist, into an exhaust-heated vessel or "vapourizer," where it immediately became gaseous; in this condition, during the suction stroke of the engine, it entered the cylinder together with a correct proportion of air drawn in through an automatic valve; this mixture was then compressed and fired and the working stroke followed as usual. To start the engine the vapourizer received a preliminary heating from a blow-lamp; a small hand-pump then furnished air for the initial spraying of the fuel into the vapourizer; the flywheel next being turned by hand, the engine started running. As soon as all was well warmed up, the blow-lamp was extinguished, the engine exhaust thereafter maintaining the vapourizer at its necessary high temperature. A test of a 4·5 horse-power, 8·5 in. bore × 12 in. stroke × 180 rev. per min., Priestman engine in 1890, using as fuel Broxburn lighthouse oil of ·81 sp.gr. and flash point 152° F, showed a consumption of 1·243 lb. of oil per B.H.P. hour. In later tests (1892) of an engine of the same size, running at 204 rev. per minute, and using as fuel Royal Daylight oil of ·79 sp.gr. and flash point

° F, the consumption was reduced to 0·842 lb. per B.H.P. ur. The pressure of compression in these tests was 35 lb./sq.in., d of explosion, 151·4 lb./sq.in. above atmosphere; and the tal heat value of the Royal Daylight oil was stated to be 21,490 Th.U. per lb.

Gardner Paraffin Engine.—Priestman was quickly followed by her inventors, as Griffin, Samuelson, Thornycroft, etc., who ed exhaust-heated vapourizers, and by Gardner, Howard, nith-Dudbridge, Crossley, etc., 10 used lamp-heated vapour- ers. In the earlier Gardner raffin engines, for example, the raffin was supplied, either by avity or under pressure, to e "mixer" diagrammatically own in fig. 9. The paraffin, tering through K, passed into e small duct D through a hand- gulated needle-valve N. The air tered through the branch A. ıe spring-supported disc, V, rne on a spindle terminating wards in a needle valve P tomatically closed the fuel pply when the engine ceased nning. The branch C com- ınicated with the lamp-heated pourizer.



FROM CLERK AND BURLS, "GAS, PETROL AND OIL ENGINE" (LONGMANS, GREEN & CO.)

FIG. 9.—EARLY GARDNER PARAFFIN "MIXER"

During each suction stroke of e engine, air drawn in through depressed the disc V, so per- tting delivery of a sprayed arge of fuel through D. The xture of the air and fuel-spray next passed via C into the pourizing vessel which was continuously heated by an external ınsen-flame oil lamp. As fuel it was found practicable to use rosenes of ·825 sp.gr. and up to 200° F flash (by close test). ur-stroke vapourizing engines of this type were built having ım 1 to 8 cylinders, and developing from 5 to 200 horse-power. In the vapourizer, heavy oil fuels were rendered gaseous, mixed th a suitable volume of air, admitted to the cylinder and then ploded exactly as in an ordinary gas engine. Simple though 's would be were heavy oils hydrocarbons of one definite emical composition, it has proved practically troublesome with tual heavy oils, which are in general composed of a mixture many different liquid hydrocarbons, boiling at temperatures ıging from 200° F to 600° F; thus completely to vapourize ch fuel its temperature must be raised at least to 600° F. But this high temperature the lighter constituents of the fuel are ble to be "cracked," *i.e.*, decomposed into free hydrogen and :bon; the carbon deposits in the vapourizer, in time choking up. In practice a fuel temperature in the vapourizer of about o° F was found to be the best to use. This necessary pre- ating of the fuel involved three serious disadvantages:—(1) ıe fresh charge of air and vapour being heated before entering e cylinder, had expanded thus reducing the mass of the charge, d hence the power output of the engine. (2) The fresh charge ing heated, only a low compression ratio, usually 3·0 to 3·5, uld be employed in order to avoid detonation and pre-ignition ubles. (3) The use of a low compression ratio kept the ther- ıdynamic efficiency of such engines low.

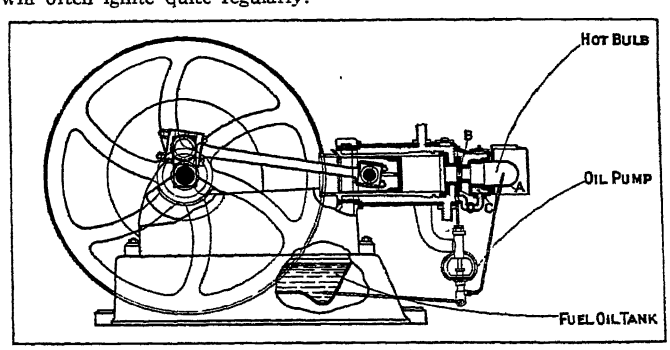
Accordingly although the heat value of kerosene usually some- at exceeds that of petrol, vapourizing oil engines designed to e either fuel usually give only some 85% of their maximum wer output with paraffin, and show a reduced economy.

In small powers (5 H.P. or so), vapourizing engines are still ed to a small extent for domestic lighting and light agricultural rk, but are rapidly being replaced (*a*) by the much more anly and convenient small petrol engine, and (*b*) by more dern and simple heavy oil engines as described later herein.

The Hornsby-Akroyd Oil Engine.—An important simplifi- ion in the working of heavy oil engines was effected by Akroyd Stuart (1886–90) who succeeded in dispensing both with a separate vapourizer and also with all ignition apparatus. The famous Hornsby-Akroyd oil engine was the first to utilize successfully the heated wall of a special portion of the combustion chamber to effect both vapourization of the fuel and the automatic ignition at the correct instant of the working charge. A sectional view illustrating this engine appears in fig. 10 which shows an ordinary single-acting horizontal four-stroke cycle internal combustion engine but with an extension A, termed the "hot bulb" attached to the end of the combustion chamber, communication between them being by a relatively small passage B.

The action is as follows:— The hot bulb receives a preliminary heating from an external blow-lamp; the engine flywheel being next turned by hand, the piston during the suction stroke draws a charge of air directly into the cylinder through an air inlet valve; at the same time the charge of oil is delivered by the small force-pump into the hot bulb where it vapourizes and the vapour, mixed with residual exhaust gas from the previous cycle thus fills the bulb, the cylinder containing air alone. On the compression stroke of the piston the air passes through the narrow passage B into the bulb and then mixes with the oil vapour; the mixture is at first too rich to ignite, but the engine is so adjusted that just as the compression is completed a correct mixture is attained; the heat of the hot bulb then causes automatic ignition, and the resulting pressure drives the piston outwards, thus performing the working stroke. The bulb temperature is maintained by heat derived from successive explosions during running. After prolonged heavy-load running the bulb tends to become too hot, which causes pre-ignition of the charge, and also "cracking" of the oil, with resulting deposit of "coke"; on the other hand if the engine be run light for some time the bulb tends to become too cool to ignite the charge. A suitable bulb temperature is maintained by varying the supply of cooling water to the jacketed forward end of the bulb by means of the hand-controlled valve C. With reference to the automatic ignition of the charge, Sir D. Clerk observes (*The Gas, Petrol and Oil Engine*, vol. ii.):

"It is a peculiar fact that oil vapour mixed with air will explode by contact with a metal surface at a comparatively low temperature, and this accounts for the explosion of the compressed mixture in the hot bulb A, which is never really raised to a red heat. It had long been known to engineers conversant with gas engines that in certain conditions of the internal surface a gas engine will run and ignite with great regularity without any special form of ignitor, if only some portion of the interior surface of the cylinder or combustion chamber be so arranged that its temperature is moderately raised. Although that temperature may be too low to ignite the mixture at atmospheric pressure, yet when compression is complete the mixture will often ignite quite regularly."



FROM CLERK AND BURLS, "GAS, PETROL AND OIL ENGINE" (LONGMANS, GREEN & CO.)

FIG. 10.—EARLY HORNSBY-AKROYD OIL ENGINE

In an old early two-stroke cycle engine (*circa* 1880) Clark screwed a bolt into the end of the piston, the bolt being long enough to project well into the explosive charge. After running the engine for about 15 minutes in the usual way he found that if the flame-igniting device were put of action the engine still continued to run regularly, the mixture being fired by the heated end of the bolt which caused ignition just as the mixture became fully compressed; in this case, however, the bolt attained a high red heat. Later, "hot-bolt" ignition was for a time used in some oil engines by, *e.g.*, Clayton and Shuttleworth and Crossley.

Test of a single-cylindered 32. B.H.P. Hornsby-Akroyd engine in 1908 gave results as follows:—

Compression pressure, 85 lb./sq.in.

Explosion pressure, 260 lb./sq.in.

Lbs. of fuel used per B.H.P. per hour (full load). 0·613.

The fuel used was "Russolene" oil having a sp. gr. of ·82, a flash point of 88° F (close test), and a heat value of 18,450

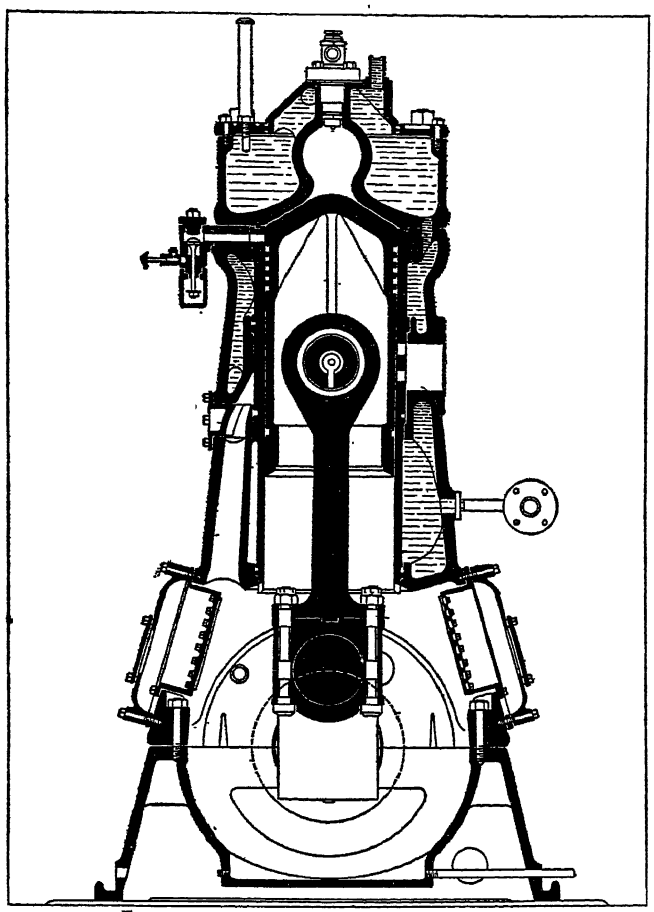


FIG. 11.—PETTER "C" TYPE HEAVY OIL ENGINE

B.Th.U. per lb.; the Brake Thermal Efficiency was therefore $\frac{2545}{\cdot 613 \times 18450} \times 100 = 25 \cdot 5\%$. The engine ran at 230 rev. per minute.

Many other "hot bulb" engines soon appeared, *e.g.*, the Blackstone, Crossley, National, Robey, Petter, Ruston, etc. Thus, in the Crossley Lampless oil engine, the oil is vapourized by injection into a hot bulb forming a prolongation of the combustion chamber; ignition is, however, here effected automatically by a hot tube which projects into the bulb and is maintained at the high temperature necessary to cause ignition by heat derived from the successive explosions; many early hot-bulb engines were similarly fitted. During prolonged running at heavy load a small spray of water could be injected into the exploded mixture through the "water sprayer"; the practice of water injection was at one time somewhat extensively adopted, but it is preferable to avoid it if possible.

Numerous hot-bulb engines have appeared since about 1886 varying only in the details of vapourization of the fuel, their mode of operation being, in general, not essentially different from that of Akroyd Stuarts' engine.

SEMI-DIESELS

Appearance of the Diesel engine (*q.v.*) in 1895, with its remarkably low fuel consumption and high efficiency of performance, attracted engineers to the problem of obtaining this low fuel consumption without being compelled to have recourse to the extremely high compression and high-pressure injection-air-blast of the Diesel, which involve a heavy and costly engine, necessitating great refinement in design and manufacturing processes to ensure satisfactory continuous running.

This problem has been very well solved by combining the hot bulb engine with a moderate compression and airless or "solid injection of the fuel at or about the instant of maximum compression in a large class of engines of both four-stroke and two-stroke cycle, now termed semi-Diesels.

The accepted definition of a semi-Diesel engine is as follows:—

"A semi-Diesel engine is a prime mover actuated by the gases resulting from the combustion of a hydrocarbon oil. A charge of oil is injected in the form of spray into a combustion space open to the cylinder of the engine at or about the time of maximum compression in the cylinder. The heat derived from an uncooled portion of the combustion chamber, together with the heat generated by the compression of air to a moderate temperature, ignites the charge. The combustion of the charge takes place at, or approximately at, constant volume."

By 1928 the great majority of hot bulb semi-Diesel engines operated on the two-stroke cycle, with or without crank chamber compression (*see* above); among the few examples of four-stroke cycle hot bulb semi-Diesels the Ruston and Hornsby "Class M" engine may be noted. These, built in single-cylindered horizontal type from 6 to 40 B.H.P., are run on crude, standard Diesel, or refined oils, and show a consumption from ·48 to ·6 lb. per B.H.P. hour. The hot bulb receives a preliminary heating by lamp, and the oil fuel is injected by a small force-pump as usual. Starting is effected by hand, or compressed air if preferred. Four-stroke hot bulb semi-Diesels were also then built by Fielding and Platt, and by Tangye; the four-stroke type though more costly to build, is somewhat more economical in fuel consumption than the two-stroke, and requires also in general considerably less oil for lubrication.

The great simplicity, low production cost, and considerable fuel economy of this type caused it to grow rapidly in favour with power users, and among prominent builders in 1928 may be mentioned:—Allen, Babcock, Beardmore, Bolinders, Campbell, Gardner, Marshall, Mirrlees, Petter and Robey.

A typical two-port, two-stroke, hot-bulb, semi-Diesel heavy oil engine with crank-chamber compression (*see* above) is the (Swedish) Bolinders engine as largely used for marine purposes in motor trawlers, etc., which is built in robust four-cylindered designs up to 500 brake horse power. In this engine air enters an enclosed crank-chamber during the up-stroke of the piston through automatic valves, and near the end of the down-stroke, under slight pressure, rushes into, and charges, the cylinder through an inlet port, and assists also in the expulsion of the burnt gases through an exhaust port on the other side. On the succeeding up-stroke the air is compressed to 125–150 lb./sq.in. into the combustion chamber and hot bulb and at the end of compression the fuel pump sprays the charge of oil into the bulb, the explosion automatically following. The hot bulb receives a preliminary heating by lamp, and the engines are started by compressed air.

To reverse the marine Bolinders engine it is slowed nearly to the stopping point, when a special device sprays a charge of oil into the bulb before the piston has quite completed its up-stroke; a premature explosion follows, and reversal of motion takes place, the engine thereafter running equally well in the new direction.

Vickers-Petter Heavy Oil Engines.—These engines are also solid-injection, two-port, two-stroke cycle semi-Diesels with crank-chamber compression, but with the bulb *water*-jacketed, as shown in fig. 11. By extended tests the makers are enabled to obtain automatic ignition of the charge using only a moderate compression pressure, and thus eliminate the *hot*-bulb. These engines are built of single-cylindered 25 B.H.P. type running at 375 rev. per min. to six-cylindered 600 B.H.P. running at 270 revs. per minute, and use as fuel refined, crude and even low-grade residual petroleum oils; the consumption is as low as 0·43 lb. of fuel per B.H.P. hour. Starting from cold is effected by compressed air in about one minute.

Though there is no "uncooled portion of the combustion chamber" in this and the following type, they are still usually classed

by engineers as "semi-Diesels" as the combustion of the fuel is, in general, of the "constant volume" type.

"Cold Starting" Heavy Oil Engines.—Lastly is to be noticed a large modern class of heavy oil engine mostly of four-stroke type in which the bulb is entirely eliminated. The type depends for ignition solely upon the high temperature attained by the air on compression; it employs compression pressures higher

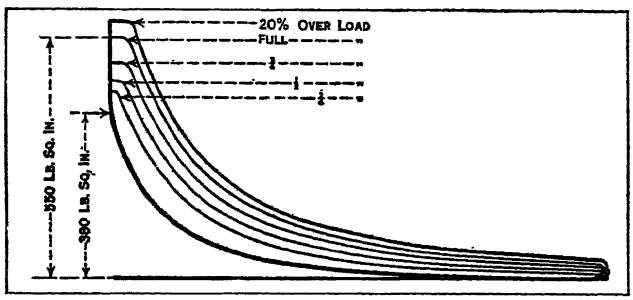


FIG. 12.—INDICATOR DIAGRAMS FROM BLACKSTONE "COLD STARTING" SEMI-DIESEL ENGINE

than those used in the hot bulb class, yet lower than those in the true Diesels; the fuel is sprayed by airless or "solid" injection into the combustion space at, or near, the instant of maximum compression, the resulting combustion being, in general, partly at constant volume and partly at constant pressure. Such are styled "cold starting" engines and are usually included among "semi-Diesels," as in a true Diesel engine the combustion pressure should not rise above the maximum pressure of compression.

This is very well illustrated by fig. 12, which is a reproduction of diagrams taken from a 150 B.H.P. Blackstone cold starting heavy oil engine. It will be observed that the maximum *compression* pressure was 380 lb./sq.in., while the maximum *explosion* pressure was 550 lb./sq.in. at full load, and that combustion continued constant at this maximum explosion pressure for a short portion of the working stroke.

Four-stroke cold-starting engines were built in 1928 by, among others, the following prominent British makers:— Blackstone, Campbell, Crossby, National, Premier, Robey, Ruston & Tangye; these were built in units of from 6 to over 300 B.H.P.

The table below shows roughly the progressive increase in fuel economy in heavy oil engines from the introduction of the early Priestman vapourizing paraffin engine of 1885 to the Scott-Still combined Diesel-steam type of 1928:—

TABLE II. *Illustrating progressive fuel economy in Heavy Oil Engines*

Type	Average fuel consumption in lb. per B.H.P. hour
Early Priestman Vapourizing "Paraffin" engine	1·24 to 0·84
Early Hornsby-Akroyd hot bulb	0·61
Later improved hot bulb engines	0·48 to 0·6
Water-cooled bulb engines	0·43
"Cold Starting" engines	0·41
True Diesel engines	0·39
Still-Diesel-steam engine	0·35

BIBLIOGRAPHY.—The subject of heavy oil engines is a large one, and only a somewhat superficial account can be presented in a short article; readers who wish to proceed further may refer with advantage to some of the following works:—

B. Donkin, *Gas, Oil and Air Engines* (1911); D. Clerk and G. A. Burls, *The Gas, Petrol and Oil Engines,* 2 vols. (1912); K. Kirschke, *Gas and Oil Engines,* trans. C. Salter (1913); W. Pollock, *Hot-bulb Oil Engines* (1919); L. H. Morrison, *Oil Engines* (1919); A. H. Goldingham, *The Design of Oil Engines* (1922); A. W. and Z. W. Daw, *Oil and Gas Power* (1923); A. H. Bird, *Oil Engines* (1923); A. P. Chalkley, *The Diesel Engine,* 6th ed. (1927). *See* the various engineering and marine journals.

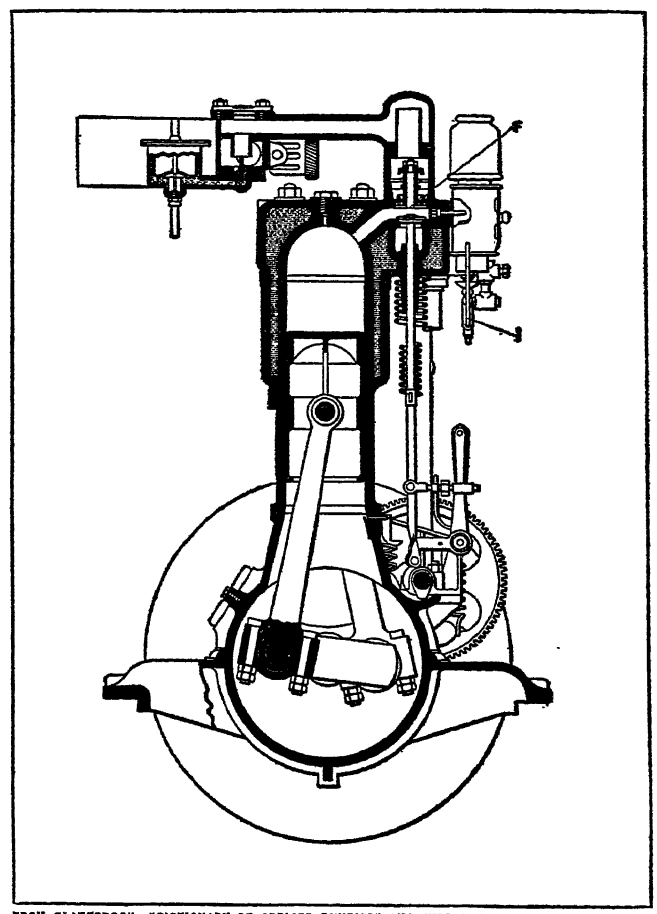
LIGHT OIL (OR PETROL) ENGINES

Few inventions in the short space of a single generation have effected such profound changes in human life as the small high-speed light oil internal combustion engine, more familiarly known as the "petrol motor." Not only has it completely revolutionized land transport, but it has also rendered popular flight by heavier-than-air machines, and in marine, submarine, industrial, agricultural, and even in domestic life has wrought important and far-reaching changes.

Daimler's Engines.—The principal credit of the invention of this all-important type of internal combustion engine is due to Gottlieb Daimler (1834–1900). Up to about 1883 even the smallest internal combustion engines were extremely heavy weighing as much as 1,100 lb. per horse-power, and running at not more than 200 rev. per min.; Daimler's 1886 engine ran at fully 800 rev. per min., and weighed only 88 lb. per horse-power. An early design by him is illustrated in fig. 13; it is of the normal four-stroke inverted-vertical type with enclosed crank-chamber and "splash" lubrication. Daimler first used the starting handle. The valves will be noted in a pocket on the right of the cylinder, the (automatic) inlet being placed above the cam-operated exhaust; between them is to be seen the platinum open-tube igniter, heated by an external petrol-burning lamp *l*.

In fig. 13.a simple type of float-feed carburetter is indicated, but in the earlier Daimler motors a surface carburetter was used in which warmed air was drawn through a constant thickness of petrol during the suction stroke of the engine.

Thus Daimler's great achievements were (1) The successful



FROM GLAZEBROOK, "DICTIONARY OF APPLIED PHYSICS" (MACMILLAN & CO.)

FIG. 13.—DIAGRAM OF EARLY DAIMLER ENGINE

employment of high revolution speeds enabling bulk and weight to be greatly lessened and power increased, and (2) The successful and safe employment of mixtures of volatile liquid hydrocarbons or "petrols" as fuel. The first Daimler motor-bicycle ran in 1886, and the first Daimler-engined car in 1887. It is curious at the present day to learn that he did not regard favourably the application of his little engine to road vehicles, and that he devoted his attention later to their use in propelling launches and canal boats, in which services they were largely used from 1887 onwards.

But in 1889 Panhard and Levassor arranged for the manufacture of Daimler's engines in France, and progress in automobilism quickly became apparent. Contemporaneously with Daimler, Benz of Mannheim had devoted much attention to the production of a small I.C. engine for road vehicles, and achieved considerable success; as early as 1878 Charles Benz fitted a tricycle with a ¾ horse-power motor, and obtained a speed of 7 miles per hour. The early Benz cars, belt-driven by a horizontal four-stroke single- or double-cylindered rather slow-running engine located in the rear of the vehicle, for some years enjoyed a deservedly high reputation; at the 1889 Paris exhibition a Benz car was the sole representative of automobilism!

Among the early pioneers must also be mentioned de Dion Bouton, who effected substantial advances in motor-car engines from 1895 onwards; these little engines—fitted even then with high tension ignition with non-trembling coil and dry battery—ran very fast and had a notably high power output. The early de Dion 1¾ and 2¾ horse-power motor tricycles were widely used for several years. Their original engine was air-cooled with the now long familiar finned cylinder and aluminium crank-case, splash lubrication, automatic inlet valve, high tension electric ignition, and ran at 1,500–1,800 rev. per min. The early heavier type cars of Daimler and Panhard were usually driven by two-cylindered engines of about 3½ in. bore×5 in. stroke×700 rev. per min., and were fitted with open-tube ignition, with external lamps to keep the tubes hot (*see* p. 500, GAS ENGINES). Four-cylindered water-cooled engines largely increased in number from 1902 onwards.

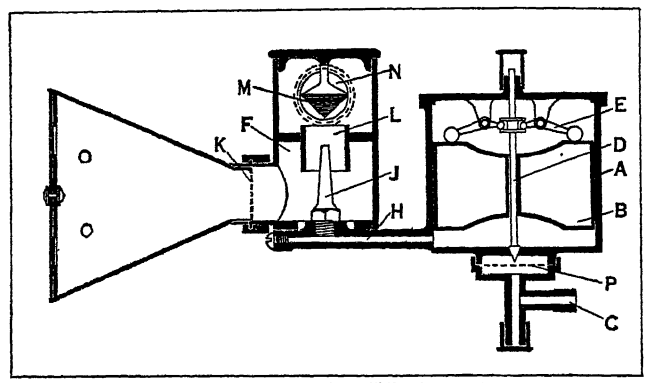
Early estimates of the power required for cars were ludicrously inadequate; even in 1896 the late Sir D. Salomons stated publicly that the horse-power necessary had been raised from four to six; yet, within a very few years cars were running with engines of 60, 80 and even 100 horse-power.

The four-cylindered four-stroke inverted-vertical single-acting water-cooled engine with cam-operated "poppet" inlet and exhaust valves, H.T. magneto ignition, float-feed carburetter and semi-forced lubrication has now for long been firmly established as the standard petrol motor of the average road automobile.

By 1928 a tendency towards the greater luxury of the six-cylinder-engined car became manifest; a few eight-cylindered cars were also built; and the Daimler Motor Co. had even put on the market a *twelve*-cylindered car, the "30 H.P. double-six." A few successful two-cylindered small cars were also largely employed in 1928, notably the 7 H.P. "Jowett," and the "Trojan."

Fuels of Petrol Engines.—The change, mainly effected by Daimler, from the heavy slow-running gas engine to the small high-speed light liquid fuel motor proved practically a lengthy task, the choice of a suitable and easily procurable fuel being particularly difficult. It is to be remembered that in his day the petroleum industry was young, and the lighter volatile and highly inflammable constituents of crude oil were regarded as dangerous, and treated mainly as waste substances. The mixture of light hydrocarbons known in Britain as petrol, in America as gasoline and in France as essence, now so largely used consists, for the most part, of the lighter constituents of crude petroleum oils, and ranges in specific gravity from about ·68 to ·78. The earliest engines "carburetted" their air, *i.e.*, obtained an explosive mixture of air and vapour from the liquid fuel, by passing the air drawn in by the engine on the suction stroke over a series of trays fitted in a closed vessel; the trays were kept supplied with a thin layer of the liquid fuel by a small pump. The air thus became saturated with vapour, and correct proportions of the mixture were obtained before reaching the engine by regulated admission of an additional quantity of fresh air. This was the general principle of the surface carburetter, which survived in a few cases (as, *e.g.*, the Lanchester) even as late as 1910. The insuperable objections to the type were (1) The difficulty of obtaining a correct mixture at varying speeds and temperatures, (2) The lighter constituents of the fuel usually evaporated first, leaving a heavier and relatively non-volatile residuum which was wasted. Hence arose a great demand for a practically homogeneous petrol of about ·68 sp.gr., but the rapid growth in the world consumption soon exhausted available supplies of this very light spirit.

Maybach's famous "float-feed" carburetter, invented in 1893, was, however, found to supply a completely satisfactory practical solution of the problem of using successfully much heavier grades of petrol, and this, in numerous improved forms, is in universal use at the present time. A diagrammatic illustration of this cele-



FROM CLERK AND BURLS, "GAS, PETROL AND OIL ENGINES" (LONGMANS, GREEN & CO.)

FIG. 14.—DIAGRAM OF EARLY "MAYBACH" CARBURETTER

brated device is given in fig. 14. Within the chamber A is a light brass or copper cylindrical float B which maintains at a constant level the petrol supplied through C by its action on the central needle valve D through the weighted levers E. A small duct H maintains constant communication between the float chamber and the spray chamber F which contains the spray nozzle J within which the petrol rises nearly to the top when the engine is at rest. During the suction stroke air is drawn through the funnel-shaped intake OO and gauze screen K, and passes up the *Vena contracta* or choke tube L surrounding the spray nozzle; in the choke tube the air velocity is great and its pressure in consequence small; the petrol accordingly issues from the nozzle in a very fine stream and, mingling with the air, is broken up into spray. This "atomization" and the subsequent vapourizing are assisted by impact upon a corrugated cone M, above the jet; the mixture then passes on to the engine along an inlet pipe N, being usually adjusted on its way by admission of a regulated further quantity of fresh air. It is clear that by use of the spray nozzle *all* the fuel is used, and no selection of the more volatile constituents is possible.

The specific gravity of commercial "petrols" has risen steadily from ·68 to ·78, the usual range being however from about ·72 to ·76. Increasingly large supplies are obtained by the "cracking" of heavier petroleum oils. (*See* PETROLEUM; LOW TEMPERATURE CARBONIZATION; GASOLENE; ALCOHOL: *In Industry*.)

Two essentials of a motor spirit for every-day use are:—(1) Easy starting, and (2) "Anti-knock" properties. Some heavier petrols do not vapourize at (British) winter temperatures and recourse must be had to carburetter warming to enable a start from cold to be effected. The possession of "anti-knocking" properties is of the greatest value in the fuel; detonation is an almost instantaneous automatic explosion of the mixture as a whole, and is evidenced by the "pinking" or "knocking" of the engine; it causes an immediate reduction in power and rapid overheating which sets up pre-ignition of the mixture. Moreover an easily detonating fuel restricts the compression ratio that may be used in the engine, and so reduces its thermal efficiency. (*See* p. 500 under GAS ENGINES.)

Certain substances, as the liquid hydrocarbon toluene (C_7H_8), the coal tar product benzol, ethyl alcohol, lead tetra-ethyl, etc., when added to ordinary "petrols" in suitable proportions possess the property of reducing the tendency of the fuel to detonate, and are accordingly often termed "anti-knock dopes." Modern petrols are carefully prepared mixtures designed to possess reasonable anti-knock and easy-starting qualities. Exhaustive investigations relating to the various liquid fuels for motors were carried out by the Empire Motor Fuels Committee, whose Report 1923–4 is of great value.

RATING AND PERFORMANCE

It is shown above that the brake horse power of a single-acting four-stroke petrol engine with N cylinders is expressed by:—

$$\text{B.H.P.} = 992 \cdot d^2 \cdot \eta p \cdot snN \times 10^{-9}. \quad (1)$$

For rating purposes in car and motor-boat competitions it was found necessary at an early date to have some formula which should give simply, and in terms of some easily ascertainable dimensions of the engine, the maximum practicable horse-power, to a reasonable degree of approximation.

An examination by Sir D. Clerk, of the performance of about 100 engines in 1905–6 showed at that time a prevailing piston speed $\left(= \frac{n \times 2s}{12}\right)$ of roundly 1000 feet per minute, with a brake mean effective pressure, ηp, averaging 70 lb./sq.in. If, in (1) above, 6000 be substituted for sn and 70 for ηp, the equation will be found to reduce by common arithmetic to:—

$$\text{B.H.P.} = 0{\cdot}417 d^2 N \quad (2)$$

In 1906, the Royal Automobile Club decided to take 0.4 as the coefficient instead of 0·417, and thus was obtained the famous R.A.C. Rating Rule for petrol engines, viz.:—

$$\text{R.A.C. Rating} = 0{\cdot}4 d^2 N \quad (3)$$

where d is the cylinder bore in inches. This simple formula was also adopted by the British Treasury for taxing purposes, and has continued in operation up to the present time.

In passing, it may be noted here that at the end of 1927 there were running on the 178,361 miles of roads in Great Britain, a total of 1,694,000 licensed motors, as compared with 270,000 in 1919. The amount received by the British Treasury for motor licences for the year ending Nov. 30, 1927, totalled £23,456,378.

The R.A.C. and Treasury rating formula, depending only upon the number and the *square* of the bore of the cylinders, immediately caused petrol engine designers to concentrate on the problem of obtaining a maximum output from the minimum cylinder.

In this direction extraordinary success has been achieved, particularly by British designers; even by 1912 tests of normal engines at Brooklands showed a power output averaging nearly 50% greater than that given by the R.A.C. formula, individual cases showing an excess of even 100%. Much of the improvement has resulted from recognition of the necessity of designing an engine not only as a prime mover, but also as a highly efficient *pump;* the increased pumping, *i.e.,* volumetric efficiency, coupled with increased revolution speeds, has enabled remarkable results to be achieved; a notable early instance is furnished by a Vauxhall four-cylinder 3·54 in.×5·12 in. racing engine, with a Treasury rating of, roundly, 20 H.P., which developed 90 B.H.P.—or 4½ times its rating—when running at 3,600 rev. per min.

After the outbreak of war in 1914 it soon became manifest that the high-speed petrol engine was of fundamental importance in connection with road transport, aircraft, and later "tanks," and all available engineering skill was for some years again concentrated upon effecting still further improvements. There have resulted very high-speed motors, both small and large, of extraordinarily high power output in relation to their size and weight, rivalling in efficiency the largest slow-running stationary types. Many examples can be cited from the tiny four-cylinder, seven H.P. and eight H.P. Austin and Singer designs respectively to the six-cylinder 35/120 horse-power Daimler engine, the lower figure representing the R.A.C. rating.

Even more striking is the astonishing success achieved with the petrol engine as applied to racing aircraft; thus the 1928 12-cylindered "broad-arrow" water-cooled four-stroke single-acting Napier "lion" racing aero-engine with a bore of 5·5 in. and stroke of 5·125 in., using a compression ratio of 10:1, and a fuel composed of 75% petrol, 25% benzol, and a small "dope" of lead tetra-ethyl, and weighing 835 lb., had a power output of 875 B.H.P. at 3,300 rev. per minute; or 1 B.H.P. for each 0·954 lb. of weight. (*See* AERO-ENGINE.)

In Table III. some figures are given for a few typical modern engines; the values in the extreme right-hand column depend on the nature of the service demanded from the engine; thus petrol engines for marine work, or for driving heavy road lorries are called upon for a much heavier continuous power output than are the engines of normal motor-cars, and are accordingly more robustly built and are in general run at somewhat slower speeds. At the extreme top of the range of output performance is the racing aero-engine from which all that is demanded is an absolutely maximum output during a very short period of time.

Capacity Rating.—A mode of petrol engine rating much employed for classifying purposes is that obtained by taking the total volume swept out by the pistons in one stroke of the engine, and this is termed the "capacity" rating. It is evidently expressed by piston area × stroke × number of cylinders, or, in symbols:—

$$\text{Capacity Rating} = 0{\cdot}7854\, d^2 sN \quad (4)$$

If d and s be in inches, the value is expressed in cu.in. It is, however, more usually expressed in cubic centimetres; so that d and s, denoting the bore and stroke in *millimetres,* and N being the number of single-acting four-stroke cylinders, we have:—

$$\text{Capacity Rating} = 7854 d^2 sN \times 10^{-7} \text{ c.c.} \quad (5)$$

or, in litres,

$$= 7854 d^2 sN \times 10^{-10} \quad (6)$$

A useful expression of performance is to state the B.H.P. per litre of capacity; this is given in the extreme right-hand column of Table III., and is of course at once obtained by dividing the B.H.P. by the capacity. If the general formulae for B.H.P. (Eq. 1) and for capacity (Eq. 4) be employed we get the useful relation:—

$$\text{B.H.P. per litre} = 771 \cdot \eta p \cdot n \times 10^{-7} \quad (7)$$

TABLE III.—*Some data relating to a few typical engines of recent years*

Engine	No. of cyl.	Bore		Stroke		Rating		Normal full speed r.p.m.	B.H.P. at normal full speed	B.H.P. per litre of capacity at normal full speed
		Inches	mm.	Ins.	mm.	R.A.C.	Capacity in c.c.			
Thornycroft 4-ton lorry engine, M/4	4	4·5	114·3	6	152·4	32·4	6,245	1,200	37	5·92
14/28 Morris-Oxford normal motor-car engine	4	2·95	75	4·02	102	13·93	1,802	1,700	24·3	13·5
35/120 Daimler sleeve-valve large car engine	6	3·85	97	5·13	130	35·5	5,764	1,600 (at a car-speed of 45 m.p.h.)	76	13·2
7 H.P. Austin; the very-small-car-type engine	4	2·2	56	3·0	76	7·74	748	2,400	10·5	14·0
8 H.P. Singer; a small four-seater car-type engine	4	2·2	56	3·38	86	7·74	848	2,000	12·4	14·6
Napier "Lion" racing aero-engine	12	5·5	139·7	5·125	130	145·2	23,907	3,300	875	36·6
Bristol Mercury Mk I. racing aero-engine	9	5·75	146	6·5	165	119	24,854	2,500	800	32·2

wherein ηp is the brake mean efficient pressure in lb./sq.in., and n is the number of revolutions per minute.

Small Motor-car Engines.—A recent 15·9 Morris engine, a typical engine of the average motor car, is a four-cylindered, four-stroke vertical unit of 3·15″ (80 mm.) bore, and 4·92″ (125 mm) stroke, and accordingly has a Treasury rating of $0{\cdot}4\times3{\cdot}15^2\times4=15{\cdot}9$, and a capacity of $7854\times80^2\times125\times4\times10^{-10}=2{\cdot}513$ litres.

The four cylinders are cast *en bloc* with side-by-side inlet and exhaust valves cam-driven through adjustable tappet rods; the valves are all of the same size, and their springs and stems are enclosed by a readily removable cover-plate to exclude dust and retain oil. The cylinder heads are detachable, facilitating greatly decarbonisation and access to the valves.

The power output by bench tests is as follows:—

At rev. per min.	1,000	1,500	2,000	2,500
B.H.P.	14·0	21·5	27·5	31·2

The off-set hollow crankshaft is borne in three bearings which are housed in the lower part of the cylinder block, thus giving great rigidity to the engine. The connecting rods are of duralumin, and all main and big-end bearings are of white metal in bronze shells. Aluminium-alloy pistons are used. Lubrication is forced,—by a drowned plunger pump driven by an eccentric on the camshaft,—to the three main crankshaft bearings, the four big ends (via the hollow crankshaft), and also to the camshaft bearings. The pump in-take is through a gauze fitter easily removable for cleaning; a gauge on the dashboard of the car indicates the oil pressure in the circulating system while running. Ignition is by the usual H.T. (high-tension) magneto.

The "Baby Austin" Engine.—The performance of the modern tiny motors typified by recent Austin and Singer designs is so remarkable as to merit special notice. A section of a seven H.P. Austin small-car engine is given in fig. 15. The four *en bloc* cylinders of 2·2 in. bore and 3·0 in. stroke (*see* table) are fitted

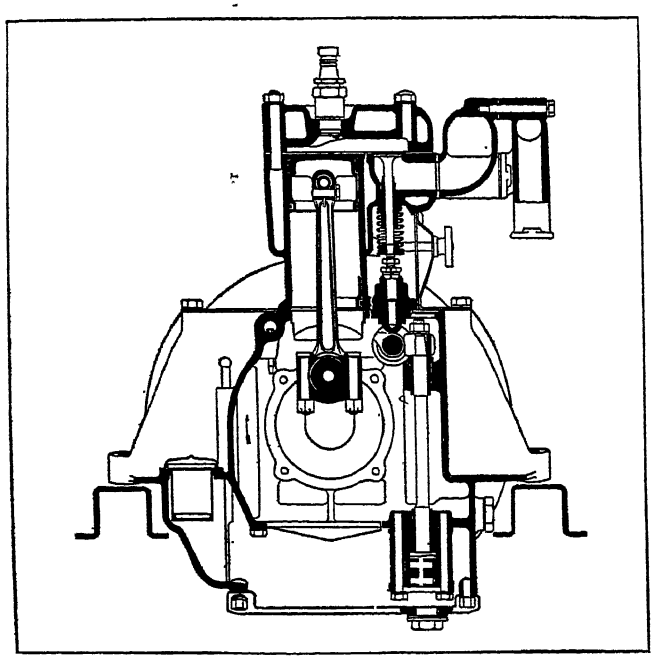


FIG. 15.—SECTION OF 7 H.P. AUSTIN ENGINE

with a detachable head. The pistons are of aluminium alloy. The side-by-side valves are cam-operated in the usual manner. Lubrication is by a drowned oil-pump driven from the camshaft as indicated, and ignition is by H.T. magneto. Thermosyphon cooling with a "film" radiator and fan. The four-throw crankshaft is borne in two roller bearings. The mixture is supplied by a Zenith carburetter. The power output is:—

At rev. per min.	1,000	1,500	2,000	2,500	2,800
B.H.P.	3·8	6·2	8·7	11·0	12·0 (max.)

This miniature engine propels its car containing three or four adults with ease at 35 miles per hour on an ordinary good road-surface, with a petrol consumption of 40–50 miles per gallon.

The Eight H.P. Singer "Junior."—A recent design of this car has an engine of the same bore as the seven H.P. Austin, but with the larger stroke of 3·38 in. (*see* table). The cylinders and crankcase form a single casting and an aluminium casing houses

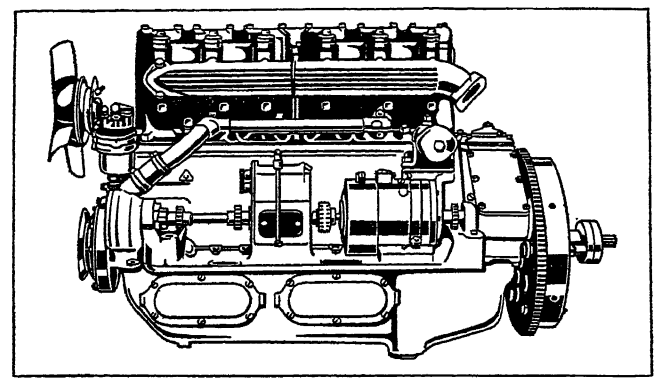


FIG 16.—THE 35/120 H.P. 6-CYLINDER DAIMLER SLEEVE-VALVE ENGINE

the timing gear and forms the front support of the engine. The short stiff crankshaft is borne in two solid white-metalled bearings. The pistons are of cast iron with three spring rings, the lowest ring securing the gudgeon pin. The connecting-rod big end bearings are of white metal in bronze shells. The valves in this engine are overhead and inclined and are operated by rockers; the overhead camshaft, oil-pump, magneto, and starting and lighting dynamo are all driven from an intermediate shaft placed above the front end of the crankshaft and driven by it through helical gearing; the drive from the intermediate shaft to the overhead camshaft is by double roller chain fitted with an automatic tensioning device. The detachable cylinder head is a single casting carrying the camshaft in three bearings, and is fitted with renewable valve guides. Lubrication is by pump and troughs; the pump intake draws the oil through an easily removable gauze filter, and delivers into four troughs into which the connecting rods dip, and also up to the overhead camshaft and valve rocker bearings. The oil pressure is indicated by a gauge on the dashboard. Cooling is on the "convection" or "thermo-syphon" system. Ignition is by H.T. magneto. A Solex horizontal carburetter is used. The engine is enclosed, dust-excluding and oil-retaining. The power output is:—

At rev. per min.	1,000	1,500	2,000	2,500	3,000	3,250
B.H.P.	6·2	9·3	12·4	14·9	16·2	16·4 (max.)

and in the autumn of 1927 a car fitted with one of these very small engines accomplished a run from London to Edinburgh, and back in 24¾ consecutive hours, corresponding to an average speed throughout of about 33 miles per hour.

Sleeve Valve Engines.—In these the poppet valves are replaced by ported sliding sleeves which, in the single-sleeved engine is the working barrel of the cylinder and has a motion partly reciprocating and partly angular, while in the double-sleeved engine both the ported working barrel and the second ported sleeve enveloping it have a simple axial reciprocating motion.

Space permits but a brief reference to the single-sleeved type, but the Burt-McCollum design has been successfully employed for some years in the engines of Barr and Stroud, Caledon, Argyll, and Karrier; an exhaustive account of this type is given by Ensor in the *Proc. Inst. Auto. Engrs.* (1927–8).

The Daimler-Knight Double-sleeve Engine.—Used with great success since 1908, the smooth running "Silent Knight" engine is deservedly famous. The four-stroke, single-acting, six-cylindered, 35/120 h.p. design, illustrated in fig. 16, has a bore of 3·85 in. a stroke of 5·13 in., and consequently a Treasury rating of 35·5. Bench tests show that at a speed of 3,000 rev. per min. the engine develops roundly 120 b.h.r. At a car speed of 60 miles per hour the engine runs at 2,140 rev. per minute. The manner in which

the ported light steel sleeves regulate the inlet and exhaust periods is clearly shown in fig. 17.

The inlet port opening and the exhaust port closing at the beginning of the suction stroke is shown in A. The inner sleeve is rising and the outer sleeve is descending. The exhaust is shown closed and the inlet closing at the beginning of the compression stroke in B. The ports in the inner sleeve are passing

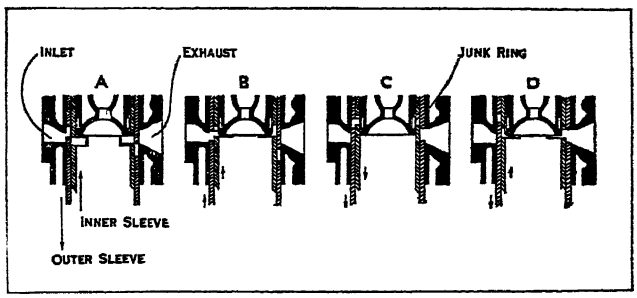


FIG. 17.—DIAGRAM SHOWING ACTION OF THE DAIMLER SLEEVE VALVES

up into the cylinder head, where they are sealed by the junk ring during the period of maximum pressure and temperature at the beginning of the firing stroke (C). In D, the exhaust is already well opened at the beginning of the exhaust stroke. The sleeves are now again moving to the position shown in A.

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SPECIAL TYPES OF INTERNAL COMBUSTION ENGINES

The Humphrey Internal Combustion Pump.—If the water within a partially filled, vertically placed U-tube be displaced it will perform nearly isochronous oscillations about its position of rest. H. A. Humphrey (1906–9) has ingeniously utilized the oscillatory motion of a large water-column to effect the raising of great volumes of water from a lower to a higher level.

A diagrammatic view of the simplest form of the Humphrey

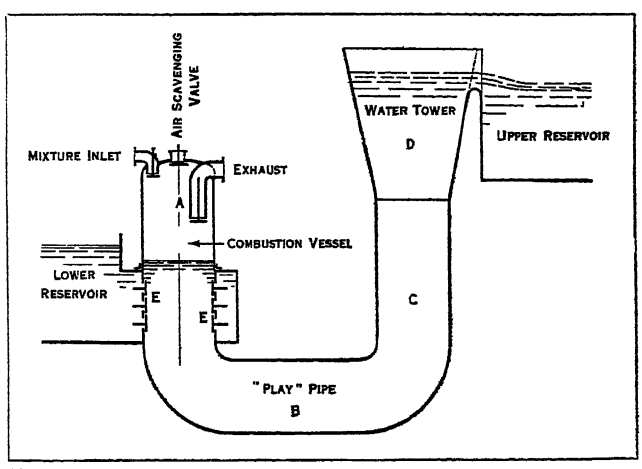


FIG. 18.—DIAGRAM OF THE HUMPHREY INTERNAL COMBUSTION PUMP

pump is given in fig. 18. ABCD is the U-tube the arm A being closed and forming the combustion vessel, while the splayed-out arm D is open and in free communication with the upper reservoir. Through the mixture inlet an explosive charge of gas and air is introduced into A and electrically fired; the pressure developed by the explosion drives down the water level in A, correspondingly raising it in D, thus producing delivery into the upper reservoir. The great momentum of the moving water column causes the downward motion in A to continue until the pressure in the combustion vessel becomes less than atmospheric; the exhaust valve then opens by its own weight and at the same time the air scavenging valve is opened by the atmospheric pressure; the burnt gases are now discharged into the atmosphere. By this time the level in A has fallen below that in the lower reservoir and a new supply of water then enters through the nest of valves EE; during the whole of this period water is evidently being delivered into the upper reservoir. The column then comes momentarily to rest, and during the return swing to the left the rising level in A first closes the exhaust valve by its impact and next compresses above it a mixture of residual exhaust and scavenge air; when the column is thus again brought to rest the pressure in the upper part of A being considerable, the column begins its second swing to the right and in the course of this the pressure again falls to less than that of the atmosphere but this time, by means of a suitable interlocking gear, the exhaust and air scavenging valves are held closed; the mixture inlet valve, however, opens and an explosive charge of gas and air enters A. The second swing of the column to the left then compresses this fresh charge in A, and the cycle is then repeated. The Humphrey pump thus works on a modified four-stroke cycle (*see* above, "Gas Engines"), but with strokes of unequal length, the working (expansion) stroke being particularly long, which makes for its high efficiency. The cycle-frequency depends upon the mass of water in the "play" pipe, and is determined by varying the length of this pipe; a frequency of 15 to 30 cycles per minute is commonly employed. The pump is very quiet, as the exhaust takes place at practically atmospheric pressure, and is suitable for lifts up to 150 feet. The pump is also built to work on a two-stroke cycle; and later designs provide for the use of oil as fuel.

At the Metropolitan Water Board's 300 horse-power installation at Chingford, Essex, England, are four pumps each with a cylinder A seven feet in diameter, and each designed to lift 40 million gallons per diem; and a fifth, with a five-foot cylinder dealing with 20 millions per diem. These are all operated by producer gas supplied by four Dowson gas producers using anthracite as fuel. The consumption per actual pump-horse-power hour is only about 0·9 lb. of anthracite.

The Still Internal Combustion Steam Engine.—Commonly some 30% of the total heat of the fuel used in a Diesel engine is carried away in the exhaust gases at a (full load) tem-

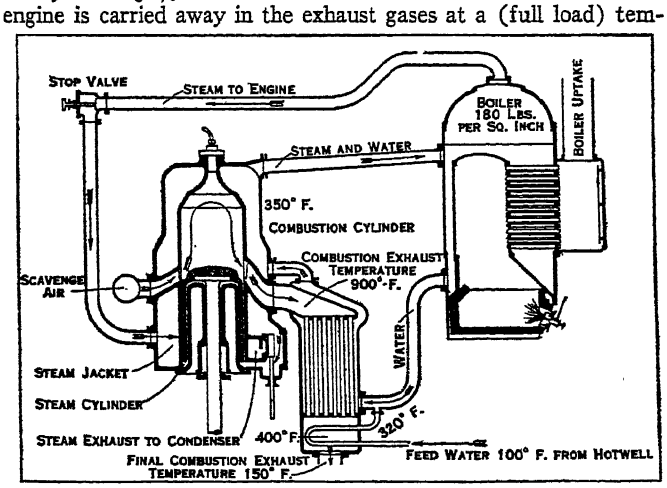


FIG. 19.—THE STILL INTERNAL COMBUSTION STEAM ENGINE

perature of some 800–900° F, and, in favourable circumstances, a saving in running costs can be effected by utilizing this heat in special types of steam boiler. W. J. Still has gone further by arranging for the exhaust and jacket heat to add directly to the power output of single-acting Diesel engines; this he has effected by enclosing the lower portion of the working cylinder, and arranging for this end to work as an ordinary high-pressure condensing steam engine.

The method adopted is illustrated by fig. 19. Above the piston the usual Diesel sequence of operation is performed. The upper (Diesel) part of the cylinder is heavily water-jacketed, and the lower part is steam-jacketed; in the steam-jacket works a slide-

valve by which admission of steam to the lower end of the cylinder is regulated; the exhaust steam from the cylinder passes into an ordinary condenser. The water-jacket is connected at its top with the upper part of an auxiliary oil-fired steam boiler (shown on right), and at its lower end, through a feed-heater, with the bottom of the same boiler. Through this feed-heater passes the exhaust from the Diesel end of the working cylinder, entering at a temper-

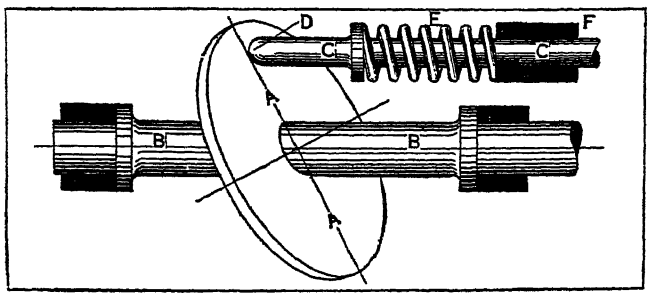


FIG. 20.—THE "SWASH-PLATE"

ature of, say, 900° F and leaving at the much reduced temperature of some 150° F only, thus giving up heat to the water system. This heated feed-water then enters the cylinder jacket, and receives some further heat by conduction through the working barrel, thereby rising in temperature to, say 350° F. The water (and steam) circulation continues through the upper pipe to the auxiliary steam boiler, in which a pressure of 180 lb./sq.in. is shown.

From the top of the boiler dome is taken the dry working steam to the steam jacket and thence, via the slide valve, to the lower end of the working cylinder. In this way heat conducted through the upper part of the cylinder liner (or "working barrel"), together with much of the heat ordinarily wasted in the exhausted burnt gases is recovered and utilized, and at full load it is claimed that up to 7 lb. of steam may be obtained per B.H.P. hour of the engine, with an increase of about 20% in power output, and much improved economy in fuel consumption. The cylinder liner in the Still engine is usually only about one-third of the normal thickness, and is ribbed externally to improve its heat-conducting properties.

Trials by C. B. Boys showed that, per B.H.P. hour, 3·28 lb. of steam was obtained from the jacket alone, and 6·0 lb. from the jacket and exhaust gases jointly; also that the mean effective pressure from the Diesel end of the cylinder was 90 lb./sq.in., while that from the steam end was 14 lb./sq.in., *twice* per cycle; accordingly this four-stroke engine showed a total mean effective pressure per cycle of $90+2\times14=118$ lb./sq.in.

A four-cylinder Scott-Still engine, 22 in. diameter × 36 in. stroke, giving 1,250 B.H.P. at 120 rev. per minute using solid (or "airless") injection with automatic fuel inlet valves (*see* DIESEL ENGINE), tested by the Marine Oil Engine Trials committee, showed a fuel consumption of only 0·354 lb. per B.H.P. hour at full load, corresponding to an indicated thermal efficiency of 40·9%, and a brake thermal efficiency of 36·9%. In this engine the steam side was arranged to operate on the compound principle, one high-pressure cylinder exhausting into a receiver whence the remaining three cylinders derived their steam supply. Scott-Still engines are also often arranged with some cylinders as ordinary single-acting Diesels and the rest as combined Diesel-steam units as above described.

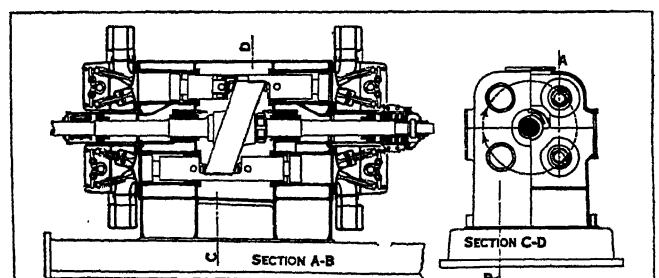
In the 1928 Scott-Still marine Diesel engine the general method of waste-heat recovery was unchanged but the steam cylinders were *separate* double-acting cylinders of normal type. The 3,000 B.H.P. Scott-Still engine of 1928 design, for example, comprised six single-acting two-stroke solid injection Diesel cylinders of 27 in. bore and 45 in. stroke, working in conjunction with two double-acting steam cylinders of 25 in. bore and 45 in. stroke at a normal speed of 105 rev. per minute.

The Still engine involves the addition of a feed heater, an auxiliary boiler, a condenser, and all the associated steam engine mechanism to the ordinary Diesel engine; but it enjoys, among others, the following valuable compensating advantages:—(1) An extremely high fuel economy. (2) By firing-up the auxiliary boiler the total mean effective pressure can be substantially increased thus enabling the engine safely to carry a big overload. (3) Steam from the auxiliary boiler serves for starting the engine, and the cylinders are well heated when the Diesel parts come into operation; the use of compressed air for starting is thus avoided. (4) Manoeuvring is also simplified, and again the use of compressed air is rendered unnecessary.

The Michell Crankless Engine.—This engine was rendered possible by the invention of A. G. M. Michell in 1905 of the famous "Michell thrust block," in which the theoretical conditions laid down by the late O. Reynolds were first definitely incorporated. Prior to the introduction of the Michell bearing, multiple collared bearings were invariably used, in which experience showed that the maximum thrust pressure practicable was about 60 lb./sq.in. Michell soon showed that 500 lb./sq.in. at 1,750 rev. per minute could be maintained continuously, with a bearing temperature not rising above 125° F; later, improved bearings were constructed which functioned continuously under a thrust pressure of 3,000 lb./sq.in.; and under special test conditions as much as 13,000 lb./sq.in. has been successfully borne.

Briefly, in the Michell bearing the rubbing surfaces are capable of tilting, thus becoming slightly inclined to one another in the direction of motion, so that the oil film between them is wedge-shaped with the thicker edge at the entrance. A continuous flow of oil between the surfaces is thus induced and the film constantly renewed, thus effectively preventing actual metallic contact from occurring. In these circumstances the coefficient of friction is reduced to about ·0018, *i.e.*, only some $\frac{1}{30}$ of the value when the rubbing surfaces are maintained strictly parallel to each other.

A plane disc fixed obliquely on a rotating shaft is an old mechanical device for obtaining reciprocating motion, and was illustrated and described as long ago as 1841 by Willis in his classic *Principles of Mechanism* wherein also it is shown that if the shaft rotates uniformly a simple harmonic motion of the reciprocating piece results. The device is illustrated in fig. 20; AA is the "swash-plate" or "slant," mounted obliquely upon a shaft BB, and CC is a rod whose end is kept always in contact with the plate as indicated. Obviously, if the shaft BB rotates on its axis the rod CC will reciprocate. Conversely, if CC reciprocate,—and friction is not too great—it will communicate to BB an angular motion through a semicircle in making its stroke from right to left; by a second rod similar to CC, placed to the left of the swash-plate the shaft can be caused to perform a second semicircle, thus completing a revolution. This is the *modus operandi* of the swash-plate engine; CC becomes the piston and piston rod, the spring E the working impulse, and the bearing F the engine cylinder. Hydraulically-operated multi-cylindered swash-plate engines have been used for years in warships for training the big



BY COURTESY OF THE NATIONAL GAS ENGINE CO.

FIG. 21.—NATIONAL-MICHELL CRANKLESS ENGINE

guns; these engines are both of single- and double-swash-plate design, the latter having two swash plates set back to back, conferring valuable balancing qualities.

The nature and action of the Michell crankless gas engine will now be clear from inspection of the diagram fig. 21, showing a "slant" with eight cylinders, arranged in opposed pairs spaced equally around, with their axes all parallel to that of the shaft. The working pressure is communicated to the "slant" through Michell thrust slippers having spherical seats, as indicated. As the engine operates on the four-stroke cycle (*see* above "Gas En-

gines"), opposed pistons are coupled together by means of a yoke in order to effect the suction strokes.

Eight 280 horse-power National-Michell crankless engines, each direct-coupled to a Michell gas booster, were installed at the works of the Australian Gas Light Co. of Sydney, N.S.W. Each unit delivers 500,000 cu.ft. of gas per hour at a pressure of 7·25 lb./sq.in., when running at its normal speed of 750 rev. per minute. (G. A. Bu.)

INTERNATIONAL, THE. A number of international associations or congresses of Labour and Socialist bodies have at various times adopted the title of the "International," and three of them are of historic importance. The first of these, having for its full title the International Working Men's Association, was established in 1864, and came to an end ten years later after a troubled existence. This was commonly known as "The International," and is thus termed historically. Founded under the leadership of Karl Marx and Engels—Marx himself drew up its programme in 1866—it was in some of its elements a revolutionary body and as such is revered by the Communists of the 20th century.

The Second (Socialist) International, was founded 15 years after the demise of the International, and constituted, down to the outbreak of the World War, a body representative of the world's Labour-Socialists. The war brought irreconcilable differences and consequent secessions, and the establishment of a Bolshevist Government in Russia led to the formation in 1919 of the Third (Communist) International, also known as the Komintern, which now leads the world's revolutionary forces, the Second (Socialist) International adhering to moderate views and the parliamentary principle. The Second and Third Internationals thus exist (1928) contemporaneously. In the following sections, the history of these three bodies is described in some detail.

THE (FIRST) INTERNATIONAL

The International Working Men's Association, commonly called "The International," was formed in London in 1864. It was a society of working men of all nations, somewhat like a cosmopolitan trades union, but bearing a still closer resemblance to an international social science association for discussing and furthering the rights of labour. The occasion of its formation is commonly alleged to be the visit of some French workmen to the London Exhibition of 1862. In the course of their visit the labour question was discussed, and a desire for the further interchange of ideas expressed. Nothing decisive was done till 1864, when a great public meeting of working men of all nations was held at St. Martin's hall, London, and a provisional committee was appointed to draft the constitution of the new association.

The first four congresses of the International, held at Geneva (September 1866), Lausanne (1867), Brussels (1868) and Basle (1869), marked the rapid development of the association. It gained its first triumph in the effectual support of the bronze-workers at Paris during their lock-out in 1867; and it repeatedly aided the English trade unionists by preventing the importation of blackleg labour from the Continent. It soon spread as far east as Poland and Hungary, and it had affiliated societies with journals devoted to its cause in every country of western Europe.

Anarchism v. Socialism.—It was supposed to be concerned in all the revolutionary movements and agitations of Europe, gaining notoriety as the rallying point of social overthrow and ruin. Its prestige, however, was always based more on the vast possibilities of the cause it represented than on its actual power. Its organization was loose, its financial resources insignificant; the Continental unionists joined it more in the hope of borrowing than of contributing support. At the successive congresses its Socialist tendencies became more and more pronounced; it declared its opposition to private property not only in railways but in mines and the soil, holding that these should revert to the community. The principle of inheritance was saved only by a narrow majority. In 1869 M. Bakunin, the Russian anarchist, with his immediate followers, joined the association, and at once asserted his character as the "apostle of universal destruction."

The relation of the association to the Communard rising at Paris in the spring of 1871 has been the subject of much dispute. It is now agreed that the International as such had no part in originating it, but its French members joined in it heartily. After the fall of the Commune the general council of London, Karl Marx included, issued a long and trenchant manifesto, approving its action and extolling the "glorious vanquished." From the fall of the Commune the decline of the association is to be dated. The English trade unionists, intent on more practical concerns at home, never took a deep interest in its proceedings; the German Socialists were hindered by law from corporate action; America was too remote. But it found its worst enemies within its own ranks; there was a deep division between the Socialists led by Marx and the anarchists led by Bakunin and the Swiss Federation of the Jura at the congress of 1872, held at The Hague, when Bakunin, being expelled by the Marx party, formed a rival International, which found its chief support in Spain and Italy. The old International now transferred the seat of its general council to New York; but it survived only long enough to hold two more congresses (Geneva 1874, Philadelphia 1876) and then quietly expired.

The party of Bakunin, styling themselves "autonomists," had a bloodier history. The programme of this party concentrated on the violent destruction of the State, passing over subsequent difficulties. It endeavoured to realize this in the great communal risings in southern Spain in 1873, when its adherents took part in the general insurrection, and at Alcoy, San Lucar de Barrameda and elsewhere were for a short while in power. They failed in leadership and organization, and were suppressed, though not without difficulty, by the national troops. The "autonomists" lingered on till 1879, when the collapse was complete of an association which once extended from Hungary to San Francisco, and alarmed the minds of men with visions of universal ruin. (X.)

THE SECOND (SOCIALIST) INTERNATIONAL

The Second International was constituted in 1889, 15 years after the disappearance of the First. Unlike the latter, it possessed no powerful central authority and its early meetings were mainly devoted to discussion of the tactics and methods of the affiliated national parties, but from 1911 onward the question of war and peace received more attention. It had already been discussed at the congress of Amsterdam in 1903, and from that date Jaurès began the study of the question which inspired his book, *L'Armée nouvelle*. At the congress of Stuttgart in 1903 the question was again discussed, at greater length, and Hervé's denunciation of all "patriotism" led Bebel and Volmar to declare that the Social Democrats would instantly rise to defend Germany if ever she were attacked.

Conditions Before the War.—The European horizon steadily darkened, especially after 1911. The Agadir incident, the Italo-Turkish War and the Balkan wars, in succession, made the menace of a general conflagration appear imminent, and the efforts of the Socialist parties to avert the catastrophe became more urgent and strenuous from that time. Their efforts culminated in the extraordinary congress (1912) at Basle, called to consider the international situation and the action to be taken by Social Democrats to prevent war. A manifesto was issued, exhorting all workers to unite to secure from their Governments a pacific foreign policy.

This problem of peace was put on the agenda for the tenth congress of the International which was to have been held in Vienna two years later, in Aug. 1914. The congress would have coincided with the 50th anniversary of the founding of the International in London in 1864. For this occasion Austrian Socialists had prepared an illustrated commemorative album in which Kautsky, Victor Adler and others had related the history of the Socialist movement during the last half century. This document, which appeared in print at the moment when the World War broke out, was distributed ten years after as a souvenir among members of the executive committee of the International when they met in the former capital of the Habsburgs in June 1924. The album contains, among other things, a series of medallion portraits of 66 members of the B.S.I. (International Socialist Bureau), which had its headquarters before the war in the Maison du Peuple at Brus-

sels. Lenin's portrait is not among them, although he was a member of the bureau for many years; but there are Rosa Luxemburg and C. G. Rakovsky, together with Jaurès, Ebert (the future president), also Stauning, Branting and MacDonald, who later became premiers of Denmark, Sweden and Great Britain respectively. There are delegates of trade unions too, but these are few and far between. The bureau, representing all the live forces of Socialism, met for the last time at the Maison du Peuple, Brussels, on July 29 and 30, 1914.

Even at that moment, when the world already lay under the shadow of war, optimism still prevailed. Adler regarded a war between Germany and France as a moral impossibility; Haase, chairman of the Social Democratic group in the *reichstag*, relied at this eleventh hour, not on humanity, but on the pusillanimity of the kaiser. Jaurès, speaking on the evening of July 30 for the last time, still affirmed his confidence in a pacific solution, but prophesied in a flash of inspiration that if, in spite of all, war were let loose on the world by its masters, then at the close, each nation would turn upon those responsible for the disasters of the war and say: "Go, and seek pardon from God and man." The next day he was assassinated in Paris, and a state of war had been declared in Germany.

The bursting of the storm put an abrupt end to all international activities (*see* SOCIALISM). While the war lasted no single meeting of the executive committee took place, but some tentative efforts were made to revive international action. The most important of these were an attempt by the Dutch-Scandinavian committee (vigorously supported by Camille Huysmans, secretary of the Second International) to convene an international congress at Stockholm in 1917, and that of the Italian Socialist Morgari to convoke conferences at Zimmerwald (Sept. 1915) and at Kienthal (April 1916). The first of these efforts (the projected Stockholm conference) proved abortive mainly because of the refusal of the Allied Powers to grant passports to the delegates; at the Zimmerwald and Kienthal conferences only certain groups of the international proletariat were represented, and from these elements there was presently to emerge the Communist International known as the Third International.

Activity After the Armistice.—On the morrow of the Armistice the need for international unification was felt with renewed force. Conferences were summoned successively at Berne (Feb. 1919), Lucerne (Aug. 1919) and Geneva (Aug. 1920) with a view to re-establishing the Second International. Meanwhile, however, the so-called Third or Communist International had been formed at Moscow, and for some time parties or groups who were unwilling to be affiliated to either the Second or the Third grouped themselves in a Workers' International Union of the Socialist parties with Vienna as its centre—hence the name "Vienna International." (The principal groups concerned were the British I.L.P., the German Independent Socialists and the Austrian Social Democrats.) In the beginning of 1920 this organization tried to bring about the unification of all proletarian organizations, and succeeded in calling together in Berlin a reunion of the executives of the three groups in April 1922. But this effort at reconciliation ended in complete failure.

Since then the Communist International has steadily accentuated its opposition to Social Democracy. On the other hand the points of dispute between Vienna and London became progressively less. In 1921–22 the French, English, German, Italian and Belgian Socialists, who were adherents either of the Vienna International or the Second International, met first in Paris, then in Frankfurt, and of one accord adopted the resolutions which have since become famous as the "Frankfurt Resolutions." Anticipating the Dawes scheme, these demanded the reduction of the German debt to a reasonable figure, and, further, demanded the end of military occupations of former enemy territory and the annulment of inter-Allied debts.

Congress at Hamburg.—By December of the same year these two internationals had agreed to call a Socialist international congress at Hamburg. This took place on May 27, 1923, when the International was reconstituted—the Communists being excluded—and the conditions on which parties or groups could be admitted were defined. Agreement was reached with difficulty on a Franco-German text which, drawing on the Marxian vocabulary for its somewhat heavy terminology, appealed to "those who acknowledged the aim of the working class to be the replacement of the capitalist mode of production by the Socialist mode of production and who see in the *class struggle* (*lutte des classes*) which manifests itself in political and economic action the means of emancipating the working class."

But when it came to translating this text into English the British delegates raised a discussion, arguing that the words *"lutte des classes"*—the touchstone of Socialism on the Continent—were not in current use in England; that the extremists, who alone used the expression, spoke not of "class struggle" but of "class war," and that it would be better in these conditions to retain the idea but to paraphrase it in such a way as this: "independent political and industrial action of the workers' organizations." And so it was arranged. The Franco-German text was retained, for it could only have been altered at the cost of emasculation; but for British consumption a free translation was allowed.

The present writer has thought it necessary to report this little incident, as it cannot fail to be instructive, showing as it does that, in spite of community of words and, on the whole, unity of tactics, English Labour men and Continental Socialists do not speak quite the same language. Now, these differences of terminology are the outward expression of other more deep-rooted differences arising out of the widely differing environment in which contemporary Socialism is formed and developed. On reading such prewar books, for instance, as the *Études socialistes* of Jean Jaurès, Ramsay MacDonald's *Socialism and Society* or Rakovsky's *Das Erfurter Program*, we see how widely the Socialism of Jaurès, instinct with the spirit of the French Revolution, and still more the Socialism of Ramsay MacDonald, who draws inspiration from the pacific and fraternal idealism of Christianity, is to be differentiated from the more "materialist" and more "economic" Socialism of the German Marxians.

Since the war, however, these differences have become less acute, even from the theoretical point of view. A sort of amalgam has been established between the various national parties. German Socialism has become less doctrinaire; French Socialism has drawn nearer to Marxianism under Guesdist influence; the Socialism of the I.L.P. has almost completely captured the English working-class movement. Between those parties which recognise Social Democracy as their basis, there exists not only international unity of organization but unity of programme.

This emerges clearly from the two first congresses of the new International. The Hamburg congress of 1923 succeeded beyond all expectations. There were present 630 delegates from 30 countries, representing 7,000,000 affiliated members. During the debates, which lasted five days, the following points were discussed: international action against international reaction, working-class policy on an imperialist peace, the eight-hour day, and the reform of international social legislation. But the most important achievement of the congress was the fusion of the London and Vienna groups and the adoption of the statutes of the new "Labour and Socialist International" (L.S.I.).

In the three years preceding the second congress of the new Second International (Aug. 1925) that organization was finally consolidated, and began to make itself more and more felt in international politics; its congresses have been held regularly at the prescribed intervals. There is no gainsaying the fact that direct action by the workers and the existence in all Western countries of a powerful Socialist party (either working within the Government or using its influence from outside) have to a very large extent determined the new policy which eventually produced the London agreement on reparations (1924) and the Locarno pact of mutual guarantee. To be convinced of this we have only to look for a comparison at the resolutions passed at Hamburg on the reparations problem and those at Marseille on security. There can be no better instance of the influence which Socialism has acquired over the various Governments and of its emergence as the decisive factor in matters of international policy. (For bibliography *see* the article SOCIALISM.) (E. VA.)

THE THIRD (COMMUNIST) INTERNATIONAL

The Communist International (abbrev. *Komintern*) is the international organization of the Communist party of all nations, founded in 1919. It is also called the Third International. In structure and programme it differs from the First and Second. Communism sympathises unreservedly with the first International, founded under the leadership of Marx and Engels, whose policy was essentially one of active revolution. As, however, its organization lacked a definite central point and had not its roots in party associations, its practical manifestation, the Paris Commune, was bound to fail. Lenin evolved his theory of revolutionary movement from the lessons of the failure of the Commune, and arrived at the conclusion that a successful revolution might begin as a spontaneous popular upheaval, but could only achieve and retain victory in the form of an organized and systematically controlled movement which could not only put down all opposition, but could at once organize the resources of the country.

Birth of the Third International.—In 1889, when the Socialist Labour movement had recovered its force, the Second International (*see* above) was founded. Up to 1914 this represented the international organization of the Socialist-Labour movement as a whole. The constructive importance of the Second International, from the point of view of the Communist parties, lay in the fact that it organized and grouped labour in trade unions, co-operatives, educational associations and political parties. The Second International already contained a Bolshevik opposition which refused to assimilate with the larger body. It was led by Lenin, who was a member of the International Bureau (B.S.I.) of the Second International in 1914. In 1914 the Second International collapsed. The Communists date the epoch of the Communist International from this moment. This epoch emerged out of a transitional period comprising the first three years of the war, during which Lenin struggled to "transform the imperialist war into a civil war." The foundations of the Third International were laid at the conferences of Zimmerwald and Kienthal in Switzerland. It only achieved real authority, however, when the leaders of the German army conceived the idea of making the Russian February revolution more extreme. The German supreme command brought Lenin and Trotsky to Russia in the fond hope that the fire of the Russian revolution which they were kindling in Russia would stop at the frontiers of Germany.

The Third International was not formally founded till March 1919. Up to that date the Communist parties believed that they would be able to break up the Socialist parties from within and transform the Second International bodily into a Communist organization in the tempest of the world revolution. Especially during the episodes of the Soviet republics in Bavaria and Hungary, and even after their collapse, during the labour troubles in Britain, Germany, Italy, etc., Moscow continually believed the outbreak of world revolution imminent every hour, and expected that the Socialist parties could be simply absorbed in the Communist parties. As it grew ever plainer that this hope (which at first was shared by Lenin) was Utopian, the Communists devoted even greater energy to their own International.

Fundamental Principles.—The following are their basic principles:

1. The Communist International is the organization of the Communist parties of each nation; it is therefore revolutionary. Its chief purpose is to accelerate the development of events towards world revolution. It rejects any compromise or co-operation with bourgeois parties. Similarly it rejects parliamentarism as a normal method of political development. In certain circumstances it advocates a unity of front with Socialist parties, including the Second International. This is, however, never more than a temporary and tactical co-operation. The Communist International is honest enough to state openly that it is only ready to support the Socialist parties so far as "the hangman's rope supports the convict." The aim of the Communist International is the creation of really revolutionary proletarian parties which shall be the advance guard of the revolution, and the combination of them in a great homogeneous international Communist party. Their headquarters are only "for the moment," as Lenin said, and probably not for long, in Moscow; later they will move to countries where the economic system and the proletariat alike are more advanced, so soon as one such country achieves a Soviet constitution.

2. The Communist International is no loose organization like the Second International, but an association bound together by a common programme and principles, and receiving its orders from a central organ, the bureau of the Third International. This central organ does not merely issue general rules of conduct, which may be carried out or not by the individual national parties according to their own convictions and views of the general situation; it lays down policy to the smallest details. The men at the head of Communist parties have been repeatedly changed under orders from the International, and tactics (*e.g.*, the question of co-operation with the Socialist parties, or the attitude to be adopted towards parliament) have often been defined in detail by resolutions of the International bureau. This central organ of the Communist International is indubitably in close personal and political touch with the Russian Government, the Soviet of People's Commissaries.

3. The individual Communist parties are, despite a general uniformity, not all organized on the Russian system. The Communist parties of Western Europe are "open parties" which anyone may join. In some countries the Communist parties are proscribed by law. Wherever it is possible, a sort of military organization probably exists, exactly as in the Nationalist and Fascist parties.

4. In matters of internal policy the individual parties are, as already stated, strongly influenced by the Communist International, but there are great differences between the nations. In countries where democracy is firmly based and parliamentary tradition of long standing, the tactics of the Communist parties are correspondingly modified. Communists take part in parliament, bring forward legislative motions, etc.; at times they even cooperate with the Socialist parties. This is, however, only a temporary tactical move, the ultimate aim being always world revolution. The formation of the so-called "unified front" is a means to an end and a tactical move. The organized workmen in the trade unions are to be captured in such a way that the trade unions gradually come under the influence of the Communist parties.

The conditions of affiliation to the Communist International prescribe that every party which desires affiliation to the C.I. must develop a systematic and persistent Communist activity within the trade unions, works committees, co-operative societies and other mass organizations of workmen. Within these organizations it is necessary to organize cells, which by persistent and continuous work must win the unions, etc., to the cause of Communism. The Communist cells must be completely subordinated to the party as a whole.

Developments Outside the Industrial Proletariat.—Since the aim of the Communist International is world revolution, and since the state of the Continent of Europe has grown much less disturbed since 1921, the chief aim of the Communist International proved unattainable. The revolution had taken the offensive at isolated points, but failed to develop into a world-wide movement. The International therefore put forward officially the doctrine that sudden enthusiasm alone will not bring about world revolution; this must be achieved by a strict organization which must first be created. Such an organization, however, presupposes a compact Communist international unified front.

The Communist International began by continuing the traditional policy of the Second International. It desired to be an organization of manual labour. But in Russia the actualities of the situation soon forced the party to admit the peasants as members (at first only the poor peasant, later the medium peasant). A Peasants' International was founded in 1923, but made slow progress. Nevertheless, it then became possible to embrace the extremist agrarian movement—a matter of the greatest importance in countries where large estates are common. The rather unexpected pronouncement was therefore made that "the peasants have become the natural allies of the workmen." Thus a link was forged with what had been the oldest revolutionary movement in Europe. To-day, indeed, with the emergence of the peasants from

[illegible], their status and feelings, especially in central Europe, have changed radically. It is most unlikely that revolutionary feelings will ever become widespread among them.

Oriental and Colonial Propaganda.—Far more important is the connection between the Communist International and parties and currents of thought which may be described as the heart of the movement for national and economic independence among the colonial and semi-colonial territories of Asia and Africa. Countries such as India, China and the wholly independent Japan are already represented in the Communist International by considerable parties, although these parties differ very markedly from those of Western Europe. The psychological bases for intensive Communist propaganda in Asia are, firstly, the appalling conditions in the newly developed enterprises (women's and children's labour, long hours of labour, barrack conditions for workmen); and secondly—perhaps more important—the breakdown of the social structures of these countries. Throughout Asia the family is the basis of society. Industry destroys this, and nothing comes to replace it. But man, in the Far East, cannot live except as member of a community. He cannot grasp the idea of an abstract existence, secured simply by a contract of labour. Existence is uprooted, and all his instincts revolt against an economic system which attempts to make him into an individual. This revolt finds its plainest expression in the Communist movement, the essence of which is thus the resistance of the social instincts to the destructive influences of industrial life.

Furthermore, the restrictions placed by the United States and Australia upon immigration, the restrictions placed on Indian emigration to Africa, the unfortunate results which attended Chinese labour conditions in South Africa, combined with the insistence laid by the white races on the preservation of racial distinctions, have created a real and practical feeling of unity among all coloured races and nations throughout the world—a feeling which extends throughout all Africa and Asia, and as far as the negroes of America. In the face of this racial antagonism, Soviet Russia is the only Power to-day which stands on principle for racial equality and full equality of rights for all races on their own territory.

Thus Communist propaganda directed against the influence of European capitalists and the partizans of racial superiority in Asia has an easy task. Even Japan has been led by similar motives to a political *rapprochement* with Soviet Russia. Communist propaganda in Asia and Africa is therefore adapted to local conditions. Social and national considerations take the first place; less insistence is laid on the purely economic factor.

The resentment against capitalist exploitation, combined with the struggle against the Imperialist European Powers and against the United States, inevitably draws the leaders of those movements towards Russia, and thus towards the Communist International. This connection has been developed by special congresses to the oriental peoples (as that of Baku in 1920), and has certainly been exploited by the Russian Government to further Russia's traditional foreign policy in Asia. In all these countries the small tenant farmers are particularly susceptible to the allurements of the Communist programme.

In the last few years, however, the economic antagonisms have become intensified in the Far East also, especially in China. Chinese industrialists and capitalists have rejected the communistic influence, which has frequently made itself felt by very drastic means, and this class antagonism in the Far East has undoubtedly caused a weakening in the authority of the Third International.

Results up to 1927.—The Communist International forms a bond between the States organized on the Communist system and the Communist parties in the capitalist bourgeois States. In this way one may look on its work as the "formation of the front line of a world-revolution." In fact, a country which contains a strong and active Communist party finds it impossible to participate in a European counter-revolutionary movement. In terms of practical politics, this means that the States of Europe would find it hard to undertake war against Russia, in face of the opposition of their own Communists and Socialists. This is probably the greatest success of the Communist International. The Communist International is therefore both an association of national parties with a definite internal political programme, and at the same time an international political organization of really international importance on a world-wide scale.

It remains to be seen to what extent the fall in Russian credit may result in a loosening of the relations of the European Communist parties with the Russian authorities so that the policy of the Communist parties will no longer depend so much on instructions from Moscow. Hitherto, in spite of the nominal independence of the Communist International, its policy has been clearly dictated from Moscow, whereas in future financial support from Moscow may possibly only take place in exceptional cases.

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(E. LE.)

INTERNATIONAL ADVERTISING ASSOCIATION, THE, according to its printed constitution, is an organization "for the purpose of furthering the best interest of advertising." It is strictly a business association and is maintained by business men and advertisers in the belief that any organization that will improve advertising will thereby reduce the cost of advertising. There were in 1928 approximately 25,000 members of this association located in nine different countries. The parent association is made up primarily of: (*a*) local advertising clubs; (*b*) departmental organizations; (*c*) sustaining members; (*d*) members at large; (*e*) Better Business bureaux.

(*a*) Local advertising clubs are voluntary associations, whose purposes are usually: (1) to prevent false, deceptive and misleading advertising in the district in which the club exists; (2) to conduct study circles and present educational courses in advertising; (3) to hold local meetings which are addressed by leading business men on business and advertising topics of general interest. Upon the payment of the stipulated dues, the amount depending upon the number of members, the local club may become affiliated with the parent association. (*b*) Departmental organizations represent specific branches of advertising such as associations of newspaper publishers, trade-paper publishers, retail advertisers or advertising agents. (*c*) Sustaining members are either individuals or concerns interested in the improvement of advertising who contribute directly to the support of the International Advertising Association. (*d*) Members at large are individuals or concerns which wish to affiliate themselves with the parent association but which, because of their geographical location or for other reasons, are not able to join one of the auxiliary groups. (*e*) Better Business bureaux are organizations similar in nature to the local advertising clubs whose chief purpose is to protect advertising from false, deceptive or misleading claims. The Better Business bureau aids the local prosecuting attorney or other officials in securing evidence to convict fraudulent advertisers.

The organization of the International Advertising Association is extremely complex. First it is divided into 18 district subdivisions. The first 12 of these are made up of various groups of States in America; the 13th of the Philippine islands; the 14th of Great Britain and all countries in the British Empire except Canada, Australia and New Zealand; the 15th, of Canada, except British Columbia; the 16th, of Australia and New Zealand; the 17th, of all Europe except Great Britain and Ireland; and the 18th, of the Orient.

Once a year the International Advertising Association holds a convention which is attended by delegates from all of the various districts. This convention opens with addresses by delegates in the various churches of the city where the convention is entertained. The four following days are given over to discussions of the most prominent problems incident to the advertising, sale and distribution of goods and services. Many of the leading business men of the world have accepted invitations to address these conventions. Some of the sessions are given over to the discussion of technical questions by the various departmental organizations. Previous to 1929, the annual conventions were held in the United States, Great Britain and Canada. (H. E. A.)

INTERNATIONAL BUREAUX. The beginnings of the international movement may be traced back for more than a century. In 1823, for the first time, scientific congresses were held in Germany, to which representatives of other countries were invited. France, England and the United States soon followed this example. The need was soon felt for permanent bureaux to carry out decisions made. This was the origin of international bureaux, some official and some private bodies, dealing with the widest range of subjects: Agriculture, trade and industry; communications and transport; labour; medicine and hygiene; economics and finance; law and administration; arts and sciences; humanitarianism, religion, morals and education; sport and travel; feminism; international languages; bibliography and documentation; disarmament.

In 1909 there were 300 such bureaux; in Nov. 1912, 510. The World War was a serious hindrance to international life, and a large number of private bureaux were closed. After the war it took a long while to re-establish international relations. Many of these bureaux became inter-allied in character and several years passed before they again became really international.

An international handbook (*Annuaire de la vie internationale*) was founded in 1905, and published in 1905, 1906 and 1907 by the Institut international de la Paix. Another series was published in 1908–09 by the International Bibliographical Institute, and in 1912 by the Union of International Associations with the aid of the Carnegie Foundation. Since the World War the League of Nations has become the centre for international bureaux. Four editions of the *Handbook of International Organizations* have been published, in 1921, 1923, 1925 and 1926. Only such bureaux as replied to the questionnaire sent out by the secretariat of the League of Nations were included and, therefore, certain omissions were inevitable. Nevertheless, it can claim to give a fairly complete survey of international life at the present day. The last edition contains about 400 entries. This shows a decided decrease in the number of international bureaux since 1912. An examination of the dates of foundation discloses a still greater diminution; for, since 157 were founded after the World War and eight during the war, it follows that of the 510 bureaux recorded in 1912, 250 at most survived. These figures prove clearly the fatal effect of the war on international relations and the long time required for their re-establishment.

The geographical distribution of these international bureaux is of interest. Switzerland heads the list with 83 bureaux. Then comes France, 74; Great Britain, 63; Belgium, 60; the Netherlands, 40; the United States, 22; Germany, 19; Italy, 8; Austria, 6; Denmark, 6; Sweden, 4; other countries, 12, one in each. The importance of these bureaux varies greatly. Several will be found under separate headings (*see* RED CROSS, etc.). Bureaux founded on general treaties, that is to say, based on international conventions, signed by the various States, should be classed separately.

Bureaux Based on International Conventions (Addresses as in 1928).

Advisory committee for the international protection of nature Founded, 1913. Seat, Basle: 22 Spitalstrasse.

Central international office for the control of the liquor traffic in Africa, 1919. Brussels: Ministry for Foreign Affairs.

Central Office for international railway transport, 1893. Berne: 36 rue Monbijou.

International bureau for the publication of customs tariffs, July 5, 1890. Brussels: 38, rue de l'Association.

International bureau of commercial statistics, 1913. Brussels: Ministry of Finance.

International bureau of the Pan American postal union, 1912. Montevideo.

International bureau of the telegraphic union, 1868. Berne: 1, Effingerstrasse.

International bureau of the universal postal union, 1874. Berne: 2, Schwanengasse.

International bureau of weights and measures, 1875. Paris: Parc de St. Cloud.

International Central-American office, 1908. Guatemala: 10a, calle Oriente, No. 1.

International commission for air navigation, July 11, 1922. Paris: 20, avenue Kléber.

International commission for the decennial revision of nosological nomenclature, 1900. No permanent secretariat.

International conference for promoting technical uniformity on railways, 1882. Berne: Federal Railway Department.

International conference for the study of epizoötics, 1920. Paris.

International exchange service, 1886. Brussels: Belgian International Service, 45 rue des Longs-Chariots.

International hydrographic bureau, 1919. Monaco: 3 avenue du Port.

International institute of agriculture, 1905. Rome: Villa Umberto 1.

International institute of refrigeration, 1920. Paris: 9, avenue Carnot.

International prison commission, 1880. Groningen (Netherlands).

International public health office, 1907. Paris: 195 Bd. St. Germain.

Office of the American international union for the protection of trade marks, Dec. 6, 1927. La Havane: 55, calle de Trocadero.

Permanent court of arbitration, 1899. The Hague.

United international bureaux of industrial, literary and artistic property, 1885. Berne: 7 Helvetiastrasse.

Article 24 of the Covenant has defined the relations of the League of Nations with international bureaux in the following terms:

"There shall be placed under the direction of the League all international bureaux already established by general treaties if the parties to such treaties consent. All such international bureaux and all commissions for the regulation of matters of international interest hereafter constituted shall be placed under the direction of the League.

"In all matters of international interest which are regulated by general conventions but which are not placed under the control of international bureaux or commissions, the secretariat of the League shall, subject to the consent of the Council and if desired by the parties, collect and distribute all relevant information and shall render any other assistance which may be necessary or desirable.

"The Council may include as part of the expenses of the secretariat the expenses of any bureau or commission which is placed under the direction of the League."

In practice these relations have been, up to now, somewhat vague. Four international bureaux have been placed under the direction of the League: The international bureau for assistance, from June 1921; the international hydrographic bureau, from Oct. 2, 1921; the central international office for the control of the liquor traffic in Africa, from Jan. 11, 1922; and the international commission on air navigation, from July 1922.

The bureaux which existed before the League of Nations was founded show no eagerness to surrender their autonomy and merely maintain contact with the international bureaux section of the secretariat of the League of Nations—of which M. Nitobé (Japan) was the director for seven years, and since 1927, M. Dufour-Féronce (Germany).

The League of Nations publishes a quarterly bulletin of information on the work of international organizations, containing a summary of the proceedings of the congresses and conferences held in the period. Further, the League of Nations allocates to the Union of International Associations at Brussels a subsidy for the publication of a collection of international resolutions; vol. i. appeared in 1923. It contains the resolutions passed by 15 conferences and congresses. When it is remembered how many bureaux there are, it will be realized that an enormous number of volumes will be required to contain all their resolutions. (E. CL.)

INTERNATIONAL CHAMBER OF COMMERCE, an important international institution established in 1920 at a meeting of the chief business interests of Belgium, France, Great Britain, Italy and the United States, and subsequently joined by 40 other nations, to promote the development of international trade, to remove or mitigate the effects of trade restrictions, and to foster harmonious commercial relations among the nations.

The machinery by which the Chamber seeks to attain its objects is as follows:—

The Chamber is governed by a council to which representatives are elected by the national committees in the various countries. The secretary-general carries out the decisions of the council under the supervision of the president and a small executive committee.

Committee organization is designed to cover important subjects which are brought before the council by the affiliated countries. There are committees for commercial policy and trade barriers; industrial statistics; international industrial agreements; fairs and exhibitions; international settlements and economic information; double taxation; bills of exchange, cheques and export commercial credits; international commercial arbitration; international protection of industrial property; trade terms; sea, air, rail and highway transport; and telegraph, telephone and postal services.

Biennially the International Chamber holds a congress in one of the affiliated countries, which is attended by delegates representing the different countries. These congresses are outstanding features of the organization. The congress which was held in Stockholm in 1927, was attended by 800 delegates from 35 different countries; previous congresses were held in Brussels (1925), Rome (1923) and London (1921).

In each country which desires to participate in membership, there is established a national committee representing the industrial, commercial, financial and transport interests of the country. The national committees are the administrative and co-ordinating links between the council on the one hand and the actual members in their respective countries. The International Chamber has established a court of arbitration to facilitate the settlement of commercial disputes between the traders of different countries.

There are two categories of members. Organization members are representative bodies such as chambers of commerce, federations of manufacturers, etc. Individual firms and companies engaged in business activities are eligible for associate membership.

INTERNATIONAL DATE LINE. If a voyager travel eastward to the Antipodes and thus "anticipate the sun," his timing will be 12 hours in advance; if another travel westward, then his will be as much in arrear. There will thus be a difference of 24 hours when they meet. To avoid confusion, mariners chose the 180° meridian as a convenient line (known as the International Date Line), at the crossing of which they changed the name of the day, forward if going west; backwards if going east. The International Date Line, largely consequent on American initiative, while retaining the 180° meridian in the Pacific, is arranged so as to bring the Aleutian islands and Alaska into the same dating as America, and certain of the South Sea islands into the same dating as Australia and New Zealand.

INTERNATIONAL HARVESTER COMPANY, THE, for many years a leader in the manufacture of farm-operating equipment, and also a large manufacturer of farm and industrial tractors, motor trucks and coaches, was originally formed in 1902 under the laws of New Jersey, and acquired at that time the farm-implement properties and businesses of a number of old established concerns, notably the McCormick and Deering companies. In 1913 the company was divided into two organizations, the International Harvester Company of New Jersey and International Harvester Corporation, the latter taking over the foreign business and manufacture of tractors, motor trucks and other so-called "new lines." In 1918 the two companies were reunited into the present International Harvester Company. Manufacturing plants and binder twine mills are situated at: Chicago (5); Canton; Rock Falls and Rock Island, Ill.; Milwaukee; Auburn, N.Y.; Chattanooga, Tenn.; Fort Wayne and Richmond, Ind.; New Orleans, La.; St. Paul, Minn.; Springfield, O.; Chatham and Hamilton, Ont.; Croix, France; Neuss, Germany; and Norrkoping, Sweden. The International Harvester Company leases iron mines in Minnesota and owns coal mines in Kentucky; it also owns steel furnaces and rolling mills in South Chicago, together with a by-product coke plant.

There are about 30 subsidiaries which represent three main groups of activity; manufacture, selling and transportation. Another activity is the purchase and sale of Manila fibre in both the Philippine Islands and the United States. The company also owns a plantation in the Province of Matanzas, Cuba, for the production of Mexican sisal fibre. For the three years 1924–26, inclusive, the company's reports showed a steady gain in net working capital. As of Dec. 31, 1926, total current assets were $203,851,000, and total current liabilities $34.449,000, leaving a net working capital of $169,402,000. Other financial statistics for the year ending Dec. 31, 1926 were: Net income $22,658,892; surplus for the year $12,107,951; total surplus, $77,042,890; and total assets $307,824,282. The capital stock authorized is $100,000,000 7% preferred cumulative (par $100) and $130,000,000 common (par $100), of which on Dec. 31, 1926 there was outstanding $65,568,400 preferred and $99,876,772 common. The general offices of the company are at Chicago. (G. A. R.)

INTERNATIONAL INSTITUTE OF AGRICULTURE. An international institution founded in 1905 on the initiative of Victor Emanuel III., king of Italy. A Californian merchant, David Lubin, convinced of the political as well as the economic importance of maintaining a proper balance between industrial and agricultural development, had come to the conclusion that in an age of international trade, of trusts, and concentrated capital, agriculture would be unable to hold its own in the economic arena against the coalesced forces of industry, commerce and finance unless organized effort, under government auspices, placed it in possession of a knowledge of crop conditions and available supply of farm products in all producing countries. He argued that on an international market, such as that for cereals, cotton, etc., prices are determined by world and not by national conditions, that information on these conditions was not then available for the farmer and the consumer as it was not procured for all countries through concerted, co-ordinated, international effort. Each country did as much or as little as it saw fit in the field of crop-reports, estimates, and statistics; reliable information was entirely missing for many important links in the chain of production; and this left the field open to the price manipulator whose activities affected injuriously farmers, traders, manufacturers and the public at large, disturbing the relative values of farm and industrial products, and replacing stability by speculation. After attempting in vain to draw the attention of persons in authority in the United States to the need of an initiative to ensure concerted effort in this field, Lubin came to Italy and laid his ideas before the king, who deeming the matter worthy of attention instructed his Government to enquire into it. On their favorable report the king took the initiative of inviting the Governments of all countries to Rome to consider the advisability of founding a permanent international organ for gathering, assembling and disseminating reliable information on the production and trade in agricultural staples and to study the needs of agriculture with regard to credit, co-operation, and marketing facilities. Thirty-six Governments answered the invitation, in May 1905 their representatives met in Rome, and signed a convention establishing in that city the International Institute of Agriculture.

The I.I.A., which opened its doors in 1908, was a pioneer in the field of international economic co-operation, being the first of those permanent official international organs which have since become so familiar a feature of the post-war world. Seventy-four Governments are affiliated to the institute which they support by annual contributions fixed by the convention of 1905 and subsequently raised to meet the depreciation of the currency in which they are paid.

In the field of crop reporting and agricultural statistics the I.I.A. has achieved much; largely as a result of its efforts these government services have greatly improved in the several countries, which send in their data regularly to the institute at Rome where they are summarized and published at monthly and sometimes more frequent intervals, thus keeping all concerned regularly posted on the expansion or shrinkage of actual and prospective supplies of the staples. With the financial assistance of the International Education Board it undertook in 1925 to organize the first international agricultural census to be taken in 1930–31 by all countries on a plan proposed by the institute to secure

comparable data. It follows the work done in the different countries in the science and practice of agriculture and in agricultural economics (credit, cooperation, marketing) its functions being informative. It promotes contacts in the agricultural world and for this purpose has organized a Permanent Committee of Agricultural Associations and an International Scientific Council consisting of 22 commissions of experts. It co-operates with the International Labour Office of Geneva through a Joint Advisory Agricultural Committee on which both bodies sit; it is represented on the Consultative Economic Committee of the League of Nations. It has become the recognized world centre for co-ordinating congresses on matters of interest to agriculture: soil chemistry, forestry, seed breeding, wheat growing, fertilizers, etc.

The I.I.A. is governed by a permanent committee of delegates appointed by the affiliated Governments, and by a general assembly of Government delegates meeting, as a rule, once every two years in Rome. The staff is international. The I.I.A. publishes a monthly Bulletin of Agricultural and Commercial Statistics, a monthly International Review of Agriculture, a Yearbook of Agricultural Statistics, a Yearbook of Agricultural Legislation, and a large number of special studies. (O. R. A.)

INTERNATIONAL LABOUR ORGANIZATION, THE. This organization was created in 1919 by Part XIII. of the Treaty of Versailles, headed "Labour." This part was reproduced in all the later peace treaties, appearing as Part XIII. of the Treaties of Saint Germain, Neuilly, Trianon, and Part XII. of the Treaty of Sèvres. These treaties are the first known to history to contain articles dealing with labour.

ORIGIN AND CONSTITUTION

The idea of protecting labour by international conventions may be traced back to the humanitarian theories of a handful of thinkers who over a century ago foresaw the necessity of establishing economic co-operation among the nations in order effectually to remedy the evils which might spring from the development of modern industry. The name of Robert Owen is often quoted as a pioneer of international Labour legislation on account of the two memoranda which he submitted to the Congress of Aachen in 1818. But though Owen was indisputably a pioneer of protective legislation, his memoranda do not contain the idea of an understanding between governments for the establishment of identical protective measures in favour of their wage-earners. A French industrialist, Daniel Le Grand, attempted to promote this idea between 1840–60. But it was only after 1890 that certain governments began to show an interest in it. A conference was held in Berlin, convened by the German Government, but it confined itself to enunciating a few very general principles. At last, in 1900 the idea took form when a private organization, encouraged and subsidized by certain governments, was formed under the name of the "International Association for Labour Legislation" with headquarters at Basle.

In 1905 a technical conference summoned by the Association worked out two draft labour conventions, the one dealing with the limitation of night work for women in industry, the other with the prohibition of the use of white phosphorus in the match industry. In 1906 a diplomatic conference adopted these drafts and a few states ratified them. A new technical conference was convoked in 1913 to regulate by new conventions the prohibition of night work for young persons employed in industry and to fix a 10-hour working day for women and young persons. The second diplomatic conference was due to assemble in the autumn of 1914. Meanwhile, the World War broke out. The work was taken up again and officially consecrated by the peace treaties which concluded the War of 1914–8.

Labour in the Peace Treaties.—The pre-War movement in favour of protection of labour was not in itself strong enough to enforce it. In most countries it was the work of intellectuals, legal experts, or politicians. With few exceptions (*e.g.*, Germany), the workers' organizations took little interest in it. But in almost all the belligerent States the War brought into prominence the share taken by the working classes in national defence and national life. The workers became conscious of this fact. As early as Sept. 1914 a manifesto of the American Federation of Labor declared that peace should not be signed without the participation of representatives of Labour. In July 1916 at a conference at Leeds, of the trade unions of the Allied countries, in Oct. 1917 at a conference of the trade unions of the neutral countries and the Central Powers at Berne, and again at the conference of the inter-Allied Socialists at London in Sept. 1918, the same idea was taken up.

"The Treaty of Peace which will end the war and will assure to the peoples political-economic liberty and independence," said the London manifesto, "must also safeguard the working class of all countries from the attacks of international capitalist competition and assure it a minimum guarantee of moral and material order as regards labour legislation, trade union rights, migration, social insurance," etc.

Immediately after the War these tendencies grew far more pronounced. Revolutions had broken out in the conquered countries and their character had been invariably social. In the victorious countries the leaders of the governments pronounced, in accordance with the general feeling, that the working classes must receive a new place in the national communities. In Feb. 1919, at Berne, the trade unions of all European countries, allied, neutral, or defeated, claimed a labour charter and suggested that the old association, with its labour office, should be transformed into a great official organization of international labour legislation. A few days earlier (Jan. 29, 1919) the peace conference had resolved to constitute a commission for international labour legislation under the presidency of Samuel Gompers, and had called on it "to enquire into the international means necessary to secure common action on matters affecting the conditions of employment." The commission sat during February and March, 1919. It worked out a text which, having been adopted by the peace conference on April 11 and 28, 1919, became part XIII. of the Treaty of Versailles.

Principles and Procedure of the Organization.—A preamble at the head of Part XIII. defined as follows the principles which gave birth to the organization.

1. Universal peace, which it is the object of the League of Nations to establish, can be established only if it is based on social justice, and social justice implies the working out of equitable conditions of labour, which it is urgently necessary to apply.

2. The regulation of labour conditions must be accomplished internationally because "the failure of any nation to adopt humane conditions of labour is an obstacle in the way of other nations which desire to improve the conditions in their own countries."

3. Examples of the methods of improving conditions of labour were given: the establishment of a maximum working day and week, the prevention of unemployment, the provision of an adequate living wage, the protection of the worker against sickness, disease and injury arising out of his employment, the protection of children, young persons, and women, provision for old age and injury, protection of the interests of workers when employed in countries other than their own, recognition of the principle of freedom of association, the organization of vocational and technical education and other measures.

In another article (427) of the Treaty of Peace, these principles are formulated afresh and in a more precise form and recognized as "well fitted to guide the policy of the League of Nations" in industrial matters. These principles having been laid down, the Peace Treaty prescribed that a permanent organization should be established for their promotion. The commission, on meeting in Paris, was approached with proposals emanating from workers' representatives and even from certain states (such as Italy) which aimed at permitting a sort of international parliament to decree labour conditions which every state would be compelled to adopt. Such proposals appeared incompatible with the idea of national sovereignty as entertained by most states. The International Labour Organization, it was thought, should not form a "super-state," any more than the League of Nations. The Commission adopted as a basis of its deliberations a British draft which was more modest and, above all, more elastic, and attempted

to reconcile the independence of individual states with the authority of an official organization.

The system adopted was as follows: The International Labour Organization consists of two essential organs: the General Conference of representatives of the members, and an International Labour Office controlled by a governing body. The conference meets "from time to time as occasion may require and at least once in every year." It is composed of four delegates of each of the member states, of which two are government delegates and the two others represent respectively the employers and the workpeople. These last two delegates must be chosen by the governments in agreement with the industrial organizations, if such organizations exist, which are most representative of employers or workpeople, as the case may be, in their respective countries. This shows a characteristic feature of the new organization. In the Assembly of the League of Nations only Government delegates have seats, but in the Labour Organization delegates representing the employers and the workpeople of the member states intervene. This indicates the solidarity of economic and protective forces which has imposed itself on the world since the War.

The conference deals with questions which have been included in its agenda by the governing body, and the agenda is transmitted to the member governments four months before the meeting of the conference. At the close of its discussions it may adopt recommendations or draft conventions by a majority of two-thirds of the votes cast by the delegates present, but not otherwise. The member states undertake that, within a year at most from the closing of the session of the Conferences, or if special circumstances prevent this, in no case later than eighteen months, they will bring the recommendation or draft convention before the authorities within whose competence the matter lies, for the enactment of legislation or any other action. In the case of a recommendation the member states will inform the Secretary-General of the League of the action taken. In the case of a draft convention the member will, if it obtains the consent of the proper authorities, communicate the formal ratification of the convention to the Secretary-General and will take all necessary action to make the convention effective.

It is necessary to consider the exact weight which the system carries. The states, under the Peace Treaty, have not undertaken to ratify automatically all draft conventions adopted by the International Labour Conference, but only to submit the drafts to the authorities competent to enact the legislation. They are still free to ratify or not. But when there was only the International Association for Labour Legislation, before the War, the states which had sent plenipotentiaries to the diplomatic conferences were not even bound to approach their parliaments with the resolutions adopted. The obligation which they have now undertaken may seem to carry little weight, since each state remains free, within its sovereign rights, to ratify or not; but in essence the whole system rests on an appeal to the public opinion of each of these states, and an appeal to parliament, the authoritative expression of this opinion. The whole mechanism invented by the negotiations of the treaty constitutes an act of faith in the feeling of justice which should animate corporate humanity.

Once the conventions have been ratified, the mechanism of their application instituted by the Peace Treaty develops in the following manner: by the act of ratification the states contract a mutual agreement to respect equally all clauses contained in a convention. They must allow mutual supervision of their application of these clauses. By Art. 408 of the Treaty of Versailles they undertake to send an annual report to the conference in which they give a list of the measures for such application. Comparison of these reports may always form the subject of discussion at the conference. It may be noted that, to facilitate this discussion, the Conference decided at its Eighth Session to set up a committee to examine the summaries of these reports. To prepare for this work, the Conference also invited the governing body to appoint a technical committee of experts. The committee of experts met for the first time in 1927 and submitted a report to the governing body, which was transmitted to the Conference. If one of the ratifying states fails to apply the convention, or applies it imperfectly, other ratifying states, or even industrial associations of employers or of workers, may file complaints. When such complaints are received, the governing body of the International Labour Office must deal with them. If necessary it may submit the complaint to a commission of enquiry (Art. 411–414). In the last instance, The Permanent Court of International Justice can be called on to pronounce judgment. This court may even, under Art. 418, indicate the measures, if any, of an economic character which it considers to be appropriate and which other governments would be justified in adopting against a defaulting government.

THE I.L.O. IN OPERATION

The first conference was convoked at Washington in Oct. 1919. The International Office was not yet constituted. The programme of the conference had been fixed in the Peace Treaty itself, and a committee of organization entrusted with its preparation. Six draft conventions were voted concerning: (1) The limitation of hours of work in industrial establishments to eight hours a day and 48 hours a week. (2) Unemployment. (3) The employment of women before and after child-birth. (4) Night work for women. (5) The minimum age for the admission of children to industrial employment. (6) Night work for young persons in industry. The Washington conference constituted the International Labour Office, and nominated its first governing body. This governing body appointed the director, M. Albert Thomas. In 1920 a conference was held at Genoa, which was devoted to maritime questions and passed three draft conventions. The first fixed the age of admission to work at sea, the second dealt with unemployment benefit in case of loss by shipwreck, the third dealt with finding employment for seamen.

In 1921 the third session at Geneva voted seven draft conventions dealing with: (1) The age of admission for children to agricultural employment. (2) The right of association and combination of agricultural labourers. (3) Workmen's compensation in agriculture. (4) The use of white lead in painting. (5) The application of the weekly rest to industrial establishments. (6) The minimum age of admission of young persons to employment as trimmers or stokers. (7) The compulsory medical examination of children and young persons employed at sea. Each of these sessions voted at the same time a number of recommendations.

The fourth session at Geneva in 1922 only voted a recommendation concerning statistical and other information relative to emigration and immigration. The fifth session at Geneva in 1923 also voted only one recommendation concerning general principles for the organization of inspection services to ensure the applications of laws and regulations for the protection of the workers. The sixth session at Geneva in 1924 instituted the procedure of giving the conventions two readings, at intervals of one year. Some conventions were thus given a first reading, most of them being voted in 1925. The session of 1924 definitely passed one recommendation only concerning the utilization of the spare time of workers. The seventh session, Geneva, 1925, finally voted four draft conventions concerning (1) workmen's compensation for accidents, (2) workmen's compensation for occupational diseases, (3) equality of treatment for national and foreign workers in workmen's compensation for accidents, (4) night work in bakeries.

The eighth session, Geneva, 1926, adopted a draft convention concerning the simplification of the inspection of emigrants on board ship; and the ninth session, also held in Geneva in 1926, adopted two draft conventions concerning respectively seamen's articles of agreement and the repatriation of seamen. The tenth session, Geneva, 1927, adopted two draft conventions on sickness insurance, one for workers in industry and commerce and domestic servants, and the other for agricultural workers. At all these sessions recommendations also were adopted. The 1927 session of the Conference put into operation for the first time a new procedure, known as the "double discussion" procedure. According to this system, a question placed on the agenda of the Conference by the governing body will, at the first of two successive sessions,

form the subject of a general discussion, and if the Conference considers that it is suitable for a convention or recommendation, it will determine the form of the questionnaire to be sent to governments with a view to the detailed examination of the question at the succeeding session of the Conference.

In all, not counting recommendations, 25 International Labour conventions were submitted to the States for ratification between 1919 and 1927. These conventions dealt with industry, commerce and, in some cases, navigation and agriculture. As regards agriculture a dispute arose in 1921. It was maintained that the International Labour Organization had not the right, under the Peace Treaty, to deal with the protection of agricultural labourers. On this point an advisory opinion of the Permanent Court of International Justice was taken through the mediation of the League of Nations under Art. 14 of the Peace Treaty. The Permanent Court gave a judgment recognizing the competence of the International Labour Organization.

Ratifications.—In Oct. 1927, the League of Nations had registered 243 ratifications. This figure has given rise to much discussion. The International Labour Organization includes 55 States. If one excepts the conventions adopted since 1925, not many of which had been ratified by 1927, about 900 acts of ratification could in theory have taken place for the other 16 conventions. There have been only 224 ratifications, that is, about one-fourth of the total possible. But this low figure calls for certain remarks. The same value cannot be attached to all ratifications.

1. There are a certain number of conventions which could not be ratified by all States, despite their general character. The maritime conventions, for example, do not interest the States which have neither coasts nor ships. Similarly, there are countries of small proprietors where the number of wage-earning agricultural labourers is quite insignificant. There are others, again, where certain unhealthy industries against which conventions are directed, have not established themselves.

2. There are numerous States in which industry is of little importance and where national labour legislation hardly exists. The Hejāz, Siam and other states have indicated that the measures laid down in certain conventions are inapplicable to the conditions under which the wage-earning labourers in these countries work.

3. International action is only beginning, and all sorts of reasons delay ratification; not merely the inexperience and inattention of the great national administrations, for which the international conventions are often matters of secondary importance, but also the hesitation to contract obligations which sometimes appear to threaten the output, or at least the competitive capacity, of the country on the international market.

Nevertheless, important results have been obtained. In the eight years preceding the War the two conventions of Berne had been ratified by a very few states only. When, since the World War, such conventions as that which forbids night work for women or that which attempts to cope with unemployment have obtained the ratification of 16 or 20 states, including great industrial countries like Great Britain, France or Italy, many thousands of workpeople are definitely assured of the benefits of reform. For, under the text of the conventions, the contracting states cannot, for a period of 10 years, go back on the obligations which they have assumed, even in crises where they would be tempted to do so. The effect of the ratifications has been also particularly important in certain countries, for example in India, where conditions of labour have been greatly improved by the application of the measures contained in the international conventions.

But even when the conventions are not ratified, they become the model on which the new national legislations form themselves. Belgium, for example, before it ratified the convention, established the eight-hour day in 1921 in strict conformity with the clauses of the Washington Hours Convention. Similarly, all the young states of Central and Eastern Europe which were formed or resuscitated in 1919 have modelled their entire labour legislation on the general rules laid down by the International Labour Organization. Thus, more progress has been achieved than might be imagined.

A Centre of Information.—The work of the International Labour Organization is not confined to preparing the international conventions, to seeking to obtain their ratification by the states, or to watching over their application. Art. 396 of the Peace Treaty also assigns it further functions which include the "collection and distribution of information on all subjects relating to the international adjustment of conditions of industrial life and labour." Also "the conduct of such special investigation as may be ordered by the conference." It has "to edit and publish in French and English . . . a periodical paper." The conference may even assign to it, besides the functions mentioned above, "such other powers and duties" as it chooses.

Thus, since 1919, the International Labour Office has become a sort of great clearing house of all information on social questions. It has a library of 150,000 volumes. The ideal would be to make it a centre where workers would be certain of finding all publications of all countries touching on the regulation of labour. This office collects by means of corresponding offices in Paris, Rome, Berlin, London, Washington and Tokyo, and collaborators in other capitals, periodical information on social developments in most great countries. It publishes two general periodicals: the weekly *Industrial and Labour Information*, which gives important news in the various branches of social life, and a scientific monthly review, the *International Labour Review*. It further publishes the *Industrial Safety Survey*, which reports all new measures taken and all experiences obtained regarding safety of labour; and a *Monthly Record of Migration*. It publishes reviews or bulletins giving a summary of all these publications for the information of different countries, in German in Berlin, in Italian in Rome, in Spanish in Madrid, and in Japanese in Tokyo. Carrying on the tradition inaugurated by the Basle office, it publishes an annual collection, in French, English and German, of the labour legislation promulgated every year in different countries (*Legislative Series*). It has undertaken enquiries on a large scale in all matters of particular importance. Among them may be mentioned the great *Enquête sur la Production* which deals with the economic situation of the world between 1918 and 1925; an enquiry into the conditions of labour in all the coal producing countries; an enquiry into legislation and labour conditions in Russia; another into labour conditions in Asia, etc. It publishes quarterly a *Bibliography of Industrial Hygiene*.

The I.L.O. has also attempted to simplify and unify methods of labour statistics used in different countries. Three conferences of labour statisticians have already been convoked, and corresponding committees, consultations of experts and special commissions, permit the Office to maintain contact with technicians and scientists in the various branches of social life.

Internal Organization of the Office.—In order to deal with its twofold task of maintaining contact with the governments, and especially with the Ministries of Labour, with which it corresponds directly under Art. 397 of the Treaty, and with the organizations of workers or employers, the Office has had to organize itself on a sound basis. Under the Peace Treaty it is administered by a governing body nominated for three years by the Conference. The governing body consists of 24 members, of which 12 represent the governments, six the employers and six the workers. Of the 12 government representatives eight belong *ex officio* to the most important industrial countries (Germany, Belgium, Canada, France, Great Britain, India, Italy and Japan). If any dispute arises about relative industrial importance, this must be settled by the Council of the League of Nations. A system of indices (based on population, working population in relation to the total population, steam horse-power, length of railway lines, etc.) makes it possible to decide this point. The six workers' representatives are nominated by the delegates to the Conference representing the workers, and the six employers' representatives by the employers' delegates. The Conference has proposed to enlarge the governing body, but this will need the amendment of the Peace Treaty, and it has not yet been done on account of the slow procedure for the ratification of such amendments.

The governing body nominates a director and gives him his instructions. The director nominated in 1920 was M. Albert Thomas, formerly a French Minister of State. He is assisted by

a deputy director, who is an Englishman, Mr. Harold B. Butler. The staff of the International Labour Office amounted in 1927 to about 376 employees of all ranks, who were drawn from 32 different nationalities. Under Art. 395 of the Peace Treaty the director "shall as far as possible, with due regard to the efficiency of the work of the office, select persons of different nationalities." The nations chiefly represented among the personnel are France and Great Britain, because French and English are the two official languages used by the office; next, Switzerland, because the executive personnel is recruited locally.

The budget of the office varies between 7.000,000 and 8.000,000 gold francs, and is introduced annually by the governing body before the Assembly of the League of Nations. It is supplied for the most part by contributions from the states which are members of the Organization. This contribution is fixed under a scale adopted by the League of Nations for its own contributions.

Relation to the League.—The International Labour Organization is, in fact, part of the organization of the League. For this reason, since 1920 it has been established at Geneva. It was first installed in an old college. In 1922 the sum of 3,000,000 gold francs was voted for the erection of a suitable building on a site which had been given for the purpose by the Swiss Federation. The I.L.O., though attached to the League of Nations, entitled to its assistance, when required, and receiving its funds through the League, is nevertheless, like the Permanent Court of International Justice, an autonomous institution. Its decisions are not subject to the control of the Council of the League. The director of the office is in no way subordinate to the Secretary-General of the League. Indeed, if membership of the League carries with it membership of the I.L.O. (Art. 387), it was decided by the persons who negotiated the Peace Treaty, as by the Assembly of the League of Nations in 1921, that states which are not members of the League can become members of the I.L.O. Thus, since 1919 Germany belonged to the I.L.O. with equal rights before being a member of the League. A representative of the German Government has always sat on the governing body; the workers' group has regularly elected a German member, and the employers have also, since 1922, had a German member in the governing body. There are German employees throughout the office. In order to gain general information and to carry through scientific research, the I.L.O. remains in almost daily contact with the U.S.A. and with Soviet Russia, the only two great states which, for various reasons, do not belong to the organization.

ACHIEVEMENTS AND GENERAL AIMS

The organization has often been criticized and reproached with the desire to exceed the limits of its competence. The Permanent Court of International Justice decided in the two cases brought before it that this criticism was not justified. It has also been reproached with being exclusively guided by the workers' interests, and even with being unduly influenced by Socialist thought. Yet no concrete case can be urged in support of such an accusation against the director, or even less against the governing body. But one fact must not be forgotten, which was brought out in 1921 by a report of the Commission of Enquiry of the League of Nations: the International Labour Office is not simply an organ of conciliation or for keeping the balance between various industrial interests; it must look for conciliation only in order to attain a definite end, which is to realize the programme drawn up in the preamble to Part XIII. of the Peace Treaty. Experience also shows that measures protecting workmen are never fully carried through unless they are made by agreement with the workers and unless the workers are interested in their application.

The International Labour Organization, as conceived and conducted since 1919, has been able to keep the sympathies and confidence of the important workers' organizations. It is true that the Communists, the leaders of the Third International, have violently attacked it. But the International Federation of Amsterdam, with its 13,000,000 members, the Christian Unions, the Italian Fascist organization, take a regular part in the conferences of Geneva, and demand that the conventions be applied. It is to be noted also that the employers continue to be represented at the conferences and on the governing body. The International Labour Organization, while it aims at bringing about the "wellbeing, physical, moral and intellectual, of the wage-earners," attempts at the same time to take account both of the interests of production, and (to quote Art. 427 of the Peace Treaty) of the "differences of climate, habits and customs, of economic opportunity and industrial tradition," which "make strict uniformity in the conditions of labour difficult of immediate attainment."

As the Preamble to Part XIII. of the Treaty indicates, the objects in view are two-fold: to protect the various countries against unfair competition based on the exploitation of the workers, and also, directly and spontaneously, to enable the workers to enjoy a higher standard of living and work. The aim is not merely to create a balance between different countries, but also to give just treatment to individuals. Even if the first object has lost some of its force, the second is as important as ever. Whatever may be the vicissitudes of political life, and however much the tide of the labour movement may ebb and flow in the industrial communities of the world, the need for social justice continues to be strongly felt. Further, from the general point of view, the I.L.O. has helped to popularize among the industrial masses, both of the workers and of the employers, the idea of a definite peace based on an economic understanding and the social solidarity of the nations. It is already the great centre of international collaboration. It is recognized as being one of the great factors of peace. Its history bears witness to all the difficulties attending new international creations. The life of a nation enjoys the natural support of geographical contiguity, of racial community and of age-long tradition. An international organization can come to birth and live only if public opinion and the judgment of the governments favour a common programme. It appears that the programme of social justice drawn up in the Peace Treaty has sufficient authority and sufficient reason to assure the existence of the International Labour Organization.

BIBLIOGRAPHY.—See *The Treaty of Peace between the Allied and Associated Powers and Germany*, Part xiii. (H.M. Stationery Office, London, 1925). A list of publications of the International Labour Office can be obtained from the Publications Department of the Office at Geneva, or from their correspondents in different countries.

(A. TH.)

INTERNATIONAL LAW, PRIVATE. Private international law means that law which is applied to the judicial adjustment of divergent private interests of an international character, whether between individuals or an individual and a State, as distinguished from the law applicable to the settlement of relations between States, which is called public international law. The court necessarily determines which State-law has to be applied, since, *ex hypothesi*, the persons interested or the circumstances are related to different States with differing systems of law which meet in competition. Hence comes the expression "conflict of law or laws" used by some writers.

Certain States which have codified most of their law have included some main rules of international law, *e.g.*, the statute introducing the German Civil Code, while other countries have been parties to treaties on the subject and in both classes the rules become binding on their courts. The most prominent series of conventions in Europe are those of The Hague, one being of Nov. 14, 1896, three of June 12, 1902 and four of July 19, 1905 selecting the rules on the validity of marriage and marriage contracts, their effects on property and status, divorce and judicial separation, guardianship of minors and interdicted persons, testamentary and intestate succession and parts of judicial procedure. It seems that Germany, Italy, Holland, Portugal, Rumania and Sweden are parties to all these conventions of 1902 and 1905 while Austria and Switzerland are parties to those on the validity of marriage, divorce and separation and guardianship of minors; but France and Belgium have since renounced on grounds of public order.

In Ibero-America we have the several treaties of Montevideo of 1889 signed by the republics of Argentina, Bolivia, Paraguay, Peru and Uruguay, dealing with domicil, capacity, family rights, property, juridical acts, marriage settlements, successions, prescription, jurisdiction, commercial law, maritime law, bills of exchange, bankruptcy, etc.

Personal Law.—Great Britain did not sign any of the above Hague Conventions, and this chiefly was for the very good reason that personal law, as conceived by the signatories, means the law of the nationality, while in Great Britain and nearly all the British colonies it means the law of the domicil; the whole basis therefore of these conventions was alien to the theory that a man's personal law by which he means and expects his rights to be governed is that of his domicil, *i.e.*, the country in which he has established himself and with whose conception of legal relations he must be deemed to have identified himself. The opposing theory treats him as carrying about with him the law of his nationality.

"Domicil" (*q.v.*) primarily refers to the domicil of his father at the child's birth, known as his domicil of origin, which he can change; but he must actually remove himself and become resident in another country, intending that to be his new home with no present intention of leaving it, so that there must be a combination of fact and intention. An English court judges acquisition of a new domicil without regard to the law of the place where the new abode is constituted (*Casdagli* v. *Casdagli*, 1919, A.C. 145; *In re Annesley, post*). The English law cannot conceive of a man without a domicil, and therefore when in doubt as to the acquisition or abandonment of a new one, it treats him as having still or reverting to his domicil of origin. Some foreign systems, *e.g.*, the Argentine, when it cannot discover his domicil, treats him as domiciled where he actually is.

Renvoi.—The necessity of applying foreign law to the solution of the forensic difficulties which arise between two systems of law, one of which applies the personal law of nationality and the other that of the domicil, has given birth to the doctrine of *renvoi*, which chiefly concerns successions. The problem, first recognized in France in the Forgo case (Clunet, 1883, 64), may be stated as follows. When an Englishman dies domiciled in France, the French court applies to his succession the law of his nationality, that being his personal law as conceived in France, and it treats the English law, including English international law, as being that personal law of nationality, although in fact there is strictly speaking no English law for nationals. It discovers that an English court would apply the law of the deceased's domicil to the succession, that being in fact the internal law of France, with the result that the French court under the doctrine of *renvoi* applies the French internal law to the succession. In the case of *In re Annesley*, 1926, Chancery at p. 707, the court recognized and followed the French law of *renvoi*, but the judge suggested that the same result would follow by rejecting the same doctrine as being part of English law; which means that if the succession was open in England instead of France, the English court would apply the French internal law as being the law of the domicil and would not enquire whether or not the French court would throw back to the internal law of England as the law of the deceased's nationality. In the result, both courts would apply the same law of succession and this solution has the virtue of simplicity, but it is not yet settled that England rejects the doctrine as being part of its own law.

While domicil formed the usual criterion in the later middle ages and onwards, it was subjected to a considerable reverse by the Civil Code of the French, commonly called the Code Napoleon, under the influence of intense national feeling, and nationality now governs France and the many nations which have followed her lead, *e.g.*, Belgium, Germany, Holland, Italy, Spain, etc., though it is nowhere possible entirely to discard the former rule in all legal relations. England and the States and colonies which derive from her, as well as Scotland and Ireland and the United States, adhere to the domicil theory and this is the case in most Spanish-American States, chiefly for the reason that States receiving large numbers of immigrants find it the most convenient rule.

In commercial matters English courts were slow to recognize personal law and as late as Lord Eldon's time they held that the capacity of a person to contract depended on the law of the place where the contract was made. Perhaps unfortunately, this has since been discarded in dicta of the personal law, but in the United States this is not universally the case, while Dicey in his *Conflict of Laws* suggests that the old rule still applies to ordinary commercial contracts.

By German law, "if a foreigner in Germany enters into a legal transaction for which he is not competent or is restricted in his competency, he is to be deemed competent as to such transaction to the extent that he would be competent by German law. This, however, does not apply to transactions relating to family rights or succession or dispositions of foreign immovables." It would seem from Pillet (*Droit Int. Privé*, 176) that after some vacillation the French decisions only protect contractants on French soil in the case of fraud by a contracting foreign incapable. Guardians, tutors, curators of minors have authority from the country which appoints them, whether it be that of the domicil or the nation. There is some doubt whether in France a guardian can trade on behalf of a foreign minor (Valery, *Droit Int. Privé*, 893).

A British court will not entertain a petition for divorce unless the husband is domiciled within its jurisdiction; but many foreign countries, basing competence on residence, apply the national law of the parties. There is some doubt whether countries like Spain, which does not admit divorce *a vinculo* within its jurisdiction, will recognize the divorce of a Spanish subject by a foreign competent court. Legitimation by subsequent marriage of the parents depends also on the personal law of the father as determined either by domicil or nationality. English law, in the absence of express contract, considers the law of the husband's domicil to govern the effect of marriage and that of a settlement of personal property; but this domicil may be a new domicil chosen to be the immediate home of the newly married, in each case known as the matrimonial domicil (*Peters* v. *Quebec Cité*, 1908, 33 Quebec Sup. Court. 361; *Union Government* v. *Larkan*, 1916, S. Africa, A.D. 212).

Personal property is for the purpose of succession treated as forming one mass located in the place where the succession is "opened," *i.e.*, generally the domicil of the deceased. Until 1926, few countries except England and those deriving from her, caused real property to descend in a different manner from personal property. These conditions, however, have been altered by the Administration of Estates Act, 1925, real property and personalty now descending in the same manner. It is remarkable that, while property relations as between husband and wife are governed by the law of the matrimonial domicil, although this be abandoned (*De Nicolls* v. *Curlier*, 1900, A.C. p. 33), this does not apply to rights of succession, which change with change of domicil.

Lex Situs.—The law of the territory in which they are situate governs immovables in almost every particular, although English practice in the sphere of jurisdiction admits of certain personal processes such as injunction and accounting. An action for the sum of money secured by a foreign mortgage is also allowed, for the reason that the security is subsidiary to the debt, but the court will go further and even order the foreclosure of the mortgage in default of payment. This cannot often happen since in some countries, such as Ireland, foreclosure is unknown and in many colonies the right is severely restricted, while the system of conveyancing, where it does not consist in conveying the estate to the mortgagee, does not admit of foreclosure. This is necessarily the case under the Torrens system of registration (*see* Burge, *Colonial and Foreign Laws*, v. pt. ii., ed. W. A. Bewes). By way of illustrating the principal rule, the law which, in the absence of agreement, imposes community of assets on husband and wife cannot in the Cape be evaded by a postnuptial agreement valid in Natal where it was made (*Union Government* v. *Larkan*, supta). It may in passing be said that property given to a wife for her separate use is not within the classes of property to which community applies (*De Serre* v. *Clarke*, L.R. 18 Equity, 587); but this decision may be open to exceptions.

Lex Loci Actus.—The form of a document and the validity of its execution, *i.e.*, its extrinsic qualities, are governed by the law of the place where it is executed, in the absence of any evidence to the contrary. Its intrinsic qualities, which affect the country where its performance is to take place, are controlled by the law of the latter place; where it will not be enforced if it is *contra*

bonos mores, contrary to any positive law or public policy (see *Law Quarterly Review* for 1921, xxxvii. 3, 5). There also the capacity of the parties, etc., may be considered. In countries where a system of registration of documents is essential for complete security or, as sometimes, for any operative effect, it is necessary that the document should be such as can be registered in the place where it is to take effect. This is specially so in the case of immovables. There is an exception to the general rule in the case of a will of personal property; for Lord Kingsdown's act of 1861 legalized three forms of will made by a British subject abroad besides that of his last domicil, viz., that of the place where the will is made, that of the testator's domicil at the time when the will is made, that of his domicil of origin, when in the British dominions; but the last does not apply to a will offered for proof in Great Britain. Another exception occurs in England where an instrument affecting land within the meaning of the Statute of Frauds must conform to its requirements wherever it is made (*Leroux* v. *Brown*, 1852, 12 C.B. 801). Not all nations are as strict as the English in rejecting documents in foreign form affecting immovables.

Lex Loci Contractus.—The law of the contract is generally the same thing as the law of the instrument. If they differ, an English court would enquire what is the proper law of the contract, with a tendency to favour the place where it is to be carried out (*lex loci solutionis*). This again is chiefly a matter of the intrinsic qualities of the contract. The contract of marriage must usually conform to the law of the place of the marriage, but exceptions are allowed under such laws as the Foreign Marriage Act 1892, which, however, in the absence of treaties, are not always binding on other Powers.

The law of the practice of the court (*lex fori*) naturally governs any action whether of an international character or not, and this rule includes the form and remedy. Prescription and limitation of actions are usually treated as belonging to this law, but when a right has become non-existent by the law which properly governs it, it will not be enforced anywhere else.

Foreign Judgments.—Rights which have been declared by a judgment of a competent foreign court have sometimes to be enforced in another country. In England such judgments, whether of foreign or colonial courts, are enforced by action, treating the sum of money awarded as due under the fiction of a promise to pay. Unlike the practice in many countries, no enquiry is allowed into the merits; but a defence is open on the ground of absence of jurisdiction, and since the action is on contract, defences as on contract are allowed. Declaratory judgments of rights of property are founded on territorial jurisdiction, while those of status depend on domicil or nationality as the case may be. No *exequatur* is required in either case. Judgments *in personam* when to be enforced abroad, *e.g.*, on contract or for a wrong, must be clothed with an order called *exequatur*, *i.e.*, "let it be carried out," and then the original judgment is executed and no new judgment is pronounced, as in England. This system in a reciprocal form has been introduced into the British empire under the Administration of Justice Act 1920, and by c. 33 of the same year, reciprocal enforcement of maintenance orders (other than affiliation orders) was provided for. It is to be noticed that many countries assume greater jurisdiction than is acquiesced in by other countries, but this excessive claim is, of course, valid for internal purposes. Under the doctrine of reciprocal treatment as between States, so popular on the Continent, the foreign courts will often refuse to enforce an English judgment except in the English way, which involves a new action. (W. A. B.)

BIBLIOGRAPHY.—The best authority on the history of private international law to the end of the 18th century is Lainé, *Introduction au droit international privé* (2 vols., 1888). *See* also L. v. Bar, *The Theory and Practice of Private International Law* (Eng. trans. 1892); Bate, *Notes on the Doctrine of Renvoi* (1904); J. Westlake, *A Treatise on Private International Law* (7th ed., 1925); A. V. Dicey, *Conflict of Laws* (ed. A. B. Keith, 4th ed., 1927).

UNITED STATES

The topic under consideration is almost universally called the conflict of laws, following the usage of Judge Story's classic treatise. Since each State of the United States is from the point of view of its law independent of each other State, and since every transaction of importance has an inter-State character, occasions for the application of the principles of private international law are much more frequent than in England and the law has therefore been much more fully developed by the courts.

Jurisdiction.—At the outset one is met with the question of jurisdiction, that is (for this purpose) the power of a State, with or without judicial action, to create legal interests which other States will recognize and enforce. Jurisdiction may be obtained in three ways: by physical power, by legal relation and by submission.

(*a*) Within the territory of a nation or State there is jurisdiction over every person or thing in it, except as such jurisdiction is prevented by some principle of public international law, such as the protection extended to ambassadors. Where, however, a thing is carried into a State by the act of God, as by a tempest, jurisdiction, at least for some purposes, is not exercised over it till the owner has a chance to remove it, and the same rule is followed where property is brought in by a wrongdoer, without the will or procurement of the owner (*Edgerly* v. *Bush*, 81 New York 199). A full jurisdiction is not exercised over a vessel temporarily in port (*Hays* v. *S. S. Co.*, 17 How. [U.S.] 596; *Brown* v. *Duchesne*, 19 How. [U.S.] 183) or over railroad cars passing through the territory (*P. P. Car Co.* v. *Pennsylvania*, 141 U.S. 18).

(*b*) The relation of allegiance to a nation, or of domicil within a State even though it is a division of a nation, is a ground for exercising jurisdiction. Thus, the United States may impose a tax upon its citizen (*Cook* v. *Tait*, 265 U.S. 47) and any State upon its domiciliary (*Kuntz* v. *Davidson County*, 6 Lea [Tenn.] 65); so a court of one of the United States may render a judgment against its domiciliary (*Henderson* v. *Staniford*, 105 Massachusetts 504).

(*c*) Submission to jurisdiction may be established by express consent of the subjected person, as by appearance in court or by accepting the terms of a contract to that effect (*Grover and Baker S. M. Co.* v. *Radcliffe*, 137 U.S. 287). Submission may also be established by proof that the subjected person has voluntarily caused an event to happen within the State, and is thereby submitted to any legal consequence of the event; or has permitted a thing in which he has property to be within the State, whereby his interest in the thing is subjected to the jurisdiction of the State.

Jurisdiction to reach by garnishment a claim due to one's debtor rests upon jurisdiction over the garnishee (*Harris* v. *Balk*, 198 U.S. 215).

Jurisdiction to grant a divorce depends upon the domicil of the spouses. Ordinarily both have the same domicil. A wife may, however, acquire a domicil separate from her husband (*Williamson* v. *Osenton*, 232 U.S. 619), and in that case neither party can obtain a legal divorce at a new domicil unless the other spouse has consented to the separate home or by his misconduct caused it, or has appeared in the proceedings (*Haddock* v. *Haddock*, 201 U.S. 562; *Bonner* v. *Reandrew*, 203 Iowa 1355).

Marriage is governed in the last analysis by the law of the domicil of the parties; but it is based upon a valid agreement of marriage, and the validity of that agreement is governed by the law of the place of marriage (*Commonwealth* v. *Lane*, 113 Massachusetts 458). Legitimacy is governed by the law of the domicil of the parent with whom the relation is to be established, whether at birth (*Moore* v. *Saxton*, 90 Connecticut 164) or from the later time of legitimation (*Scott* v. *Key*, 11 Louisiana Annual 232).

Property.—All immovable property is governed in all respects by the law of the country where it is situated (*Clark* v. *Graham*, 6 Wheaton [U.S.] 577). The transfer of title to chattels *inter vivos* is governed by the law of the place of the chattels at the time of transfer. This title once accrued will ordinarily be recognized in any State into which the chattels are brought (*Emery* v. *Clough*, 63 New Hampshire 552). Where, however, a mortgage or other lien on a chattel is created in one State, and all require-

ments of the law of that State are satisfied, it is held in some States that if brought into another State the lien will not be recognized unless the requirements of the second State for the recognition of such liens are satisfied (*Hervey* v. *Rhode Island Locomotive Works*, 93 U.S. 664), but the preferable and prevailing view is otherwise (*Langworthy* v. *Little*, 12 Cushing [Mass.] 109). The administration of a trust of chattels is governed by the law of the State where the creator of the trust intended the trust to be managed (*Greenough* v. *Osgood*, 235 Massachusetts 235). The inheritance of movables, while governed in the last resort by the law of the situs, is determined by the law of the domicil of the deceased owner at the time of his death (*Moultrie* v. *Hunt*, 23 New York 394). Upon the marriage of an owner of movable property, the other spouse acquires such an interest in the property then held as is given by the law of the husband's domicil at the time of marriage (*Harral* v. *Harral*, 39 New Jersey Equity 279).

Contracts.—Capacity to enter into a contract, including a contract of marriage, is governed by the law of the place of contracting (*Milliken* v. *Pratt*, 125 Massachusetts 374); and the form necessary for the validity of the contract is governed by the same law (*Scudder* v. *Union National Bank*, 91 U.S. 406). There is great difference of opinion as to what law determines whether an agreement which is in due form is legally binding. Some courts hold that this is determined by the law of the place of contracting; some, by the law of the place of performance; some follow the English rule, and determine the validity of the contract by the law intended by the parties. The first view is the best accredited, and is likely to prevail.

Questions as to the performance or breach of a contract depend upon the law of the place of performance. Thus the acts required of sureties are those laid down at the place for the principal to perform (*Cox* v. *U.S.*, 6 Peters [U.S.] 172). What constitutes payment (*Graham* v. *Bank*, 84 New York 393), the time for payment (*Stebbins* v. *Leowolf*, 3 Cushing [Mass.] 137), the allowance of days of grace on a note (*Bowen* v. *Newell*, 13 New York 290), the proper medium of payment (*Benners* v. *Clemens*, 58 Pennsylvania 24), the rate of interest and the measure of damages, all depend upon the law of the place of payment. The form of protest for non-payment of a bill is also regulated by the law of the place of payment, but the necessity for notice of non-payment of a bill and the nature of the notice depend upon the law of the place where the obligation arises (*Aymar* v. *Sheldon*, 12 Wendell [N.Y.] 439). The validity of an assignment of a contract is determined by the law of the place of assignment (*Miller* v. *Campbell*, 140 New York 547).

Wrongs.—The law governing an act or its result is the law of the State where the act or resulting event took place; the State where any proximate result of an act takes place may make that event wrongful. Whether the result was a legal wrong is determined by the law of the place where it happened (*American Banana Co.* v. *United Fruit Co.*, 213 U.S. 347); whether the act itself was justified is determined by the law of the State where the actor did his act.

Judgments.—A foreign judgment creates an obligation which is both recognized and enforced in another State, whether the judgment is at law or in equity, and whether it is for the plaintiff or the defendant; and it is equally binding though a suit between the same parties with the same subject-matter was pending in the other State, and even if proceedings were first begun there (*Paine* v. *Ins. Co.*, 11 Rhode Island 411); nor do mistake of law or of fact or irregularity of local practice in the foreign court affect the binding nature of a judgment. It is often said that a foreign judgment may be impeached for fraud, and indeed it may usually, like a domestic judgment, be so impeached in equity; but by the better view it cannot be so impeached at law, though this doctrine is sometimes referred to the Constitution and confined to inter-State judgments (*Christmas* v. *Russell*, 5 Wallace [U.S.] 290; Gray, J., in *Hilton* v. *Guyot*, 159 U.S. 113). The judgment must be for a sum of money of ascertained amount; if the amount is uncertain the judgment cannot be enforced; but it may be for an amount payable from time to time, like a decree for alimony, and it will then be enforced as to all overdue payments (*Lynde* v. *Lynde*, 181 U.S. 183).

A judgment for the doing of an act, except the mere payment of money, is not directly enforceable in another court, even of the same State. It is therefore impossible to enforce a foreign decree that an act be done by the defendant, such as making a conveyance, either by decreeing the conveyance without judicial investigation or by regarding it as made (*Bullock* v. *Bullock*, 52 New Jersey Equity 561).

Administration.—Estates administered by a court are administered in accord with the law of the State where the administration is had. Each State may administer such things only as are within its jurisdiction; so that in the case of an estate part of which is found in each of two or more States administration must generally be undertaken independently in each State. In the case of administration of the estate of a deceased, the executor or administrator gets power to collect claims owing to the deceased from, and is obliged to pay claims against the deceased by, the statutes of the State of his appointment; and he can neither sue nor be sued on such a claim in another State (*Johnson* v. *Powers*, 139 U.S. 156). In cases, however, where no domestic administrator has been appointed and there are no local creditors to be prejudiced, a foreign administrator may collect claims due the deceased (*Wilkins* v. *Ellett*, 108 U.S. 256).

Recognition and Enforcement of Foreign Rights.—A right having been created by the appropriate law, the recognition of its existence follows everywhere (Folger, J., in *King* v. *Sarria*, 69 New York 24). So a body created as a corporation in one State will be recognized as such in another State (*Bank of Augusta* v. *Earle*, 13 Peters [U.S.] 519). This is true even though the right so created is absolutely illegal in the State which recognizes it. Thus, a polygamous or incestuous marriage contracted in a State where it is valid will be recognized as a legal status of that kind even in a State where it is illegal (*Sutton* v. *Warren*, 10 Metcalf [Mass.] 451); though it need not be treated as a so-called "Christian" marriage would be. It is merely recognizing a foreign fact. A slave for the same reason must be recognized as such even in a free State. It is true that if a slave comes into a free State he cannot be restrained by his master; not because he ceases to be a slave, but because in such a State there is no right in a master to restrain a slave (Ware, J., in *Polydore* v. *Prince*, Ware [U.S. district court] 402).

Though a foreign right will always be recognized as existing, it does not follow that it will be given any legal force. No foreign right will be enforced unless the law of the State so provides. Where a right has once been created by the proper law it will be enforced in another State even where it would not originally have been created by that State on the same facts (*Greenwood* v. *Curtis*, 6 Massachusetts 358), but enforcement of a foreign right will be denied where it would be illegal to carry it out, as where the right was created in evasion or fraud of the domestic law (*Hill* v. *Spear*, 50 New Hampshire 253), or against public policy or morality (*Emory* v. *Burbank*, 163 Massachusetts 326). So where a foreign marriage is valid and the spouses come into a State where it is regarded as incestuous they may not cohabit as man and wife in that State (*State* v. *Brown*, 47 Ohio 102).

No governmental right of another State will be enforced, like a right to taxes or a claim for a criminal fine; and for the same reason an alimentation claim created to save the State from the burden of support of a dependent person will not be enforced in another State.

Remedy.—The remedy afforded for the enforcement of a foreign right is such only as a State may choose to allow. The State may open its courts to whom it pleases; but foreigners are usually allowed free access to courts (*Roberts* v. *Knights*, 7 Allen [Mass.] 449). No action can be brought if it may bring into question the title to foreign land; nor can a foreign right be enforced which requires for its proper enforcement a procedure which the court of forum cannot provide.

Where suit is brought in a foreign court, all matters relating merely to the remedy are determined by the law of the forum.

Thus the law of the forum determined the proper parties, the proper form of action (*LeRoy* v. *Beard*, 8 How. [U.S.] 451), the exemptions from attachment (*Mineral Point R.R.* v. *Barron*, 83 Illinois 365), the right to set-off (*Gibbs* v. *Howard*, 2 New Hampshire 296), the right to confess judgment (*Hamilton* v. *Schoenberger*, 49 Iowa 385). The law of the forum determines whether action is barred for usury (*Gale* v. *Eastman*, 7 Metcalf [Mass.] 14) or for failure to comply with the statute of frauds, where usury or the statute of frauds goes rather to the remedy than to the right. If it is claimed that remedy is barred by the statute of limitations, it is the statute of the forum which decides (*Townsend* v. *Jemison*, 9 How. [U.S.] 407), unless indeed some statute which has power to do so has actually extinguished the right. That may happen where it was a condition of the right at the time of its creation that it should be exercised within a certain time (The Harrisburg, 119 U.S. 199).

The rules of evidence applied are those of the forum; and so presumptions of fact are determined by the law of the forum (*Hoadley* v. *Transportation Co.*, 115 Massachusetts 304). The measure of damages, since it has to do with the nature of the right of action, must be determined by the law of the State where the action arose; it is not a question of remedy (Paynter, J., in *R.R.* v. *Whitlow*, 105 Kentucky 1; see *Meyer* v. *Estes*, 164 Massachusetts 457). So interest, where given by way of damages, is regulated by the law of the place of payment, not of the forum (*Peck* v. *Mayo*, 14 Vermont 33; *Healy* v. *Gorman*, 15 New Jersey 328; *contra*, *Ayer* v. *Tilden*, 15 Gray [Mass.] 178).

Where, however, a statutory regulation of damages amounts not to a settlement of the rules for measuring compensation but to a limitation (irrespective of the amount of damage) of the amount allowed to be recovered, it has to do with remedy rather than with right, and is governed by the law of the forum (Finch, J., in *Wooden* v. *R.R.*, 126 New York 10; compare *R.R.* v. *Babcock*, 154 U.S. 190).

BIBLIOGRAPHY.—The classical treatise is J. Story, *Conflict of Laws* (1st ed. 1834); the latest and most trustworthy is H. F. Goodrich, *Conflict of Laws* (1928). *See* also "Restatement of the Conflict of Laws," *American Law Institute*. (J. H. BE.)

INTERNATIONAL LAW, PUBLIC, the general term for the law governing the relations and intercourse of States *inter se*. The parties are States and not nations. so that the word "international" does not accurately define the scope of the subject. Nor do authors always confine themselves to its proper limitation. Thus the rules relating to nationality and naturalization, extradition, patents, trade marks, etc., which affect States on the one side and foreign persons on the other, are generally included among the subject-matter of international law. There is a special branch of international law, known as Private International Law (*see* INTERNATIONAL LAW, PRIVATE), which deals exclusively with the relations of persons belonging to different States, in which States as such are not parties.

The term "international" was first used by Bentham, who observed:—

"The word *international*, it must be acknowledged, is a new one; though, it is hoped, sufficiently analogous and intelligible. It is calculated to express in a more significant way the branch of law which goes commonly under the name of 'law of nations,' an appellation so uncharacteristic that, were it not for the force of custom, it would seem rather to refer to internal jurisprudence. The chancellor d'Aguesseau has already made, I find, a similar remark; he says that what is commonly called *droit des gens* ought rather to be termed *droit entre les gens*." (Introduction to the *Principles of Morals and Legislation*.) But Franciscus and Victoria had already in the 16th century used the Latin form *jus inter gentes*.

There has been much controversy as to the aptness of the use of the word "law" in this connection. "Strictly speaking," observed Lord Chief Justice Coleridge in his judgment on the Franconia case (*R.* v. *Keyn*, 2, Ex. D. 63), "international law is an inexact expression, and it is apt to mislead if its inexactness is not kept in mind. Law implies a lawgiver and a tribunal capable of enforcing it and coercing its transgressors, but there is no common lawgiver to sovereign States, and no tribunal has the power to bind them by decrees or coerce them if they transgress. The law of nations is that collection of usages which civilized States have agreed to observe in their dealings with one another. What these usages are, whether a particular one has or has not been agreed to, must be matter of evidence. Treaties and acts of States are but evidence of the agreement of nations, and do not, in England at least, *per se* bind the tribunals. Neither certainly does a consensus of jurists, but it is evidence of the agreement of nations on international points, and on such points, when they arise, the English courts give effect as part of English law to such agreement." Sir James Stephen took a similar view.

This was declared by Lord Russell of Killowen to be based upon Austin's definition, which was too narrow and relied too much on force as the governing idea. "If," he added, "the development of law is historically considered it will be found to exclude that body of customary law which in early stages of society precedes law, which assumes definitely the character of positive command coupled with punitive sanctions. But even in societies in which machinery exists for the making of law in the Austinian sense, rules or customs grow up which are laws in a very real sense of the word, as for example the law merchant. Under later developments of arbitrary power, laws may be regarded as the command of a superior with a coercive power in Austin's sense: *'Quod placuit principi, legis vigorem habet.'* In stages later still, as government becomes more frankly democratic, resting broadly on the popular will, laws bear less and less the character of commands imposed by a coercive authority, and acquire more and more the character of customary law founded on consent. . . . I claim, then, that the aggregate of the rules to which nations have agreed to conform in their conduct towards one another are properly to be designated international law." (Address at Saratoga Springs [N.Y.]; see *Law Quarterly Review*, p. 311, 1896.) This recalls Blackstone's definition: "The law of nations is a system of rules, deducible by natural reason, and established by universal consent among the civilized inhabitants of the world, in order to decide all disputes, to regulate all ceremonies and civilities, and to ensure the observance of justice and good faith in that intercourse which must frequently occur between two or more independent States, and the individuals belonging to each." (*Commentaries on the Law of England*, 4th ed., iv. 66.) The current English narrower view owes its origin chiefly to the influence of John Austin, and the current broader one to that of Sir Henry Maine. The increasing popularity of references to international arbitration (*see* ARBITRATION, INTERNATIONAL), the adoption of a large number of special treaties making such references compulsory in certain cases, the establishment of an increasing recourse to the court for the decision of difficulties between States created by The Hague "Convention for the pacific settlement of disputes between States" of 1899 (*see* PEACE), the adoption of fixed rules of law in the international conventions in 1899 and 1907 dealing with many of the most controversial questions of international usage, and the creation of the League of Nations and its Permanent Court of International Justice (*q.v.*), have so transformed the subject that if, as Lord Coleridge said, law implies a law-giver and a tribunal capable of enforcing it, these conditions are now, at any rate, partly fulfilled. We shall see below to what extent it may be necessary to regard power of enforcement against transgressors as requisite to give international law the character of law properly so-called.

Sanctions.—The subject of the enforcement of international law, or its "sanctions," has given rise to much controversy. The word "sanction" is derived from the Lat. *sanctio*, which in turn is derived from *sancire*, to consecrate. In its original sense *sanctio* means consecration. From this followed the sense of religious obligation. Thus *sancire legem* is used by Roman writers as meaning that observance was made obligatory, but without reference to the idea of there being a remedy or penalty for non-observance.

Bentham, who worked out the theory of legal sanctions as applied to modern law, describes them as equivalent to pleasures and pains derived from four different sources. These are physical, political, moral and religious.

Austin's analysis of this vague subdivision led him to a more precise determination of the relationship of sanctions to law, viz., that a law properly so-called is a command and its sanction is the power to enforce obedience to it. Stated briefly, any other kind of law according to Austin is not positive law but merely called so by analogy. Applying this test to international law he concludes that the law obtaining between nations is not positive law; for every positive law is set by a given sovereign to a person or persons in a state of subjection to its author. The law obtaining between nations is only law set by general opinion with duties which are only enforced by moral sanction, by fear on the part of nations, or by fear on the part of a sovereign, of provoking general hostility, and incurring its probable evils, in case they should violate maxims generally respected. (*Province of Jurisprudence determined,* 2nd ed., 1861, p. 177; Austin explains his view more fully at p. 127.)

Sir H. Maine's somewhat indirect answer to Austin may now be taken as the view held at least by British theoretical writers. "Austin," he said, "has shown, though not without some straining of language, that the sanction is found everywhere, in positive law, civil and criminal. This is, in fact, the great feat which he performed, but some of his disciples seem to me to draw the inference from his language that men always obey rules from fear of punishment. As a matter of fact this is quite untrue, for the largest number of rules which men obey are obeyed unconsciously, from a mere habit of mind. Men do sometimes obey rules for fear of the punishment which will be inflicted if they are violated, but compared with the mass of men in each community, this class is but small; probably it is substantially confined to what are called the criminal classes, and for one man who refrains from stealing or murdering because he fears the penalty there must be hundreds of thousands who refrain without a thought on the subject." (*International Law,* p. 50.)

The view, however, that a law is not devoid of binding character because there is no authority to enforce its observance hardly requires justification at the present day. The fact that any well-established international usage is observed, and that States invariably endeavour to answer any reproach of departing from such usage by explanations showing that the incriminated act is justified by recognized rules of international law, is evidence of its binding character. As the late Prof. Rivier, one of the leading authorities on Roman law, as well as an international jurist of eminence, has expressed it: "The law of nations is positive law because States wish it to be so. They recognize its compulsory character and proclaim it. As they are their own legislators and make their common laws by express or tacit consent, they attest explicitly and implicitly their conviction that its principles are binding upon them, as judicial principles, as law. Innumerable public acts, affirmations, declarations and conventions are there to prove it. On the other hand, never in any published official act of the present age, verbal or written, has a State dared to declare that it did not consider itself bound by the law of nations and its principles." (*Droit des gens,* 1896, i. 22.) With this we may compare Savigny's words: "A community of judicial conscience can be formed among nations like that which positive law creates in the bosom of one people. The foundations of that intellectual community are constituted partly by a community of race, partly and especially, by a community of religious convictions. Such is the basis of the law of nations which exists principally among European Christian States. . . . We are entitled to look upon this law as a positive law, although it is an incomplete judicial formation." (*System des heutigen, römischen Rechts,* 1840, i., s. 11.) States, as Prof. Rivier says, have again and again solemnly declared their determination to abide by the principles of international law. Witness the Declaration of Aix-la-Chapelle of Nov. 15, 1818, in which the representatives of five Powers, Austria, France, Great Britain, Russia and Prussia, solemnly stated that "the sovereigns in forming this august union have regarded as its fundamental basis their unchangeable resolution never to depart, either amongst themselves or in their relations with other States, from the strictest observance of the principles of the law of nations, principles which, in their application to a permanent state of peace, can alone effectively guarantee the independence of each government and the stability of the general association." In the negotiations for the Treaty of London concerning the Black sea (Mar. 13, 1871), at which seven Powers were represented, Austria-Hungary, France, Germany, Great Britain, Italy, Russia and Turkey, a resolution on the sanctity of treaties was annexed to the first protocol, stating that the plenipotentiaries recognize that it is an essential principle of the law of nations that "no Power can liberate itself from the engagements of a treaty, nor modify the stipulations thereof, unless with the consent of the contracting powers by means of an amicable arrangement." Even in 1908, when Austria-Hungary proceeded to the annexation of Bosnia-Hercegovina without obtaining the prior assent of the high contracting Powers, who under the Treaty of Berlin of 1878 had granted her temporary occupation of the annexed provinces, the protests of the Powers concerned were answered by Austria-Hungary declaring that she had done nothing contrary to the law of nations or affecting the sanctity of treaties, because the Powers had given their tacit consent to the practical transformation of her temporary into a permanent occupation.

The public opinion of the civilized world, in fact, plays in an ever-increasing degree the part of a sanctioning authority. With the growth of international intercourse and international interdependence the danger of isolation or of discredit or even of "boycotting" becomes a matter of increasing importance in the conduct of States. The national press and periodical literature, with exceptions no doubt, are among the chief factors in the development of this public opinion, but it is by no means dependent upon them. Personal intercourse among citizens of the same country, and between statesmen, politicians and citizens of different countries has a still greater effect in the creation of the mental attitude of nations towards each other. This exposes any departure from recognized usage or any disregard for international obligations to such reprobation throughout the whole world, that, far from taking advantage of the absence of any coercive method of enforcing obedience to the principles of international law, States compete with each other in asserting their strict fidelity to such principles. And now successive diplomatic conferences have codified many of the chief branches of international usage, thus diminishing the possible cases in which States can take advantage of the uncertainty of the law and, by quibbling over its interpretation, escape from its obligations.

Sources and Foundations.—It is usual, following Wheaton's classification (*Elements,* 1885, pp. 22 *et seq.*), to enumerate the sources of international law in the following groups: text-writers of authority as witnesses of usage; treaties of peace, alliance and commerce; ordinances of particular States, prescribing rules for the conduct of their commissioned cruisers and prize tribunals; adjudications of international tribunals; written opinions of official jurists given confidentially to their own government; history of wars, negotiations, treaties and other transactions relating to the public intercourse of nations. It is in these different classes of opinions and precedents that writers have been in the habit of searching for those arguments and analogies on which have been built up the system and principles called international law.

Wheaton, it is seen, regarded text-writers as witnesses of the usage of nations. He explains his meaning as follows: "Without wishing to exaggerate the importance of these writers, or to substitute in any case their authority for the principles of reason, it may be affirmed that they are generally impartial in their judgment. They are witnesses of the sentiments and usages of civilized nations, and the weight of their testimony increases every time that their authority is invoked by statesmen, and every year that passes without the rules laid down in their works being impugned by the avowal of contrary principles." This distinguished writer's quasi-explanation of the sources of international law is extremely vague. He masses together cause and effect, private and public opinions, usage and exceptions. Oppenheim has endeavoured to give a more scientific explanation of the growth and development of international law, and objects to calling sources of international law what are mere factors influencing its growth:—

". . . Custom and treaties," he observes, "are the two exclusive sources of the law of nations. When writers on international law frequently enumerate other sources besides custom and treaties, they confound the term 'source' with that of 'cause' by calling sources of international law such factors as influence the gradual growth of new rules of international law without, however, being the historical facts out of which these rules receive their legal force. Important factors of this kind are: Opinions of famous writers on international law, decisions of prize courts, arbitral awards, instructions issued by the different States for the guidance of their diplomatic and other organs, State papers concerning foreign politics, certain municipal laws, decisions of municipal courts. All these and other factors may influence the growth of international law either by creating usages which gradually turn into custom, or by inducing the members of the family of nations to conclude such treaties as stipulate legal rules for future international conduct.

"A factor of the special kind which also influences the growth of international law is the so-called comity (*Comitas gentium, Convenance et courtoisie internationale, Staatenkunst*). In their intercourse with one another States do observe not only legally binding rules and such rules as have the character of usages, but also rules of politeness, convenience and good-will. Such rules of international conduct are no rules of law, but of comity. The comity of nations is certainly not a source of international law, as it is distinctly the contrast to the law of nations. But there can be no doubt that many a rule which formerly was a rule of international comity only is nowadays a rule of international law. And it is certainly to be expected that this development will go on in future also, and that thereby many a rule of present international comity will in future become one of International Law." (*International Law*, 1905, s. 19.)

Precedents.—We prefer to regard international law as deriving the rules composing it from practically the same sources as domestic law, and to attribute to text-writers more or less the same value in its development as in that of the private law of nations. The same primary rules of conduct are appealed to between States as between individuals, and precedents play exactly the same part wherever human actions are concerned. In both cases what has been done before commends itself when the responsibility of taking steps pledging the future is concerned. Statesmen on whom great responsibility impends, on whom the conduct of momentous negotiations has devolved, and who will have to render an account of their work to the sovereign or nation they represent, preserve an argument in their own favour in departing as little as possible from any course taken in previous similar circumstances. Precedents, moreover, are arguments for acceptance by their adversaries or counter-negotiators. In fact, in diplomacy even more than in matters of domestic government precedents play a dominant part in the growth of usage. These precedents are often in themselves originally local usages, such as grew up in the intercourse of the Italian communities. Italy, in fact, served as a laboratory for early diplomatists and writers. It was in the intercourse of these active and ambitious States that grew up the very notion of a foreign diplomacy and the necessity of rules of conduct in this miniature Europe, with its perpetual antagonisms and jealousies, its balance of power, its idea of a State distinct from a nation and of a community of States elbowing each other in their daily contact. It was there that grew up the institution of passports, the distinction between armed forces and civilians, international comity, and in fact the very notion that States have an interest in the observance of law and order among them. In the same way the active commercial intercourse in the Mediterranean led, in the common interest, to the development of rules of the sea, in time of peace, and later to others in time of war.

In the north of Europe, again, out of the active commercial intercourse among the Baltic and North sea communities grew rules of the sea in the same common interest. It was the Thirty Years' War, with its revolting cruelty, which brought out the contrast between the more humane practice of war as an art in Italy and the mere bludgeonry which prevailed in the brutal struggle which disgraced the first half of the 17th century. The brutality of the struggle turned thinkers' attention to the need of formulating rules for the protection in time of war of non-combatants and the innocent subjects of absolute sovereigns, the treatment of the sick and wounded, the prohibition of wanton pillage and the other horrors which shocked the awakening conscience of northern Europe. It was the starting-point of the age of text-books.

Authoritative Text-writers.—The first effective work, the one which was the first to influence sovereigns and statesmen, was Grotius's *De jure belli ac pacis* (Paris, 1625), which practically exhausted the theoretical arguments in favour of the new subject. Nobody has in fact since brought to light any new conception of the foundations of international law. An exhaustive and masterly treatise having been published, no further subsequent treatise was necessary to show what all men were beginning to feel. He sublimated the feelings of his age, and having arrived at the pure substance, the work of proving the need of his subject was disposed of for all time. Pufendorf (1632–97), who, in the sequence of effective text-writers, succeeded Grotius, endeavoured to base international law on an ethical basis accepted by all peoples without necessity for a common creed or standard of morals, but it is doubtful, whatever may have been the extent to which he stimulated the study of jurisprudence, whether he did much in advancing the practical development of the law of nations. His book *De jure naturae et gentium* (1672), as its name indicates, based international law on what he called the law of nature, a subject which has much exercised the minds of jurists searching for an ethical basis for existing law.

The scientific mind of Leibnitz (1646–1716) revolted against this theoretical and doctrinaire tendency of Pufendorf and other writers, who were following with feeble tread in the giant footsteps of Grotius. He saw that the practice of nations was taking a course dictated by the current moral standards of civilized society, and that the philosophizing of the text-book writers was leading them away from that actual practice which they should use as data for their conclusions. Natural science, moreover, had taught him the risk of theorizing on imperfect data, and while writing a history of Brunswick it occurred to him that treaties and diplomatic documents generally were the substances and tests of the publicist's laboratory. His *Codex juris gentium diplomaticus* (1693–1700) gave a more precise direction to speculations on the subject.

The next great writer of authority united all the qualities of a practical lawyer and jurist. This was Bynkershoek (1673–1743). He was the first writer on international law who dealt with public maritime law as a matter demanding special treatment and involving a set of principles not called into action in territorial warfare. A magistrate administering the law in a great commercial country, whose interests were on or across the high seas rather than within the narrow European limits of Holland, Bynkershoek, like Leibnitz, searched for his data in the actual practice of nations in their intercourse with one another. He applied his clear, legally trained mind to deriving principles from practice instead of endeavouring to build up a practice on abstract principles. It was he who first generalized the different isolated usages which had grown up at different spots in northern Europe in the interest of maritime defence, and evolved from practice the principle that dominion seawards was limited to the extent to which it was possible to enforce it (cannon-shot range), a principle which not only created the legal institution of territorial waters, but has since been imported into other branches of international law, and has indirectly influenced the suppression of fictitious blockades and fictitious occupations of territory.

A contemporary of Bynkershoek was Christian de Wolff (1679–1754), a philosopher, mathematician, theologian, lawyer and disciple of Leibnitz. Wolff's great work on the *Institutions of the Law of Nature and Nations* is a learned and accurate treatise drawn from all the well-known sources of knowledge, and, just as Grotius based his demonstrations on the then imperfect knowledge of public events of his time, Wolff based his on the more accurate sources of information which had grown up under the influence of Leibnitz, and created a connected system out of the

scattered fragments available. But his book was written in Latin at a period when scholarship had declined, and its influence was only felt after Vattel (1714–67) wrote his *Droit des gens, ou principes de la loi naturelle appliquées à la conduite et aux affaires des nations et des souverains* (1758). His book had all the charm, although Vattel was a Neufchâtelois, of the French writers of his time, and he it was who popularized the study of international law. His book was based chiefly on the work of Wolff; in it he gave what was best amongst his predecessors without attempting to add anything original of his own. It became the handbook of statesmen and jurists, and has never ceased to be quoted by them down to the present day.

But the opinions of jurists in international law can have little more than the value of criticism and co-ordination. They have seldom served to make law, though they have the weight of all statements made by those who have made a special study of any branch of law, as to what they had gathered to be the existing practice at the time when they wrote, or as to the trend which they showed that practice might be taking. Great lawyers and writers like those we have mentioned, and such as Lord Mansfield, Sir William Scott, Chief Justice Marshall and others, have done the work of classifying facts, deducing conclusions from them and connecting rules with psychological and ethical motives, and have thus sent a current of higher intelligence through the subject which has raised it to its present methodical form. Still international law remained a wide field for controversy. Authors were agreed on general principles, but when these general principles were applied in practice, the shortcomings of unwritten usage often caused as much difficulty as that which the appeal to principles was intended to overcome.

Hague and London Conferences.—What may be called the first enactment of rules of international law was the Declaration of Paris of 1856 (*q.v.*), but the great work of codification, or rather of reducing into writing the rules which had been floating as an unwritten law in the conscience of Europe, was undertaken by The Hague Conferences, which may be said to be and to have created an entirely new factor in the domain of international law. Two of the conventions adopted in 1899 completed work which had already been commenced long before, viz., those on the usages of war and on the adaptation of the Geneva Convention to naval war. The third established methods for the pacific settlement of international difficulties, including the formation of The Hague Court of Arbitration. Recourse to the latter was purely optional, but the other two conventions have been absorbed into the national law of the ratifying countries, and thus have also the domestic sanction States give to their own laws. The work of the Conference of 1907 was of a much wider and more exhaustive character than that of 1899. It comprised, besides revised conventions on the matters dealt with in 1899, new conventions on the following subjects: Opening of hostilities; position in naval war of enemy's merchant ships at beginning of hostilities; conversion of merchant vessels into warships; rights and duties of neutral States in naval war; the laying of automatic submarine contact mines; the bombardment of undefended places by naval forces; treatment of fishing vessels, postal correspondence and capture generally in maritime war; and recovery by force of contract debts. It also adopted a convention for the creation of an International Prize Court of Appeal, which led to the calling of a fresh conference on prize law. This conference sat in London from Dec. 4, 1908, to Feb. 26, 1909, and was confined to representatives of the following countries: Great Britain, France, Germany, United States of America, Italy, Austria-Hungary, Russia, Japan, Holland and Spain. It adopted a series of rules on naval warfare relating to blockade in time of war; contraband of war; unneutral service; destruction of neutral prizes; transfer to neutral flag; enemy character; convoy; and resistance to search and compensation.

Standard of Right Conduct.—Underlying the details of both the new international legislature and the new international judicature are certain principles which may some day have to be officially defined. These principles have necessarily fluctuated with the standard of morals of each period. With the contemporary development of the public conscience, they are undergoing changes and a betterment which it is not desirable to check by yet nailing them up as immutable articles of faith. Till quite recently it was usual to speak of the common standard of right conduct prevailing throughout the Christian world, a standard to which responsible statesmen tried to adjust their direction of the affairs of State. The admission of Japan into the councils of the Great Powers has introduced a non-Christian element whose standard of conduct was not identical with nor based upon Christian morals. Turkey, though admitted in 1856 to European councils, remained rather the occasion of their deliberations than a deliberating party. Her new position as a constitutional State, with a code of morals at any rate in some essentials distinct from that of Christian peoples, will add a further new non-Christian element into the moral foundations of international conduct. The influence of western Europe, however, in both Japan and Turkey, has hitherto in all external development been paramount. Japan, after examining all the existing systems, has even adopted the best she found in Western morals, and in her schools inculcates Christian ethics as a subject *per se* without reference to Divine revelation or authority. Turkey, too, has the advantage of possessing a code of morals which produces so high a standard of right conduct in private life that very little in the way of moral lessons will have to be learned by the Ottomans from Western civilization. As regards practice, it is unreasonable to expect that the high estimate of the moral standard of west European civilization, which is cherished by those who profess its principles, should be accepted by other peoples with unqualified assent.

The very notion of the "right of conquest," and that the victorious are entitled to an indemnity without reference to any question of right and wrong or of justice and injustice, shows that there are principles in actual practice which lie outside and have no analogy in the principles of private law. In the partition of Africa, native States have been treated as non-existent except as local bodies. They have been annexed to European States without reference to their will or consent. Treaties have indeed been made with them, but they have rather been regarded as evidence of prior occupation than as involving any question of native right. The test in the distinction between civilized and uncivilized States which is regarded as warranting exclusion from enjoyment of the right to consideration as independent States, and admission to the community of the civilized world, is in practice the possession of a regular government sufficient to ensure to Europeans who settle among them safety of life and property. Every country, in principle, possessing such a government has *prima facie* the rank of a State and is entitled to treatment as a civilized community. Treaties made with it for the purpose of extra-territorial jurisdiction are intended merely to take into account a difference of judicial institutions but are not supposed to detract otherwise from the possession of such equality and independence. This principle has no analogy in private morals, and has been, slight as it is, more honoured in the breach than the observance. If indifference to native right has provoked reaction, it has been on the part rather of philanthropists than of statesmen. Their movement for the protection of African aborigines has, however, resulted in at least one great international charter for the prevention of the further degradation of African aborigines, viz., the General Act of Brussels of 1885. A vigorous outcry has also been raised against the methods of the Government of the Congo State. But the agitation ought not to be confined to this part of Central Africa. Other Governments are also in fault. In fact, the contact of the European with Central Africa has, throughout, with few exceptions, been one of barbarous practice quite inconsistent with the principles which Christian missionaries have been sent to teach the African native.

European enterprise in Asia has had still less justification. The action taken for the repression of the "Boxer" movement in China, like previous European incursions, had no essential characteristic distinguishing it from the incursions of the Northmen. The Japanese took part in the "Boxer" expedition, and the example of respect for native right and of orderly self-restraint they set has been universally acknowledged. But the lesson is one of

greater significance than one of comparative ethics. The rise of the power of Japan and her obvious determination to constitute herself the champion of the races of eastern Asia has widened the scope of international law, and we may now regard China as henceforth under the protection of the same principles as European States.

Fundamental Principles.—The three chief principles of inter-State intercourse, those, in fact, on which international law is based are:—

1. Recognition of each other's existence and integrity as States.
2. Recognition of each other's independence.
3. Recognition of equality, one with another, of all independent States.

As regards the first of these principles *see* STATE. From the principle of independence it follows that every State has a right to change its form of government and to enjoy the free exercise of its internal energies. This is subject only to the limitation that in the exercise of this right other States or their subjects shall not be molested or otherwise suffer. The equality of all independent States entitles them to respect by other States of all the forms of ceremonial and to the same treatment by others, where their interests are identical, whether they are strong or weak. This principle has often been violated, but it is, nevertheless, acknowledged wherever possible, as in diplomatic conferences relating to all matters of an economic, hygienic, industrial or social character. Even at the Conference of Algeciras, though the Powers immediately concerned from a political point of view were only Great Britain, France, Germany and Spain, the following were also represented as having economic interests. in Morocco, viz., Austria-Hungary, Italy, Russia, Belgium, Holland, Portugal and Sweden.

Ships on the high sea being regarded as detached portions of the national territory, there is also the derived principle of the freedom of the high sea, of the independence and equality upon it of the ships of all nations subject only to due respect being paid to the independence and equality of all others and to such conventional restrictions as States may impose upon themselves (*see* TERRITORIAL WATERS). This principle is re-enunciated in the preamble to the Convention of 1907 on the laying of automatic submarine contact mines (*see* PEACE CONFERENCES).

The Hague Conventions are based on these principles, to which there is a tendency to add another, viz., the right to arbitration in certain cases. This principle is set out more or less tentatively, it is true, but it is being completed by separate treaties of compulsory arbitration in connection with the cases referred to. It is enunciated in the following article of the Convention of 1907 for the pacific settlement of international disputes:—

"In questions of a legal nature, and especially in the interpretation or application of international conventions, arbitration is recognized by the contracting Powers as the most effective, and, at the same time, the most equitable means of arranging disputes which diplomacy has failed to settle. Consequently, it is desirable that, in disputes regarding the above-mentioned questions, the contracting Powers should, if need be, have recourse to arbitration, in so far as circumstances permit." (Art. 28.)

The principle of arbitration has also been adopted in reference to the recovery of contract debts under the following article of the "Convention respecting the limitation of the employment of force for the recovery of contract debts":—

"The contracting Powers agree not to have recourse to armed force for the recovery of contract debts claimed from the Government of one country by the Government of another country as being due to its subjects or citizens. This undertaking is, however, not applicable when the debtor State refuses or neglects to reply to an offer of arbitration, or, after accepting the offer, renders the settlement of the *compromis* impossible, or, after the arbitration, fails to comply with the award." (Art. 1.)

The codification of international law itself, begun at The Hague and London Conferences, is an admission of the binding character of the primary principles set out above.

One of the chief tendencies of contemporary reform is also to restrict the effect of fictions and reduce rights to the limits of their practical application. Between two alternatives, the one to assert rights which cannot possibly be maintained by force such as claims to dominion over portions of the high sea (*see* HIGH SEA, WATERS, TERRITORIAL), "paper blockades" (*see* BLOCKADE) and fictitious occupations of territory (*see* OCCUPATION), and the other to require actual physical assertion, a medium course is growing up, viz., that of recognizing potential assertion, *i.e.*, assertion limited to physical possibilities. With the aid of the Institute of International Law, the International Law Association and other reforming agencies (*see* PEACE), expert opinion in these matters is becoming homogeneous throughout the civilized world, and the ground is being prepared for a clearer understanding of these fundamental principles by the statesmen and State officials who have to apply them in practice.

The outstanding developments in international law since the World War are so distinctive that it has been considered expedient to deal with them under separate headings, rather than to attempt to present them in any one general article. The attention of the student is especially drawn to the following articles: ARBITRATION, INTERNATIONAL; BLOCKADE; CONTRABAND; CONVOY; COVENANT; INLAND WATER TRANSPORT; LABOUR LAWS; LEAGUE OF NATIONS; MANDATES; MIGRATION; MINORITIES; NEUTRALITY; PERMANENT COURT OF INTERNATIONAL JUSTICE; PRIZE AND PRIZE COURTS; SANCTIONS AND GUARANTEES; TREATIES; VISIT AND SEARCH; WAR, LAWS OF; WASHINGTON CONFERENCE.

(T. B.)

INTERNATIONAL MERCANTILE MARINE COMPANY, a corporation engaged in the transportation of passengers, mails, live stock, merchandise, and other goods between various parts of the world, was incorporated June 6, 1893, under the laws of New Jersey, as the International Navigation Company, with a perpetual charter, which provides also for the "purchasing, owning and holding of stocks, bonds and other securities." On Oct. 1, 1902, the charter was amended, capital raised to $120,000,000, and the White Star, Leyland, Atlantic Transport and Dominion lines were acquired, and the name of company changed to International Mercantile Marine Company. On Jan. 1, 1928, the steamship lines owned by the company were the American, Red Star, Atlantic Transport, Leyland and Panama Pacific, as well as a 5% interest in the Holland-America line; and it also owned the Number One Broadway Corporation, New York city, in which is vested ownership of the building at that address. International Mercantile Marine Company formerly owned the White Star line also, but on Jan. 1, 1927, it sold for £7,000,000 the entire business and fleet to the Royal Mail Steam Packet Company. At the time of this transaction, an arrangement was made whereby the International Mercantile Marine Company agreed to act as agent for the White Star line, in the United States and Canada, for at least two years from the date of the sale. On Dec. 31, 1926 (before that sale had been effected), the Company's fleet comprised 100 ships, whose gross aggregate tonnage was approximately 1,091,000; Jan. 1, 1928, the total number of ships was 53, with aggregate tonnage of about 465,000. The organization owns terminal property and an office building in Antwerp and has terminal arrangements at London, Southampton, Liverpool, Montreal, New Orleans, Philadelphia, Boston and other ports; a leasehold, until 1983, of Oceanic House, an office building in London; and a lease until 1940 of five piers on the Hudson river, New York city. Sailings of the International Mercantile Marine Company and its subsidiaries cover some 40 services, which include most of the principal ports on the eastern coast and the Gulf of Mexico (U.S.A.) as well as Los Angeles and San Francisco; the leading European and English shipping points; and Mexico, Central America and the West Indies. For the ten years 1917–26, inclusive, the aggregate consolidated net income was $34,016,000, after depreciation. As of Dec. 31, 1926, the net working capital was $17,903,000 (or about 25% more than on Dec. 31, 1925); total current assets were $35,215,000, more than twice the amount of current liabilities ($17,311,280); net income of the parent company, $906,000; total surplus, $17,147,069; total assets, $216,060,308; capital

stock, authorized and issued, consisted of $60,000,000 each of $100 par common and 6% cumulative preferred, of which the company held in its treasury $10,128,200 common, and $8,275,000 preferred. The company's principal office is in New York city. (P. A. S. F.)

INTERNATIONAL NEWS SERVICE. This news service was organized in 1906 by William Randolph Hearst. It is a profit-making corporation, as distinguished from the mutual news association, and its function is to serve evening and Sunday newspapers with the latest news from all parts of the world. Several hundred newspapers, in the United States and other countries, subscribe either for the full daily report, which is transmitted over leased telegraph lines, or for limited reports confined to a daily word ration or to a class of news interest, such as sports. The Universal Service, an auxiliary, supplies subscribing morning and Sunday newspapers with special or "feature" news. The headquarters are in New York city. (M. E. P.)

INTERNATIONAL PAYMENTS. The observer who learns that, during a given year, England imported £100,000,000 worth of raw cotton from the United States, and sold £50,000,000 worth of coal to the Continent, and that simultaneously Austria, Hungary, Finland and other countries raised loans totalling $200,000,000 in New York, can be excused for wondering exactly how these huge sums of money are remitted. Even if he is conversant with the theory of the balance of trade (*q.v.*), or has learnt that "imports pay for exports," and even if he knows something of the principles of Foreign Exchange (*q.v.*), he may still be excused for a failure to realize how it works out in actual practice.

In reality the process of remittance from country to country is extremely simple, and the chief stumbling blocks are the existence of different currencies, the huge sums involved and the use of technical terms by those engaged in the business. The easiest way to approach the question is by the examination of the normal financial relations between individual and individual.

Take the case of: (1) Brown, a butcher, who banks at bank A; (2) Jones, a farmer, who banks at bank B; (3) Smith, a needy relative of Jones, who banks at bank C.

Brown buys cattle from Jones and in due course owes him £50. Smith buys meat from Brown, also to the tune of £50. Finally Smith goes to Jones and borrows £50. In each case, to settle the amounts outstanding, the payer, whether he be debtor or lender, draws a cheque for £50 in favour of the payee, whether he be creditor or borrower. The cheque is drawn on the drawer's bank, and paid by the payee into his own bank.

The result is that bank B holds a cheque for £50 drawn by Brown on bank A and relating to his purchase of cattle. Bank C holds a cheque for £50 drawn by Jones on bank B and relating to his loan to Smith. Bank A holds a cheque for £50 drawn by Smith on bank C, and relating to his butcher's bill. To clear these three cheques, three operations are necessary in the case of each one. The first of these is the crediting of the payee's bank account with £50, and the third is the debiting of the drawer's bank account with £50. These are effected simply by entries in the banks' ledgers. The second, which in theory appears more complex, is the transfer of funds from bank to bank, for bank A owes bank B £50 on Brown's cheque, bank B owes bank C £50 on Jones's cheque, and bank C owes bank A £50 on Smith's cheque. In practice, to effect these settlements, representatives of each bank meet together in a local place of refreshment, present their cheques to each other and proceed to cancel them out. It remains to add, in case this last sentence seems very picturesque, that the London Clearing House is said to have originated in a coffee-house.

Now it makes no difference whether or not these cheques were for £50 or £5,000,000, or whether Brown turns into the Mammoth Meat Packing Syndicate, Jones into the Incorporated Graziers' Society and Smith into a civic corporation or even into an important national government. In theory the banks can cancel out the cheques and in practice they have devised means of doing so. The obstacle of the huge amounts involved has clearly been overcome, and the only necessary condition is that the drawers and banks are together good for the amount, however large it may be.

Examples of International Payments.—In the article upon FOREIGN EXCHANGES, it is explained that each bank maintains balances with other banks, called its "agents" or "correspondents," in every important financial centre of the world. A London bank will keep a dollar balance in New York, a franc balance in Paris, a mark balance in Berlin, and so on; and American, French and German banks will do the same. We can now construct cases parallel to the three already cited. (1) Brown, a cotton grower in Alabama, sells $10,000 worth of cotton to Jones, a Manchester spinner. (2) Jones sells £2,000 worth of cotton yarn to Schmidt, a Bremen manufacturer of shirts. (In this calculation, for the sake of simplicity, £1=$5=Mks. 20.) (3) The Bremen city corporation raise a loan of $10,000 in New York.

Now here the currency question must be dealt with. Brown wants to be paid in dollars, and Jones can only pay in sterling. Jones, in his turn, wants sterling from Schmidt, who can only pay in marks; and while the Bremen corporation raise a dollar loan, and so undertake to pay principal and interest in dollars, they want their money in marks.

The key obviously lies in bankers' foreign balances.

(*a*) Brown draws a bill for $10,000 on Jones, and sells it to his American bank for $10,000, less discount. So Brown gets his dollars. The American bank sends the bill to its London agent, who presents it to Jones, who pays it with £2,000. This sum of £2,000 is placed by the London bank to the credit of the American bank's balance with it. This settles Brown and Jones.

(*b*) Jones, when he sold his yarn, told Schmidt to have a confirmed (or irrevocable) credit of £2,000 opened in his (Jones's) favour at a London bank. Schmidt arranged for his Bremen bank to do this with their London agents, where they (the Bremen bank) kept their balance. Once this credit is opened, Jones goes straight to the London bank, identifies himself, hands over the documents relating to the shipment of cotton yarn to Schmidt, and gets his £2,000. The London bank debit the Bremen bank's balance with them to the tune of £2,000, and the Bremen bank debit Schmidt's account Mks. 40,000, plus their own charges. This settles Jones and Schmidt.

Now for the Bremen corporation and their loan. The investors in New York who bought the loan paid $10,000 in dollars over to the New York issuing house, and the issuing house lodged them to the credit of its account with its New York bankers. It next instructs its bankers to remit Mks. 40,000, which is the mark equivalent, to the Bremen corporation. The New York bank decides to do this through London, so it instructs its London agents to transfer £2,000, the sterling equivalent, from their balance to the Bremen corporation bank's balance, which may be with them or with another London bank. This is done, and the Bremen bank's London agents advise them of the receipt of £2,000, on account of the Bremen corporation's New York loan. Whereupon the Bremen bank credit the Bremen corporation with the mark equivalent of £2,000; *i.e.*, with Mks. 40,000. This settles the loan.

Now just as, in the first instance, no money passed between banks A, B and C, so, in this instance, the total of sterling held in London on either American or German account, remains unchanged. In the first of the last three transactions, the American bank's London balance was increased by £2,000; in the second, the Bremen bank's London balance was decreased by £2,000; in the third, the American balance lost £2,000 to the Bremen balance. The result is a complete "cancel out."

Other Methods.—In the first instance, the debt was paid by means of a bill of exchange; in the second through the medium of a banker's credit (*see* BILL OF EXCHANGE, FOREIGN EXCHANGE); in the third by direct instructions to the bank immediately concerned. In either case the debtor could have bought a banker's draft, mail transfer, cheque or telegraphic transfer drawn in the creditor's currency. The banker's foreign balance would have lost or gained in the same way.

Recent Historical Instances.—One or two cases from recent history may in conclusion be cited.

(1). American Liberty bonds can be tendered at par in pay-

ment of debts due to the American Government. On one occasion the British Government, in anticipation of a coming instalment due on the American debt, paid sterling over to an international finance house's office in London, and arranged for the house to credit the British Government with the equivalent in dollars in New York. It next instructed the finance house to use those dollars to buy Liberty bonds at the current Wall street price, which was then 90. These bonds were tendered in settlement of the instalment to the American Government, who, by its own law, was bound to accept them at par.

(2). When the franc collapsed in the spring of 1924, the French Government arranged for credits to be opened in its favour by banks in London and New York. In other words, these banks engaged to lend the French Government pounds and dollars on demand up to the limits of the credits. The French Government broker then went on the Paris Bourse and sold pounds and dollars to the market, so arresting the fall in the franc. Long before the credits were exhausted, the worst of the crisis was over. The essential point was that the French Government had previously arranged for an adequate supply of pounds and dollars.

(3). When the pound and, later, the lira were stabilized, the British and Italian Governments arranged credits in New York. If speculators had tried to break the stabilization by selling pounds or lire for dollars, the Governments concerned would have drawn on their New York credits, and so put up all the dollars needed to buy up the pounds or lire the speculators were selling.

In short, the system of banker's foreign balances, even if only held in one common foreign centre such as London, provides a ready means of transferring funds from one centre to another right across the world. For the maintenance of these foreign balances by the banks themselves, and for the reasons why the banks add to them and deplete them on their own account, the reader is referred to the article on EXCHANGE, FOREIGN. (*See* also BALANCE OF TRADE; BANKING AND CREDIT; BILL OF EXCHANGE; CHEQUES.) (N. E. C.)

INTERNATIONAL SOCIETY FOR CONTEMPORARY MUSIC, an organization founded at Salzburg, in 1922, by a number of leading modern musicians, with the object of promoting closer international musical relations by means of annual festivals devoted to representative modern works drawn impartially from all countries. Edward J. Dent, now professor of music at Cambridge university, was elected president, and yearly festivals on the lines indicated have since been regularly held. The society now has some 20 different branches in the principal countries, with headquarters in London at the offices of the British Music Society, which constitutes the British section of the organization.

INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, THE, a holding and operating company, incorporated under the laws of the State of Maryland, U.S.A., having its principal office in New York city. This corporation was organized to develop, in a broad international sense, electrical communication in all its branches. Its present activities through associated companies include:—

(1) The furnishing of telephone service in the Argentine, Brazil, Chile, Cuba, Mexico, Porto Rico, Spain and Uruguay. The Cuban American Telephone and Telegraph Company, owned jointly with the American Telephone and Telegraph Company, operates three submarine telephone cables between Florida and Havana, Cuba.

(2) A radio telephone and telegraph network, which will include the principal countries of South America, designed to provide service from these countries to North America and to Europe. Seven stations were under construction in 1929.

(3) The All America Cables Inc. owns and operates some 27,000 nautical miles of submarine telegraph cables and connecting land lines, extending from New York through the West Indies, the Panama Canal Zone and Central America to the west and east coasts of South America. It provides cable service to practically the whole of Latin America.

(4) The Postal Telegraph and Cable Corporation (The Mackay system) owns and operates a complete network of telegraph lines throughout the United States as well as some 36,000 nautical miles of telegraph cables from the United States and Canada to England, France and Cuba, and from San Francisco via the Hawaiian Islands to the Philippines and China. The Mackay system also owns and operates a point to point wireless telegraph system between the principal cities of the west coast of the United States.

(5) The International Standard Electric Corporation, which is the manufacturing branch of the International system, has factories in England, France, Belgium, Spain, Italy, Austria, Hungary, Czechoslovakia, China and Japan, with a sales organization extending throughout the world. It also maintains fundamental research and development laboratories in London and Paris.

The authorized capital stock of the International Telephone and Telegraph Corporation is $250,000,000 divided into 2,500,000 shares of $100 par value each. The corporation has in addition a funded debt of $35,000,000 in gold debenture bonds due July 1, 1952, and $57,000,000 convertible gold debenture bonds due Jan. 1, 1939. (A. L. Ho.)

INTERNATIONAL TRADE ASSOCIATIONS AND CONGRESSES. The first striking demonstration of the international character of modern civilisation was the great exhibition of 1851, itself a temporary and loose international association for economic ends. Its successor of 1862 (the International Exhibition in London) contributed to the formation of the first regular association which sought to modify economic conditions by international effort, the International Working Men's Association (*see* INTERNATIONAL, THE). At about the same time the growth of international trade led to the earliest official international unions, such as that constituted by the International Telegraphic convention of 1865, and the General Postal union of 1874 (*see* POST AND POSTAL SERVICES). Quite exceptional was the International Sugar union of 1864 which consisted of four countries only and was dissolved in 1875; its successor of 1902 is dealt with below.

The International Metrical union of 1875 dealt with one of the fundamental elements of civilisation; the Latin Monetary union was formed in 1865 but has extended only to five States and failed to prevent the dissociation of the currencies after the war of 1914–18. No private international association for advocating an international currency exists. On the other hand, the advocates of an international language can choose among half-a-dozen associations.

Agriculture.—Although association is notably difficult in agriculture, one of the most effective and beneficent of international associations is the International Institute of Agriculture founded by a conference at Rome in 1905. Due to the firm resolve of a single individual, David Lubin, to create an organisation to minimise the disadvantages under which the unorganised farmers faced the organised railways and buyers, the Institute is a union of States practically universal in scope. Its main work is the publication of complete statistics of crops of all kinds throughout the world, of trade and stocks and of freights and prices. Having established a standard average for the world crop in each product it can produce from the current statistics continually received estimates of the available supplies, which are of the greatest value in stabilising prices and guiding markets. The Institute also studies other international aspects of agriculture, such as comparative legislation, wages, plant diseases. It eschews domestic questions.

The International Seed-testing association founded in 1924, after a series of international conferences, is an important addition to the scheme of international co-operation for agriculture; its members are the official seed-testing associations in the chief agricultural countries.

Private interest in this field is represented by the International Agricultural commission which dates from 1889 and has held numerous international congresses, and by the World Agricultural society, of American origin.

Separate branches of agriculture have their own international institutions such as the International Association of Poultry Instructors and Investigators (1912), the International Dairy federation (1903), and the Permanent Committee of International Congresses of Beekeeping (1897).

The preservation of food is even more important than its production from the international point of view, and with the Inter-

national Institute of Agriculture may be associated the International Institute of Refrigeration. Founded in 1920 (to take the place of a similar association dating from 1900) by an international convention, it is a union of upwards of 30 States and is devoted to the study of cold storage in its scientific and practical aspects. It is governed by two committees, one representing every member State and one containing only 17 persons in all. The United States of America is represented specially in the Institute by the American Association of Ice and Refrigeration.

PERMANENT ASSOCIATIONS

Industry.—International exhibitions, apart from their direct function of celebrating and displaying the achievements of the world's work, are instrumental in the formation of more permanent associations for common effort. From international congresses held in connection with the universal exhibitions at Vienna in 1873 and Paris in 1878 resulted what may be called the first steps in international legislation for industry. They were concerned with the protection of "industrial property" or property in ideas applied in manufacture or embodied in manufactured products (*see* PATENTS and TRADE MARKS). The first Convention dated 1883 at Paris was followed by the Agreements of Madrid (1891) and the additional Act of Brussels (1900). These instruments were revised at Washington in 1911 and again at The Hague in 1925, though the instruments signed on the last occasion have come into force, only as regards a few countries, including, however, Great Britain, Canada, Germany and Italy. They contained provisions designed to safeguard rights in patents, designs, industrial models and trade marks, and to prevent false indications of origin on goods. The signatory States, 38 in number, of these international measures are known collectively as the International Union for the Protection of Industrial Property, and an International Bureau of the Union was set up at Berne, of which the most important function is the international registration of national trade marks to be protected in the territories of all the States which are parties to the Special Agreement for the International Registration of Trade Marks (one of the Madrid agreements of 1891). The International Union is at present little more than the relation created by a multilateral treaty or common undertaking between several States to enforce certain domestic legislation.

The American counterpart of the above arrangement for the international registration of trade marks is the Pan American Convention of Buenos Aires, 1910, revised at Santiago in 1923, under which two registration offices were to be set up, one at Havana for North America, and one at Rio de Janeiro for South America, but the latter office has not in fact been opened, as several signatories failed to ratify or withdrew from the Convention.

A scheme for the establishment of an International Patent Office at Brussels was considered at a Conference at Paris in 1919, and subsequently a Convention was signed at Paris in 1920, but has not yet become effective. The International Association for the Protection of Industrial Property is a non-official association devoted to the subject in a general way, making specific proposals for official adoption in connection with the international regime established by the above mentioned Agreements and Unions.

Special Industries.—Of international associations relating to a single industry or trade the International Federation of Master Cotton Spinners' and Manufacturers' Associations is the best example. Founded in 1904 to conserve the common interests of the cotton industry in all parts of the world, this Federation of 21 International Associations, through its Committee of Management, exercises positive functions of considerable importance, especially in connection with the supply of raw cotton; in particular, it tabulates statistics of the consumption of cotton by mills and of the stocks held by them, and other data which are now regarded as essential to the proper conduct of the industry.

A similar but smaller Federation of Linen Trade Associations was founded in 1909, but its activities have been suspended since the war of 1914–18. The International Wool Conference, representing six European countries (including Great Britain) meets periodically.

Among other International Trade Associations which are primarily concerned with the direct interests of a single industry or trade, are the International Committee of the Wine and Spirit Trade founded in 1900 by the International Vintners' Congress held on the occasion of the Universal Exhibition at Paris of that year; the International Federation of Master Tailors, 1910, and the International Federation of Seed Crushers (1910, reconstructed 1920) and the Permanent International Bureau of Motor Manufacturers (1919).

All these are private associations of manufacturers or traders, or of their national representative bodies. The absence of such bodies in the case of some of the largest staple trades such as coal, oil, iron and steel, and rubber is worthy of note. On the other hand the number of international associations for the workers in particular trades (*see* LABOUR) is very large. For the lighting industry the International Committee on Photometry was founded by the International Gas Congress (1900), and succeeded in 1913 by the International Commission on Illumination constituted by national committees from 10 countries.

Power.—The universal aspects of power production are thoroughly studied by the World Power Conference which held its first meeting in 1924 in connection with the British Empire Exhibition at Wembley. The purpose of this Conference, which has a permanent Executive Council, is to consider how the various sources of power may be adjusted nationally and internationally; it is representative of practically the whole world, and works through a series of plenary conferences at long intervals with more frequent sectional meetings. Earlier provision for co-operation between the workers of all countries in this field was made by the International Electrotechnical Commission (1906) consisting of National Committees of 19 countries in which America, North and South, is well represented, and in 1925 was founded the International Union of Producers and Distributors of Electricity, whose first Congress, held in 1926, was attended by representatives of 13 nations. Specialisation has led to the formation of the International Conference of the Leading High Tension Electric Systems, at whose session in June 1927 the above-mentioned bodies and 28 countries were represented.

Commerce.—The first instance of co-operation between States on a multilateral basis in the sphere of international trade or commerce in the proper sense is the Convention of 1890 whereby the International Bureau for the Publication of Customs Tariffs was established. Its functions are simply to supply in five languages (English, French, German, Italian and Spanish) the current Customs Tariffs of all countries. Practically the whole world subscribes to this work.

This modest organ remained the only one in the international body politic to function for the health of commerce until 1921, when the International Bureau of Commercial Statistics began its work. The aim of the States in founding this Bureau, going beyond mere collection of statistical information, was to facilitate the comparison of national statistics by unification on the basis of a common nomenclature which had been elaborated by the Convention of 1913 which established the Bureau. It accordingly publishes an annual bulletin of co-ordinated statistics of imports and exports.

An older, private association for the advancement of statistics of all kinds is the International Statistical Institute, which was founded in 1885, and includes representatives from a large number of States; its permanent office dates from 1913.

International congresses of a non-official character dealing generally with commerce and industry began to be held in the eighties of last century, and were organised periodically by the International Congress of Chambers of Commerce and Commercial and Industrial Associations until the World War. In 1919 a Conference held at Atlantic City (U.S.A.) of representatives of commerce from that country, Great Britain, France, Italy and Belgium, decided to found the International Chamber of Commerce which held its first Congress at London in 1921, where 35 countries were represented, and thenceforward others biennially, the fourth Congress at Stockholm in 1927 being attended by 800 delegates from 35 countries. The International Chamber has also a permanent organisation consisting of National Committees electing

representatives to a Council whose decisions are carried out by the Secretariat. The actual members of the International Chamber are either bodies such as local Chambers of Commerce, and National Trade Associations, or individual firms or companies.

The main aim of the Chamber is to foster international trade by promoting harmonious commercial relations between the various national interests, the domestic side of their work, and to remove restrictions on trade, the more public side of their work, which brings them into contact with the framework of laws and regulations within which trade has to find its way.

At their 1921 Congress the International Chamber adopted 27 Resolutions dealing with subjects ranging from Double Taxation to the Reform of the Calendar, and from the Channel Tunnel to Reconstruction in Poland. While a good many of these Resolutions dealt with matters of temporary importance connected with the War's upheavals, others dealt with matters of permanent interest to Commerce such as double taxation, international arbitration, unification of tariff nomenclature, treatment of commercial travellers, and in these cases the preliminary work of this International body has been followed either by bilateral government action or by definite provision of the reforms desired in international conventions, such as the Protocol on Arbitration Clauses of 1923, and the Convention on Arbitration Awards of 1927, which give effect precisely to the resolution on this subject of 1921 referred to above. The International Chamber has itself established a Court of Arbitration for commercial disputes and appoints Arbitrators.

With a view to facilitating the passage into law of the measures, which international opinion indicates as appropriate for the benefit of commerce, the International Parliamentary Conference on Commerce was founded in 1914, and its Assembly in 1927 was attended by representatives of 43 countries, appointed for the most part by the national Parliaments themselves. It brings together the experience of the several legislative bodies in dealing with commercial matters, and its activities are thus complementary with those of the International Chamber. At the meeting of this Conference in 1919 yet another Association was founded, the International Institute of Commerce which, under the direction of the General Council of the Parliamentary Conference, is concerned with commercial statistics and legislation, including Commercial Treaties; its membership (17 States have officially adhered), is relatively restricted.

The Union of International Fairs, founded in connection with the International Fair of Milan (1925–6), describes itself sufficiently. There is no corresponding body for international exhibitions, though these have, as we have seen, been instrumental in promoting the formation of many international associations of various kinds. Their popularity has, however, increased to the point at which it has become necessary to suggest some understanding among the chief industrial countries as to their limitation.

Mention of separate associations for special industries or trades has already been made. An Association of a different type is the International Sugar Union of 1902, being an isolated example, apart from the earlier Sugar Union of 1864, of a Union of States for the regulation, for economic and not humanitarian reasons, of the trade in a single commodity. It provided for the abolition of bounties and the limitation of protective duties and, to supervise the execution of the various provisions of the Convention, created an international committee with a permanent office at Brussels. The Union worked effectively until 1912 when Great Britain left it; it ceased entirely in 1920.

Transport and Communications.—As is natural, the field of transport and communications is well covered by international bodies. International association among shipping companies did not take proper shape until the 20th century however, for the so-called Shipping Conferences which were first formed in the seventies of the 19th century, though they may include fleets under several flags, are hardly to be regarded as "international" in the sense in which the word is used in this article. They are limited in scope of course to specific trades and correspond rather to those limited industrial associations which are formed by the organised groups of a few countries for definite business purposes such as the regulation of competition (*see* under SHIPPING, TRUSTS and CARTELS). The Baltic and White Sea Conference (1905) has a much wider scope than its title indicates. Representing shipowners and shipbrokers in 19 countries it is the main authority for the standard form of charter party. It also seeks to fix minimum freights. The International Maritime Committee for the unification of Maritime Law had been founded in 1897 and itself created the national committees through which it works in 16 countries. The Committee was responsible for the initial preparation of the International Conventions on collisions and salvage signed at the Brussels diplomatic Conference in 1910 which have since been widely adopted as national law. Conventions on the limitation of shipowners' liability, maritime mortgages and liens, and bills of lading, which the Committee similarly prepared, have also been adopted by diplomatic Conferences and their inclusion in the national legislative systems is proceeding.

The Permanent International Association of Navigation Congresses (1902) consisting of representatives of 43 governments and other bodies and individuals deals mainly with technical matters.

The International Shipping Federation (1909), a federation of the shipowners' associations of 8 European countries, is concerned exclusively with their interests as employers. The International Shipping Conference which first met in 1921, consists of the national organisations of the shipping industries in 15 countries and is concerned with the general policy of the shipping industry in all questions other than labour. It seeks to establish uniformity in practice and action; it co-operates with the International Chamber of Commerce.

The group of international associations which deal with railways illustrates well the international regulation of the world. As long ago as 1882 the International Conference for promoting Technical Uniformity on Railways was founded at Berne (Switzerland being regarded as the "turn-table" of Europe) to develop international railway traffic and uniformity in certain railway equipment; this is an association of States, or of State Railway Administrations, the members consisting of those European States in which the railways are of standard gauge, and thus form a system capable of unification.

In 1885 there was founded an International Association of the Railway Congress, replaced in 1919 by a body of the same name whose effective members are the Railway Administrations of all the important countries of the world (except Russia); its functions are to promote general railway progress by congresses and publications.

The well known Berne Convention for the carriage of goods by rail of 1890, revised in 1924, and adopted by the same States as those represented in the Technical Conference described above, provided the common rules whereby goods could be sent over the railways of any number of these States by a single consignment, and this necessitated the establishment of the Central Office for International Railway Traffic at Berne in 1893, an institution created by the States themselves which has financial duties as a clearing house between the several railway administrations, and powers to settle disputes referred to them by the latter.

POST-WAR RECONSTRUCTION

The post-war reconstruction of European transport included new institutions for facilitating the international working of railways. The International Railway Wagon Union was founded in 1921 by the Convention of Stresa, again by the standard gauge countries of Europe, to manage the common user of wagons. A little later as a consequence of resolutions of the Conference at Porto Rosa (November 1921) and Genoa (May 1922) the International Railway Union, which includes the railway administrations of all the larger European countries, not excluding Russia and Spain, and also those of China and Japan, came into being with the general function of unifying and improving railways and railway working. It is preparing a scheme of nomenclature for international tariffs and a basis for international statistics.

The European Time Table Conference which secures correspondence in the timing of the principal European passenger services on the standard gauge railways, was put on a permanent foot-

ing as from 1923 by the Lucerne Conference, while the Union for International Users of Passenger Rolling Stock established by the same Conference regulates the reciprocal use of passenger rolling stock by the several administrations, also for Europe only.

America has her own International Railway Association in the shape of the Permanent Pan American Railway Committee founded in 1902 with the specific object of securing the construction of a through railway joining the United States and Mexico to Central and South America. This is an offshoot of the Pan American Union and its members are the American Republics concerned.

The common interests of the more restricted types of transport are cared for by the International Union of Tramways, Local Railways, and Public Motor Transport which corresponds with, and originated in the same year (1885) as, the International Association of Railway Congresses; it was reconstructed in 1919. Its members include local transport undertakings and public bodies.

Road transport in general is represented by the International Association of Recognised Automobile Clubs (1904) on the more private and sporting side, and by the Permanent International Association of Road Congresses (1908), an association of 38 governments.

The organ for the international control of air traffic is the International Commission for Air Navigation which, under the International Air Convention of 1919, makes rules dealing with the registration, marking and airworthiness of aircraft, and with the issue of certificates of competency for their operating crews, with the lights and signals to be used by aircraft, and the conduct of air traffic generally. The Commission does not administer these rules or otherwise directly control air transport, but the establishment by a central body of these governing rules, which are adopted of course by the parties to the Convention (now some 25 in number), shows how this latest form of transport is internationalised to a definitely greater degree than shipping, the form with which it has the strongest analogies.

Somewhat similar to the International Maritime Law Committee is the International Technical Committee of Legal Experts for Aviation (Comité International Technique d'Experts Juridiques Aeriens) established in pursuance of recommendations of the International Conference on Private Aerial Law of 1925. It consists of experts appointed by over 30 States and prepares draft international conventions on legal questions such as, for example, the liability of the carrier by air for loss and damage.

Private interest in aviation is co-ordinated by the International Aeronautic Federation (1905) and commercial effort by the Air Traffic Association (1919), which consists of certain important air service companies. The former body is an association of Aero Clubs which is concerned with flying as a sport and the records it authenticates are internationally accepted.

Communications.—Postal and telegraphic services naturally called for their appropriate international organs at an early stage, as has already been stated. The Postal Union is now truly universal in scope, embracing some 175 different countries including dependencies. Ordinary and wireless telegraphic communications have their corresponding unions and international bureaux dating respectively from 1865 and 1906, while the recent International Advisory Committee on Long Distance Telephone Communications brings together the administrations of some 18 European countries (for further details *see* POST and POSTAL SERVICES).

What was described by Mr. Hoover in his closing address as the largest international conference in history, the third International Radio Telegraph Conference of Washington, held in October and November, 1927, brought together representatives of over 70 different Governments and of all the important Wireless Companies as well as those of several international institutions among which were the International Commission for Air Navigation and the International Shipping Conference. This Conference after a thorough survey of the great developments which had taken place in radio telegraphic communication since the last Conference, that of 1912, reached unanimous conclusions in the shape of the International Radio Telegraph Convention and Regulations of November 25, 1927; this instrument was signed by representatives of over 70 Governments, and provided for the general control of radio electric communication and for the assignment of different bands of wave lengths covering the whole range from about 6 metres to 30,000 metres to the various services such as, for example, long distance trans-oceanic services and broadcasting. The new Convention came into force on January 1, 1929, and instituted a new international body in the shape of a Technical Advisory Committee with the function of studying technical and related questions on this subject. This is attached to the existing International Bureau of the Telegraph Union which acts as the Secretariat of the Radio Telegraph Union and will continue to carry out any administrative duties arising out of the revised Regulations which the Conference adopted.

Professional.—The Permanent Committee of International Congresses of Actuaries (1895) is devoted generally to the interests of that profession and the International Association of Accountancy (1911) seeks to systematize terminology and practice in book-keeping. They are both private organisations, but the former has public administrations among its members and the latter receives some State subventions.

Miscellaneous.—The International Co-operative Alliance was founded in 1895 to develop co-operative methods in all countries and relations between the national societies, while in 1924 the International Co-operative Wholesale Society, consisting of all the European national societies of this kind, was founded with a similar object (*see* CO-OPERATION). Advocating a similar ideal, but for adoption by the various Governments and not individuals, the International Committee to promote universal Free Trade was founded in 1921 and embraces the national Free Trade Societies of 14 countries. Its counterpart in the shape of a union of societies for the promotion of economic nationalism or separatism not unnaturally does not exist.

Relation to League of Nations.—This habit of associating internationally and this endeavour to treat the world as one for an ever-increasing number of purposes, grows continually and has a cumulative effect. Only a world-wide catastrophe such as the war of 1914–18 can interrupt it, and that war has in the sequel had the effect of greatly stimulating these international movements, and it has given them a supreme international association of States, the League of Nations, which serves to focus their various efforts, and to secure that real effect is given to those of their aims which the world is generally ready to adopt.

The Covenant of the League of Nations lays down in Article 24 that there shall be placed under the direction of the League all international bureaux already established by general treaties, if the parties to such treaties consent, and that all such international bureaux and all commissions for the regulation of matters of international interest hereafter constituted shall be placed under the direction of the League. The bureaux here referred to are of course the creation of States; unofficial international bureaux or associations may at their request be placed under the League's directions; the tendency, however, is for such international bodies not to do so, but to work with the League Organizations. The execution of the extensive programme which the World Economic Conference of 1927 laid down, in the sphere of international economic questions, and which covers mostly the same ground as the recommendations of the various International Associations dealt with above, is entrusted to the Economic Committee of the League of Nations, aided by the Consultative Committee. It has been decided that on the latter body should be represented the International Chamber of Commerce (3 members), while co-operation is intended with such bodies as the International Management Institute and the International Co-operative Alliance.

Representatives of several international organizations, such as the International Shipping Conference, took part in the General Conference on Communications and Transit in 1927, and provision is made in the new statute for this branch of the League for the participation in its work in an advisory capacity of representatives of international organizations. It is thus becoming clear that these bodies, for the most part private in origin and constitution, are likely to find in this sphere the opportunity for their most effective work, since they can contribute to the work

of the paramount official international association the best available experience and generally matured policy.

International law has so far made no provision for giving a definite status to international associations, but the question of regularizing their position (which is especially desirable when they are not the creation of specific agreement between States) is on the agenda of the League of Nations Committee for the Codification of International Law for 1928.

BIBLIOGRAPHY.—The Handbook of International Organisations published by the League of Nations gives particulars of international associations on all subjects; the League's Quarterly Bulletin gives particulars of international conferences held or forthcoming, also a list of current publications by international organisations.

P. B. Potter in his "Introduction to the Study of International Organisation" (1922) has chapters on international associations, official and private, and gives a brief bibliography. More recent and full is W. Kaufmann's "Les Unions Internationales de Nature Economique" (1924) with a full bibliography published in the Recueil des Cours de l'Académie de Droit International. *See* also MONETARY CONFERENCE. (E. J. E.)

INTERPELLATION, a term meaning, in general, an interruption, more particularly used of a method of procedure adopted in some of the legislative chambers of continental Europe, especially those of France and Italy. It was originally confined to the asking of a question, after due notice, on some affair of State. It is now, however, the chief means by which the policy or action of the Ministry of the day is challenged. An interpellation can be brought on without the consent of the minister to be attacked; it is usually made the subject of a general debate, and ends with a vote of confidence or want of confidence in the Ministry.

INTERPENETRATING MOULDINGS, in architecture, are mouldings of the same or different profiles, which meet at an angle, as at the top of an arch or the corner of an opening, and instead of stopping at the line of intersection, are carved as though they passed through each other and continued on until received by some projecting member or surface. Such a juncture is known as an interpenetration. This treatment is characteristic of flamboyant Gothic (*see* FLAMBOYANT STYLE), especially in France and Germany.

INTERPLEADER: *see* PRACTICE AND PROCEDURE.

INTERPOLATION, in mathematics, the process of obtaining intermediate terms of a series of which particular terms are known; from the Latin *interpolare*, to alter, or insert something fresh, connected with *polire*, to polish. The logarithms, for instance, shown in Table I, may be regarded as terms of a series,

TABLE I.

No.	Log.	1st diff.
.	.	+
.	.	.
.	.	.
2·70	·4314	.
		16
2·71	·4330	
		16
2·72	·4346	
		16
2·73	·4362	
		16
2·74	·4378	
		15
2·75	·4393	.
.	.	.
.	.	.
.	.	.

and the logarithm of a number between 2·70 and 2·75 may be found by interpolation from the table. The process of obtaining the logarithm of a number lying outside these limits would be *extrapolation*; the formulae which apply to interpolation apply in theory to extrapolation, but in practice special precautions as to accuracy are necessary. The present article deals only with interpolation.

The term is usually limited to those cases in which there are two quantities, x and u, which are so related that when x has any arbitrary value, lying perhaps between certain limits, the value of u is determinate. There is a given series of associated values of x and of u, and interpolation consists in determining the value of u for any arbitrary value of x, or the value of x for any arbitrary value of u, lying between two of the values in the series. Either of the two quantities may be regarded as a function of the other; it is convenient to regard one, x, as the *independent variable*, the other, u, being treated as the *dependent variable, i.e.*, as a function of x. If, as is usually the case, the successive values of one of the quantities proceed by a constant increment, this quantity is to be regarded as the independent variable. The two series of values may be tabulated, those of x being placed in a column (or row), and those of u in a parallel column (or row); u is then said to be *tabulated in terms of* x. The independent variable x is called the *argument*, and the dependent variable u is called the *entry*. Interpolation, in the ordinary sense, consists in determining the value of u for a value of x intermediate between two values appearing in the table. This may be described as *direct interpolation*, to distinguish it from *inverse interpolation*, which consists in determining the value of x for a value of u intermediate between two in the table. Graphically, the data for interpolation are certain ordinates of the graph of u with regard to x, and direct interpolation consists in deducing the magnitude of any other ordinate whose position is given, while inverse interpolation consists in determining the position of an ordinate whose magnitude is given. The methods employed can be extended to cases in which the value of u depends on the values of two or more independent quantities $x, y, \ldots$

The subject will be treated under three heads: I. Direct Interpolation (equal intervals), II. Direct Interpolation (unequal intervals), III. Inverse Interpolation.

I. DIRECT INTERPOLATION (EQUAL INTERVALS)

1. **Notation and Arrangement.**—We have a table showing the values of a quantity u corresponding to values of a quantity x. The values of x proceed by a constant increment h. We denote the values of x by $\ldots x_0, x_1, x_2, \ldots$, so that $x_m = x_0 + mh$; and the corresponding values of u are $\ldots u_0, u_1, u_2 \ldots$. We want to find u_θ, which is the value of u corresponding to $x_\theta = x_0 + \theta h$; for preciseness, we can say that θ lies between -1 and $+1$.

The first step, usually, is to arrange the u's in a vertical column, followed by columns containing the successive differences. The differences of the u's are the *first differences*, those of the first differences are the *second differences*, and so on. These are also called *differences of the first, second ··· order*.

The differences, like the u's, have to be distinguished by suffixes. There are three systems, the advancing-difference, the receding-difference and the central-difference. On the *advancing-difference* system, $u_1 - u_0$ is regarded as the first difference of u_0, and is denoted by Δu_0, so that $\Delta u_1 - \Delta u_0$ is $\Delta^2 u_0$; on the receding-difference system, which is less important, $u_1 - u_0$ is the first difference of u_1. On the *central-difference* system, $u_1 - u_0$ is a difference corresponding to the interval between u_0 and u_1, and is therefore denoted by $\delta u_{\frac{1}{2}}$, so that $\Delta^2 u_{-1}$ is $\delta^2 u_0$; there is also a symbol μ for the mean of any two adjacent entries in a column, so that $\mu u_{\frac{1}{2}} = \frac{1}{2}(u_0 + u_1)$, $\mu\delta u_0 = \frac{1}{2}(\delta u_{-\frac{1}{2}} + \delta u_{\frac{1}{2}})$, and so on. The system is more fully set out in CALCULUS, DIFFERENTIAL AND INTEGRAL.

2. **Fundamental Principle.**—The methods which we are considering are, in general, applicable when the result of taking successive differences is to bring us ultimately to differences of a certain order, say the kth, which are practically constant, so that the differences of the next order, the $(k+1)$th, are zero or at any rate are negligible. The fundamental principle then is that we assume that interpolation can be performed as if these latter differences were actually zero. The implication of this assumption will be considered further in §6. The assumption may, in the case of a mathematical table, be made as a matter of course; for the table is constructed so as to be used in this way. In other cases it must be justified by the facts.

3. **Interpolation by First Difference.**—In Table I. we see that, as x increases, u increases steadily. We therefore use the

principle of proportional parts, *i.e.*, we assume that for any increase in x there is a proportional increase in u. Thus we can say that the logarithm of 2·725 is ·4346+8 (where "+8" denotes the addition of 8 to the last figure of the tabulated entry, *i.e.*, means ·0008)=·4354; and similarly log 2·7225=·4350.

Algebraically, we express the relation between x and u by saying that u is of the form $p+qx$. It follows that the formula for u_θ is

$$u_\theta = u_0 + \theta(u_1 - u_0) = u_0 + \theta\Delta u_0. \qquad (1)$$

Graphically, this means that we take the upper boundary of the graph, between u_0 and u_1, to be a straight line joining the tops of the corresponding ordinates.

To find log 2·724 we should have to add ·4 of 16=6·4. But it would be incorrect to write the result as ·43524; for this would imply that we could find the logarithm to five decimal places, which the table does not enable us to do. We can do either of two things. If we only want the best value, to four places, that we can get, we must take ·4 of 16 to be six, so that our answer is ·4352. But a better method, if we are going to use log 2·724 for further calculation, is to retain an extra two or three figures in our work. We therefore, for the time being, write the logarithm in the form ·4352 40 or $\cdot 4352^{40}$; any extra figures retained in this way are dropped at the conclusion of our work, the preceding figure being adjusted if necessary. This principle applies throughout the whole of our work.

As stated above, the table shows that as x increases u increases steadily. But this does not mean that the second differences of u are absolutely zero; it only means that when we are working to four places of decimals they are negligible. That they do exist, can be seen either by taking more correct values, as in Table II., or by taking values of x at greater intervals, as in Table III.

TABLE II.

No.	Log.	1st diff.	2nd diff.
2·70	·4313638		
		16055	
2·71	·4329693		59
		15996	
2·72	·4345689		59
		15937	
2·73	·4361626		57
		15880	
2·74	·4377506		59
		15821	
2·75	·4393327		

TABLE III.

No.	Log.	1st diff.	2nd diff.
2·5	·3979		
		171	
2·6	·4150		7
		164	
2·7	·4314		6
		158	
2·8	·4472		6
		152	
2·9	·4624		5
		147	
3·0	·4771		

Similarly we could detect the existence of differences of the third or a higher order.

The sequence of differences, of whatever order, will present some irregularities. These are due to the fact that the tabulated values are necessarily not exact. Thus in Table I. the occurrence of the difference 15 immediately following a series of 16's is due to the entry for 2·74 being slightly too large (as will be seen from Table II.), while the entry for 2·75 is slightly too small. A similar explanation applies to the 57 in Table II.: the entry for 2·73 is too small, and that for 2·74 is too large.

4. **Interpolation with Second Differences.**—If we have to use second differences, but do not need third differences, the formula is

$$u_\theta = u_0 + \theta\Delta u_0 + \tfrac{1}{2}\theta(\theta-1)\Delta^2 u, \qquad (2)$$

in which $\Delta^2 u$ may be either $\Delta^2 u_0$ or $\Delta^2 u_{-1}$. It is usually best to take the one which lies nearest in the table (see Table II. or Table III.); thus if θ lies between $-\frac{1}{2}$ and $+\frac{1}{2}$ we should use $\Delta^2 u_{-1}$, but if it lies between $+\frac{1}{2}$ and $+\frac{3}{2}$ we should use $\Delta^2 u_0$.

In most cases in which this formula has to be used, $\Delta^2 u$ is small: a convenient form for calculation is then

$$u_\theta = u_0 + \theta\{\Delta u_0 - \tfrac{1}{2}(1-\theta)\Delta^2 u\}. \qquad (3)$$

5. **General Formula.**—The general formula, involving differences beyond the second, may be written in terms of advancing differences or of central differences.

(i.) The advancing-difference formula is

$$u_\theta = u_0 + \theta\Delta u_0 + \frac{\theta(\theta-1)}{2!}\Delta^2 u_0 + \frac{\theta(\theta-1)(\theta-2)}{3!}\Delta^3 u_0 + \cdots, \qquad (4)$$

in which the coefficients of u_0, Δu_0, $\Delta^2 u_0$, $\cdots$, are those of the powers of Δ in the expansion of $(1+\Delta)^\theta$ by the binomial theorem. If differences of order exceeding k are negligible, the series ends with a term in $\Delta^k u_0$. This is known as the *Newton-Gregory formula*.

(ii.) The central-difference formula is of two forms, but we need only consider one, viz., that which uses u_0 and the central differences on or adjoining a horizontal line through it. Thus (see §1) the differences involved are

$$u_0,\ \mu\delta u_0 \equiv \tfrac{1}{2}(\delta u_{-\frac{1}{2}} + \delta u_{\frac{1}{2}}),\ \delta^2 u_0,\ \mu\delta^3 u_0 \equiv \tfrac{1}{2}(\delta^3 u_{-\frac{1}{2}} + \delta^3 u_{\frac{1}{2}}),\ \delta^4 u_0 \cdots$$

Let us write (*see* CALCULUS, DIFFERENTIAL AND INTEGRAL).

$$\left.\begin{aligned}
c_1 &\equiv \mu\delta u_0 - \tfrac{1}{6}\mu\delta^3 u_0 + \tfrac{1}{30}\mu\delta^5 u_0 - \tfrac{1}{140}\mu\delta^7 u_0 + \cdots \\
c_2 &\equiv \delta^2 u_0 - \tfrac{1}{12}\delta^4 u_0 + \tfrac{1}{90}\delta^6 u_0 - \tfrac{1}{560}\delta^8 u_0 + \cdots \\
c_3 &\equiv \mu\delta^3 u_0 - \tfrac{1}{4}\mu\delta^5 u_0 + \tfrac{7}{120}\mu\delta^7 u_0 - \cdots \\
c_4 &\equiv \delta^4 u_0 - \tfrac{1}{6}\delta^6 u_0 + \tfrac{7}{240}\delta^8 u_0 - \cdots \\
c_5 &\equiv \mu\delta^5 u_0 - \tfrac{1}{3}\mu\delta^7 u_0 + \cdots \\
c_6 &\equiv \delta^6 u_0 - \tfrac{1}{4}\delta^8 u_0 + \cdots
\end{aligned}\right\} \qquad (5)$$

Then the formula is

$$u_\theta = u_0 + c_1\theta + c_2\frac{\theta^2}{2!} + c_3\frac{\theta^3}{3!} + c_4\frac{\theta^4}{4!} + \cdots \qquad (6)$$

6. **Basis of Formulae.**—Formulae (1) and (2) may be regarded as particular cases of (4), differences after the first in the one case, and after the second in the other, being negligible. But it is more instructive to consider them separately.

(i.) For first-difference interpolation we take the upper boundary of the graph to be a straight line; and this straight line must obviously pass through the tops of the ordinates representing u_0 and u_1. Or, conversely, taking Table I. for an illustration, let us suppose that we have the graph drawn with absolute accuracy. Then, if we are unable to measure the magnitude of u_0 and u_1 and intermediate ordinates to a greater accuracy than is represented by four significant figures, we are unable to see that it is anything but a straight line. The equation to the graph must therefore be taken to be $u_\theta = u_0 + \theta\Delta u_0$.

(ii.) Now suppose that (*see* Table II.) we are able to measure to a degree of accuracy represented by six or seven significant figures. Then the boundary of the graph will appear to be a parabola, its equation being of the form $u = p + qx + rx^2$. To determine p, q, and r we require three ordinates. If we take these to be u_0, u_1, and u_2, the equation to the graph becomes $u_\theta = u_0 + \theta\Delta u_0 + \frac{1}{2}\theta(\theta-1)\Delta^2 u_0$; if we take them to be u_{-1}, u_0, and u_1, the equation is $u_\theta = u_0 + \theta\Delta u_0 + \frac{1}{2}\theta(\theta-1)\Delta^2 u_{-1}$. The connection between the equation being of the form $u = p + qx + rx^2$ and the formula not going beyond second differences is that, if u is of this form, second differences of the u's are 0. Table IV. illustrates this for the particular case of $u \equiv x^2$.

TABLE IV.

x	0	1	2	3	4	5	···
$u \equiv x^2$	0	1	4	9	16	25	···
1st diff.	1	3	5	7	9	···	
2nd diff.	2	2	2	2	···		
3rd diff.	0	0	0	···			

(iii.) Finally, suppose that differences beyond those of order k are negligible, and let us, for simplicity, take k to be even and $=2g$. Then u is a polynomial in x, of degree $k \equiv 2g$. If we want to use advancing differences, we find the constants in this polynomial by passing a curve of degree k through the tops of the

ordinates $u_0, u_1, u_2, \cdots, u_{2g}$; and we then get the formula

$$u_\phi = u_0 + \phi\Delta u_0 + \frac{\phi(\phi-1)}{2!}\Delta^2 u_0 + \cdots + \frac{\phi(\phi-1)\cdots(\phi-2g+1)}{(2g)!}\Delta^{2g}u_0 \quad (7)$$

If, on the other hand, we pass the curve through the tops of the ordinates $u_{-g}, u_{-g+1}, \cdots, u_{-1}, u_0, u_1, \cdots, u_{g-1}, u_g$, we get the central-difference formula for u_θ in terms of $u_0, \mu\delta u_0, \delta^2 u_0, \cdots, \delta^{2g}u_0$.

(iv.) An important fact is that, viewed algebraically, there is no essential difference between the advancing-difference formula and the central-difference formula. If, as in (iii.), we pass a curve of degree $2g$ through the tops of the ordinate $u_0, u_1, u_2, \cdots, u_{2g}$, the formula for u given by this curve is a central-difference formula for interpolation between $u_{g-\frac{1}{2}}$ and $u_{g+\frac{1}{2}}$, but it is also an advancing-difference formula for interpolation between u_0 and u_1, and a receding-difference formula for interpolation between u_{2g-1} and u_{2g}.

7. **Central-difference Formulae.**—A central-difference formula, in the general sense, is one which involves differences, or pairs of differences, lying on or close to a horizontal line in the table. There are several of these, but they are all equivalent either to (6) or to a formula constructed on the same principle but involving $\mu u_{\frac{1}{2}}, \delta u_{\frac{1}{2}}, \mu\delta^2 u_{\frac{1}{2}} \cdots$ Three of these, known to Newton but subsequently discovered by other writers, may be mentioned.

(a) The *Newton-Gauss formula* is a zigzag formula involving $u_0, \delta u_{\frac{1}{2}}, \delta^2 u_0, \delta^3 u_{\frac{1}{2}} \cdots$

(b) The *Newton-Stirling formula*, easily obtained from the above, involves $u_0, \mu\delta u_0, \delta^2 u_0, \mu\delta^3 u_0, \cdots$, and becomes (6) if the coefficients of $\theta, \theta^2, \theta^3, \cdots$ are collected.

(c) The *Newton-Bessel formula* involves $\mu u_{\frac{1}{2}}, \delta u_{\frac{1}{2}}, \mu\delta^2 u_{\frac{1}{2}}, \delta^3 u_{\frac{1}{2}} \cdots$ If the coefficients of $\theta-\frac{1}{2}, (\theta-\frac{1}{2})^2, (\theta-\frac{1}{2})^3, \cdots$ in this formula are collected, we get an alternative formula to (6), for use throughout an interval in the table.

8. **Sub-tabulation.**—When the values of u have been tabulated for values of x, proceeding by a difference h, we may want to deduce a table in which the differences of x are h/n, where n is an integer. For the common case of $n=10$, we can proceed by two steps, first halving the interval, and then dividing the new interval into fifths.

(i.) For halving the interval we have

$$u_{\frac{1}{2}} = \tfrac{1}{2}(U_0 + U_1), \quad (8)$$

where

$$U \equiv u - \tfrac{1}{8}\delta^2 u + \tfrac{3}{128}\delta^4 u - \tfrac{5}{1024}\delta^6 u + \cdots. \quad (9)$$

(ii.) For any other value of n than 2 we use a formula due to J. D. Everett. If we write $\phi \equiv 1-\theta$, *Everett's formula* is

$$u_\theta = \theta u_1 + \frac{\theta(\theta^2-1^2)}{3!}\delta^2 u_1 + \frac{\theta(\theta^2-1^2)(\theta^2-2^2)}{5!}\delta^4 u_1 + \cdots + \phi u_0 + \frac{\phi(\phi^2-1^2)}{3!}\delta^2 u_0 + \frac{\phi(\phi^2-1^2)(\phi^2-2^2)}{5!}\delta^4 u_0 + \cdots \quad (10)$$

For actual calculation we replace $\theta u_1 + \phi u_0$ by $u_0 + \theta\Delta u_0$. Then, if we write

$${}_\theta V_n \equiv \frac{\theta(\theta^2-1^2)}{3!}\delta^2 u_n + \frac{\theta(\theta^2-1^2)(\theta^2-2^2)}{5!}\delta^4 u_n + \cdots \quad (11)$$

we have, for interpolation between u_0 and u_1,

$$u_\theta = u_0 + \theta\Delta u_0 + {}_\theta V_1 + {}_{1-\theta}V_0, \quad (12)$$

the successive values of θ being $1/n, 2/n, \cdots, (n-1)/n$. For interpolation between u_1 and u_2 we have, with the same succession of values of θ,

$$u_{1+\theta} = u_1 + \theta\Delta u_1 + {}_\theta V_2 + {}_{1-\theta}V_1. \quad (13)$$

The values of ${}_{1-\theta}V_1$ in (13) are exactly the same as those of ${}_\theta V_1$ in (12), but in the reverse order. The process of constructing the new table is therefore very simple.

II. DIRECT INTERPOLATION (UNEQUAL INTERVALS)

9. When the differences of consecutive x's are not all equal, we use formulae analogous to ordinary interpolation-formulae, but with the differences prepared in a special way. The best-known formulae are Newton's (original) formula and Lagrange's formula; the former uses "divided" differences.

Let the tabulated values of x be $\cdots, a, b, c, d, \cdots$, the corresponding values of u being denoted by $\cdots, f(a), f(b), f(c), f(d) \cdots$ Then our table is of the form:—

x	u	Divided Differences			
		1st	2nd	3rd	⋯
a	$f(a)$	$f(a,b)$	$f(a,b,c)$	$f(a,b,c,d)$	etc.
b	$f(b)$	$f(b,c)$	$f(b,c,d)$		etc.
c	$f(c)$	$f(c,d)$			
d	$f(d)$				

In this table

$$f(a,b) \equiv \frac{f(b)-f(a)}{b-a}, f(b,c) \equiv \frac{f(c)-f(b)}{c-b}, \cdots$$
$$f(a,b,c) \equiv \frac{f(b,c)-f(a,b)}{c-a}, f(b,c,d) \equiv \frac{f(c,d)-f(b,c)}{d-b}, \cdots \quad (14)$$
$$f(a,b,c,d) \equiv \frac{f(b,c,d)-f(a,b,c)}{d-a}, \cdots$$
etc.

The quantities $f(a,b) \cdots$ in the first line are called *divided differences of the first order*; those in the second line are *divided differences of the second order*; and so on. If u is a polynomial of degree k in x, the divided differences of order $k-1$ are all 0. It should be observed that the value of any divided difference is independent of the order in which the u's involved in it are arranged; thus $f(a,b)=f(b,a), f(a,b,c)=f(a,c,b)$, etc.

Newton's formula for unequal intervals is

$$f(x) = f(a) + (x-a)f(a,b) + (x-a)(x-b)f(a,b,c) + \cdots, \quad (15)$$

the series continuing until the differences are zero or negligible. This formula covers all those with which we have so far dealt; thus the Newton-Gauss formula (§ 7) is obtained by taking the x's in the order 0, 1, −1, 2, −2, ...

The method was subsequently modified by Newton, in a manuscript written in 1676 but not known to the world until 1926. Another method, similar to this modified method, but not identical with it, is that of "adjusted differences."

Lagrange's formula is

$$f(x) = \frac{(x-b)(x-c)(x-d)\cdots}{(a-b)(a-c)(a-d)\cdots}f(a) + \frac{(x-a)(x-c)(x-d)\cdots}{(b-a)(b-c)(b-d)\cdots}f(b) + \frac{(x-a)(x-b)(x-d)\cdots}{(c-a)(c-b)(c-d)\cdots}f(c) + \cdots \quad (16)$$

This gives exactly the same result as Newton's formula. It is not so convenient for calculation as the latter, and it does not show how many u's have to be taken into account; but it is important in dealing with the theory of the subject.

III. INVERSE INTERPOLATION

10. **Inverse Interpolation: Simple Cases.**—In all cases of inverse interpolation we have to pay special attention to the degree of accuracy of the result. This depends largely, in ordinary

cases, on the initial figure of the first difference.

If the first difference is practically constant, inverse interpolation is very simple. The direct formula

$$u_\theta = u_0 + \theta \Delta u_0$$

gives

$$\theta = (u_\theta - u_0)/\Delta u_0 .$$

If we have to go to second differences, the direct formula is

$$u_\theta = u_0 + \theta \Delta u_0 + \tfrac{1}{2}\theta(\theta - 1)\Delta^2 u$$
$$= u_0 + \theta\{\Delta u_0 + \tfrac{1}{2}(\theta - 1)\Delta^2 u\},$$

where, if θ lies between 0 and 1, $\Delta^2 u$ may be either $\Delta^2 u_{-1}$ or $\Delta^2 u_0$. We can calculate the expression in { } by taking an approximate value of θ; and then θ is found more accurately by dividing $u_\theta - u_0$ by this expression.

11. **General Formula.**—If third or higher differences have to be taken into account there are two methods.

(i.) We can use the general formula (6), viz.:

$$u_\theta = u_0 + c_1\theta + c_2\frac{\theta^2}{2!} + c_3\frac{\theta^3}{3!} + c_4\frac{\theta^4}{4!} + \cdots ,$$

and proceed by successive approximations. By transposition and division, we get

$$\theta = \left(u_\theta - u_0 - c_2\frac{\theta^2}{2!} - c_3\frac{\theta^3}{3!} - c_4\frac{\theta^4}{4!} - \cdots\right) \div c_1 .$$

We begin with an approximate value of θ. Substituting this on the right-hand side, we get a closer approximation; and so on.

(ii.) The above method is only applicable when the intervals in x are equal. An alternative method, suitable for cases of unequal intervals, but not always applicable, is to invert the table—*i.e.*, to interchange the x column and the u column and find divided differences of the x's—and proceed by direct interpolation.

BIBLIOGRAPHY.—Edmund T. Whittaker and G. Robinson, *The Calculus of Observations* (1924), the chapters dealing with interpolation are published separately, as *A Short Course of Interpolation*. J. F. Steffenson, *Interpolation* (1927). *See* also Duncan C. Fraser, *Newtons Interpolation Formulas* (1927) and *Isaac Newton*, Memorial volume (1927). *See* also DIFFERENCES, CALCULUS OF. (W. F. S.)

INTERPRETATION, in general, the action of explaining, or rendering the sense of an obscure form of words or an unknown tongue into a language comprehended by the person addressed. In legal use the word is employed in the sense of ascertaining the meaning of the language of a document. (*See* CONTRACT; WILL, etc.) It is usual for statutes to contain definitions and the British Interpretation Act of 1889 is of general application. This term is used similarly in the United States.

INTERREGNUM, strictly a period during which the normal constituted authority is in abeyance, and government is carried on by a temporary authority specially appointed (Lat. *inter*, between, and *regnum*, reign). Though originally and specifically confined to the sphere of sovereign authority, the term is commonly used by analogy in other connections for any suspension of authority, during which affairs are carried on by specially appointed persons. The term originated in Rome during the regal period when an *interrex* was appointed (traditionally by the senate) to carry on the government between the death of one king and the election of his successor (*see* ROME: *History*).

The most noteworthy use of the term "interregnum" in post-classical times is that of the Great Interregnum in German history between the death of Conrad IV. (1254) and the election of Rudolf of Habsburg (1273). *See* GERMANY: *History*.

INTERRUPTED CONTINUOUS WAVES, in radio, are waves obtained by the interruption at audio-frequency in a periodic manner of an otherwise continuous wave.

INTER-STATE COMMERCE includes the movement of passengers and freight from one State to another, and the agencies and facilities by which the transfer is accomplished; it comprises the mechanism and services of trade, transport and communication between citizens of different States. Broadly defined, the term commerce applies to a wide range of economic services, to exchange or distribution in general, but as here used it is limited to the traffic and trade that crosses State boundaries in the internal or domestic commerce of the United States. Foreign trade is not included, nor are communication agencies and services.

Inter-State commerce may be carried on by an individual or a partnership but it is for the most part conducted by corporations, which, like those concerned with production, tend to become larger, their activities being increasingly subject to regulation by the States and particularly by the Federal Government. In the interest of public safety the facilities employed by rail, highway, ocean and air carriers must conform to standards fixed by State and national laws whose enforcement is furthered by Government inspection of equipment of many kinds. Corporations must compete in inter-State commerce by methods that are "fair," and the accounts, finances, charges and services of carriers are comprehensively regulated by the national Government.

The principal agencies by which inter-State freight and passenger movements, or trade and travel, are effected, are the steam and electric railways, the vessels operated coastwise and on the Great Lakes, the rivers and canals, the carriers operating motor trucks and buses, and the aeroplanes. Carriers other than railroads subject to the Inter-State Commerce Act of 1887 as amended to date include pipe line companies (other than water companies), sleeping car, express, telegraph and telephone companies. Inter-State carriers by water are regulated in part by the Inter-State Commerce Commission, but mainly by the United Shipping board whose powers are defined by the Shipping Act of 1916 as amended and extended by the Merchant Marine Acts of 1920 and 1928. There is a Federal Trade Commission, created by the act of Sept. 26, 1914, to prevent unfair methods of competition in commerce. The Air Commerce Act of May 20, 1926, gives the secretary of commerce jurisdiction over inter-State air facilities and services.

Volume of Inter-State Commerce.—The volume of inter-State as distinct from intra-State commerce is not stated in official records, but it is well known that most goods shipped between points within the United States or sent to or received from foreign countries pass State boundaries. By far the larger share of the traffic of rail, water, highway and airway carriers being goods carried from one State to another, reference to the tonnage transported by these several carriers will indicate the magnitude of inter-State commerce in the United States.

During the year 1926, the railroads in the United States transported 1,439,427,824 tons of revenue freight, their service being equivalent to the movement of one ton nearly 447 billion miles, the number of tons having nearly doubled and the ton miles having more than doubled in 20 years. There were 13 tons and over 4,000 ton miles of railroad freight per inhabitant, and, as the average distance a ton was hauled was 311 m., it is evident that most of the traffic must have been inter-State.

The domestic water-borne commerce of the United States in 1926 moved coastwise and on the Great Lakes and other inland waterways totalled 405,210,902 short tons. Roughly two-fifths of the entire tonnage consists of coastwise domestic traffic, a somewhat smaller share moves on the rivers and canals, and between 20 and 25% is transported on the Great Lakes. The major portion of this large traffic was contributed by coal and coke and iron-ore, of which there is a heavy tonnage on the Great Lakes, by petroleum and its products which move coastwise in great volume, by lumber and logs, transported and rafted largely on the Pacific seaboard, and by such articles as sand, gravel and stone that are shipped locally on numerous inland waterways. The traffic on the rivers is of less relative importance than the tonnage would indicate because the average length of haul is much shorter than on the Great Lakes and along the seaboard. One cause that has contributed largely to the growth of coastwise commerce has been the Panama canal, through which in 1927 nearly 11,000,000 long tons of cargo moved between the two seaboards of the United States, the average length of haul being quite 5,000 nautical miles.

The American Automobile Association has stated that on Jan. 1, 1927, 2,468 common carrier motor buses were operated by 458 companies over 52,017 m. of inter-State routes. On the same date the total bus route mileage, inter-State and intra-State, was

given as 270,000 miles. The corresponding mileage over which motor trucks were operated in contract and common carrier services is not known, but it would doubtless be greater than the bus route mileage for intra-State and less for inter-State operations.

The bureau of public roads of the U.S. department of agriculture has conducted surveys in several States to determine the nature and volume of motor passenger and freight traffic. In a small State like Connecticut, with its dense population and highly diversified industries, and with the city of greater New York close by, there would be a large use of the highways, and it was found that 27·5% of the motor freight tonnage on the Connecticut highways was inter-State traffic. In the State of Texas, however, only 2·5% of the motor truck transportation is inter-State; and in Minnesota it was found that 99% of the motor truck operators did intra-State hauling exclusively.

Inter-State motor traffic is but a small share of the total, because the motor hauls are of short average length. In eight States studied by the united bureaux of public roads in 1925 it was found that over 50% of the suburban and inter-urban motor bus routes were less than 20 m. in length and nearly three-fourths were less than 30 m. long, only 11·9% being over 50 miles. Inter-State bus routes in these eight States had from 4 to 15% of the total mileage of all routes. Motor truck hauls are also of short average length, hauls of less than 30 m. comprising 58% of the total in California, 71% in Ohio and 80% in Pennsylvania.

Air transport routes are as characteristically long as motor routes are short, and most air services over regular routes are inter-State. Aeronautics is making rapid progress in the United States; but, with the exception of the air mail service in which greater development has been made than in any other country, the United States is surpassed by both Germany and France. Commercial air transport promises to be much larger in the United States in the near future. Its early development has been relatively slow, because it has not received Government subsidies, while European countries have given large aid to companies to enable them to maintain passenger and package air transport services.

In 1927 there were 433 commercial air service and transport companies and 1,000 aeroplanes in commercial services of different kinds. There were 23 companies constructing aeroplane engines and 66 building aeroplanes. Of the 433 commercial companies 300 were engaged in transporting passengers and freight for hire. The number of passengers carried during the year 1926 was 387,852, but many of these were taken on short rides and not over regular routes. The amount of freight transported was 792,678 pounds. This, however, was much less than the weight of merchandise carried either in France or Germany. On the contrary, air mail transport in the United States is well developed and is rapidly increasing. In 1928, aeroplanes were carrying mail 20,000 m. daily. On Sept. 1, 1927, the American Railway Express company began accepting packages for transmission by the air mail carriers with whom the company entered into contracts. Several large manufacturers are operating planes in connection with their business operations. The next step to be taken in the development of air transport is the operation of large passenger planes, probably in connection with the railroads, and the inauguration of regular common carrier services for the carriage of package freight of high value per bulk and weight. Such passenger and freight services, as well as those for the carriage of mail and express, will be mainly inter-State.

Freedom of Inter-State Commerce in the United States.—The commerce passing State boundaries in the United States has become of great volume because there are no legal barriers. The United States throughout its wide territory is a single commercial unit with full freedom of internal trade. In this regard the United States is in marked contrast with Europe, where racial and historical causes have brought about the existence of many nations each of which is concerned with safeguarding its own internal trade against the undue encroachment of the commerce of other countries. Freedom of trade within a continental area richly endowed with natural resources has been of great assistance to the economic development of the United States.

Freedom of inter-State commerce has been as great an aid to political success as to economic welfare. The commerce clause of the Constitution made a united country possible; in spite of sectional divergencies and a civil war over the issue of slavery, the nation has been held together and the States have grown into an indissoluble union because industry, trade, transport and communication have known nothing of State boundaries or of political differences. Government under the Articles of Confederation broke down not only because Congress had no power to levy taxes, but also because the central Government having no authority over commerce, each State sought to develop its domestic and foreign trade at the expense of the other States. Economic as well as political necessity forced the States to organize a commonwealth with nation-wide authority over trade.

Power of the United States Government over Inter-State Commerce.—The power "to regulate commerce with foreign nations, and among the several States" is vested in Congress by the Constitution which also stipulates that "No State shall, without the consent of the Congress, lay any imposts or duties on imports or exports, except what may be absolutely necessary for executing its inspection laws"; also that "No State shall, without the consent of the Congress, lay any duty on tonnage." The Constitution provides that Congress shall levy no tax or duty "on articles exported from any State," and that "No preference shall be given by any regulation of commerce or revenue to the ports of one State over those of another. Nor shall vessels bound to or from one State be obliged to enter, clear, or pay duties in another." These prohibitions in the Constitution prevent restrictive regulation of commerce while the positive power granted to Congress is comprehensive and has been so interpreted by Congress and the Supreme Court as to make regulation positive and constructive. In regulating, Congress can promote inter-State commerce, and that, to an increasing extent, has been the policy of the Federal Government.

The interpretation of the commerce clause of the Constitution, through a long series of Supreme Court decisions, has tended to narrow the powers of the States and to broaden those of the Federal Government over inter-State, and indirectly over intra-State commerce. Chief Justice Marshall laid a broad and secure foundation for Federal authority in 1824, in the case of *Gibbons* v. *Ogden* (9 Wheaton 1). In this classic decision, denying to the State of New York the power to grant to a steamboat company a monopoly of steam navigation in the waters of the State to the exclusion of others owning vessels licensed by the United States, the chief justice enunciated the principle that has guided the Supreme Court in all subsequent interpretations of the commerce clause when he said:— "By virtue of the comprehensive terms of the grant, the authority of Congress is at all times adequate to meet the varying exigencies that arise, and to protect the national interests by securing the freedom of inter-State commercial intercourse from local control."

The extension of the power of Congress over inter-State (and incidentally intra-State) commerce by legislation and court decisions has affected all four categories of commerce and carriers—commerce by waterways, railroads, highways and air.

Federal Regulation of Inter-State Shipping.—Among the Supreme Court decisions defining the boundaries of State and Federal power over shipping was *Sinnot* v. *Davenport* (22 Howard 227) which in 1860 held unconstitutional a law enacted by Alabama in 1854 requiring special State registration of all vessels navigating waterways in the State. The court ruled that a vessel enrolled by the United States cannot be compelled to secure State registration. Likewise in 1871 the Supreme Court annulled a law enacted by Alabama in 1866 imposing a tax of $1.00 per ton on all vessels operating upon the navigable waters within the State. The States may tax ships as property, but may not levy a tonnage tax (*Cox* v. *the Collector*, 12 Wall. 204). A State is also without power to impose port wardens' fees upon ships entering its ports (*Steamship Company* v. *Port Wardens*, 6 Wall. 31, decided 1867), or to place an occupation tax on persons or corporations employing vessels in a manner authorized by a U.S. licence (*Moran* v. *New Orleans*, 112 U.S. 69, decided in 1884).

These Supreme Court decisions negatived attempts of the States

to burden the facilities of commerce. The legislative policy of Federal regulation has been a positive one. Harbours have been improved and inland waterways have been canalized and extended; the Shipping Act of 1916 and the Merchant Marine Acts of 1920 and 1928 provide both for aiding and for regulating shipping. Moreover, the Inter-State Commerce Act, particularly as amended by the Transportation Act of 1920, empowers the Inter-State Commerce Commission to establish through routes and rates by railroads and waterways and thus to promote the use of waterways by making them a part of a co-ordinated system of rail and water lines for the service of inter-State commerce.

Regulation of Inter-State Commerce by Rail.—The main carriers of inter-State commerce in the United States are the railroads. The Federal regulation of railroads which began with the Inter-State Commerce Act of 1887 has been extended in scope by subsequent laws until it now applies comprehensively to all such carriers engaged in inter-State commerce. Moreover, inter-State and intra-State commerce and railroad services are so interrelated that the Federal Government in exercising its plenary power over inter-State commerce incidentally limits in large measure the regulation of intra-State trade and traffic by the States. The U.S. safety laws apply to all railroad equipment; railroad finances are regulated by the Inter-State Commerce Commission which must approve of the location and combination of proposed railroads and of the issue of securities; and the States may not establish intra-State rates that unreasonably discriminate against the inter-State charges fixed or authorized by the Federal Commission.

When the States began to regulate railroad rates, shortly after 1870, some of the States fixed rates on all railroad traffic including both that moving within and that crossing State boundaries, but in 1886 the U.S. Supreme Court in *Wabash* v. *Illinois* (118 U.S. 557) held that the States could not fix the rates on inter-State traffic. To do so would be to regulate inter-State commerce over which the United States has jurisdiction. For 25 years after this decision by the Supreme Court no question was raised as to the power of the States to fix rates on intra-State traffic that were *per se* reasonable, but in 1911 the Railroad Commission of Louisiana complained to the Inter-State Commerce Commission that the railroad rates fixed by the State authorities of Texas on traffic within that State were so much lower than the inter-State rates as to discriminate against traffic from Louisiana into Texas and to prevent Shreveport, La., from competing with Houston and Dallas for the trade of north-eastern Texas. The commission decided in favour of the complainant and ordered the railroads to cease the discrimination which they did by raising the rates that had been fixed by Texas. This order of the Inter-State Commission and this action of the carriers were sustained by the U.S. Supreme Court in 1914 in the so-called Shreveport decision (234 U.S. 342). The principle established by this decision was extended and strengthened in the Transportation Act of 1920 by which the Inter-State Commerce Commission was given authority to prescribe rates and fares to take the place of intra-State rates that the Commission has found to discriminate unjustly against inter-State or foreign commerce.

To carry out the rate-making provisions of the Transportation Act of 1920 and to enable the carriers to obtain a reasonable return on their property, the Inter-State Commerce Commission raised rates and fares on all railroad traffic, intra-State as well as inter-State. The State of Wisconsin had fixed passenger fares by statute at 2 cents a mile, and the Railroad Commission brought action in the Federal courts to test the power of the United States to substitute for those fares others fixed by the Inter-State Commerce Commission. The Supreme Court (257 U.S. 563) upheld the statute and the order of the Inter-State Commission. Likewise, on the same day that it handed down this decision, the Court, in *New York* v. *the United States* (257 U.S. 591), set aside a contract provision in the charter of the New York Central railroad which had limited the fare on the main line of that road between Albany and Buffalo to 2 cents a mile, the Court holding in effect that the State in requiring such a fare to be charged was unjustly discriminating against inter-State passenger traffic subject to a charge of 3·6 cents per mile.

Federal Authority over Inter-State Commerce by Highways.—The U.S. Supreme Court, in a series of recent decisions, has defined the boundaries of State and Federal authority over highway carriers engaged in inter-State commerce, just as the powers of the States and the nation over commerce by railroads have been determined by judicial interpretation. In 1923 the State of Michigan enacted a law requiring all motor carriers for hire upon the roads of the State to secure a certificate from the public utilities commission. The act also provided that such motor carriers for hire should be common carriers subject to the laws applicable thereto and should be required to carry insurance or furnish an indemnity bond. A motor carrier engaged solely in inter-State transport on a contract basis contested the validity of the law and the U.S. Supreme Court held that "It is a burden on inter-State commerce to impose on plaintiff (a private inter-State carrier) the . . . liability of a common carrier, and the obligation of furnishing such indemnity bond" as conditions precedent to engaging in inter-State commerce. The Court also held that a State could not by legislative fiat convert a private carrier into a common carrier, "for that would be taking private property for public use without just compensation" (*Duke* v. *Public Utilities Commission*, 266 U.S. 570).

A man desiring to operate a common carrier bus line between Seattle, Wash., and Portland, Ore., was granted an authorizing certificate by Oregon, but was refused one by Washington. The director of public works in Oregon ruled that there was no need for another carrier and denied the petition because "under the laws of the State, the certificate may not be granted for any territory which is already being adequately served." The Supreme Court, however, held that the law was a regulation of inter-State commerce forbidden by the commerce clause of the Federal Constitution (*Buck* v. *Kuykendall*, 267 U.S. 307, March 2, 1925).

These and other decisions of the Federal courts have given effect to a general definition of the powers of the States and of the United States respectively, which were clearly stated by the Supreme Court as early as 1915 in the case of *Hendrick* v. *State of Maryland* (235 U.S. 610) when the Court declared that "In the absence of national legislation covering the subject, a State may rightfully prescribe uniform regulations necessary for the public safety and order in respect to the operation upon its highways of all motor vehicles—those moving in inter-State commerce as well as others. . . . The reasonableness of the State's action is always subject to inquiry in so far as it affects inter-State commerce, and in that regard it is likewise subordinate to the will of Congress."

The Air Commerce Act of 1926.—To encourage the development of commerce by air, Congress passed a comprehensive Air Commerce Act, approved on May 20, 1926. The regulation of inter-State and foreign air commerce and of the aircraft employed therein is vested in the secretary of commerce and an additional assistant secretary of commerce provided for by the act. All civil aircraft operated inter-State or to foreign countries must be registered and rated by the secretary of commerce, who must examine and license airmen and establish air traffic rules. Provisions are made for the co-operation of the postmaster general, the secretary of agriculture (through the weather bureau), and the secretary of war with the secretary of commerce in the establishment and equipment of air routes, and the creation of emergency landing fields and other facilities. The Government does not provide terminal landing fields or airports and does not operate aircraft of its own, other than military and naval aircraft, and the postmaster general contracts with private air transport companies for the carriage of mails. The most helpful assistance given to air commerce by the Federal Government is that made possible by the provision of the act of 1926 which authorizes the secretary of commerce "to designate and establish civil airways, and within the limits of available appropriations hereafter made by the Congress (1) to establish, operate and maintain along such airways all necessary air navigation facilities except airports; and (2) to chart such airways and arrange for publication of maps of such airways, utilizing the facilities and assistance of existing

agencies of the Government so far as practicable."

The States and municipalities are establishing landing fields and airports in large numbers and the Federal Government is adding to and extending the established air routes, equipping them with temporary landing fields, with signal lights and radio apparatus. Conditions favourable to a rapid future development of inter-State and foreign air commerce are being established.

Prohibition of Combinations in Restraint of Inter-State Commerce.—The Antitrust (Sherman) Act of July 2, 1890, as amended and strengthened by the Clayton Act of Oct. 15, 1914, makes illegal contracts or combinations in the form of trusts, or otherwise, in restraint of inter-State or foreign commerce. In 1896, in the case of the *United States* v. *Trans-Missouri Freight Association* (166 U.S. 290), the Supreme Court held that the law applied to all combinations in restraint of inter-State or foreign commerce, including those that had previously been considered reasonable under the common law. This literal interpretation of the law hampered the development of large-scale organization in the conduct of commerce until 1911, when, in the Standard Oil company case (*United States* v. *Standard Oil Co.*, 221 U.S. 1) the Supreme Court enunciated and applied the "rule of reason," the effect of which was to hold that the Sherman Act prohibits only such combinations and restraints as were illegal at common law. This decision was not satisfactory to those who favoured a stringent curb on combinations, and the Clayton Act was passed to define more specifically what combinations or restraints were prohibited and to extend the law more definitely to agreements made to fix prices for the purpose of lessening competition or creating monopoly. The act, however, exempted labour and agricultural organizations from the provisions of the antitrust laws. The Clayton Act did not, in fact, strengthen the Sherman Act of 1890, the general terminology of the original law having proved more comprehensive than the more specific definitions and specifications of the later act.

Railroad rate agreements and railroad consolidations, which by the decision of the Supreme Court in the Trans-Missouri Freight Association case in 1896 and the Northern Securities case in 1904 (*Northern Securities Co.* v. *United States*, 193 U.S. 197) had been brought under the prohibitions of the Antitrust Act, were, by the Transportation Act of 1920, made legal when approved by the Inter-State Commerce Commission.

Fair Competition in Inter-State Commerce.—In 1914, Congress enacted a law, approved on Sept. 26, "to create a Federal Trade Commission and to define its powers and duties." The purpose of the act was "to prevent persons, partnerships, or corporations, except banks, and common carriers subject to the acts to regulate commerce, from using unfair methods in commerce." The commission of five members is given ample powers of investigation. If the commission finds that methods of competition prohibited by law are being employed it may order the violator of the law to desist from such practices. If the order is not obeyed, the commission may apply to a U.S. circuit court of appeals to enforce the order. As the court has the power to affirm, modify or set aside the order, the Trade Commission is in reality more an investigating than a regulatory agency. It has, however, served a useful purpose, not only because it may proceed upon its own motion, but also for the reason that it may be called upon by the attorney-general to report upon the manner in which a corporation that has been found by a court to be violating the antitrust laws is carrying out the court's decree. The Trade Commission may also be directed by "the President or either house of Congress to investigate and report the facts relating to any alleged violation of the Antitrust Acts by any corporation."

By the so-called Webb Act, approved on April 10, 1918, Congress exempted from the provisions of the Sherman and Clayton Antitrust Acts "an association entered into solely for the purpose of engaging in export trade," provided such association does not restrain trade within the United States. Such associations are subject to the prohibitions against unfair methods of competition contained in the act creating the Federal Trade Commission. The association must file with that commission full information regarding its organization and shall furnish such data concerning the conduct of its business as may be required by the commission, whose duty it is to inform the attorney-general of any violations of law by the association.

The U.S. domestic commerce, most of which is inter-State, is changing constantly with the evolution of industry and industrial processes, with the shifting of the major centres of production of the leading staples of manufacture, and with improvements in transport agencies and in methods of transport. Moreover, while commerce is increasing in volume, large-scale organization of business is more and more taking the place of small enterprises. For these reasons, inter-State commerce is the subject of frequent legislation and of an increasing measure of administrative regulation.

BIBLIOGRAPHY.—The statutes concerning the regulation of inter-state commerce by the United States may be found in convenient form in *Barnes' Federal Code 1919* and its *Cumulative Supplement 1919–1926*. The U.S. Supreme Court decisions referred to in the article contain a large amount of historical and economic information. The *Annual Reports of the Inter-State Commerce Commission*, and *The Census of Water Transportation: 1926*, compiled by the department of commerce, are to be consulted for statistics of the volume of domestic traffic by rail and water. *See* also E. R. Johnson, G. G. Huebner and G. Lloyd Wilson, *Principles of Transportation* (1928), which contains much information concerning railroad, highway, ocean and air traffic in the United States. (E. R. J.)

INTERSUBJECTIVE, in psychology, means that which pertains at once to a number of conscious beings. So whatever is experienced simultaneously by several minds is described as intersubjective experience; and whatever is valued in the same way by a number of persons is said to have intersubjective value. The term is more especially used in conjunction with the term intercourse (intersubjective intercourse) to denote the intercourse of several minds. J. Ward lays special stress on intersubjective intercourse as a potent factor in the development of the human mind.

See J. Ward, *Naturalism and Agnosticism* (1907), *Psychological Principles* (1920); R. Goldscheid, *Entwicklungswerttheorie* (1908).

INTERVAL, a space left between the component parts of a continuous series, a pause in continuous action, a period of time intervening between two other points of time. (Lat. *intervallum*, space between the palisades on a rampart [*vallum*], or between the rampart and the tents of the legionaries.) In military language "interval" is the lateral space between men or bodies of troops, measured from the flank of one body to the flank of the next. It is used in contradistinction to "distance," the space from front to rear. In medical language "interval" is used of the intervening periods between attacks of a disease, particularly of the periods of a normal condition of mind sometimes experienced by an insane person, a "lucid interval."

In music, an interval is the distance separating one note from another in respect of pitch. It is named according to the number of degrees of the scale, otherwise the number of alphabetical notes, included by the two notes which contribute it. Thus E to F, E to F sharp and E to F double sharp are all seconds because there are in each case two degrees of the scale included. Similarly E to G, E to G sharp and E sharp to G are all thirds because there are three alphabetical notes included in each case. It is obvious, however, that the actual intervals are not the same in these cases and additional qualifying terms are therefore employed. Thus E to F, E to F sharp and E to F double sharp are minor, major and augmented second respectively; while E sharp to G, E to G and E to G sharp are similarly diminished, minor and major thirds. Intervals beyond the 9th are regarded as repetitions and classed as compound. (*See* MUSIC.)

INTESTACY, in English law, applies to the case of a person who dies leaving property but no will or one which fails to operate. It is also applied under the Administration of Estates Act, 1925, to cases where a person dies leaving a will which does not dispose of all of his property; such a person is intestate so far as his undisposed property is concerned and the rules as to intestacy apply to this property.

Formerly the devolution of property where its owner died intestate depended upon whether such property was realty or personalty. At common law the realty vested immediately on the

owner's death in his common law or customary heir while his personalty vested in the ordinary before the Probate Act of 1857 and after that act in the judge of the court of probate. This rule was modified by the Conveyancing Act of 1881, but the Transfer of Land Act, 1897, which enacted that fees simple should be administered by the personal representatives of the deceased owner did not affect this rule until the probate court appointed administrators of the real property of an intestate if vested in his heirs. Now, by the Administration Act of 1925, all that is changed; and on the death of a person absolutely intestate all his property, real and personal, vests in the judge of the court of probate until that judge appoints an administrator. It is to be remembered in this connection that a hereditary title of honour is, in law, realty but that modern legislation has no application to it and that it descends according to the old law of inheritance, *i.e.*, to the heir even notwithstanding any will of the deceased owner or any claim of creditors.

Until Jan. 1, 1926, on the death, intestate, of an owner of heritable estates in land, *i.e.*, estates in fee simple and estates in fee tail, his fee simple estates vested in his heir and his fee tail in the heir of his body. On the other hand his personalty vested, as before mentioned, in trust, after payment of his debts, for his next of kin according to the Statute of Distribution, 1670–71. The Administration of Estates Act, 1925, has, so far as England is concerned, abolished the whole law of inheritance. Henceforth an heir will take only as a person mentioned in the grant of an estate in land. The heir of the body of a deceased tenant in tail will take under this head, and when property is limited to a person and on his death to his heir, it will vest in his heir, notwithstanding his will, as the rule in *Shelley's case* has been abrogated. Subject to these limitations, on the death of an owner of real and personal property intestate all his estate vests in his administrators on their appointment by the court. They hold his real estate on a trust for sale; this and the personalty form a joint fund for the payment of his debts and subject thereto such fund is to be distributed among the persons entitled under that Act. If there are no such persons the fund goes to the Crown as *bona vacantia.*

By the Administration of Estates Act, 1925, not merely the law of inheritance but the ancient preference of the male over the female line is abolished. On the death of a spouse intestate if the other spouse survives he or she will be entitled absolutely to all the deceased's personal chattels, a first charge of £1,000 on the estate whether the deceased died childless or not and a life interest in half of the rest of the estate: if the deceased died childless the life interest is in the whole of the residue. Subject to this the whole estate is divided equally between the descendants of the deceased, grandchildren of deceased children taking equally their parent's share, no share of an infant to vest absolutely until the infant comes of age or marries. Meanwhile the infant's share is to be held in trust for him by the administrators who have power to apply the income for the infant's maintenance and half of his prospective share for his advancement. If there are no descendants then the estate is to go to the deceased's parents equally or, if one is dead, to the survivor. If there are no brothers or sisters of the whole blood those of the whole blood equally, descendants of a deceased brother or sister to any degree taking *per stirpes, i.e.*, by family, the interest which their deceased ancestor would, if he were alive, have taken *per capita, i.e.*, as an individual member of the inheriting class. If there are no brothers or sisters of the whole blood those of any of the half blood succeed in the same way and if there are none of them then the grandparents, or such as may be surviving, succeed. If there are no grandparents surviving the property both real and personal goes to the Crown as *bona vacantia.*

It will be well to notice that the Administration of Estates Act makes three great changes as to the devolution of property on death. First, the whole law of inheritance is abolished and all an intestate's property devolves beneficially on his statutory next of kin; secondly, representation of a deceased ancestor is inherited in the collateral line, and thirdly no relative beyond the grandparents and their descendants is entitled to claim as next of kin. (J. A. St.)

Scotland.—In the law of Scotland heritage descends to the heirs-at-law while the free movable estate of the intestate is divided amongst the heirs *in mobilibus* who are the next of kin and those entitled to share in the succession under the Intestate Movable Succession Acts. 1855 to 1919. The heir of the heritable (*i.e.*, real) property, if one of the next of kin, must collate with the next of kin if he wishes to share in the movables. Proximity of kin is reckoned in the same order as in the case of inheritance. The Intestate Movable Succession Acts, among other changes, allow the issue of a predeceasing next of kin, not more remote than brothers and sisters, to come in the place of their parent in succession to an intestate; give the father of an intestate dying without issue one-half of the movable property in preference to brothers or sisters; and if the father be dead, a similar preference entitles the mother to succeed to the whole, failing the father and brothers and sisters: they admit brothers and sisters uterine in the absence of brothers and sisters german or consanguinean, also father and mother.

There are now rights of succession in both heritage and movables between a mother and her illegitimate issue under the Legitimacy Act. 1926, s. 9 (4). (J. Wa.)

United States.—The devolution of both real and personal property is governed in all States by statute. The American legislation at an early period disregarded the common law rules of inheritance that gave preference to the eldest male and to males over females, and was modelled upon the civil law rules of inheritance as set forth in the 118th Novell of Justinian and followed by the English statute of distributions governing the devolution of personal property. The distinction between real and personal property remains important inasmuch as in most States realty vests immediately upon the death of the intestate in his heirs, whereas the title to personalty vests in the administrator for benefit of the next of kin. Between the time of the intestate's death and the appointment of an administrator, title to the personalty remains in abeyance but relates back to the intestate's death upon the grant of letters of administration. Furthermore, the devolution of realty is governed by the law of the State where it is situated, but personalty descends according to the law of the deceased's domicile.

The different State statutes of distribution have infinite variations. The rights of the surviving spouse are uniformly favoured. Curtesy (*q.v.*) is generally abolished, though dower (*q.v.*) is widely retained, the widow generally being required to elect between dower and the right to such distributive share as she would be entitled to under the statutes. The right of representation is generally limited to lineal descendants or close collaterals, and except where representation is permitted, kindred of the degree nearest to the intestate succeed to the exclusion of those of more distant degree, degree of kindred being reckoned according to the civil law principles. When all the heirs are of an equal degree of consanguinity, they commonly take *per capita,* but where they stand in different degrees the more remote take only *per stirpes.* Such States as California, Louisiana, New Mexico and Texas, where the civil law of Spain was once in force, have retained many features of intestate succession peculiar to the civil law. (J. M. La.)

INTESTINAL OBSTRUCTION (ILEUS), in surgery, a condition in which the onward passage of the intestinal contents is prevented. It is often associated with strangulation of the gut, leading to gangrene, and with systemic poisoning due to the absorption of toxins, resulting from the changes in the intestinal wall. The sole availing treatment is surgical, and that at the earliest possible moment. Intestinal obstruction may be conveniently divided into acute and chronic.

Acute Intestinal Obstruction.—One of the most urgent of surgical emergencies. The following are its chief causes: (1) strangulation by bands or adhesions or through apertures; (2) volvulus; (3) acute intussusception; (4) congenital malformations of the intestines; (5) the impaction of foreign bodies. Acute obstruction is also the natural termination of chronic obstruction, and often accompanies appendicitis and hernia (*qq.v.*).

(1) *Strangulation by Bands or Adhesions or through Apertures.*—These bands may result from stretching of inflammatory adhesions left by a former peritonitis, and are commonly situated between different parts of the mesentery or between the mesentery and another organ such as the appendix. A loop of bowel passes under a short constricting band and cannot return, or if the band is long it may form a noose in which the bowel is strangled (fig. 1.) A coil of intestine may also slip into a hole in the mesentery or omentum or find its way into a pouch of peritoneum, forming what is known as an internal hernia. The patient is abruptly seized with acute abdominal pain associated with collapse. The pain is usually referred to the umbilicus, but this is no guide to the situation of the lesion. Vomiting is persistent, and starts the earlier as the obstruction is higher in the intestinal tract. Ultimately it becomes faecal. There is no obvious tumour; constipation is present, the abdominal walls are flaccid at first, but if no relief is obtained become tender when peritonitis ensues. In cases not treated by operation the average duration is five to seven days, and death takes place from exhaustion or from toxaemia following peritonitis.

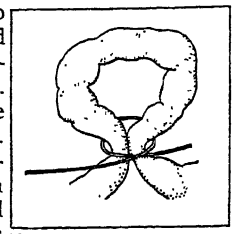


FIG. 1.—INTESTINE STRANGLED BY A BAND OF TISSUE

(2) *Volvulus* is a twisting of the gut usually preceded by chronic constipation. There are two chief varieties: (1) in which the bowel is twisted upon its mesenteric axis (fig. 2); (2) in which it is wound round another coil of intestine. The sigmoid flexure is the commonest seat for volvulus. When once present, plastic peritonitis fixes the coil in position and the blood supply becomes obstructed. The acute symptoms start abruptly and are those of internal strangulation, but the pain at first is more intermittent in type. There is usually early tenderness over the spot and constipation is absolute. Much distress is occasioned by abdominal distension from flatus, which develops with remarkable rapidity. The swelling is localized at first. Spontaneous natural cure is unknown, and without surgical interference death is inevitable.

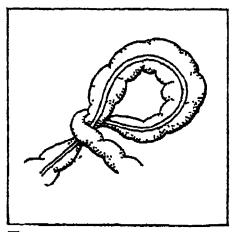


FIG. 2.—BOWEL TWISTED UPON ITS MESENTERIC AXIS

(3) *Acute Intussusception* forms about 30% of all cases of intestinal obstruction, and is the most common variety found in children. More than 50% of the cases are found during the first ten years of life, and half that amount in babies under one year; the large preponderance is in males. By intussusception is meant an invagination or protrusion of a part of the intestine in the lumen of the intestine immediately below it; the lower part of the intestine may be said to have swallowed that immediately above it. The mesentery attached to the upper portion is necessarily dragged in with it. The condition may be seen by referring to the diagram (fig. 3). It is to the constriction of the vessels in the entering mesentery and later to their possible complete obstruction that are due the late serious phenomena of intussusception, *e.g.*, gangrene or rupture of the gut. Peritonitis also ensues, and by the formation of adhesions between the serous coats of the entering and returning parts leads to irreducibility of the intussusception. Spontaneous reduction of the invagination sometimes occurs, but the common result is gangrene with perforation of the intestine and acute septic peritonitis. Occasionally when there is no perforation adherence takes place between the segments, and the gangrenous portion sloughs off and is discharged by the rectum. The cause of intussusception is said to be violent peristaltic action, however produced. Polypoid tumours or masses of worms, or masses of irritating ingesta, are said to lead to its occurrence. X. Dolore and R. Leriche, however, contend that the primary factor is congenital mobility of the caecum, and that this explains why two-thirds of the cases occur in children less than one year old. Intussusception is met with in four chief situations: (*a*) the ileo-caecal, which is said to be the most frequent, constituting 44% of all cases (Treves); (*b*) the enteric variety, involving the small intestine; (*c*) the colic form; (*d*) the ileo-colic, the ileum being invaginated through the ileo-caecal valve. Intussusception may be acute or chronic, sometimes lasting intermittently for years. The acute form is the most common. In young children there is severe pain, at first paroxysmal but later continuous; vomiting is less early and less continuous than in strangulation by bands, and tenesmus, much straining and the passage of blood and mucus from the anus are common. Collapse soon supervenes. Early in the case the abdomen is but little distended, and in about half the cases a distinct tumour can be felt. Sometimes the invaginated gut presents at the anus. Chronic intussusception occurs more frequently in adults than in children; the symptoms may resemble chronic enteritis and be so indefinite that the nature of the illness remains undiagnosed until an acute attack supervenes, or the patient succumbs to the diarrhoea, vomiting and haemorrhage.

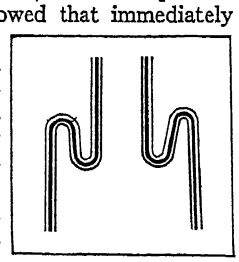


FIG. 3.—VAGINATION OF INTESTINE INTO PART BELOW

(4) *Congenital Malformations of the Intestines.*—Persistence of Meckel's diverticulum, a structure which passes between the navel and the middle of the ileum and represents the nutrient canal of the foetus, may act as a band. Cases have been recorded in which the small intestine ended in a blind pouch. Imperforate anus is a fairly frequent occurrence in young infants, but attention is usually called to the condition. Partial strictures of the intestine, if the stricture be not too narrow, may pass unnoticed for years, and final complete obstruction may result from a blockage of the stricture by some foreign substance such as a plug of hard faecal matter or a fruit stone.

(5) *Impacted Foreign Bodies.*—These are gall-stones, faecal concretions (enteroliths) and foreign bodies swallowed by accident or otherwise, though knives, coins, pipes, flints, etc., swallowed by jugglers, are known to have passed by rectum without injury. The caecum and duodenum are favourite situations for obstruction. Foreign bodies may remain weeks or months *in situ* before giving rise to serious symptoms. Their diagnosis has been much simplified since the introduction of the X-rays.

Chronic Intestinal Obstruction.—The causes of chronic obstruction are very numerous, and may be divided into the following groups: (1) intra-intestinal conditions, *i.e.*, the impaction of foreign bodies and impaction of faeces; (2) affections of the intestinal wall such as stricture, new growths in the intestine, particularly those of a malignant type, adhesions or matting together of the intestines from peritonitis or kinking of the gut from disease of the mesenteric glands; (3) chronic intussusception; (4) compression of the bowel by a tumour or bands developing outside the intestine. Of these the commonest are malignant growths and faecal impaction.

The general symptoms of chronic obstruction are more or less alike. The patient is attacked with gradually increasing constipation, which may alternate with diarrhoea which is generally set up by the irritation of the retained faeces. In obstruction due to malignant growths low in the rectum the character of the motions is changed, they become scybalous, pipe-like or flattened. The abdomen becomes distended, and at intervals severe symptoms may supervene, consisting of pain and vomiting with complete constipation owing to some temporary complete obstruction. The attacks usually pass off, and relief may be obtained naturally or by the administration of a purgative, but they have a tendency to recur and in malignant disease to increase to complete obstruction. Finally a seizure may persist and take on all the characters of an acute attack, and death may supervene from exhaustion, perforation or peritonitis, unless immediately treated. When it arises from simple stricture no tumour is to be felt, but in malignant disease the tumour may frequently be palpated, unless during an acute attack, when the abdomen is much distended with gas.

(1) *Faecal Impaction* is not uncommon in adult females who have suffered from chronic constipation. The common seat of the blockage is in the colon, chiefly in the sigmoid flexure and in the

rectum, but it may occur in the caecum. The accumulation may form a doughy tumour, which in parts may be nodular and intensely hard. The causes are due to the state of the contents of the bowel itself, to congenital or acquired weakness and diminished expulsive power of the bowel, or to painful affections of the anus, fissures, piles and painful bladder affections. The acute symptoms are always preceded by a prolonged period of malaise; the breath is offensive and the tongue foul, and the temperature may be raised from the absorption of toxins. Faecal impaction requires the regular and repeated administration of large enemata, given through a long tube, together with the administration of calomel and belladonna. Large impacted masses in the rectum may be broken up and removed by a scoop.

(2) *Strictures of the Intestinal Wall.*—Simple strictures are infrequent, and are dealt with by the operation of lateral anastomosis. They follow dysenteric or tuberculous ulceration or the passage of gall-stones. Stricture due to carcinoma of the intestinal wall occurs usually in the old or middle-aged, and the symptoms come on insidiously. As soon as the condition is diagnosed an attempt should be made to remove the tumour if freely movable, or if this is not possible to afford relief by short-circuiting the intestine or by colotomy.

(3) *Chronic Intussusception* has been frequently mistaken in the diagnosis for rectal polypus, cancer, tuberculous peritonitis, etc. (Treves). If diagnosed it may be reduced by inflation with air, but frequently too many adhesions are present for this to be possible, and laparotomy with excision of the mass should be undertaken; the results are said to be very encouraging.

(4) *Compression of the Bowel* due to a tumour or bands external to the bowel may occasionally give rise to obstruction. An exploratory operation should be undertaken for the excision of the tumour, or the separation of adhesions and release of the bowel, or if the intestines are much matted together by peritonitis an intestinal anastomosis may give relief. Obstruction due to paralysis of the muscular coat of the intestine has been described (adynamic obstruction), but its existence is a subject of dispute.

(H. L. HE.)

INTESTINE, in anatomy, the lower part of the alimentary canal; in man and mammals divided into the small intestine, from the pylorus to the iliocaecal valve, and the large, reaching from the caecum and colon to the end of the rectum. The word is frequently applied to the whole of the alimentary canal in invertebrates. (*See* ALIMENTARY CANAL.)

INTOXICATION, poisoning, or the action of poisons, whether of drugs, bacterial products or other toxic substances, and hence the condition resulting from such poisoning, particularly the disorder of the nervous system produced by excessive drinking of alcohol. (*See* INEBRIETY and DRUNKENNESS.)

INTRANSIGENT, one whose attitude is that of an irreconcilable. The term is used chiefly of politicians of an advanced type; those in complete antagonism to the existing form of government; but is especially applied on the continent of Europe to members of legislatures holding extreme Radical views. The word is also used non-politically, in the sense of intractability and intolerance.

INTROIT: *see* PLAINSONG.

INTROSPECTION, in psychology, the process of examining the operations of one's own mind with a view to discovering the laws which govern psychic processes (Lat. *introspicere,* to look within). The introspective method has been adopted by psychologists from the earliest times, more especially by Hobbes, Locke, Berkeley, Hume, and English psychologists of the earlier school. It possesses the advantage that the individual has a more direct and fuller knowledge of his own mind than of any other mind, and is able therefore to observe its action more accurately under systematic tests. On the other hand it has the obvious weakness that in the total content of the psychic state under examination there must be taken into account the consciousness that the test is in progress. This consciousness necessarily arouses the attention, and may divert it to such an extent that the test as such has little value. Such psychological problems as those connected with the emotions and their physical concomitants are especially defective in the introspective method; the fact that one is looking forward to a shock prepared in advance constitutes at once an abnormal psychic state, just as a nervous person's heart will beat faster when awaiting a doctor's diagnosis. The purely introspective method has of course always been supplemented by the comparison of similar psychic states in other persons, and in modern psychophysiology it is of comparatively minor importance.

See PSYCHOLOGY, ATTENTION, etc.; G. F. Stout's *Manual of Psychology* (1919).

INTUITION, a term employed in philosophy and in ordinary life in many different meanings, some of which indeed are not only different but opposite. To disentangle them all adequately would require a discussion of the philosophical conceptions which lie at their several bases. The salient points may be indicated as follows. The constant element in the meaning of the term is that of direct or immediate apprehension.

Difficulty of Definition.—The difficulties and differences arise from different views as to what really is apprehended directly, as distinguished from what only appears to be so apprehended. One thing all would probably be agreed upon, namely, that the term intuition excludes all inference, all discursive reasoning, which is an indirect rather than a direct mode of apprehension. For the rest, however, the views are very conflicting. Some would include under intuition both sense intuition (or sense perception), like seeing a patch of colour, and conceptual or intellectual intuition, like grasping that "things equal to the same thing are equal to one another." Some would restrict the term to sense intuition only, and exclude all intellectual or conceptual elements from it. And others, again, employ the term to denote a process that is hardly comparable with ordinary sense-perception or with ordinary intellectual intuition. This is true not only of certain mystics, but also of some philosophers. In ordinary life, moreover, the term is often used to cover beliefs or prejudices which one cannot justify or excuse. Now even if intuitions may need no justification, it is a flagrant fallacy to treat every unwarranted opinion as an intuition, not to say an inspiration.

In Spinoza's Philosophy.—In the history of modern philosophy the term intuition occupies a prominent position chiefly in the philosophy of Spinoza, in the moral philosophy of the so-called intuitionist or intuitionalist school, and in the philosophy of Bergson. The intuitionist school of moral philosophy is dealt with in the articles ETHICS and ETHICS, HISTORY OF. So we need only add a few words about intuition in the thought of Spinoza and of Bergson. Spinoza distinguished three main grades of knowledge or cognition. The lowest is that which is merely empirical, and does not rise above sense-perception; the next higher stage is what may be called scientific knowledge, the knowledge acquired by careful reasoning about observed phenomena—at this stage knowledge is no longer confined to mere particulars, more or less in isolation from each other, but includes the laws which connect them and gives them a certain orderliness. At the highest stage human knowledge rises to the comprehension of the whole universe as one inter-connected, self-dependent system, a complete pattern, so to say, of which the laws discovered at the second stage are the continuous but single strands. This highest kind of knowledge Spinoza called "intuitive knowledge" (*scientia intuitiva*). It rises above empirical and scientific knowledge, but it grows out of them; they culminate in it. Spinoza did not want to deprecate either sense perception or ordinary conceptual activity when he set up "intuitive knowledge" as the goal of intellectual and spiritual endeavour.

In Bergson's Philosophy.—In the philosophy of Bergson the case is rather different. His stress on intuition is definitely a protest against what he conceives to be the excessive tribute usually paid to intellect, or intelligence, and to science as the ripest fruit of intelligence. Bergson's advocacy of the claims of intuition is one aspect of the growing recognition in recent decades of the part played by instinct, as contrasted with intelligence in human life. For Bergson intuition is simply "instinct that has become disinterested, self-conscious, capable of reflecting upon its object

and of enlarging it indefinitely." Intelligence, according to Bergson, has for its original function the construction and use of inorganic tools in the service of life. It is, therefore, most at home in the world of inert solids. Now, for the practical purpose of making tools it is convenient to treat material bodies as discrete units each divisible *ad libitum*. But when intelligence becomes theoretical, and seeks to explain life and thought as well as inert matter, then it leads astray. For it tends to treat all things as if they consisted of lifeless matter, and the whole of reality is reduced to a dead mechanism, for intelligence is unable to comprehend life.

This defect of intelligence must be made good by intuition, which as instinct is moulded on life, so that its procedure is organic, not mechanical. When the consciousness which slumbers in instinct awakes, when it is wound up into intuition instead of being wound off into action, it can reveal the most intimate secrets of life. Intuition leads us to the very inwardness of life as successfully as intelligence guides us into the secrets of matter. Human consciousness is predominantly intellectual. But man is not entirely lacking in intuition, which functions whenever our deepest interests are at stake. "On our personality, our liberty, on the place we occupy in the whole of nature, on our origin and, perhaps, also on our destiny, it throws a light feeble and vacillating, but which none the less pierces the darkness of the night in which the intellect leaves us." And it is the function of philosophy to seize, to expand, and unite these floating intuitions, and so to introduce us into the spiritual life. Still, intuition must not be divorced from intellection, nor philosophy from science. A philosophy which rises upon and above scientific foundations is a very different thing from mere mysticism.

Largely as the result of Bergson's stand against the exaggerated estimate of the conceptual or intellectual elements in human orientation, various other thinkers have voiced the claims of what has been called the non-rational elements in human knowledge. It is possible that the pretensions of some forms of rationalism need checking. But the non-rational is apt to be rather inarticulate, and it is easy for obscurity to harbour the irrational as well as the merely non-rational or merely non-conceptual. (*See* KNOWLEDGE, THEORY OF; LOGIC; ETHICS).

See H. Bergson, *Introduction to Metaphysics* (1912) and *Creative Evolution* (1922); R. Müller-Freienfels, *Irrationalismus* (1922).

(A. Wo.)

INTUITIONISM: *see* INTUITION, ETHICS and ETHICS, HISTORY OF.

INULIN, in chemistry, a starch-like carbohydrate $(C_6H_{10}O_5)_{6n}$, known also as alantin, menyanthin, dahlin, synanthrin and sinistrin. It occurs in many plants of the large family *Compositae,* to which the elecampane (*Inula Helenium*) belongs; and forms a white tasteless powder, sparingly soluble in cold water, very soluble in hot water and insoluble in alcohol. It is coloured yellow by iodine, and reduces ammoniacal silver and gold solutions, but not Fehling's solution. Heated with water or dilute acids, it is converted into laevulose (*d*-fructose). (*See* CARBOHYDRATES.)

INVALID COOKERY. As the aim in invalid cookery is to build up bodily weakness and strengthen the tissues, light and nourishing food should be given that entails a minimum of effort for the digestive organs. Small, frequent meals should be the rule, and these ought to be served as daintily as possible to attract the eye of the patient. Hence, moulds and other receptacles used for invalid cookery should be small. Where possible, broiled or steamed food is best, as by these methods the maximum of nourishment is conserved. Never give fried food to invalids. The best invalid food for many serious cases is milk. Doctors' special orders should be followed accurately. As a general rule, unless otherwise ordered, a fever patient requires a fluid diet, mainly milk. Milk may be mixed with lime water or barley water, or peptonized powders are sometimes used for those patients who find difficulty in taking large quantities of plain milk, but allowance should be made for dilution.

Where "solids" are permitted, corn-starch, arrowroot, patent barley and egg jellies are recommended. Beef juice and meat extracts, though excellent in certain cases, should not be given to patients suffering from rheumatic troubles. Diabetic cases are not generally allowed starch and sugar, but plenty of fats and proteid are required. Saccharine should be substituted for sugar and gluten and proteid breads are useful. Gastric patients generally need peptonized foods, and when convalescent they may take beef juice or light meats; *e.g.,* chicken or lamb. In tuberculosis it is very necessary to give plenty of nourishing food, especially milk, fats and oils; *e.g.,* cream, fat bacon, yolks of eggs, etc. Lemon and orange juice and thin barley water are useful invalid drinks. Where iced water is given great care should be taken that the ice is pure and well washed.

Barley water can be made either with uncooked chicken barley or cooked pearl barley; many doctors advise the former method. The barley water is needed for cleansing purposes. For this, wash 2 oz. of uncooked chicken barley, place in a jug and pour over it one pint of boiling water; allow to stand until cool and strain off the clear liquid. Serve with a slice of lemon. Ordinary barley water is prepared by boiling 2 oz. of washed pearl barley in one pint of water until quite soft. Strain off the liquid. Flavour with lemon and sweeten to taste.

Oatmeal gruel is made with patent groats, English fine oatmeal or Scotch meal; for infants the fine oatmeal or prepared groats is best. Mix one teaspoonful with a little cold water; stir in half a pint of cold water; boil for fifteen minutes stirring all the time to keep free from lumps; strain and mix with half the quantity of milk; reheat, and sweeten and flavour to taste.

(J. A. St.)

INVALIDITY PENSIONS. It is a generally accepted principle in almost all civilized countries that where an employed person becomes permanently incapacitated for work through sickness or accident he should receive from some source regular periodical payments with a view to preventing him from falling into destitution. Provision of this kind may be made in several different ways. In the case of persons employed by the State, local authorities, statutory undertakings or many establishments, provision is usually made under a superannuation scheme. towards the cost of which contributions are paid by the employer and ordinarily by the employees also. Where the incapacity is due to an accident or an industrial disease arising out of the worker's employment, the worker becomes entitled to relief under the laws relating to workmen's compensation. (*See* WORKMEN'S COMPENSATION.) It is, of course, also open to any individual employed person to make provision for himself by private insurance. There remains, however, a large residue not covered by any of these forms of provision and in most countries the State has assumed the responsibility of making provision against the risk of invalidity amongst the general body of workers who are not otherwise protected.

In Great Britain such provision was first made in 1911 as part of the scheme of national health insurance. (*See* NATIONAL INSURANCE: *Health.*) Under that scheme an insured person who is rendered incapable of work through sickness or physical or mental disability is entitled in the first instance to receive sickness benefit up to a maximum period of 26 weeks, and if incapacity continues beyond the end of that period he remains entitled to weekly payments at a reduced rate in the form of disablement benefit for so long as his incapacity continues, until he attains the age of 65, when the provisions of the old age pensions scheme become available.

Under the Blind Persons Act, 1920, a person who is so blind as to be unable to perform any work for which eyesight is essential is entitled to a pension at the age of 50 on the same conditions as are applicable to persons of 70 under the general scheme of non-contributory old age pensions. (*See* OLD AGE PENSIONS.)

In all countries except Great Britain, State provision against invalidity is made not in conjunction with the State scheme of sickness insurance but ordinarily in association with the scheme of old age pensions, or in some cases under an entirely independent scheme. The essential difference between the schemes in force in most European countries and the British scheme is that the former involve the conception of invalidity as a permanent physical condition requiring the minimum amount of supervision,

whereas under the latter the payments are subject to the furnishing at short intervals of proof of continued incapacity for work.

It is interesting to note that although several European countries had not, up to 1928, adopted general compulsory schemes of insurance against sickness, schemes of compulsory insurance against permanent invalidity were in operation in every country except Hungary, Norway, the Baltic States and parts of Switzerland. The schemes are ordinarily on a contributory basis, the cost being shared between employers, workers and the State. In some countries the schemes apply only to certain classes of workers, for example, in Austria, to miners and salaried employees only, and in Denmark, only to such persons as have voluntarily insured themselves against sickness.

German System.—The following short summary of the German scheme will give an indication of the general character of the schemes in operation in most European countries:

In Germany a scheme of insurance for invalidity and old age pensions for all manual workers was introduced in 1889 and a scheme for salaried workers in 1912. Under the former scheme the State contributes a fixed sum annually towards each pension, while under the latter it makes no contribution towards the pension but bears the whole cost of administration. The contributions are graded according to earnings and are shared equally between employers and employed. The amount of the pension also varies in accordance with earnings and with the number of contributions paid. An insured person is entitled to a pension if, after he has exhausted his title to sickness insurance benefit, that is to say after 26 weeks of incapacity, he remains incapable, owing to sickness or infirmity, of earning one-third of his usual wages. A small additional allowance is made in respect of each dependent child of the insured person. The attainment of age 65 is treated for the purposes of the scheme as equivalent to permanent invalidity, and pension is thereafter payable for life. The scheme is administered by insurance boards composed of Government officials and representatives of employers and insured persons. These boards have been pioneers in preventive and curative work and have provided sanatoria, hospitals and other institutions in which preventive and remedial treatment is given. Treatment in such institutions may in suitable cases be substituted for the invalidity pension.

In Australia a non-contributory scheme of invalidity pensions, of which the whole cost is met by the State, has been in operation since 1908. Up to 1928 no State scheme had been introduced in Canada, South Africa or New Zealand. In the United States also there is no public provision for insurance against invalidity.

(E. HA.)

INVAR, an alloy of nickel and steel, characterized by an extremely small coefficient of thermal expansion; it is specially useful in the construction of pendulums and of geodetic measuring apparatus, in fact, in all mechanical devices where it is an advantage to avoid temperature compensation. The name was chosen as expressing the invariability of its dimensions with heat. (*See* CLOCKS; GEODESY.)

INVARIABLE PLANE, in celestial mechanics (*q.v.*), that plane on which the sum of the moments of momentum of all the bodies which make up a system is a maximum. It derives its celebrity from the demonstration by Laplace that to whatever mutual actions all the bodies of a system may be subjected, the position of this plane remains invariable.

INVENTIONS AND DISCOVERIES. The act of invention, like many other human activities, is difficult to define precisely. The distinction often made between invention and discovery is not logically justifiable. For example, the great advance which primitive man made in the first use of pottery may be viewed either as the discovery of certain properties of burnt clay or as an invention in forming and hardening clayey materials into valuable utensils. As in this instance, most cases of inventive progress include both an element of discovery and an element of invention.

Definitions of the process of invention set up in the patent laws of most countries involve three fundamental ideas; novelty, utility and the ability of the device to work. With regard to the third point, for example, the rules of the U.S. patent office require that an inventor prove, on demand, that his device is operable. This is why inventors of pretended "perpetual motion" machines are asked first to demonstrate a working model. But even in patent law, exactness of definition of invention is difficult as is witnessed by the continual stream of patent cases in the courts of most countries.

The history of invention begins before that of mankind. Many inventions have unquestionably been made by animals; for example, nests, a crude use of tools, the beginnings of language. It is probable, furthermore, that no distinction of kind can be drawn between the most modern inventions of man and very ancient animal "inventions" which have been crystallized into instincts like those of the ants or bees or in bodily devices like the flexible backbone of vertebrates, the force-pump heart or the warm blood of birds and mammals. It is customary and justifiable for evolutionists to speak of the "invention" of the backbone by some species of primitive worm which developed the ability to stiffen itself against the flowing water of ancient streams.

In the history of mankind as distinct from that of his more ancient animal ancestors, the most fundamental and useful inventions were made, undoubtedly, before recorded history. Many lists of the "world's greatest inventions" have been prepared, all widely different. The following list of seven has no unusual authority but is perhaps defensible.

Most important of all human inventions is probably the invention-discovery of the function of the seeds of plants, resulting in agriculture and in freeing mankind from dependence on accidental finds of food. Next in practical importance although perhaps first in time, was the discovery of how to control fire. Third was the invention of pottery. These three are prehistoric. Their combined effect was to free man in considerable degree from threats of immediate starvation. Fire made available (by cooking) some foods not previously edible. Pottery dishes made it possible to cook foods more successfully and to store them for hours or days; pottery may have been both the result and partially the cause of settled houses, for fragile dishes could not be carried on daily wanderings and pot-stored foods in cave or hut created an incentive to return to that same spot at nights. Two other inventions of great human importance seem to have been made in ancient Babylonia, or close by in Indo-Persia. One is the invention of writing; the other the invention of standards of measurement, weight, time and money.

Two other great inventions are modern ones: the germ theory of disease imagined by Pasteur and the invention of tinned food. The method of preserving food in tins or other containers is probably defensible as the greatest of all inventions in historic times. Its effect has been to relieve mankind of dependence upon the annual harvest, since food can be carried over from year to year, or upon the local food supply, since canned food can be imported. It has been said that modern canned food for his armies would have enabled Napoleon to conquer the world. It is impossible to date the invention of food preserving precisely or to ascribe it to any individual. Like many of the world's greatest inventions and discoveries, the art was developed gradually over many years and by many individuals. It is significant that of the seven inventions just suggested; seeds, fire, pottery, writing, standards, the germ theory and canning, all except Pasteur's discovery are hopelessly anonymous.

Other lists of this kind often include speech, the domestication of animals, the concept of medical treatment, the invention of weapons, the development of a form of government, the erection of buildings, and others. In each instance there seem definite reasons for assigning these to lesser rank. Whatever theory one accepts as to the origin of speech, there can be little doubt that it was a slow development, beginning even in animals and characterized by a long series of small inventions; a word here, a bit of grammar there, rather than by any definite inventive act. The same is true of the ideas of leadership and government—devices also familiar, in some degree, to man's animal cousins and probably to his ancestors.

Man's first rude huts probably grew naturally out of shelters

made accidentally by fallen branches or perhaps in imitation of animal nests and lairs, like the nests that orang-utans still make in trees. Weapons, in the form of sticks or hurled stones, were probably also ape possessions long before man. One human invention of real importance was, however, that of the chipping or grinding of flint to make a sharp edge—an invention probably made many times independently in prehistoric days. The bow and arrow, incomparably the cleverest invention of prehistoric weapon makers, is of unknown history. There is some reason to believe it Asiatic and perhaps as ancient as the post-Neanderthal type of man.

The domestication of animals is another development probably slow, accidental and mutual; for the animals first domesticated must have gained much more than they lost by association with man. It is far more probable, for example, that dogs first adopted man than that man singled out the wild dog for a companion. The idea that mankind itself could cure its bodily ills—the central idea of medicine—is inextricably entangled historically with the ideas of religion and of magic; indeed it can scarcely be said, even now, that any large percentage of mankind has real confidence in medical science as distinct from trusted, but mysterious, skill.

In addition to these items, prehistoric times must be credited with the beginnings of mechanics, hydraulics, metallurgy, navigation, chemistry and many other arts, including painting and sculpture, well known from the caves of France. To prehistoric mechanics we owe the lever, the wedge, the saw and probably the pulley and rope. That remarkable invention, the wheel, was probably conceived in Europe or in Asia Minor relatively late in prehistoric times, for the Asian migrants into North America who survived as the American Indians did not possess it. Among the most surprising facts in the history of invention is that this simple and useful idea seems never to have occurred to so large a fraction of the human race.

The first known examples of practical hydraulics are the irrigation canals of Babylonia, but it is probable that both canals and wells were known to still earlier Asian peoples for the same purpose. Well drilling for water might be given rank, indeed, as one of man's really great inventions, were it not that it probably came about naturally and accidentally through the cleaning and deepening of springs as the water receded in times of drought. Drainage, sewerage and internal water supply to houses seem to have been arts begun in Babylonia and reasonably well understood by the time of the great Cretan civilization of nearly four thousand years ago. It is probable that man's first iron was obtained from meteorites found on the ground; perhaps accidentally as a result of trying to chip flint weapons out of the hard, heavy mass. Copper holds rank as probably the first metal made by fire from its ores. Both the Egyptians and the Babylonians evidently understood the metallurgy of this metal more than six thousand years ago.

Among the items of prehistoric chemistry are glazes for pottery, fluxes for use in working gold and other metals, and some knowledge of opaque glass for beads; all of these were already highly developed at the time of the first recovered civilizations of Babylonia. Navigation, probably first discovered by the accident of floating on a log, seems to have developed independently and very differently at different places and times; as witness craft so diverse as the inflated skin boats of Asia, the American Indian canoe, the dug-out tree trunks of Africa and the Pacific Islands, and many others.

Last among great prehistoric inventions should be mentioned lamps and clothes, making man in some degree independent of darkness and cold. The adoption of clothing is so largely instinctive that it seems to have happened over and over again with almost every conceivable material and with infinite variety of custom. The origin of lamps is still uncertain, although the first form was undoubtedly a crude wick floating in a dish of oil and was probably invented by those unknown forerunners of the Babylonians to whom we also owe, it is believed, the knowledge of copper and of irrigation, the invention of writing and not improbably that of the wheel.

Within historic times, one interesting lost chapter of the history of invention is that of the beginnings of mechanism; of things like treadmills and waterwheels and pumps. The first definite records of such things go back to the Greek mechanicians of Alexandria, including Archimedes. However, the picture of mechanics and hydraulics in their day is already that of a well-developed science with a considerable history behind it. It is probable, too, that Greek miners were using stamping and grinding machines for ores several centuries earlier. Mechanical grist mills rotated by oxen, to replace the prehistoric mortar, devices to lift water for irrigation, primitive water clocks to measure time by the drip of fluid through a hole, are other candidates for the honour of the world's first mechanism. To decide between them is now impossible.

The present century is characterized by what is called technology; it is sometimes called the "machine age." This modern civilization, differing in many fundamentals from any previous period of world culture, may be said to depend upon five basic inventions and discoveries. First of these, both in time and in importance, is the discovery of the use of coal as fuel and the resulting invention of a practicable steam engine. The principle of the steam engine was known 17 centuries ago. What made it practicable was coal fuel. Second is the improvement of the metallurgy of iron and steel; the chief steps of this being the perfection of the blast furnace, of the Bessemer converter and of the modern rolling mill. Third is the development of electric power; beginning with the physical researches of Oersted, Ampere, Henry and Faraday and culminating in modern dynamos and motors. More recent developments of electricity promise to revolutionize this science and to make it much more useful to man, as a result of the perfection of vacuum-tube methods of handling electrons, such as are used in radio. The fourth basic invention which may be said to support modern technology is the internal combustion engine, with its application to automobiles, motor boats, aircraft and other vehicles. The fifth is cement. Some observers might add others to this list; for example, telephony, cheap aluminium, the aeroplane or printing. It may be objected, however, that these are adjuncts to modern technology and improvements produced by it in the advantages of life, rather than fundamentals which lie at modern civilization's roots.

One invention in a somewhat different field is defensible, however, as among the most fundamental and important of modern times. This is the invention of the joint-stock, limited-liability company, typified by the modern corporation. It would be possible to argue that no social device in human history has accomplished so successfully the divorce of business policies or industrial undertakings from the hazards of individual human lives. Another gain to be credited to the idea of corporate organization is perfected continuity of information and experience from one generation to another.

Calculations are often made of the percentage of modern wealth due to invention, discovery and technology, as distinct from the unaided efforts of man. The following table summarizes one such estimate, rough but perhaps approximately correct for the average annual earnings of the citizens of the United States. It should be noted, however, that in no case are these earnings due solely to invention or to its results. The growing ability of men to work together with each other (as is typified by the corporation) has become, in this modern world, one essential of the production of any income.

It is probably significant that among the activities shown in the table on p. 547, the one with the lowest percentage use of modern technology (fisheries) is the lowest in total earning capacity.

Since the beginning of the 20th century there has developed, chiefly in the United States, a system of invention and discovery which promises revolutionary results. This is what has been called "organized research." Large American corporations have establish well-equipped laboratories staffed by engineers and scientific men of proved ability. The idea is that the co-operative effort of organized, well-equipped staffs of specialists will progress farther and faster in scientific research and in invention or discovery than is possible to the so-called "garret inventor" working alone with limited equipment and meagre funds.

Annual Income in the United States of America

Activity	Total annual income (added value)	Estimated percentage of annual income due to the use of technology	Total annual earnings of technology
	Thousand million of dollars	%	Thousand million of dollars
Farms	15·0	80	12·0
Forests	3·0	50	1·5
Fisheries	·2	10	·02
Mines	8·0	95	7·6
Transportation (including railways)	9·0	100	9·0
Manufactures	26·0	90	23·4
Commerce	30·0	85	25·5
Total	91·2	87·7 (average)	79·02

It is noteworthy that this idea of co-operative research has been tried twice before in human history; first by Aristotle under the patronage of Alexander; second by the Alexandrian school in Egypt under the auspices of the Ptolemies. Little of permanent value in the field can be credited to the efforts of Aristotle. The Alexandrian school has a better record, since it is probable that the discoveries of fundamental principles in geometry, mechanics, hydraulics and pneumatics together with significant advances in optics were accomplished by the Alexandrian group. It is still too soon to determine the value to the world of the renewal of co-operative research. The danger of mere "organized mediocrity" has been suggested. It remains to be seen whether it can be avoided as co-operative research laboratories grow older and perhaps lose inspiration. It is already certain, however, that such co-operative investigation is able to pay dividends of almost immediate utility and money to the individual corporations which use it.

The constituents of what might be called "inventive ability" have not yet been made clear by the psychologists. The mental processes of an inventor may be separated, perhaps into two superficially different methods. One is sometimes called the "Edisonian" method, because of its supposed employment by Thomas Alva Edison. This consists in trying all conceivable possibilities more or less at random. For example, when Edison desired a suitable filament for his electric lamp his procedure, it is said, was to test every thread-like or wire-like material which could be obtained. Thus was it discovered that carbonized bamboo fibre was a suitable material.

The other manifestation of the inventive process is what is loosely called the flash of genius; a sudden inspiration, apparently accidental, which provides the germ of the invention. Although the psychology of such inspiration is quite unknown, it may perhaps be suggested that, after all, the process does not differ so markedly from the first and seemingly more laborious method. It is conceivable that the conscious inspirational flash which solves the inventor's problem really results from long turning over in his mind of the characteristics of the desired invention.

In any inventive process, therefore, it is probable that the essential thing is the inventor's ability to put together, either actually or in imagination, facts the possible mutual relations of which are not obvious. If this be true, the mental processes of the inventor must be nearly the same as those of the author inventing fictional plots. In both cases there must be added, however, a saving salt of critical ability; enabling an author to select plot combinations which are reasonable and workable, and an inventor to select for physical trial the particular imagined combinations of ideas which are most apt to bring practical success. (E. E. F.)

INVENTORY, a detailed list, schedule or enumeration in writing, of goods and chattels, credits and debts, and sometimes also of lands and tenements.

(*See* also BANKRUPTCY; EXECUTORS AND ADMINISTRATORS; STOCK-TAKING.)

INVERARAY, royal burgh and county town of Argyllshire, Scotland. Pop. (1921) 490. It lies on the southern shore of a bay, where the river Aray enters Loch Fyne, 40 m. directly N.W. of Glasgow, and 85 m. by water. Near the church stands an obelisk in memory of the Campbells who were hanged, untried, for their share in the Argyll expedition of 1685 in connection with the duke of Monmouth's rebellion. The ancient market-cross is supposed to have been brought from Iona in 1472. The chief industry is the herring fishery. The town originally stood on the north side of the bay, clustering round an ancient baronial hold, but it was removed to its present site in the middle of the 18th century. Inveraray became a burgh of barony in 1472; and Charles I., while a prisoner in Carisbrooke castle, raised it to a royal burgh in 1648. Much has been done for it by the ducal house of Argyll, whose seat, Inveraray Castle, was built between 1744 and 1761 from designs by Robert Adam. The earls and dukes of Argyll were great planters of trees—mainly larch, spruce, silver fir and New England pines—and their estates around Inveraray are among the most finely wooded in the Highlands. Duniquoich, a timbered conical hill, adjoins the castle on the north.

INVERCARGILL, the chief town of Southland county, South Island, New Zealand, 139 m. by rail S.W. by W. from Dunedin. Pop. (1927) 22,590. It lies on a deep estuary of the south coast named New River Harbour, which receives several streams famous for trout-fishing. It is the centre of the large grazing and farming district of Southland; and has a number of factories, including breweries, foundries, woollen mills and timber-works. The plan of the town is rectangular, with wide streets; and there is a fine open reserve. The harbour is deep and well sheltered, but the greater part of the trade passes through the neighbouring Bluff Harbour, the port of call and departure for steamers for Melbourne and Hobart. Southland was a separate province between 1860 and 1870, but, failing financially as such, rejoined the parent province of Otago. The town is the regular starting-point of a journey to the famous lakes Wakatipu and Te Anau, which are approached by rail.

INVERCLYDE, BARON: *see* BURNS, SIR GEORGE.

INVERELL, a town of Gough county, New South Wales, Australia, on the Macintyre river, 341 m. N. of Sydney, with which it is connected by rail. Pop. (1926) 4,510. It is the centre of an agricultural district producing, chiefly, wheat and maize; the vine is also grown and excellent wine is made. There are silver, tin and diamond mines near the town. Inverell became a municipality in 1872.

INVERFORTH, ANDREW WEIR, 1ST BARON (1865–), British shipowner and administrator, was born at Kirkcaldy, Scotland, on April 24, 1865. He was educated at Kirkcaldy and afterwards adopted a business career, founding in 1885 the firm of Andrew Weir and Co., shipowners and merchants, of London and Glasgow. Having made a large fortune in business, in April 1917 Mr. Weir entered Lloyd George's government as surveyor-general of supply at the War Office, and held this post until Jan. 1919. The same year he was sworn of the privy council and raised to the peerage. He was minister of munitions and supply from Jan. 1919 to March 1921.

INVERNESS, royal burgh, seaport and county town, Inverness-shire, Scotland. Pop. (1921) 20,937. It lies on the Ness. It is an important railway centre, 118 m. N. of Perth by the L.M.S.R. Owing to its situation at the north-east of Glen More, the beauty of its environment and its fine buildings, it is held to be the capital of the Highlands; and in summer it is visited by many tourists. The present castle dates from 1835, and stands on the site of the ancient fortress, blown up by the Jacobites in 1746. Of the churches, the High or Parish church has a tower containing one of the bells which Cromwell removed from Fortrose cathedral. On the left bank of the river stands St. Andrew's Episcopal Cathedral, erected in 1866. Public buildings include a library and museum, with a collection of Jacobean relics, in Castle Wynd. In front of the Town Hall (1882) stands the Forbes memorial fountain, and near it is the old town cross of 1685; at the foot of the latter, protected since the great fire of 1411, is the famous stone called Clach-na-Cudain (Stone of

the Tubs), from its having served as a resting-place for women carrying water from the river. The old gaol spire, slightly twisted by the earthquake of 1816, serves as a belfry for the town clock.

Half a mile to the west of the Ness is the hill of Tomnahurich (Gaelic, "The Hill of the Fairies"). The open spaces include Victoria park; the Ness islands, connected by a bridge with the mainland; and the ground where the Northern Meeting—the most important athletic gathering in Scotland—is held.

Inverness is the great distributing centre for the Highlands, and the annual sheep and wool market is well known. Petroleum is the largest import. Its industries, however, are not extensive, and consist mainly of tweed manufactures, brewing, distilling, nurseries, saw-mills, granite works, an iron foundry and railway shops. There is some shipbuilding and a considerable trade with Aberdeen, Leith, London and the east coast generally. The Caledonian Canal passes within 1 m. of the town on its western side. In Muirtown Basin are wharves and at Clachnaharry the Canal enters Beauly firth. The harbour, formed by the mouth of the Ness, covers about three acres. There are piers and a breakwater at Kessock at the river mouth, with excellent anchorage and a slipway at the junction of the Ness with the Firth. The river at Inverness is crossed by four bridges and a railway viaduct.

Inverness was one of the chief strongholds of the Picts, and in 565 was visited by Columba with the intention of converting the Pictish king Brude, who is supposed to have resided in the vitrified fort on Craig Phadrick, 1½ m. W. of the town. The castle is said to have been built by Malcolm Canmore, after he had razed the castle in which Macbeth according to tradition murdered Duncan. William the Lion (d. 1214) granted the town four charters, by one of which it was created a royal burgh. Of the Dominican abbey founded by Alexander III. in 1233 hardly a trace remains. On his way to the battle of Harlaw in 1411 Donald of the Isles burned the town, and 16 years later James I. held a parliament in the castle to which the northern chieftains were summoned, of whom three were executed for asserting an independent sovereignty. The house in which Queen Mary lived in 1562, when denied admittance to the castle, stands in Bridge street. At the north end of the town Cromwell built a large fort, but with the exception of a portion of the ramparts it was demolished at the Restoration.

INVERNESS-SHIRE, highland county, Scotland, bounded north by Ross and Cromarty, and the Beauly and Moray firths, north-east by the shires of Nairn and Elgin, east by Banff and Aberdeen shires, south-east by Perthshire, south by Argyllshire and west by the Atlantic. It includes the Outer Hebrides south of the northern boundary of Harris, and several of the Inner Hebrides and is the largest shire in Scotland. Its area (excluding water) is 2,695,094 ac., of which more than one-third belongs to the islands. The county comprises the districts of Moidart, Arisaig and Morar in the south-west, Knoydart in the west, Lochaber in the south, Badenoch in the south-east and the Aird in the north. Excepting comparatively small and fertile tracts in the north on both sides of the river Ness, in several of the glens and on the shores of some of the sea lochs, the county is wild and mountainous and the scenery is very beautiful. There are more than 50 mountains exceeding 3,000 ft., among them Ben Nevis (4,406), the highest mountain in the British Isles, the extraordinary assemblage of peaks forming the Monadhliadh mountains in the south-east, Ben Alder (3,757) in the south, and the group of the Cairngorms on the confines of the shires of Aberdeen and Banff. Almost the whole mainland part of the county is occupied by the younger highland schists and metamorphic rocks, with many isolated patches of granite, of which the largest is on the eastern boundary, including Cairngorm. Athwart the county from south-west to north-east strikes Glen More, the Great Glen, or Glen More-nan-Albin, an old fault or line of earth-fracture along which displacements have occurred during more than one geological period. It contains Loch Lochy and Loch Ness, and through it was constructed the Caledonian canal (*q.v.*). Only in the north-east of the shire, and extending up Glen More midway along Loch Ness, does the Old Red Sandstone replace the typical highland rocks. (On the islands, *see* HEBRIDES and SKYE.)

Rivers and Lakes.—In the north-west the Beauly river (16 m.) is formed by the confluence of the Farrar and the Glass. The Enrick (18 m.), rising in Loch-nan-Eun falls into Loch Ness, just beyond Drumnadrochit. The Ness (7 m.), emerges from Loch Dochfour and enters the sea to the north of Inverness. The Moriston (19 m.) flows out of Loch Clunie and falls into Loch Ness 4 m. south of Mealfourvounie (2,284 feet). The Lochy (9 m.), issuing from the loch of that name, runs parallel with the Caledonian canal and enters Loch Linnhe at Fort William. The Spean (18 m.), flowing westwards from Loch Laggan, joins the Lochy as it leaves Loch Lochy. The Nevis (12 m.), rising at the back of Ben Nevis, enters Loch Linnhe at Fort William. The Leven (12 m.) drains a series of small lochs to the north-west of Rannoch, and the Dulnain (28 m.), rising in the Monadhliadh mountains; enters the Spey near Grantown, falling in its course nearly 2,000 ft. The Truim (15½ m.), rising close to the Perthshire frontier, flows into the Spey. Three of the larger rivers of Inverness-shire finish their course in other counties. These are the Spey, which for the first 60 m. of its course belongs to the shire; the Findhorn (70 m.), rising in the Monadhliadh mountains a few miles north-west of the source of the Dulnain; and the Nairn (38 m.), rising within a few miles of Loch Farraline. The two falls of Foyers are celebrated for their beauty, but their volume is affected, especially in drought, by the withdrawal of water for electric power works derived from the river Foyers. Other noted falls are Moral on the Enrick and Kilmorack on the Beauly.

There are many hill tarns and little lakes, considerably more than 200 being named. Loch Ness, the most beautiful and best known, is 22½ m. long, 1¾ m. broad at its widest point and 751 ft. deep. It is the largest body of fresh water in Great Britain, and forms part of the scheme of the Caledonian canal. Loch Oich (4 m. long) and Loch Lochy (9½ m.) also form portions of the canal. Loch Arkaig (12 m.) lies in the country of the Camerons, Achnacarry house, the seat of Lochiel, the chief of the clan, being situated on the river Arkaig near the point where it issues from the lake. The old castle was burnt down by the duke of Cumberland, but a few ruins remain. Loch Quoich (6 m.) lies north by west of Loch Arkaig, and Loch Garry (4½ m.) a few miles to the north-east; Loch Morar (11½ m. long by 1½ broad) is only about 600 yd. from the sea, to which it drains by the river Morar, which falls over a rocky barrier. The loch is 1,017 ft. deep and is thus the deepest in the United Kingdom. Loch Ericht, partly in Perthshire, is 14½ m. long and lies at a height of 1,153 ft., being thus the highest lake of such large size in Great Britain. It is finely situated in wild highland country at the foot of Ben Alder. Loch Laggan (7 m.) and Loch Treig (5½ m.) in the south are situated in the midst of natural forests. The principal salt-water lochs on the Atlantic seaboard are Loch Hourn ("Hell's Lake," so named from the wild precipices rising sheer from the water), running inland for 14 m. from the Sound of Sleat and separating Glenelg from Knoydart; and Loch Nevis (14 m.), a few miles farther south.

The parallel roads of Glen Roy, a glen with a north-easterly to south-westerly trend, a few miles east of Loch Lochy, presented a problem that long exercised geologists. At heights of 1,148 ft., 1,067 ft. and 835 ft., there run uninterruptedly along each side of the glen terraces of a width varying from 3 to 30 feet. They are now generally taken to be the gently sloping banks of lakes dammed up at different levels successively by glacier ice. Further evidences of glacial action are abundant in many places, in the form of roches montonées, striations, moraines, etc. At several points on the coasts remains of old marine terraces are seen at 100 and 25 ft. above present sea-level.

Among the finer glens are Glen Urquhart and Glen Moriston to the west of Loch Ness, Glen Feshie in the east, and Glen Nevis at the southern base of Ben Nevis. Glen Garry, to the west of Loch Oich, gave its name to the well-known cap or "bonnet" worn both in the Highlands and Lowlands. In Glen Finnan, at the head of Loch Shiel, Prince Charles Edward raised his standard in 1745. The great straths or valleys are in the north and east, the chief among them being Strathfarrar, Strathglass and Strathnairn, and the heads of Strathearn and Strathspey.

History.—To the north of the boundary hills of the present counties of Argyll and Perth (beyond which the Romans attempted no occupation) the country was occupied in Roman times by the Picts. The territory was afterwards called the province of Moray, and extended from the Spey and Loch Lochy to Caithness. These limits it retained until the 17th century, when Caithness (in 1617), Sutherland (in 1633) and Ross-shire (in 1661) were successively detached. Towards the end of the 6th century Columba undertook the conversion of the Picts, himself baptizing their king, Brude, at Inverness; but paganism died hard and tribal wars prevented progress. In the 11th century, after the death of Duncan, Scotland was divided between Macbeth and the Norwegian leader Thorfinn, who took for his share the land peopled by the northern Picts. Malcolm Canmore, avenging his father, defeated and slew Macbeth (1057), and at a later date reduced the country and annexed it to the kingdom of Scotland. Insurrections continued until the reign of David I., when colonists of noble birth were settled in various parts of the shire. After the battle of Largs (1263) the Norse yoke was thrown off. In 1300 Edward I.'s expedition to Scotland passed through the northern districts, his army laying siege to Urquhart and Beaufort castles. After the plantation the clan system gradually developed and attained in the shire its fullest power, the chief being the Frasers, Chisholms, Grants, Camerons, Chattan, Macdonalds of the Isles, Clanranald Macdonalds and Macleods. The clans were constantly fighting each other, or their sovereigns.

In many quarters the Protestant movement made no headway, the clansmen remaining steadfast to the older creed. At the era of the Covenant, Montrose conducted a campaign in the interests of the royalists, gaining a brilliant victory at Inverlochy (1645), but the effects of his crusade were speedily neutralized by the equally masterly strategy of Cromwell. Next Episcopacy appeared to be securing a foothold, until Viscount Dundee fell at Killiecrankie, that battle being followed by a defeat of the Highlanders at Cromdale in 1690. The futile rising headed by Mar in 1715 led to a combined effort to hold the clans in check. Forts were constructed at Inverness, Kilchumin (Fort Augustus) and Kilmallie (Fort William); Wade's famous roads—exhibiting at many points notable examples of engineering—enabled the king's soldiers rapidly to scour the country, and general disarming was required.

Prince Charles Edward's attempt in 1745 had the effect of bringing most of the clans together for a while; but the clan system was broken up after his failure and escape. Heritable jurisdictions were abolished. Even the wearing of the Highland dress was proscribed. The effects of this policy were soon evident. Many of the chieftains became embarrassed, their estates were sold, and the glensfolk, impoverished but high-spirited, sought homes in Canada and the United States. As time passed and passion abated, a proposal to raise several Highland regiments for the British army was entertained with surprising favour, among the regiments then enrolled being the 79th Cameron Highlanders. Fort George, afterward the depot of the Seaforth Highlanders, 12 m. N.E. of Inverness, was begun in 1748.

Stone axes and other weapons or tools have been dug up in the peat, and prehistoric jewellery has also been found. Lake dwellings occur in Loch Lundy in Glengarry and on Loch Beauly, and stone circles are numerous, as at Inches, Clava, and in the valley of the Ness. Pictish towers or brochs are met with in Glenbeg (Glenelg), and duns (forts) in the Aird and to the west and south-west of Beauly and elsewhere. Among vitrified forts the principal are those on Craig Phadrick, Dundbhairdghall in Glen Nevis, Dun Fionn or Fingal's fort on the Beauly, near Kilmorack, Achterawe in Glengarry and in Arisaig.

Forests and Fauna.—Deer forests occupy an enormous area, particularly in the west, in the centre, in the south and south-east and in Skye. From the number of trees found in peat bogs, the county must once have been thickly covered with wood. Strathspey is still celebrated for its forests, and the natural woods on Loch Arkaig, in Glen Garry, Glen Moriston, Strathglass and Strathfarrar, and at the head of Loch Sheil, are extensive. Part of the ancient Caledonian forest extends for several miles near the Perthshire boundary. Many of the rivers and several of the lochs abound with salmon and trout, the salmon fisheries of the Beauly, Ness and Lochy yielding a substantial return.

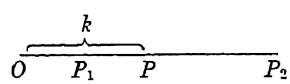
Agriculture.—The percentage of land under crops is small, and almost half the total area is mountain and heath. The Aird and Beauly districts, some of the straths and several of the glens are fertile. Oats are the predominant crop, barley is grown (mostly for the distilleries), but the wheat acreage is trifling. Turnips and potatoes are grown. About one-third of the holdings are crofts of five acres or under, and only about one-seventh of the holdings are over 30 acres. The operations of the Crofters' Commission (1886) have been beneficial in improving the condition of the people. The hills furnish good pastures. The flocks of sheep are heavy, the chief varieties on the uplands being Cheviots and black-faced and in some of the lower districts Leicesters and half-breeds. Of the cattle the principal breed is the Highland, the largest and best herds of which are in the Western Isles. Polled and Shorthorns are also reared, and Ayrshires are kept for dairy purposes. Highland ponies are raised on the hill farms.

Industries.—Excepting the industries carried on in Inverness, these are almost entirely confined to distilling—at Fort William, Carbost, Muir of Ord and some other places—brewing, wool and flax spinning, milling and (near Inverness) artificial manures. The catering for the wants of sportsmen and tourists, however, provides employment for many. The fisheries are of great value, especially at Fort William and in the Hebrides. Schemes to develop the industrial use of water power are in progress near Fort William.

Communications.—Rail communication in the shire is somewhat restricted, but the L.M.S. railway enters the shire from the south near Dalwhinnie and runs to Inverness via Aviemore and Daviot. Another portion of the same system also reaches the county town from Nairnshire. The Dingwall and Skye railway passes along the southern shore of Beauly Firth. In the south-west the L.N.E. railway enters the county 2 m. N.W. of Rannoch station and terminates at Mallaig, via Fort William and Banavie, sending off at Spean Bridge a branch to Fort Augustus. There is also communication by steamer from Glasgow with the piers of the Caledonian canal and with the Western Isles. Considerable shipping reaches Beauly and Inverness by way of Moray Firth.

Population and Government.—The population was 82,455 in 1921, when 35,449 persons spoke Gaelic and English, and 4,443 Gaelic only. The only considerable towns are Inverness (pop. in 1921, 20,937) and Fort William (1,913). The county returns three members to parliament with Ross and Cromarty. Inverness forms a sheriffdom, with resident sheriffs-substitute at Inverness, Fort William, and Portree, and is under school-board jurisdiction.

INVERSION, a term used in the study of geometric figures. To take a simple case, suppose in this figure



that $OP=1$, $OP_1=\frac{1}{2}$, and $OP_2=2$. Then $OP_1 \cdot OP_2=OP$. Let us say that $OP=k$. Then it is evident that there is an infinite number of points P_1, P_2 on the line such that $OP_1 \cdot OP_2=k$. A geometric transformation which replaces each point P_1 by a point P_2 such that $OP_1 \cdot OP_2=k$ is called an *inversion*. In such case O is the *centre of inversion* and k is the *radius of inversion*. As P_1 moves nearer to O, P_2 moves farther away. As P_1 approaches P, P_2 also approaches P. In general we say that, when $xy=k$, x and y are inversely proportional, one decreasing as the other increases. We may also say that if $y=f(x)$, we may inversely consider x as a function (implicit) of y.

INVERTEBRATA, a term commonly used in zoology to denote all those animals not possessing a backbone (*e.g.*, insects, snails, worms), in contradistinction to the Vertebrata (*q.v.*), in which a backbone, or some structure representing it, is present. The animals thus brigaded together do not form in any sense a natural assemblage, but the term is none the less a very convenient one. For the purposes of this dichotomous division the Protochordata (*Amphioxus, Balanoglossus* and the Tunicata, *qq.v.*) are included in the Vertebrata, though they have no true vertebral

column. (*See* ZOOLOGY, ZOOLOGICAL NOMENCLATURE, INVERTEBRATE EMBRYOLOGY.)

INVERTEBRATE EMBRYOLOGY. The word embryology means literally the science of the fruit of the womb (Greek ἔμβρυον), but in practice its meaning is extended to embrace all forms of individual development or life-history, whether that development takes place within the mother's womb, as in a human being, within a shell, as with a chicken, or freely in the open, like the frog tadpole.

The term invertebrate is a comprehensive one which includes all animals that are not vertebrates. There are two grades of animals, *viz.*, the Protozoa and the Metazoa. The first consist either of single cells, or of small masses of protoplasm with numerous nuclei, but not divided into cells, or, finally, of small groups of similar cells connected with one another, all of which are similar to one another and which carry out the same functions in the animal. When the animal reproduces they all take part in this act, so that the mother disappears in giving rise to her offspring. The bodies of the Metazoa, on the other hand, are composed of cells which are not all alike, but which are differentiated into sheets called *tissues,* which have different tasks to fulfil in the economy of the animal. When reproduction takes place this is carried out only by some of the cells, and so a distinction is made between the "germ-cells," which undergo development and give rise to new individuals, and the "soma" or body which carries out the other functions, such as digestion, movement, excretion, etc., and which shelters and nourishes the germ.

The life-history of the Protozoa (*q.v.*) exhibits essentially the same phenomena as that of the Metazoa, but for practical considerations it is not included in an account of the embryology of the Invertebrata. The Metazoa include about 16 distinct groups of animals, termed "phyla" (Greek φυλον, race). One of these phyla consists of the Vertebrata or back-boned animals to which we ourselves belong; all the rest are called Invertebrata.

The invertebrate phyla are (1) the sponges (Porifera, *q.v.*), (2) the sea-anemones, corals, polyps and jelly-fish (Coelenterata, *q.v.*), (3) the flat-worms (Plalyhelminthes, *q.v.*), (4) the proboscis-worms (Nemertea), (5) the thread-worms (Nematoda, *q.v.*), (6) the arrow-worms (Chaetognatha, *q.v.*), (7) the segmented worms (Annelida, *q.v.*), (8) the articulates or jointed-legs (Arthropoda, *q.v.*), (9) the shell-fish and cuttle-fish (Mollusca, *q.v.*), (10) the spiny-skinned radiates (Echinodermata, *q.v.*), (11) the wheel-animalcules (Rotifera, *q.v.*), (12) the moss-animals (Polyzoa, *q.v.*), (13) the foot-axis animals (Podaxonia), (14) the lamp-shells (Brachiopoda, *q.v.*) and (15) the Enteropneusta (*q.v.*), worms, breathing by slits in the wall of the gut, which constitute a bridge between the Invertebrata and the Vertebrata.

The reproduction of the invertebrate Metazoa takes place by two methods,—by budding or fission and by sexual germ-cells or gametes. Owing to considerations of space we can only consider reproduction by germ-cells.

The gametes are of two kinds, termed male and female, which normally must unite with one another before development is possible. The male cells are produced by a special type of individual called a male, the female cells by another type, the female. Occasionally both are formed in the same individual, which is then termed a *hermaphrodite.* The product of the union of a male and a female gamete is a *zygote.* The general structure of these cells is remarkably constant throughout the whole range of the Metazoa, from the sponges up to man himself. The female cell, the egg or *ovum,* has stored in its protoplasm deposits of reserve material or *yolk,* which enable the zygote to carry on its existence till it is able to obtain food from the outside.

These deposits vary enormously in bulk and bear little or no relation to the size of the future organism, but solely to the time which must elapse before food is available from outside, and the amount of the deposit regulates the size of the egg. Thus the egg of a woman is only $\frac{1}{125}$ in. in diameter, whereas that of a hen (termed "the yolk") is, as we all know, the size of a golf-ball. When an egg has very little yolk it is termed *alecithal.* When there is a good deal of yolk massed towards one pole the egg is said to be *telolecithal;* when the yolk is in the centre surrounded by a skin of protoplasm, the egg is called *centrolecithal.* The Echinodermata (star-fish, sea-urchins, etc.) have, with few exceptions, alecithal eggs; the eggs of Mollusca (snails, clams and cuttle-fish) are telolecithal, whilst those of Arthropoda (crabs, spiders, insects, etc.) are centrolecithal.

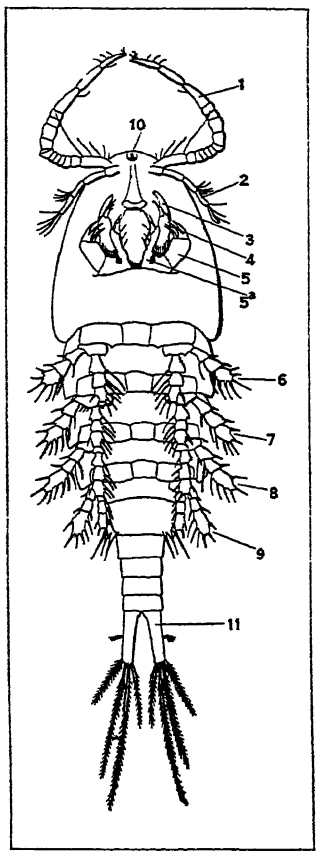
The male gamete, the *sperm* or *spermatozoon,* is, when young, a simple rounded cell indistinguishable from a young female cell, but as it grows and ripens it undergoes remarkable changes. A vibratile filament termed the *tail* grows out from close beside the nucleus; the nucleus shrinks, expelling the nuclear sap and becomes converted into a small dense mass, termed the *head,* and the whole of the protoplasm is then sloughed off. The sperm, in virtue of the possession of a tail, is endowed with the power of locomotion; its task is to seek the female cell and to unite with it. When the head touches the surface of an egg the screw-like motion of the tail drives it in. As soon, however, as it is immersed in the protoplasm of the egg, the egg reacts by producing a membrane at its surface termed the *vitelline membrane,* which may be regarded as the primitive egg-shell, within which the zygote completes the first stages of its development. This membrane, in most cases, cuts off the tail of the spermatozoon, and in all cases prevents more spermatozoa from entering, so that all the potencies of the father who produces the male germ-cell are conveyed into the egg by a single nucleus, a fact which has a most important bearing on theories of heredity (*q.v.*). Once inside the egg, the spermatozoon head absorbs fluid and swells up to form a normal nucleus. (*See* CYTOLOGY.) The two nuclei now approach one another and become placed side by side to form the compound nucleus of the fertilized egg or zygote. In some cases the two components, male and female, can be distinguished from one another in the zygote nucleus during the first divisions of the egg, and it is then seen that the plane of division always cuts male and female portions of the nucleus symmetrically, so that equal portions of paternal and maternal nuclear substance are distributed to each daughter-cell. (*See* REPRODUCTION.)

Both the eggs and the male cells in all Metazoa divide twice during the process of ripening; these divisions in the male-cell give rise to four equal spermatids, all of which develop into spermatozoa, but in the case of the female germ cell they give rise to the ripe egg and to three minute vestigial cells termed *polar bodies.* The polar bodies, or at least one of them, adheres to the egg for some time, and the area to which they cling is known as the *animal pole* of the egg; the opposite pole towards which yolk is massed is known as the *vegetative pole.* In small and moderate-sized eggs the spermatozoon enters at the vegetative pole and makes its way upwards towards the female nucleus, which decends to meet it after having divided to form the second polar body; the path taken by the entering sperm seems to fix the future median plane of symmetry of the embryo.

There are two phases of development, such as are exemplified by the unhatched chick and the frog tadpole: they are termed respectively the *embryonic* and the *larval* phases. In the embryonic phase, the young organism is protected from the outside world by an egg-shell or within the womb of the mother and derives its nourishment either from stores of yolk or from the mother's womb. In the larval phase on the other hand, the young animal moves freely about and has to escape from its enemies and obtain its food by its own efforts. In every life-history there is both an embryonic and a larval phase; for no egg is ever thrust out naked into the world. Every one during the earliest part of development, as we have already seen, is protected by a vitelline membrane; and no animal is hatched exactly like the adult parent. Every animal undergoes a shorter or longer period of growth after birth during which it changes its shape and proportions and this part of its life-history may justly be called a larval phase. The first question to be settled is how these two phases are related to one another—which is the primary and which is the derived one?

A comparison with one another of allied species leaves no doubt that the larval phase is generally the primary mode of development and that the embryo is usually merely a concealed

and modified larva. This could be proved by instances selected from any invertebrate phylum, but more familiar cases are seen amongst the vertebrates. Everyone is acquainted with the tadpole larva of frogs and toads, and with its fish-like organs adapted to its life in water. The tadpole has three feather-like gills projecting from the head on each side, and between these gill-clefts, reaching into the throat, it has a flattened tail fringed with a fin. Now, in the West Indies there is a tree-frog, *Hylodes,* which lays its eggs far from water. From these eggs there emerge, not tadpoles, but froglings ready to take up their life on land. Nevertheless, if the covering of the egg be dissected off half way through development there will be found inside it a tadpole with gills and tail. These organs have no meaning in the embryonic life—they can be explained only if we assume that the embryo was formerly a larva.



FROM SHIPLEY AND MACBRIDE, "ZOOLOGY" (CAMBRIDGE UNIVERSITY PRESS)

FIG. 1.—MALE WATER FLEA (CYCLOPS SP.)

1. Antennule. 2. Antenna. 3. Mandible. 4. Maxillule. 5. Maxilla. 5a. Maxillipede. 6, 7, 8, 9. Forked trunk lims. 10. Eye. 11. Tailfork

We are now faced with the question, what is the meaning of the larval phase? If we base our reasoning on a broad comparative view, we shall be driven to the conclusion that the larva is a recapitulation of a former adult condition of the race. We find amongst the invertebrate phyla a typical anatomical structure common to the overwhelming majority of the members of each group, but there is always a minority of species with aberrant structure. When we examine the young stages of these aberrant members, *i.e.,* their latest larval phases, we find that during this period of their life they possess the typical structure of the group. As no comparative anatomist doubts for a moment that the aberrant members have been derived from more typical ancestors, this means that these aberrant forms in their later development repeat or recapitulate the history of the race. A good example of this phenomenon can be found amongst the oar-footed Crustacea (Copepoda). Certain species such as *Achtheres* attach themselves to the gills of fish and nourish themselves by sucking the blood. These develop into shapeless maggots devoid of limbs—except the third pair of jaws with which the copepod clasps the gill-filament of the host. But when first hatched from the egg, *Achtheres* is a free-swimming copepod with a typical head, thorax and abdomen and two pairs of swimming legs. In such cases, where the immediate ancestry of the species is clear and undisputed, the meaning of the larval phase is also quite clear, and we are therefore justified in adopting the same explanation for earlier larval stages, corresponding to which living adult forms embodied in other species are no longer to be found. Behind the first larval stage we come to the embryonic stages, to which a similar explanation must be applied, and so we are led back step by step to the fertilized unsegmented ovum, which on this interpretation represents the original unicellular protozoon from which all the higher animals are descended.

But if the whole course of development is thus to be regarded as a series of superposed recapitulations, these are by no means close and accurate reproductions of the ancestral history which they represent. Like human memories, they have suffered blurring and distortion, and like human memories also, the earliest ones have suffered most, and we shall presently study the principal influences which have brought about this distortion. But since the life-history of every species in the same phylum is a separate edition of the same history, and since the distorting influences vary from species to species, by the aid of a truly comparative embryology we can eliminate most of these secondary alterations from the primitive history and thus restore—not in minute detail, but in broad outline—the general course of the development of animal life on the earth.

We have seen that the primary type of development is generally the larval, and that the essential nature of the larva is to be active. All its organs are functional—its nature is expressed by its habits. *Therefore a larval stage is a recapitulation of a former series of habits* which the ancestors of the present race possessed; and the passage to the present state of affairs, the last stage in evolution, was a change of habits.

The recapitulation of ancient habits in the earlier stages of the life-history therefore means that the change to modern habits took place when the animal had reached a certain size, but when it was still capable of growth and modification. The new habits, by causing the animal to use some of its organs more and others less, produced alterations in its structure through the stimulation of the growth of the more used organs and the inhibition of the growth of the less used ones; these alterations in succeeding generations were produced more and more easily and on slighter stimuli; in a word, the tendency to produce them became more deeply ingrained in the organism, till finally—as in the embryonic phase—they supervened without any external stimulus at all. As the new habits prove more advantageous in getting food and promoting growth, the change from larva to adult comes on at earlier and earlier periods of growth, and so the larva is usually very small compared to the adult. But occasionally the reverse change has taken place—the adult phase has become more dangerous, and serves not for feeding and growth, but chiefly for mating. In this case the larval stage may be more and more prolonged and the full-grown larva may be actually larger than the adult; this is the case with most moths and butterflies. In the case of certain salamanders such as the axolotl, the same change has taken place, and here the adult phase under ordinary circumstances is suppressed altogether; the animal mates and lays its eggs whilst still a larva. By exposing such animals to abnormal conditions, however, the lost adult phase may be brought to light. (*See* METAMORPHOSIS: *Experimental.*)

The larva is very small compared to the ancestral stage which it represents. For instance, organs repeated in series which act together and form a physiological unit, are represented in the larva by shortened series—sometimes organs which are in pairs are represented only by one. Thus the larva of *Achtheres* has *two* pairs of swimming limbs, whereas the normal copepod has *four* pairs. Occasionally the normal type of environment to which the larval organs are adapted has been changed. This difficulty may be met in two ways; either the larval phase is transformed into an embryonic one—as in *Hylodes*—or the larva is forced to change its habits, and then its ancestral features may be almost entirely obscured. This is the case with many larvae of insects.

In the actual history of the race, the transition from one set of habits to another and the accompanying changes of structure must have been gradual; but it often happens that in the course of time the transitional habits are not suited to the available environment and the corresponding stage is very rapidly passed through. During this period of rapid change the animal takes no food, and relies on the stores accumulated in the previous stage. *See* METAMORPHOSIS.

In embryonic stages yolk impedes the process of cell-division. In the normal cell this process is accompanied by a stiffening of the protoplasm; the two daughter-cells at the moment of division seem, as it were, to round themselves off by a kind of coagulation. This stiffening does not last, however, and after the division is completed the protoplasm again becomes semi-fluid and the two cells flatten themselves out against each other. When much yolk is present it acts exactly like water mixed with honey; it dilutes the protoplasm. Hence the amount of stiffening previous to cell-

division is much less, the division proceeds slowly and the cells produced are clumsy and large. During the period of relaxation, the daughter-cells often fuse with one another and the process of division is undone. When very much yolk is present, cell-division becomes quite impossible and only division of nuclei takes place.

In such eggs, where the protoplasm is concentrated at one pole, development proceeds rapidly in this area, whereas at the opposite

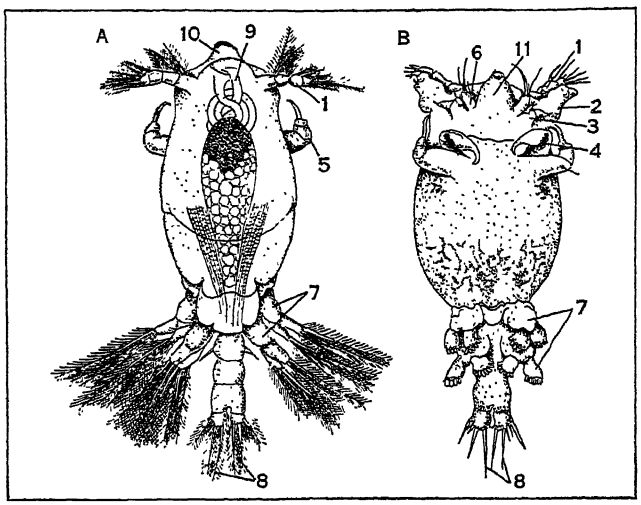


FIG. 2.—LARVA OF THE GILL-MAGGOT (ACHTHERES AMBLOPLITIS)
A. Dorsal view. B. ventral view. 1, 2, 3, 4, 5 as before; 6. mandible; 7. forked trunk limbs; 8. cordal fork; 9. gland producing adhesive filament; 10. upper lip; 11. under lip

pole it is at first at a complete standstill. So the embryo gradually acquires the features of the adult, whilst bearing attached to it a huge sac filled with yolk. Such eggs are termed *meroblastic*, as opposed to *holoblastic* eggs, in which the whole egg is divided into cells. The yolk-sac is eventually surrounded by a layer of cells budded from the edges of the developing area; and as the organs of the embryo become formed the yolk is gradually digested, and conveyed by blood-vessels to the growing part of the body. The yolk-sac shrinks and its covering is eventually incorporated in the skin of the young animal. Amongst invertebrates meroblastic eggs are found amongst Cephalopoda (cuttle-fish), and it is a ludicrous sight to see a miniature squid attached to one pole of a large egg.

The organs of the embryo, as opposed to those of the larva, are functionless, and where they are not transformed into adult organs they are apt to be almost entirely suppressed; thus in the embryo of the earthworm no trace remains of the broad equatorial belt of cilia, which is so characteristic of the trochophore larvae of other worms and which forms their principal means of locomotion. So, too, in the embryonic development of most snakes no traces of the ancestral limbs are preserved.

The embryonic phase can be divided into three stages, which are respectively (*a*) segmentation of the egg, (*b*) formation of germ-layers, and (*c*) organogeny.

The segmentation of the egg means its division into a large number of cells or *blastomeres*. In the eggs of the most primitive creatures, in which there is little or no yolk, the blastomeres are almost equal in size to one another, and as they increase in number they separate from one another in the centre, so that they become arranged like a balloon round a cavity. This cavity is called the *blastocoele* or primary body-cavity, and the whole balloon is known as the *blastula*. In the case of the Echinodermata, Driesch has proved that the cells of the blastula not only look like each other, but are really like each other in their potencies, for if the blastula be cut into pieces any piece of sufficient size will round itself off so as to form a new blastula of reduced dimensions, which will develop into a perfectly normal larva.

When the distorting influence of yolk is absent or not much developed, the blastula stage can be detected in life-histories belonging to all the invertebrate phyla. Thus in Mollusca it is clear in the development of the limpet (*Patella*) and the pond-snail (*Paludina*), amongst Arthropoda in the development of the fairy-shrimps (*Branchipus*), and of the water-fleas (Copepoda), amongst sponges it is seen in *Oscarella*, whilst it is almost universal amongst Coelenterata, Echinodermata, Nemertea (proboscis-worms) and Brachiopoda. In the sponge *Oscarella*, the coelenterate *Eudendrium* and in Echinodermata, the blastula is a larval stage, and therefore it may be legitimately considered as a recapitulation of a common ancestor of all the Metazoa. There exists even at the present time a hollow bell-like organism consisting of ciliated cells tied together by protoplasmic filaments. This creature is termed *Volvox*, and it is sometimes regarded as a compound Protozoon allied to the simple Flagellata.

The "formation of layers" implies the transformation of this balloon into a double-layered cup termed the *gastrula*, by the in-pushing of one of its sides. The inner layer, which is called *endoderm*, gives rise to the digestive layer lining the gut—the outer layer or *ectoderm* to the skin. From the inner layer pockets or cellular outgrowths are given off which give rise to body-cavity and muscles and these are termed the *mesoderm*. Ectoderm, endoderm and mesoderm are the three *germinal layers*. The gastrula can be recognized as a stage in the development of all Metazoa except sponges. It exists as a larva amongst the Echinodermata and, in modified form, amongst Coelenterata, in which it is known as the *planula*. The inner layer in the most primitive forms arises as a process of in-bending or *invagination*. It looks exactly as if it were pushed in by an invisible finger. The opening produced by this process is called the *blastopore*. The process of invagination can be analysed into three factors. There is (*a*) a process of growth and multiplication of cells at one point on the blastular wall which produces lateral pressure; (*b*) an alteration in character of the cells of the blastular wall. Although after the process of invagination has begun the cells at the animal pole look just the same as before, they have lost some of their original powers—for Driesch has proved that if the upper part of the blastular wall be cut off after this event, though it is able to round itself and form a new blastula, this blastula is incapable of further development; it has become ectoderm. The new cells formed in the zone of growth are from the beginning divided into two categories, one being ectoderm and the other endoderm; (*c*) a tendency to flow inwards towards the interior of the blastocoele. It is obvious that mere lateral pressure due to increased growth would be relieved by a bending outwards as well as by a bending inwards, and Driesch has shown that under abnormal circumstances this can actually happen with the gastrula of the sea-urchin. There must, therefore, be a special factor in normal development to ensure that invagnation or bending inwards takes place. This we may call *inward cytotaxis*.

The planula differs from the typical gastrula in that the ingrowth of endoderm is a solid mass of cells, not a finger-shaped tube. This mass subsequently becomes hollowed out by the absorption of its central cells and forms the lining of the gut. Indeed, the Coelenterata might be regarded as retaining throughout their lives the gastrula type of structure. In some Coelenterata, such as *Aurelia* (the common jelly-fish), and *Urticina* (a common sea-anemone), the planula is replaced by a hollow gastrula and the blastopore becomes the mouth of the animal. If we have to decide whether the planula or the hollow gastrula gives the most faithful recollection of a distant ancestor, we must decide in favour of the gastrula. For in the history of the race there must have been continuity of function; at every stage in the process the animal must have been a working machine. Now, a solid mass of cells could not serve as an organ for digesting food, but a hollow tube is adapted to this end. Hence we conclude that the gastrula and not the planula gives us the truest picture of the ancestor.

The sponge *Oscarella*, as we have already seen, is hatched as a typical ciliated blastula. But it does not become converted into a gastrula. The hinder cells lose their cilia and become granular; in this stage the larva is termed an *amphiblastula* and the majority of sponges are hatched in this stage. The amphiblastula, like the planula, attaches itself to the bottom by its anterior end, but this end now flattens out and then becomes bent inwards and upwards whilst it is overgrown by a great extension of the granular cells

which form the outer dermal layer of the sponge. If we call the inbending of the ciliated cells invagination, then this invagination takes place at the opposite pole from that at which it occurs in the planula. From these ciliated cells the gastral or inner layer of the sponge and the so-called flagellate chambers are derived.

How shall we interpret this metamorphosis? If a blastula-like animal was the ancestor of all the Metazoa, there must have been a remote period in the world's history when the seas swarmed with this type and when nothing higher was in existence. If some of these blastulae, instead of seeking a living in midwater, like the rest of their brethren, descended to the bottom to feed and found it profitable to do so, then in this divergence of habit amongst members of the same strain we should have the explanation of the primary cleavage between the phyla Porifera and Coelenterata. Similar divergences of habit have taken place at every stage in the history of life.

The free-swimming blastulae in their search for food perhaps gradually substituted for a random rolling motion a screw-like motion in one direction, and so the posterior end became specialized for the capture and swallowing of food, whilst the front part became the organ of locomotion. So the gastrula grew out of the active blastula, and the cells at its anterior end being the first to encounter changes in the environment, became transformed into a sense-organ with stiff sense-hairs and alternately gave rise to the first nervous centre. Such a sense-organ has been demonstrated by Duerden in the planulae of certain corals. But the very same difference of habit which manifested itself at the blastula stage, supervened again. Some of the gastrulae sought the bottom and attached themselves there; these gave rise to the great army of plant-like polyps and sea-anemones which constitute the major portion of the Coelenterata. But there was a minority amongst the Coelenterata which never abandoned the original free-swimming life; these are represented in our present seas by the beautiful comb-bearers (Ctenophora) which propel themselves by eight radiating bands of cilia arranged in little transverse combs. These bands culminate in a beautiful sense-organ resting on a nervous cushion—situated, unlike the nervous centres of other Coelenterata, in front. Out of animals somewhat like these the evolution of most of the higher invertebrates has proceeded. The ctenophore is nothing but an active, sensitive, glorified gastrula, and in the life-history of the flat-worms (Platyhelminthes) the memory of this ancestor is preserved as *Müller's larva*. This larva, after a brief free-swimming life, sinks to the bottom and flattens out and becomes converted into a leaf-like flat-worm or turbellarian crawling on its cilia. Müller's larva is an oval organism with a sense-organ at one pole and along its sides eight ciliated lobes which correspond to the eight meridians of combs in the ctenophore.

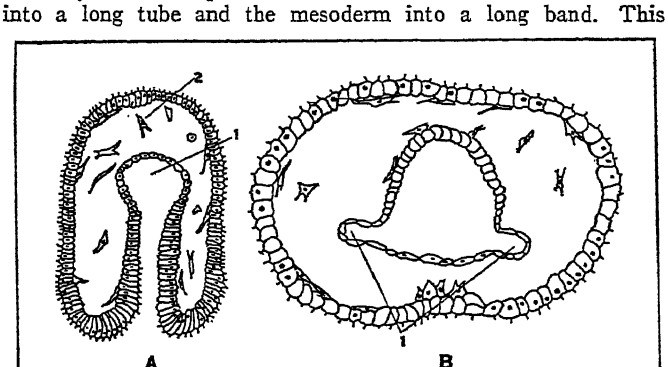
In the life-history of the proboscis-worms (Nemertea) a larva termed the *Pilidium* occurs, which also seems to be a memory of a ctenophore-like larva. It is shaped like a helmet with a strongly developed sense-organ at its apex. Below there is a wide sac-like gut opening by a wide blastopore. The ciliated ribs have coalesced into a wavy circular band which, however, retains two side-lappets like the lobes of Müller's larva. The pilidium, however, is transformed into the Nemertine worm by an abrupt metamorphosis which, doubtless, represents an extreme compression of an originally long life-history, and which it has been impossible up to the present to interpret satisfactorily.

The trochophore larva which appears in the life-history of not only the shell-fish (Mollusca) but also the Polyzoa and the segmented worms (Annelida) is a further development of the ctenophore-like gastrula. The typical trochophore is an almost spherical larva, with an apical sense-organ at one pole essentially similar to the sense-organ of Müller's larva and the *Pilidium*. Round the equator is a belt of powerful cilia, by the aid of which the larva moves. This band is termed the prototroch: Wilson has shown in the case of *Patella* and Waltereck has proved in the case of the worm *Polygordius* that this ring consists at first of four separate lozenge-shaped patches, in which the cilia are arranged in transverse combs. The trochophore may thus represent a four-ribbed ctenophore-like ancestor. Below the prototroch there is, as in the *Pilidium*, a sac-like gut opening by a wide blastopore, which changes into a narrow longitudinal slit, that becomes closed up so as to form a seam-like ciliated groove, except in front, where an opening persists which forms the mouth. In the primitive worm *Polygordius* there is an opening also at the hinder end of the seam which is the anus. In the case of other trochophores, the anus is usually formed as a new opening at the hinder end of the seam. In these processes we clearly have blurred memories of a history which converted the wide single opening into the gut possessed by the Coelenterata and the flat-worms (Platyhelminthes), into two openings, a mouth for taking in food and an anus for ejecting waste. Since the nemertine worm also has an anus, the pilidium larva represents only the early stage of the trochophore ancestor before the division of the blastopore and the later stage is obscured by the metamorphosis.

The second great advance shown by the trochophore is the formation of a true mesoderm. Two large cells, which in the early trochophore form part of the wall of the hinder part of the gut, are ejected into the primary body-cavity or blastocoele. Here each cell begins a process of active growth and multiplication. The daughter-cells are budded off in front, whilst the original mother-cell remains behind; in this way a band-like mass of cells, the so-called *mesodermal band* is produced, which develops a cavity termed the secondary body-cavity or *coelom*. From the wall of this cavity the germ-cells are developed, and it develops tube-like extensions which reach the exterior and form the so-called *coelomiducts*. Some of these serve as genital ducts (their primary function) and others secondarily acquire an excretory function. In front of the coelom a pair of string-like ingrowths of the skin or ectoderm cells become hollowed out to form vesicles or tubes. These are the primary excretory organs or *nephridia*.

The coelom turns up in other phyla where the trochophore larva is not formed, as for instance in the arrow-worms (Chaetognatha) and in the Brachiopoda. In these two phyla it is formed as a pair of hollow pouches of the gut, and on the same principles of interpretation which we employed in the case of the planula, we regard the out-pouching of the gut as the primitive method of forming the coelom, and the ejection of cells from the gut-wall as a secondary modification of this process.

If we now follow the trochophore in its gradual process of development into a worm and a mollusc respectively, we find that the change in the first case consists in the gradual lengthening of the body behind the prototroch. The intestine becomes drawn out into a long tube and the mesoderm into a long band. This



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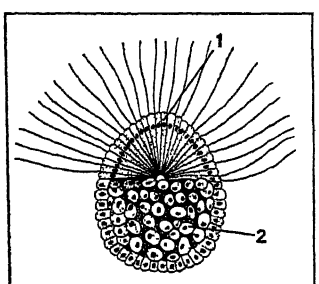
FIG. 3.—THE GASTRULA LARVA OF ASTERIAS VULGARIS

A. Side view. B. Cross section. 1. Rudiment of coelom; 2. Mesenchyme cells budded into blastocoele

band becomes broken by cross fission into a series of blocks, in each of which a section of the coelom is formed by the absorption of the central cells. The skin becomes indented by a series of grooves corresponding to these blocks, and so the well known appearance of the segmented worm is produced. The prototrochal cells are then absorbed or cast off and the worm sinks to the bottom and begins its burrowing life, varied by brief seasons of spasmodic activity, during which it swims through the water by undulatory movements. These movements are carried out by alternate contractions of the longitudinal muscles on both sides,

and these muscles are developed out of the lateral walls of the segments of the mesodermal bands. When, however, the trochophore develops into a mollusc a different set of changes supervene. The body behind the prototroch becomes arched dorsally into a protuberance known as the *visceral hump*, inside which is contained the larval stomach. On the apex of the hump a saddle-shaped groove of thickened cells makes its appearance. This is the so-called *shell gland*, and by this gland a horny cap, the first rudiment of the shell, is secreted. On the ventral surface of the post-trochophoral body, a ciliated wedge-shaped projection grows out, along the line of the ciliated groove which marks the position of the sealed-up blastopore. This is the *foot*, by which the mollusc moves. In primitive Mollusca this movement is just a gliding by means of cilia over the bottom, but in more advanced and larger forms the ciliary movements are replaced by muscular wrigglings. We can now catch a glimpse of the divergences of habits which led to the separation of the two great groups of Annelida and Mollusca. The trochophore stock, like the more primitive stock represented by Müller's larva, sought their food on the bottom. Under these circumstances two different modes of life were open to them. They might either seek their food in the most superficial layer of the bottom deposit, and in this case they became molluscs; or they might burrow into it, and in this case they became segmented worms (Annelida). But, as we have already pointed out, the Annelida really lead a double life; in all the more typical forms burrowing alternates with rapid swimming excursions through the open water. The accentuation of this later habit, and the gradual forgetting of the tendency to burrow led to the evolution of the great phylum Arthropoda, or jointed-leg animals, which contains about three-quarters of the known species of living animals.

The Arthropoda differ from the Annelida in the much greater thickness of the cuticle. The coelom has disappeared, leaving only occasional pocket-like remnants, so that the large body-cavity of the arthropod is really a blastocoele. In the early embryonic development of all the Arthropoda there are developed two well-marked mesodermic bands, just like those of Annelida, and in these transverse segmentation and coelomic pockets appear; in a word it might be said that the embryonic arthropod is an annelid. The three great groups of living Arthropoda, the Crustacea, the Arachnida and the Insecta, differ amongst themselves very much as to the extent to which the larval phase is developed. The Arachnida, except in their most primitive forms, leave the egg-shell with practically all the organs of the adult developed, but amongst the Crustacea the larval phase is strongly developed. It is a memory of the gradual transformation of an annelid into an arthropod and shows that this transformation began in front and gradually progressed backwards as the higher types were evolved.



AFTER DENDY, BY COURTESY OF THE ROYAL SOCIETY OF VICTORIA

FIG. 4.—AMPHIBLASTULA LARVA OF THE SPONGE, GRANTIA LABYRINTHICA

1. Flagellated cells. 2. Granular cells

The most primitive larval phase found in Crustacea is the nauplius, which has already been mentioned. This phase occurs as a larva in the Phyllopoda (leaf-foot Crustacea), the Copepoda, the Cirripedia (barnacles), the Ostracoda and amongst certain primitive members of the Malacostraca, shrimps, lobsters, crabs, etc. As an embryonic stage it can be detected in the life-history of the highest Crustacea. The nauplius is an oval or cylindrical larva with a single simple eye in front and three pairs of jointed legs, one pair slightly in front of the mouth and the two pairs behind it. The mouth is a transverse slit on the under side overhung by a large lip or labrum. The first pair of limbs consists of a straight rod on each side carrying sensory hairs and is termed the *antennule*: the second and third pair are forked, each limb consisting of a basal piece from which inner and outer branches spring, each having two or three joints. The basal piece on each limb carries an inwardly directed hook which the larva uses for seizing its food. These hooks are termed masticatory hooks. The second pair of limbs eventually becomes the *antennae* of the adult, whilst the last pair become changed into the *mandibles*. In most nauplii the body behind the mouth is totally unsegmented but, as already noted, in the nauplii of the primitive Phyllopoda this region is long and cylindrical and marked out into a multitude of very fine ring-like segments. We may interpret this larva as a reminiscence of an ancestral worm, in which the first two or three segments had developed appendages suitable for grasping food, and in which the cuticle of this region was greatly strengthened, but in which the hinder part of the body retained largely its soft, worm-like character. It must be remembered that the marine worms have soft wing-like outgrowths from their segments known as *parapodia*, and it is these that are converted into the limbs of arthropods when the cuticle becomes thicker.

Since an arthropod is confined within a rigid cuticle, growth is only possible when this cuticle is thrown off. So the life-history presents the appearance of a series of stages of fixed appearance, known as *instars*, separated by shorter stages known as *moults*, during which changes in appearance take place. Of course these changes are not really as sudden as they appear, for they have been gradually going on in the soft tissues underneath the cuticle, but they only become manifest when the cuticle is shed.

Want of space forbids us to describe in detail the various moults by which the nauplius larva transforms itself into a phyllopod, a copepod, a cirripede and an ostracod respectively. We propose to give only a brief account of the development of the Malacostraca.

In only the most primitive shrimps such as *Penaeus* is the young organism hatched as a nauplius; in the vast majority of cases, this stage is passed over within the egg-shell and the animal is born as a larva of quite a different kind, termed a *zoaea*. In the lobster even the zoaea stage is passed through before hatching; the young lobster begins its career as a larva of a more advanced type known as the mysis larva, but in the case of all the shrimps and crabs, the zoaea is the typical larva.

The zoaea is divided into an anterior rounded portion, the *cephalo-thorax*, and a hinder segmented portion ending in a broad tail fin, the *abdomen*. The cephalo-thorax ends in front in a spike or rostrum; at the sides of this are two large eye-stalks bearing compound eyes, whilst at the base of the rostrum, the single eye of the nauplius can still be detected. The cephalo-thorax is covered by an undivided shield termed the *carapace*, the sides of which form free flaps hanging down at the side of the body; between these flaps and the body is a groove in which are the first traces of the gills. Of the naupliar appendages, the antennule has shrunk very much in size, the antenna retaining its forked condition only in the primitive zoaea of *Penaeus*. In the zoaea of the common crab, for instance, as in most zoaea, the outer branch of this limb has assumed the adult form of a scale, the so-called squame. The mandible is reduced to its basal stump. Behind the mouth come two segments carrying the two additional pairs of jaws, the maxillules and the maxillae, which are common to all Crustacea. Behind the second of these is the groove which marks the limits of the head region, as distinct from the *thorax*. The segments of the thorax are exceedingly compressed—only the first two carry limbs; these are large forked appendages and are used in swimming. In the zoaea of the shrimp the first three pairs carry limbs. The abdominal segments are without appendages.

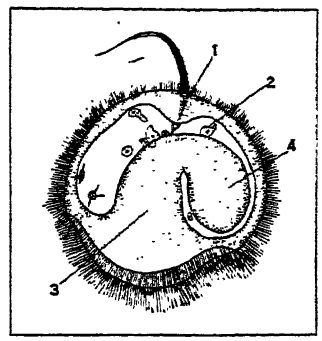
No adult crustacean exactly like the zoaea is found living. But if we watch how the larva uses its limbs, we see clearly that it represents a stage in functional evolution between the primitive arthropod represented by the nauplius and one of the higher Crustacea. In the primitive arthropod, swimming and getting food were functions carried out by the same limbs, but when the arthropod became a crustacean, three of the pairs of limbs, mandibles, maxillules and maxilla, were changed into jaws and the swimming function was relegated to the two or three pairs of limbs behind them which in later life became the foot jaws

or maxillipedes. The fact that in the crab zoaea the hinder segments of the thorax and the segments of the abdomen have no limbs may be explained, in the same way as their absence was explained in the nauplius, by the assumption that in the ancestor they were thin and undifferentiated and of little functional importance. In the primitive zoaea of *Penaeus* the second antenna remains, as in the nauplius, large and forked and still aids in swimming as it does in many of the lower Crustacea, and only one pair of maxillipedes is developed; this represents an older ancestral stage than the typical zoaea. Weldon has given a vivid picture of the movements of a crab zoaea; the little creature swims on its back, using the rostrum and a spine which sticks up from its back as a keel; it rows itself by its maxillipedes and uses the abdomen as a rudder. This last observation of Weldon throws a flood of light on the causes which led to the evolution of the abdomen. Strictly speaking, this term is only applicable in the higher Crustacea, in which the primitive uniform series of limbs behind the mouth is interrupted after the eighth limb, and the thoracic limbs or *peraeopods* are succeeded by the much smaller abdominal limbs or *swimmerets*. The primary reason for the differentiation of the abdomen and the dwindling of its limbs seems to have been its use as a rudder.

The zoaea of the shrimp gradually changes into the adult form by a series of moults. In these moults, some of the legs belonging to the hinder segments of the thorax make their appearance, and begin to take part in the swimming function. In extreme cases as many as six pairs of legs, all similar to one another, may eventually be engaged in this function. The larva now bears a striking resemblance to one of the Schizopod shrimps such as *Mysis*, and for this reason it is known as the *mysis-larva*. The lobster is hatched from the egg in this stage. The mysis-larva evidently represents an ancestor in which the swimming function has been adopted by more legs than was the case with the zoaea ancestor. In the common shrimp the last four pairs of the thoracic limbs, however, do not develop into swimming organs, but remain as rudimentary buds till the final moult gives them their adult form. The mysis-larva is transformed into the adult shrimp by the appearance of the abdominal limbs and the disappearance of the outer swimming branches of the thoracic limbs. In the adult shrimp the thoracic limbs are used only for grasping and walking; swimming is performed exclusively by the abdomen, so that the swimming function which in the nauplius ancestor was performed by the most anterior appendages has been gradually passed back until it has reached the hinder end of the body.

In the life-history of the crab, the mysis stage is missed out, and the zoaea moults four times, whilst still retaining the same general structure and appearance. But at each moult the hinder thoracic appendages become more prominent, although they are never forked and never become functional. The abdominal appendages, too, make their appearance as small buds. Then a final moult takes place at which the zoaea completely changes its shape and becomes a larva of an entirely different type known as the *megalopa*. This larva strongly resembles a small lobster. It has all the last five pairs of appendages of the thorax as unforked limbs, and the abdominal appendages are fully developed and forked and adapted to swimming. At the next moult the megalopa changes at once into a small crab, but all the swimmerets disappear. Now the adult crab possesses four pairs of swimmerets in the female and in the male two pairs of modified swimmerets. The swimmerets in the female are quite normal in structure, but they are not used for swimming, but merely for holding the egg; the swimmerets in the male are modified into styles and are used for transferring the male cells into the female opening. These appendages are only developed as the little crab grows larger and approaches sexual maturity. Now, in the history of the race there is no doubt whatever that the swimmerets of the lobster ancestor became the swimmerets of the crab, and the disappearance and subsequent reappearance of these limbs in the life-history is one of the most curious phenomena of development and throws a great light on the nature of heredity. *We see quite clearly that what is inherited is not a structure as such, but a potency or memory which can embody itself in a structure when the functional necessity for it arises.*

The development of insects shows the paradox that the most modified insects have a long larval life and that their larvae are worm-like in appearance, whilst the development of the lowest and most primitive insects is almost entirely embryonic, and they are hatched resembling their parents in most points except size. Many authorities hold, therefore, that the larvae of insects are secondary modifications of the life-history and have no ancestral meaning whatever; but this explanation is in our view unnecessary. The best known larval form amongst insects is the familiar caterpillar. This creature has a pair of very short antennae in front. At the sides of the mouth are a strong pair of biting blades, the mandibles, followed by two other pairs of jaws; then follow the three segments of the thorax, each carrying, as in all insects, a pair of jointed legs and then the abdomen consisting of ten segments, of which segments II., IV., VI. and IX. carry a pair of soft, unjointed legs. Now, if we examine the lowest and least specialized insects such as the little wingless *Machilis*, which scavenges amongst sea-weed left dry by the receding tide, we find that they also have short antennae, biting mandibles and an abdomen every segment of which carries a pair of unjointed legs; so that we see that the larva of a butterfly may be taken to represent an ancestor which had attained the level of the adult stage of *Machilis*. This conclusion is strengthened by two other sets of facts, viz.: (1) A closely similar caterpillar larva occurs as a phase in the life-history of the wood-wasps, which are primitive Hymenoptera utterly different in structure from the butterflies; (2) if we examine the embryos of insects like the cockroaches, which are hatched as so-called "nymphs" resembling the adult in most features but devoid of wings, we find in these embryos an almost complete series of unjointed abdominal legs. The caterpillar therefore need not be a secondary adaptation, because it occurs as a phase in the life-history of widely different orders, and it is found as an embryonic phase in life-histories where as a larval phase it is absent.



BY COURTESY OF THE "QUARTERLY JOURNAL OF MICROSCOPICAL SCIENCE"

FIG. 5.—THE PILIDIUM LARVA OF THE NEMERTINE WORM, CEREBRATULUS LACTEUS

1. Apical sense organ; 2. Mesenchyme cells; 3. Mouth; 4. Stomach

The most primitive land arthropod is the worm-like *Peripatus;* in the best-known species of *Peripatus* the development is entirely embryonic and takes place within the oviduct of the mother. In the course of this development a gastrula stage is clearly seen, which has a long slit-like blastopore that closes up in the middle and leaves the two ends open as mouth and anus. In the insect this blastopore is represented by a long groove on the under surface of the yolky egg, from the bottom of which cells are budded into the yolk, and at the two ends of which mouth and anus are formed.

The great difficulty is to explain why the caterpillar stage should be embryonic in such primitive insects as cockroaches, grasshoppers, crickets, etc., and in all the bugs, and larval in the highest insects such as the Lepidoptera (butterflies and moths) and the Hymenoptera. But the caterpillar does not develop continuously into the adult insect or imago. A resting stage, the chrysalis or pupa, intervenes. In this stage the larva is protected in a case either secreted by itself or composed of materials collected by it and stuck together by its secretion. It undergoes profound changes, and becomes changed from a worm-like form to that of an insect with rudimentary wings—in fact it becomes quite similar to the young of a cockroach or a grasshopper when this is just hatched. The wings develop in the primitive forms as external protuberances, in the more advanced forms from the bottom of deep pits. We see, in a word, that the chrysalis of the higher insects corresponds to the nymph of the lower insects. It is exactly as if the insect, having begun as a larva, had gone back

into an embryonic stage. Only a tentative hypothesis as to the cause of this anomaly can be suggested. We know, however, that insects of the cockroach and grasshopper type flourished exceedingly during the Carboniferous period and attained a gigantic size. Such large insects were never again produced. In the period which succeeded to the Carboniferous two catastrophes overtook the world. In the north there was widespread aridity and the pro-

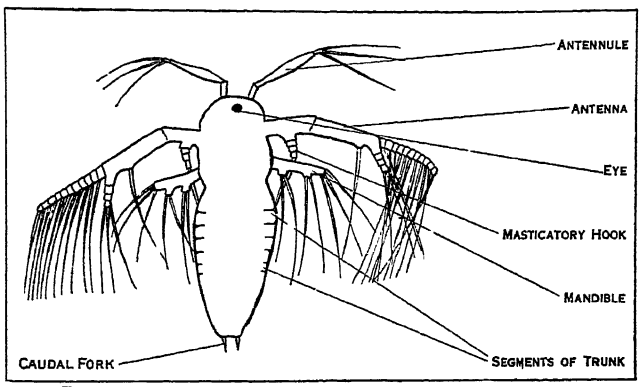


FIG. 6.—THE NAUPLIUS LARVA OF CHIROCEPHALUS (SP.)

duction of extensive deserts, whilst in the south there was an equally widespread ice-epoch. One or both of these climatic changes, it may be suggested, forced the insects which survived them to modify their larval development profoundly. In the higher insects the middle period of development was converted into the chrysalis stage, whilst in the lower insects the earlier part of development, the caterpillar stage, became embryonic. The caterpillar, like the lowest insects, is a scavenger. It was retained as a larval form amongst the higher insects because the parent has had the intelligence to find a suitable environment for the larva and to lay its egg there.

The great group of the Echinodermata (spiny-skinned radiates) have typically life-histories with a very long larval phase and their larval forms are very different from any which we have as yet described. Living Echinodermata consist of four classes of free-living forms, the true star-fish (Asteroidea), the brittle-stars (Ophiuroidea), the sea-urchins (Echinoidea) and the sea-cucumbers (Holothuroidea). Each of these classes has its characteristic larva, but all these larvae are obviously modifications of one type. If we take the common sea-urchin (*Echinus miliaris*) as an example of the Echinodermata, we find that the eggs are small and alecithal, *i.e.*, almost devoid of yolk. They segment rapidly into blastomeres of almost equal size and a typical blastula is formed, the cells of which are provided with flagella. By means of these it rotates within the vitelline membrane, which it very soon bursts; it then escapes and swims freely about as a larva. Within 12 hours cells are budded from one side of the blastular wall into the blastocoele; these cells, which are termed *mesenchyme,* are a sort of primitive connective tissue. They become massed in two places, right and left, and within these groups little tridents of calcareous matter are secreted which develop later into the larval skeleton. Before this is accomplished, however, one side of the blastula becomes flattened and in the centre of this surface an invagination gives rise to a finger-shaped gut or archenteron and the blastula becomes a gastrula. Within 30 hours, from the apex of this a little bilobed vesicle is cut off which promptly divides into right and left vesicles. These vesicles —outgrowths of the gut—are the rudiments of the coelom. After this event the gastrula becomes converted into what is known as the prism larva. Another side of the larva becomes flattened so that the original sphere becomes a wedge and the tip of the gut bends towards this second surface. In the centre of it there appears a shallow funnel which is the rudiment of the mouth and oral funnel or *stomodaeum.* This funnel meets and opens into the blind end of the gut and so a complete alimentary canal is established. The gut has now become divided by constrictions into gullet, stomach and intestine and the blastopore forms the anus. The cilia are now restricted to a ring around the edge of the surface into which the mouth opens—and at the lower edges of the surface two blunt lobes or arms grow out. With the appearance of these lobes or arms the prism larva becomes a *pluteus* or "easel-like" larva, as it was first termed by its discoverer, Johannes Müller. The arms are supported by long spine-like outgrowths of the calcareous tridents. They occur along the course of the ciliated band and the first pair are known as the *post-oral arms.* But other branches of the tridents extend forwards along the sides of the gullet and mouth and here impinge on the ciliated band and give rise to a second pair of arms, known as the *antero-lateral* pair. Johannes Müller not having observed his larva in the living active state, placed it wrong way up, with the pointed posterior end above, and compared the four long ciliated arms to the legs of the painter's easel. In order to distinguish this larva from the somewhat similar larva of the brittle-star it is now termed the *echinopluteus.*

As the echinopluteus grows, it develops four other ciliated arms, two overhanging the mouth termed the *pre-oral*—the calcareous rods supporting these grow from a median calcareous centre in the dorsal region above the gullet—and two at the sides behind the antero-lateral called the *postero-dorsal*—each of these is supported by a rod growing from a new centre on the side of the larva. The echinopluteus retains the same general appearance as it grows bigger and older, until at the age of about four weeks it suddenly descends to the bottom and changes into a young sea-urchin. Four crescent-shaped outgrowths from the ciliated band, two placed dorsally and two ventrally, are developed; these in later larval life become very large and on them the main part of the swimming function devolves; but these crescents, termed "epaulettes," are peculiar to the genus *Echinus* itself and some allied genera. Want of space compels us to describe in briefest outline the change of the echinopluteus into the sea-urchin. The coelomic sacs formed in the prism larva become divided into anterior and posterior halves on each side. From the anterior section on the left side a small rounded vesicle termed the *hydrocoele* is budded off. Round this bud the whole organization of the future urchin is built up. The hydrocoele becomes bent into a short thick hoop, the ends of which join so that a ring is formed. This becomes the ring canal of the water vascular system. From the ectoderm opposite the hydrocoele a deep pouch is developed which becomes a closed sac. The roof of this sac is called the amnion. Its floor grows out to form the first spines and tube-feet of the future sea-urchin; into the tube-feet, of course, branches of the hydrocoele project. Through the centre of the floor a new intucking marks the position of the adult mouth, which has no known relation to the larval mouth. The whole complex of spines and tube-feet is known as the *Echinus-rudiment.* From the anterior coelomic sac on the *right* side a small vesicle is budded off the corners of which lie above the gullet almost in the mid-dorsal line. This sac is called the "pericardium." Its floor is bunched up to form a tube and the space—part of the blastocoele—included between the upper wall of the gullet and this floor is called the heart. The tube-like ingrowth pulsates rhythmically and causes the blastocoele fluid to circulate.

As the larva grows older the "Echinus-rudiment" increases in size till it occupies the whole side of the larva. Finally, the "amnion" becomes absorbed and the first tube-feet project freely. Then these feet take hold of the substratum and in a marvellously short time—about half an hour—the larval arms are all absorbed, the ciliated band and ciliated epaulettes vanish. The larval buccal funnel loses its connection with the gullet, shallows out and disappears, and the easel-like larva is reduced to a minute round flattened disc, which then takes up the ordinary creeping life of the sea-urchin.

The larva of the brittle-stars (Ophiuroidea) is also called a Pluteus. In fact it is the original Pluteus which was described by Johannes Müller. It differs, however, in many important respects from the larva of the sea-urchin and for this reason it is now termed the ophiopluteus. The eggs of brittle-stars agree closely with those of sea-urchins in their segmentation, blastula and gastrula stages, and in the way in which mouth arms and coelom are formed. In the early pluteus stage, however, the first arms

to be formed are not the post-oral, but a pair growing out from the sides of the larva. These arms (occasionally present in the echinopluteus) are directed forwards and are the longest arms of the larva. They are followed by antero-lateral, postero-dorsal and post-oral arms, but no pre-oral arms are formed, so that here again we find an eight-armed larva; but the arms are not quite the same as those of the echinopluteus. The arms are stiffened by calcareous rods, but all the rods on the same side of the larva are outgrowths of the same calcareous star. The coelom is formed in the same way as in the echinopluteus; it divides and gives rise to the hydrocoele bud in the same way; but the history of this bud is rather different. It becomes converted into a ring-canal, and this ring-canal gives off five lobes, *but these lobes project, not into an amniotic space, but into the buccal funnel of the larva.* As the ophiopluteus grows older, the ciliated arms become absorbed; but the postero-lateral ones persist and even grow longer. The buccal funnel of the larva shallows out and disappears, thus exposing the first formed tube-feet, which take hold of the substratum and there metamorphosis is completed and the creeping life of the adult is begun. Then the postero-lateral arms finally disappear. *It is to be noted that here the adult mouth is the opening between the buccal funnel of the larva and the gullet and that no new opening is formed.*

The larva of the ordinary starfish is called the *bipinnaria* and seems at first glance very different from both the echinopluteus and the ophiopluteus. Closer examination reveals its essential similarity. The egg segments in the same way and the blastula and gastrula stages are the same; the larval mouth, the coelom and arms are formed in the same way. But the next stage is sausage-shaped. This shape is due to the existence of a long forehead or pre-oral lobe in front of the mouth. Into this the anterior division of the coelom extends on both sides and two sacs fuse into a median sac in front of the mouth. When the ciliated band is formed out of the general ciliated covering of the gastrula, it runs along the sides of the larva to the front end; arrived here it bends backwards along the underside of the pre-oral lobe. This loop of the band is soon constricted off from the rest and forms a special pre-oral ciliated band. Both bands, the pre-oral and the main one, develop outgrowths, but these are not supported by calcareous rods; they resemble the wings (pinnae) of insects, whence the name bipinnaria. The main band of cilia develops a median anterior "pinna." The division of the coelom into anterior and posterior portions takes place as in other echinoderm larvae; and the hydrocoele bud develops as in the sea-urchin, but there is no amnion formed and the primitive tube-feet from their first appearance project freely to the outside. The adult mouth is formed as a new perforation in the centre of the hydrocoele ring. What distinguishes, however, the bipinnaria from the other larvae of free echinoderms is the mode of its metamorphosis into the adult. After swimming about for two months, during which time the hydrocoele and its appendages grow larger in relation to the rest of the body of the larva, the bipinnaria develops at its anterior end between the pre-oral and main ciliated bands a group of three short arms ending in adhesive knobs; by means of these the larva anchors itself to the sub-stratum. It has now become a *brachiolaria*. An oval suctorial disc, consisting of sticky cells, is developed at the apex of the forehead between the bases of these arms; by the contraction of the arms the disc is brought into contact with the substratum (often a bit of seaweed) and so a permanent fixation of the larva is effected and the pre-oral lobe is converted into a stalk. After becoming fixed, the ciliated bands and their pinnae disappear, and the stalk shortens till it becomes a small knob. The buccal funnel of the larva shallows out and disappears, the shortened stalk is attached near the adult mouth to the under surface of the future starfish. Finally, as the hydrocoele and its tube-feet become more and more developed, the starfish wrenches its vestigial stalk loose from its attachment and walks away.

The *auricularia* larva of the sea-cucumbers resembles the bipinnaria in outer appearance. There is a pre-oral lobe, though not as well developed as that of the bipinnaria; and the ciliated band is prolonged into a pre-oral loop on the underside of this lobe but this is never quite cut off from the main band. The band grows out into lobes or pinnae, which, like those of bipinnaria, are not supported by calcareous rods. There is a blunt anterior median one, and the postero-lateral pinnae are long and curved and have been compared to little ears (auriculae), whence the name of the larva. The development of the coelomic vesicle is different in the auricularia from what it is in other echinoderm larvae; it remains unpaired and divides into anterior and posterior halves; the posterior portion subsequently divides into right and left halves. The anterior portion, which represents the left anterior vesicle of other larvae, gives rise to the hydrocoele; this grows round the larval gullet, no separate adult mouth being formed. The auricularia swims about, gradually growing bigger for a fortnight, and then suddenly changes into another larval form known as the *pupa*. This is smaller than the auricularia and its tissues are much more dense and opaque. The first-formed tube-feet grow out into the buccal funnel (larval stomodaeum). When the change into the pupa occurs this stomodaeum deepens and its opening becomes narrowed and practically closed; it is then known as the *atrium*. The atrium shifts from its original ventral position to the left side of the larva and then by the shrinkage of the pre-oral lobe, the opening of the atrium becomes terminal. At the same time the ciliated band of the larva becomes broken into short pieces which re-unite to form circular bands of cilia surrounding the pupa as the hoops surround a barrel.

The first-formed tube-feet project into the enlarged buccal funnel or atrium just as they do in Ophiuroidea; but these tube-feet are not terminal appendages of the radial canals, as they are in the other three classes, but basal ones—the so-called buccal tube-feet, which, in the adult sea-cucumber, are arranged around the mouth and are used to collect food. The radial canals extend along the body of the pupa outside the atrium. After swimming for a few days the pupa loses its ciliated bands and drops to the bottom; it develops a skeleton of calcareous plates almost touching one another and recalling the shell of a sea-urchin. The atrium opens and the tentacles protrude and begin to collect food and tube-feet develop on the radial canals, first on those that lie on the under side of the sausage-shaped animal and then on those that lie on the upper side.

From the descriptions just given it seems clear that the bipinnaria, ophiopluteus, echinopluteus and auricularia are modifications of one original type of larva. In our view, this larva is a recapitulation of an original free-swimming ancestor of all the echinoderms, which, like most free-swimming animals, was bilaterally symmetrical. Like the trochophore, the echinoderm larva gives evidence of having passed through blastula and gastrula stages in the history of the race, but there the resemblance ends.

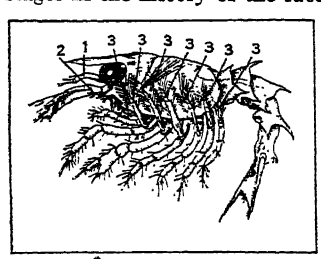


FIG. 7.—THE MYSIS LARVA OF THE AMERICAN LOBSTER, HOMARUS AMERICANUS
1. Antennule; 2. Antenna; 3. The seven pairs of exopodites born by the thoracic limbs

The protoplasm of the cells composing the trochophore blastula is already specialized, so that when these cells are separated from their fellows, they pursue, so long as they live, the same development as they would have done in the intact organism. The cells of the echinoderm blastula, on the other hand, are unspecialized; any sufficiently large portion of the blastula wall will round itself off and form a blastula of reduced size, which will pursue a normal development and give rise to a small normal larva. The echinoderm larva is, therefore, in a much more primitive condition than the trochophore larva from which Annelida and Mollusca have very possibly been derived. We saw that the ciliated band of the trochophore was built up of four discrete groups of ciliated cells which very probably represent the "ribs" of a ctenophore ancestor. The ciliated band of the echinoderm larva shows no such indications; it is not transverse but obliquely longitudinal, crossing the dorsal surface on the pre-oral lobe or forehead and the ventral surface in front of the mouth. The

coelom in the trochophore is a derivative of the growth of two large cells—originally part of the gut wall. This method of formation represents an original gut-pouch, modified in connection with the extreme specialization of the cells of the trochophore; in the echinoderm larva the origin of the coelom from a gut-pouch is obvious. Another difference concerns the fate of the blastopore. This in the trochophore closes up in a longitudinal seam, one end of which remains open as the mouth, while in some very primitive forms the other end remains open as the anus. In the echinoderms the blastopore is always a round hole which persists as the larval anus, and the mouth is a new opening formed apparently completely independently of the blastopore. To sum up, the trochophore and the echinoderm larva both represent simple free-swimming ancestral forms which were, however, markedly different from one another; to trace these back to a common root it is necessary to go back almost to the beginnings of the Metazoa.

The most remarkable feature in the life-history of the echinoderms is their change from the bilateral symmetry of the larva to the radial symmetry of the adult.

It is obvious that no light is thrown on its meaning by the sudden metamorphoses of sea-urchins, brittle-stars and sea-cucumbers. In the life-history of the common starfish (Asteroidea), however, a fixed stage intervenes between the free-swimming phase and the crawling adult. Some members of other phyla desert the open water to seek food at the bottom—and in many cases—owing probably to the existence of powerful currents, they develop the habit of holding on to one place and seizing the food as it drifts past them. All such animals tend to develop tentacles on all sides, for instance, the Polygoa (*q.v.*). If in the fixed echinoderm ancestor the hydrocoele had already developed its tentacles; then these must have been developed on both sides, and in asteroid, ophiuroid and echinoid larvae a second hydrocoele bearing tentacles is occasionally developed on the right side as well as on the left. But some constitutional peculiarity of the stock favoured the left side at the expense of the right, and so this hydrocoele developed into a ring suppressing the corresponding organ of the right side altogether. The formation of this ring and the functional importance of the organs developed from it is the foundation of the radial symmetry; all the other organs of the body are adapted to it. As the ancestral starfish spread into more tranquil waters, they wrenched themselves loose from their stalks and gave rise to the free living Echinodermata. The Ophiuroidea are only more specialized starfish, and the sea-urchins, when just metamorphosed, are little flat disc-like starfish, in which nothing of the globular form of the adult can be seen. They developed, we may suppose, out of starfish which took to climbing in vertical crevices—situations which mountaineers call chimneys—and in these circumstances the tips of the arms were bent upwards to get a better grip of the cliffs above them and so the globular form was attained. The sea-cucumbers are perhaps the result of a further development of this habit, for from climbing vertical walls to wriggling amongst stones is an easy passage; but the young post-larval sea-cucumber still show traces of the shell of the sea-urchin ancestor from which it was derived.

There still exist at the present day a few stalked echinoderms, represented by the class Crinoidea—the last survivors of an immense multitude of Palaeozoic forms, so numerous at one time that vast masses of limestone are formed of their accumulated remains. The stalk springs from the centre of the back, whilst mouth and anus are both on the opposite surface. The eggs of the only crinoid whose development has been worked out are large and full of yolk, and the earlier stages of development are embryonic, and during the short larval phase the young animal takes no food. Nevertheless, this larva shows in broad outline some resemblance to the bipinnaria, although the cilia are arranged in transverse bands as in the pupa of sea-cucumber. It has a long pre-oral lobe containing a single anterior body-cavity; and at the apex of this lobe there is a sucking disc by which it soon fixes itself and the pre-oral lobe is then changed into a stalk. There is a larval buccal funnel or stomodaeum, which, however, never opens into the gut, since the larva takes no food, and into this funnel the first tentacles project just as they do in Ophiuroidea and Holothuroidea. But the changes which supervene after the larva is fixed are quite different in the Crinoidea from what they are in Asteroidea. The buccal funnel of the larva, instead of being pressed closer to the substratum, as it is in the starfish, is rotated backwards till it reaches the posterior pole of the larva, which is, of course, directed upwards towards the open water. Then it opens and the ciliated tentacles spread out and collect the microscopic plants and animals that swim freely through it. We now see that the wide distinction between the fixed and free echinoderms rests ultimately on a different choice of food. When the ancestral echinoderm began to hold on to the ground with its pre-oral lobe and to grope about in the water with its tentacles for food, two courses were open to it—it might either bend downwards to grasp what was drifting beneath it, or reach upwards to attain what was floating above it—the first course led to the development of the free echinoderms, the second to the crinoids.

If we search through the animal kingdom for larvae resembling those of echinoderms, we find such a larva only in the phylum Enteropneusta. This is the tornaria larva of the worm-like *Balanoglossus* which is described in the article BALANOGLOSSUS. But the resemblance is so close that tornaria was actually regarded as an echinoderm larva until its life-history and metamorphosis were known. It has a longitudinal ciliated band with a pre-oral loop which resembles that of the auricularia. It has a long pre-oral lobe containing a single anterior coelom like the bipinnaria. Besides this coelomic sac, a pair of anterior sacs at the sides of the gullet represents the hydrocoele, and its missing fellow on the right side and a pair of posterior sacs represent the posterior sacs of the echinoderm larva. Most striking of all, it has above the gullet a small pericardial sac, the floor of which vibrates and acts as a heart, exactly as it does in the larvae of Asteroidea, Ophiuroidea and Echinoidea. The tornaria has some additional features. There is a posterior transverse ring of cilia behind the longitudinal ciliated band and an apical nervous plate with two eyes at the apex of the pre-oral lobe. Such a plate is not found in the bipinnaria but is found in the echinopluteus. The fate of the tornaria larva is different from that of the echinoderm larva because the adult habits are different, but there can be no serious doubt that it represents the same ancestral stock. An ally of *Balanoglossus, Cephalodiscus,* actually uses its pre-oral lobe for temporary fixation and has the middle section of the coelom on each side developed into long ciliated tentacles. As pointed out in the article BALANOGLOSSUS, this animal in its gill-sacs, and rudimentary nerve-tube and notochord, shows unmistakable affinities to the vertebrates, so that here the embryology of the Invertebrata merges into that of the Vertebrata.

In this article we have striven to give some idea of what has already been gleaned as to the past history of life by the study of invertebrate embryology. But what has been discovered is only a small fragment of what is still unknown and could be known if more life-histories were studied and compared.

(E. W. MACB.)

See also EMBRYOLOGY; REPRODUCTION; METAMORPHOSIS and the articles on the various groups of invertebrates.

INVERT SUGAR: *see* SUGAR.

INVERURIE, royal burgh and parish, Aberdeenshire, Scotland, situated at the confluence of the rivers Don and Ury, 16¼ m. N.W. of Aberdeen by rail, on the L.N.E. railway. Pop. (1921) 4,455. Paper-making and the making of mineral waters are the chief manufactures. It also contains railway workshops and is a summer resort. At Harlaw, about 3 m. to the N.W., was fought in 1411 the great battle between Donald, lord of the Isles, and the royal forces under the earl of Mar. Not far from the scene of this conflict stands Balquhain Castle, a seat of the Leslies, now a mere shell, which was occupied by Queen Mary in September 1562 before the fight at Corrichie between her forces, led by the earl of Moray, and those of the earl of Huntly. Near Bennachie (1,619 ft.) are stone circles and monoliths. There is a branch line from Inverurie to Old Meldrum.

INVESTIGATION, CRIMINAL. Criminal investigation is that branch of criminal jurisprudence which applies the principles and practices of philosophical analyses, science, art and

technical skill in judicial proceedings, subject to legal rules and forms in which there must be elucidation of questions relating to crime. This covers the questions: who the victim was; the exact place at which the offence occurred; how the crime was committed, with what weapon it was committed, or what were the means employed in its commission; what was the time of attack, what was the motive or object of attack, and the identity of the offender or offenders. Criminal investigation is employed also in the search for and interrogation of material witnesses who are able and willing to give competent and relevant testimony against the suspect or offender, and in the reconstruction of all facts connected with the crime in order that, at the trial of a defendant, a true picture of what occurred may be presented in such manner as to leave no doubt in the minds of the jurors or judge regarding the guilt or innocence of the accused.

History.—Although the beginning of criminal investigation is unknown there is reason to believe that in a very rudimentary form it came into existence with the origin of legal trials. It is clearly laid down in the Code of Hammurabi (*c.* 2250 B.C.) that suspicion does not give ground for condemnation; receiving of testimony, and even elaborate examination of sites or circumstances by the court itself, were established rules of procedure. In Athens, by about 500 B.C., the examination of facts had become meticulous; a defendant, having lost his case, might bring suit against a witness for bearing false testimony and, if successful in his new suit, would go free of his earlier condemnation. In the Fuotinian legislation (6th century A.D.) evidence was so construed as to imply the co-operation of experts in certain cases. In the middle ages, whether in civil or in ecclesiastical courts, and generally in the commercial and customary tribunals, the weighing of evidence was as careful as it has ever been. The introduction, in that period, of courts of inquest whose object was avowedly to procure condemnations, such as those of heretics, and the survival of certain ancient uses of the ordeal have obscured the prevalence of careful taking of evidence in the middle ages.

In 1507 a penal code containing exact instructions as to evidence was issued by a bishop of Bamberg, and in 1532, the Caroline code of the German States contained provisions for the examination of criminals. In 1575, a French physician described the form in which judicial reports should be made in medico-legal cases, and at the close of the 16th century, outlines of the method of testifying in such cases were numerous, especially in Italy. Toward the end of the 18th century, legal medicine was recognized as a science. Orfila, who occupied the chair of chemistry and medical jurisprudence in the University of Paris, was employed as an expert in judicial proceedings; in 1814 he published a *Traité des Poisons*. In 1689 Johannes Bohn, of Leipzig, published a work on the examination of wounds, the distinction between ante-mortem and post-mortem wounds, the different effects of death by injury, strangulation and drowning. In another of his works, published in 1704, he gives rules for the conduct of physicians during court testimony. During the latter part of the 18th century German scientists published numerous books on the subject. Lectures in medical jurisprudence were given at the University of Edinburgh in 1792, and in 1806 the university gave the title of "Professor of Medical Jurisprudence" to A. Duncan, Jr. Percival, with his *Medical Ethics* (1803), made himself one of the first noteworthy English contributors to medical jurisprudence, and was followed by John Gordon Smith. In 1823, Paris and Fonblanque published the first English work which associated the medical and legal professions. In 1836, Dr. Alfred Swaine Taylor published his *Elements of Medical Jurisprudence*, an authoritative work. The first Spanish treatise on legal medicine (1796–97) was written by Juan Fernández de Valles. In 1844, Prof. Pedro Mata of Madrid published the first edition of a work on legal medicine and toxicology, which, in the development of its subsequent editions, has become the most important Spanish treatise on the subject. The fathers of the modern school of scientific investigation are Dr. Hans Gross, formerly a professor of criminology; Dr. R. A. Reiss, of the University of Lausanne, and Dr. Alfred Niceforo. Most procedure now follows their principles.

The old trial-and-error method in criminal investigation is being rapidly displaced by scientific methods, including the use of very highly specialized instruments. Philip Valois initiated the modern police system of criminal investigation. In Paris, in 1327, he appointed *commissaires*, or royal officers, who were not part of the judicial system and who conducted preliminary examinations in the enforcement of police regulations. The *Maréchaussée*, a military police, was organized in 1356, becoming the *Gendarmerie* in 1720. The first modern police organization, however, was founded in London in 1829. Twenty-five years later the Paris civil police were reorganized on the London model. In 1830 all ungarrisoned Prussian cities were authorized to establish a police force.

Police investigators of crime were originally spies. In England they entered the service to obtain rewards offered for the capture of criminals and in France for political prestige and pecuniary rewards. Later, members of the uniformed force were detailed to plain clothes police duty. These officials cultivated the acquaintance of criminals and of persons able to supply information for the apprehension and prosecution of offenders. The results justified the experiment and the plain-clothes man of yesterday is the police detective or criminal investigator of to-day, whose chief stock in trade is common sense, with coolness, courage, patience, perseverance, an analytical mind and a large acquaintanceship with criminals.

Since the majority of crimes reported to police departments are offences where property is obtained by theft, fraud or violence, police departments, drawing from their large experience in such investigation, have developed fairly effective technique; criminal investigation methods successful in one community have been adopted by others until there is now a certain uniformity in procedure. Existing differences in technique are of minor importance and are traceable either to local conditions or to the emphasis placed by police executives on one or another phase of general procedure.

Large police departments divide the detective force into small groups, members of each group devoting their attention to a particular type of crime or criminal. Investigators detailed for duty with the pickpocket squad have little interest in, or knowledge of, the practices of burglars. Men employed in combating the activities of hold-up men frequently know little or nothing of the passer of worthless checks, but seek to acquaint themselves with the name and address, associates, habits and haunts of every bandit at large in their community. A member of the burglary squad may know who is implicated in a complaint made to the police department as soon as he reads the details of the crime.

MODERN METHODS

Classification of Criminals by their methods of operation is now a permanent and invaluable feature. Some departments use the Atcherley *modus operandi* system for this purpose. Major-General L. W. Atcherley, originator of this system of classifying criminals according to their *modus operandi*, utilizes the following classes:—

(1) *Classword*—Kind of property attacked, whether dwelling house, lodging house, hotel, etc.
(2) *Entry*—The actual point of entry, front window, back window, etc.
(3) *Means*—Whether implements or tools used, such as a ladder, jimmy, etc.
(4) *Object*—Kind of property taken.
(5) *Time*—Not only time of day or night, but whether church time, market day, during meal hours, etc.
(6) *Style*—Whether criminal describes himself as mechanic, canvasser, agent, etc., to obtain entrance.
(7) *Tale*—Any disclosure as to his alleged business or errand which the criminal may make.
(8) *Pals*—Whether crime was committed with confederates, etc.
(9) *Transport*—Whether bicycle or other vehicle was used in connection with crime.
(10) *Trademark*—Whether criminal committed any unusual act in connection with crime, such as poisoning a dog, changing his clothes, leaving a note for the owner, etc.

Many departments use their own system for keeping a record

of the criminal's specialty. Race, age, sex, colour. class and occupation of the victim are noted. Whether the attack occurred in a dwelling place, office, public or semi-public building, store, shop, vehicle, vessel, public place or on a thoroughfare, is an important item in classifying the criminal. How a burglar entered an enclosure, particularly the actual point of entry, as for example, first floor, kitchen door or second storey, rear window, or how the bandit attacked his victim, whether by beating, drugging, or otherwise, are additional means of connecting the criminal with the crime. Tools, instruments, devices, or weapons used, or means employed in committing the offence, the actual time of day, as well as the particular day, the kind of article stolen and all individual characteristics associated with the offence are factors which assist in narrowing the scope of investigation.

The object clue is always important. Second-hand dealers and pawnbrokers are required to furnish a description of all articles sold or pledged. Although the laws regulating pawnbrokers and second-hand dealers vary somewhat, in the main they require that every person who carries on the business of pawnbroker or who purchases gold bars, gold quartz or gold bullion, or mineral containing gold, shall, at the time of the transaction, enter in a register kept by him for that purpose, the date, duration, amount and rate of interest of every loan made by him; an accurate description of the property pledged; the estimated value of the property purchased; the name, residence and description of the pledgor or seller. A written copy of such entry shall be delivered to the pledgor or seller and a written account shall be kept of all sales made by the pawnbroker or seller. Police investigators assigned to pawnshops visit these and second-hand stores regularly to inspect the records and view all articles sold or pledged.

Record-keeping.—In the written report which the criminal investigator makes of stolen property, he separates the identifiable from the non-identifiable articles. His report eventually reaches a police clerk who writes a description of each identifiable article on a 5 × 3 in. card. These cards are then filed in cabinet drawers behind appropriate guides. Unnumbered articles are filed according to an elaborate decimal system, or behind alphabetically arranged guides containing the names of the articles. Numbered articles such as watches, cameras, automobiles, etc., are filed behind numerical guides. The last two or three figures in the number are arbitrarily used as primary guide divisions. Cards are arranged in strictly numerical order within these divisions. Thus, in a two-number system, a card containing a description of a watch numbered 1,100 would be filed behind the guide 00 and would follow the card in this division numbered 1,000. A record of all articles pledged or sold is also filed in these cabinets. Pledged or sold articles are distinguished from stolen property by different coloured cards. Hence, when two cards containing the same description or numbers, but on different coloured cards, are brought together in the files, it means that property which has been stolen and reported to the police department has been located in a second-hand store or pawnshop. As previously stated, the pawnshop or second-hand store record contains a description and signature of the pledgor or vendor and this information frequently helps the police investigators in their search for the criminal.

Police investigators still believe in "fighting fire with fire" and retain a remnant of the old spy system. Criminals, prostitutes, gamblers and other underworld characters are employed as undercover agents and report regularly to one or more contact officials, whom the chief of the criminal investigation division designates. A safe-breaker lavishly spending money; a bandit or burglar suffering from gunshot wounds; an automobile thief possessing numerous licence plates; a pawnbroker or second-hand dealer buying "hot stuff" (stolen articles) and neglecting to enter the sale as required by law; robbery, burglary or theft being planned; criminals proposing to move from one community to another;—all these are types of instances reported to the contact official or officials by undercover agents. These may have important bearing upon a crime that has already been committed or may be committed in the future. Apart from the regularly employed undercover agents, individual investigators obtain information from criminals and other persons that they have befriended and thus clear up a baffling mystery that would otherwise be unsolved.

An old, successful investigator once said, "I spend most of my time cultivating the friendship of people who can help me to clear up crimes that are assigned to me for investigation; they often pay enormous dividends on a very small investment."

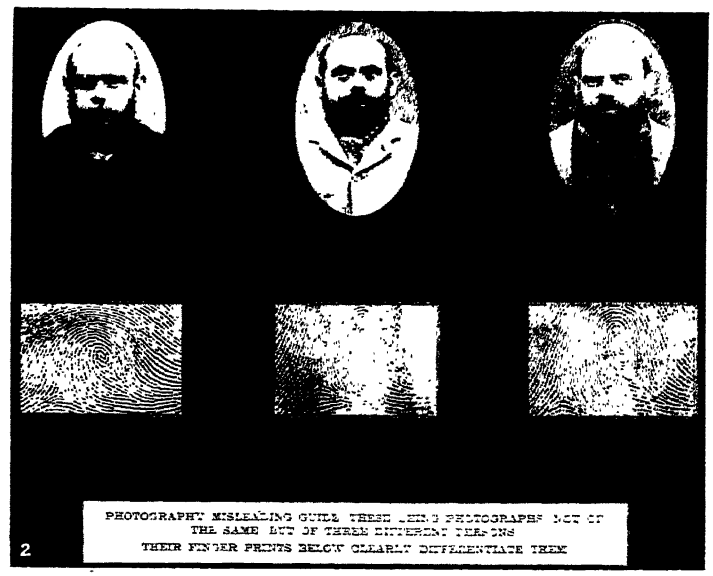
PRINCIPLES OF INVESTIGATION

General Rules.—Hans Gross's rules for guiding investigators are quite generally observed by police detectives assigned to investigate crimes. Briefly, they are: Take the simplest view at the outset and disregard all strange and extraordinary suppositions; omit the romantic features of fiction writers, remove exaggerations and confine the investigation to bare facts; never follow one idea exclusively; since women play either an indirect or direct part in many crimes and also aid in the concealment and escape of criminals, it is well to look for the woman in the case; search for causes; observe and report on all facts; make comparisons; examine localities with minute care; make measurements of places and things, and take photographs; check statements of witnesses as to time and distance, also memory of events and persons in order to determine whether their statements rest on false suppositions; remember there is usually one great blunder which a criminal nearly always commits, especially in big crimes; interview persons who have been employed in the district and know the inhabitants; endeavour to find the victim, relative or interested person from whom the preliminary information regarding the crime can be obtained; never alter the position of, pick up, or even touch an object before it has been minutely described in the report; note all points where traces of the crime or important details are to be found, *e.g.*, clothing, finger-prints, foot-prints, hair, marks caused by firearms or tools, impressions and stains of all kinds—in short, everything which may have been produced by the criminal and everything which may have been left behind by him. Absolutely everything must be carefully examined, for there is no place where important objects connected with the crime may not be found. Often the strongest proof is found in the smallest details. Foot-prints, traces of blood and forgotten or discarded objects must be protected until experts have had an opportunity to collect or preserve such evidence. The ultimate objective of the examination or interrogation is to give the investigator of the occurrence as much detail as if he had been present in person. The investigator must have a wide acquaintance with experts and their capabilities for they are indispensable assistants and their findings and conclusions enable the detective to obtain a broader perspective of the case.

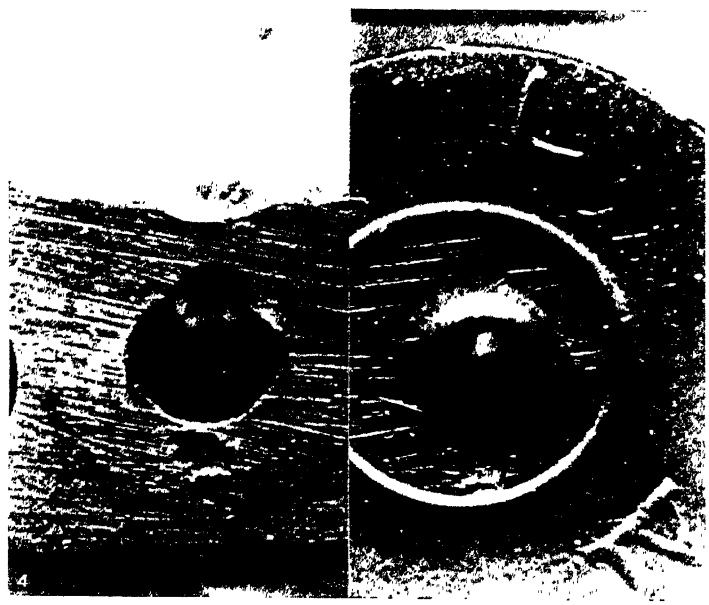
The Expert.—Police photographers and finger-print experts are commonly employed by criminal investigators, and experts in special fields occasionally assist in clearing up crimes. Seemingly insoluble problems have been unravelled by workmen and artisans of every trade, occupation or profession.

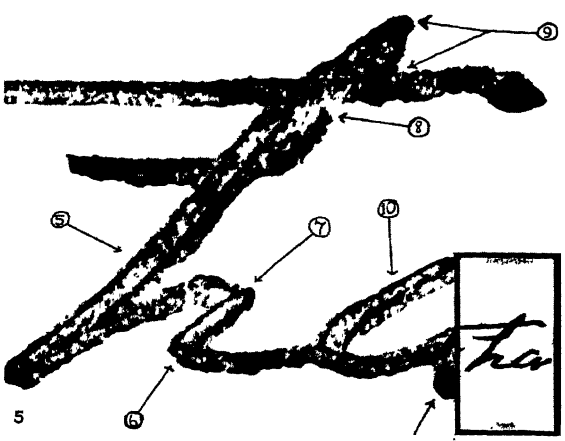
Obviously, medico-psychologists are valuable aids of the police, and the types of cases in which they assist cover a very wide field: ante-mortem and post-mortem examinations of wounds; all fractures and contusions; blood examinations; determination of the cause of illness, death or abnormal behaviour; observation of mental conditions of victims and suspects; and the restoration of decomposed, discoloured, mutilated or mummified remains. In many cases they are able to give the exact race, stature, age and sex from a study of the teeth and skeletal remains. On one occasion, the mutilated and mummified remains of a murdered woman were soaked for three hours in a 1% solution of potassium-hydrate and then placed in a 2% solution for 18 hours. After the soaking process, the body was drained and dried, cuts in the cheek were sewed up, cavities in the head and face were stuffed with cotton and then filled with plaster of paris, the filled-in places were smoothed over with flesh coloured embalmer's wax, artificial eyes and hair were placed in position, a missing ear was worked up in wax, flesh tints were added, and eyebrows and lashes painted on. A photograph of the reconstructed body was then taken and easy identification was made possible. Very slight traces of blood may be readily distinguished with the aid

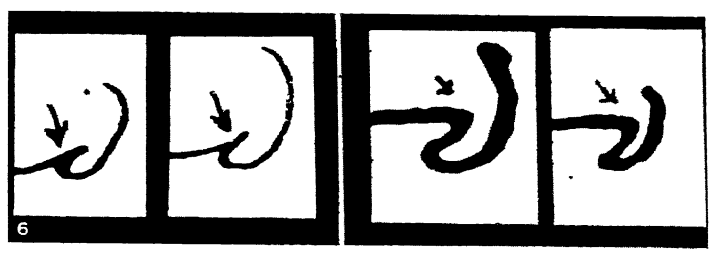












PHOTOGRAPHS, (1, 2, 4) BY COURTESY OF SCOTLAND YARD, PHOTOGRAPHS AND NOTES, (3, 5, 6) BY COURTESY OF G. F. GURRIN, F.R.M.S.

BURGLARS' TOOLS AND METHODS OF DETECTING CRIMINALS

1. Plant and burglars' tools used in burning out the lock of a safe with oxyacetylene gas
2. *See* description under picture
3. By means of specially prepared transmitted light photographs, it is possible to ascertain whether an envelope has been illicitly opened and resealed. In the accompanying illustration will be seen white patches inside the outline of the envelope flaps. These patches indicate that the surface beneath the top flap has been disturbed after sealing
4. Photographs showing the identical coincidence of marks transferred from the breech shield of a revolver to the back of a cartridge case fired by that revolver
5. Detection of a forgery. A natural size photograph of the letters "h" and "a" from a disputed signature, with an enlarged photograph of the same letters showing imperfections pointing to a freehand forgery
6. The two illustrations on the right are instances of the letter "d" (enlarged) taken from specimens of an authentic handwriting. The two illustrations on the left are instances of the same letter (similarly enlarged) taken from a forgery of the same handwriting. In attempting to reproduce the characteristic finishing stroke of the "d," the copyist overlooked the less obvious characteristic of the direction of connecting strokes (*see* arrow)

of the Dudley Roberts occult blood test. When a stain is definitely determined to be blood, the pathologist utilizes the well known precipitin test to discover whether it is human blood or not. A microscopic study of the size, shape and colour of the corpuscles often makes it possible to determine from which particular group of animals the blood has come.

The micro-analyst recognizes at a glance all the structures which may appear within the field of the compound microscope and interprets the findings with a reasonable degree of accuracy. Lower plants and animals, plant and animal tissues, vegetable, animal and inorganic fibres, starches, dextrins, sand, soil and minerals are readily identified and their connection with the case under investigation may be quickly established. Dust or stains found in or attached to clothing or weapons, also deposits found under finger-nails, have furnished the investigator with the only and occasionally the most important clue. A single hair from the head of a human being has pointed unerringly to the perpetrator of a felonious offence. The fact that it was human hair, also the age, sex, race, probable colour of eyes, and probable weight of the person to whom the hair belonged, were ascertained by the micro-analyst after examining the four structural parts of the one strand that was left behind by the criminal. The hair of every fur-bearing animal has its own characteristics and these characteristics are so well defined that the expert experiences little difficulty in determining the type of mammal from which the single strand of fur came (*see* HAIR).

The chemical analyst is employed in all cases where the investigator believes that poison has been given, whether through the mouth or otherwise. He may also supplement the work of the micro-analyst. These experts are able to prove the nature of the substance that was administered and to determine also the nature of organic or inorganic substances that play an important part in any criminal investigation. Particles of dust may prove distinctly injurious to some persons and sometimes perfectly healthy people are affected fatally by doses of common drugs or by simple kinds of food. When this occurs, the chemical analyst will discover the true cause of death. Such information has occasionally cleared accused persons.

Firearms.—Forensic ballistics is that branch of criminal investigation which deals with the identification of firearms, bullets, cartridge cases and explosive materials used in guns. Experts in this field study also the effect and trajectory of bullets fired from guns; they can determine whether a bullet was fired from, or a cartridge case ejected from, a particular firearm. After examining a bullet they are able to state the make, calibre, type, approximate date of manufacture and the approximate serial number of the gun from which it came. This information is obtained by studying the following points on the bullet:—number of rifling lands, pitch or twist of rifling, width of grooves and lands, depth of grooves, calibre and weight of bullet, and the individual characteristics which are to be found in the barrel of every firearm, such as rough spots, gouges, imperfections and emery marks. These peculiarities are impressed upon the bullet when fired from the gun.

Identification of cartridge cases discharged from an automatic weapon is made possible by examining the scratches on the side of the case which are produced by the several mechanical operations connected with automatic loading and unloading, the marks made by the extractor hook, the firing pin imprint on the primer, the breech face imprint on the primer and shell base, and the imprint of the ejector blade or shoulder. When the cartridge case has been exploded in a revolver, the firing pin and breech face impressions on the primer and shell base furnish means for identification. Chemical composition of alloys used in the manufacture of bullets is easily ascertainable from slight traces of the metal, especially if the composition is unusual, while micro- and chemical analysis of powder found upon a bullet, even after it has entered a foreign body, has revealed the manufacturer's formula.

To the handwriting expert are referred questioned documents of every description. He studies erasures, obliterations, additions to writing, false seals, water marks, imitations of stains or marks of any character whatever on the paper, age and chemical nature of inks and papers, type of pen or pencil used.

Photography and the Deception Test.—Photography and photo-micrography play an important rôle in criminal investigation. Speaking of the value of the photograph to the criminal investigator. Reiss says:—"(1) It constitutes an indestructible document taken automatically which reproduces all the facts and acts as an artificial memory. (2) It is a help to all those called to discharge duties during the trial without knowing the place of the crime. (3) It is able to exercise a psychological effect, whether upon the jury or on the judge. (4) The little details photographically revealed upon the place of the crime, such as the foot impressions, the digital markings, or anything of that nature, aid in the conviction of a criminal or the finding of the one responsible for the crime."

Briefly, the camera is employed as a recording agent whenever it is desired to obtain absolute, objective, permanent and easily controlled proofs.

Recently one other tool has been added to the equipment of the investigator: *i.e.*, the psycho-physiological deception test, although it is better known to the public as the "lie-detector." With this technique it is possible to establish guilt or innocence in a comparatively short period, thus avoiding the long, wearisome hours given to the examination of persons who are under suspicion.

The technique of the deception test consists primarily in securing a blood pressure curve, taken synchronously with a respiratory and a time curve. In practice, the suspect is seated on a chair, a cuff is then strapped on the upper part of the arm for the purpose of recording the blood pressure and a rubber tube is hooked round the chest for recording the respiration. After adjusting the blood pressure device, the instrument is set in motion and permitted to run for a few minutes in order that the normal reaction for this individual may be obtained. The expert conducting the investigation then follows this by an introductory statement to the effect that the suspect is being subjected to a test to determine his guilt or innocence and, further, that taking the test is optional for him. A few questions are then asked which require an answer of "yes" or "no," the correct answers being known to the expert before they are given. The graph, which includes the brief run without questions and reactions to the preamble and indifferent questions, is used for comparison with the later record obtained when questions relating to the crime under investigation are asked of the suspect. Results obtained thus far indicate that the deception test (*q.v.*) affords a convenient and reliable method for detecting deception.

Identification.—Criminal investigation and criminal identification go hand in hand. The identification expert is the foremost ally of the investigator. Occasionally the identification expert furnishes information to the investigator regarding the identity of the person who committed the crime as well as supplies the evidence that serves to convict the offender after his apprehension. The duties of the identification expert are:—

(1) To ascertain identification of the perpetrator of the crime prior to his apprehension (a) by the use of the alphabetical index when the name of the offender is known; (b) by photograph when the criminal has been seen by his victim or by witnesses; (c) by the *modus operandi* of the criminal; (d) by the handwriting of the criminal; (e) by finger impressions left at the scene of the crime.

(2) To ascertain identification of offenders after arrest (a) by the alphabetical index; (b) by a photograph, where no finger-prints have been taken; (c) by the *modus operandi* system connecting the arrested criminal with numerous other crimes; (d) by comparison of the criminal's handwriting with documents connected with criminal offences; (e) by finger impressions of the criminal found at scenes of crimes committed by him, of which he was not suspected by the investigator; (f) by the ten-digit finger-print system when the offender has been previously recorded in the bureau.

Criminal identification may be said to have originated with the branding of criminals. In 1487, it was enacted in England that every person convicted of a felony in which benefit of clergy was admitted should be branded on the brawn of his thumb; with an M if his case was murder and with a T if it was theft. Tattooing was also used in marking criminals.

A name registry of convicted criminals marks the beginning of modern criminal identification methods. This registry has served officials effectively and is still used in an amplified form. Quite early, however, a name registry was found to be comparatively worthless for the purpose of identifying habitual and migratory criminals because they changed their names or residence with every arrest.

SCIENTIFIC ENQUIRY

The earliest scientific method used for the purpose of criminal identification was photography. In 1850 photography made rapid advances with the introduction of the collodion process, for then untrained persons could easily learn how to take and develop photographs. The result was that photographs of criminals were taken in various countries. When photography was introduced, it was believed that this means of identification would furnish a solution to the problem which confronted the law enforcement officials. In the course of a few years, however, the collection of criminal photographs grew so large that it became physically impossible to locate a previous record of the offender. Experts spent weeks in an effort to identify a person suspected of having a prior record. England then started a tattoo registry to supplement the photograph record. This, too, became unwieldy and yielded comparatively small results, considering the enormous amount of labour expended in maintaining and searching the registry.

Bertillon System.—Many unsuccessful methods were devised to break up and make serviceable the huge collection of photographs and finally Dr. Alphonse Bertillon, chief of the identification bureau in Paris, invented the signaletic system in 1882. This system is divided into three parts: (1) the anthropometric signalment, which consists in measuring some of the characteristic dimensions of the bony structure of the body, under prescribed conditions and with the utmost precision; (2) the descriptive signalment, which is the observation of the shape and movements of the body, and even the most characteristic mental and moral qualities; (3) the signalment by peculiar markings, which is the observation of peculiarities of the surface of the body resulting from disease, accident, deformity or artificial disfigurement, such as moles, warts, scars, tattoo marks, missing or deformed members. The following measurements are taken:

Measurements of the body: Height (height of man standing) Reach (length of the outstretched arms from finger-tip to finger-tip) Trunk (height of man sitting).

Measurements of the head: Length of the head. Width of the head. Length of the right ear. Width of the right ear.

Measurements of the limbs: Length of the left foot. Length of the left middle finger. Length of the left little finger. Length of the left forearm.

Bertillon's system has been discarded by most police departments, but his descriptive methods are used by investigators because no better scheme has yet been devised for furnishing a minutely descriptive, verbal portrait of an individual. Colour of eye, shades of hair and complexion, shape of the forehead, nose and ear, and build of the criminal are subjected to a rigorous but simple classification scheme. Other complementary features included in the verbal portrait are a description of the lips and chin, the general contour of the head, including profile and face, the various modes of implantation of the hair, the beard and the eyebrows, the shape of the eyelids, the form and size of the eyebrow and the orbit, the mouth, the wrinkles and furrows of the face, the expression of the physiognomy, also various kinds of information relative to the general aspect of the subject and the visible marks, scars, moles and missing or deformed parts of the anatomy.

Finger-prints.—Dactyloscopia, the science which deals with the identification of individuals through their finger-prints, was removed from the realm of theory and made practical by Juan Vucetich of Buenos Aires in July 1891. A finger-print registry was established by him at La Platte on Sept. 1 of the same year to supplement the Bertillon system, which at that time was found to be wanting in many respects. Later the Bertillon system was eliminated.

A theoretical classification of finger-prints was presented to the University of Breslau by Prof. John Purkenje in 1823. This classification was the foundation of all the theoretical and practical work that followed. Purkenje divided finger-prints into nine basic types. In 1888 Francis Galton made an additional and distinct contribution to the science of dactyloscopia by analysing and counting the papillary ridges in the bulbs of the fingers. His method has been followed by all later investigators. Application of one or two digital impressions as a substitute for signatures and as a means for identification, was made as early as 1858 by Sir William Herschel, head of the Indian Civil Service district of Hooghly, Bengal. The governor-general, in June 1897, directed that the E. R. Henry finger-print system of identification should be adopted in British India. In 1892 the first identification was made from bloody finger-prints left at the scene of a crime. In that year Francisca Rojas, an Argentinian, who had charged a neighbour with the murder of her sons, was found to be the assassin. The proof of her guilt was established by the bloody impressions left on the jamb of her door.

Vucetich divides all finger-prints into four primary groups. The first group consists of all those designs formed by curved ridges without angles or deltas, the ridges extending from one side of the finger to the other without recurving. They are called arches. The second group has the angle or delta situated at the right of the person observing it and the directive lines have their exit toward the left. They are called internal loops. The third group has the delta situated at the left of the person observing it and the direction of the lines runs toward the right. They are called the external loops. The fourth group has two deltas and the directive lines circumscribe circular figures. They are called whorls.

For classification purposes the arch, internal loop, external loop and whorl are denominated respectively A. I. E. W. for the thumbs; and 1. 2. 3. 4. for the fingers. Accordingly a hand containing internal loops in the ten fingers would classify I 2222 —I 2222. The total possible primary combinations of the Vucetich system number 1,048,576.

Primary classification will suffice for the ordinary collection of finger-prints but Vucetich provides for subdivision of large groups in the following classification scheme. Arches: natural arch, 5; internal inclination, 6; external inclination, 7; tented arches, 8. Internal loops: natural, 5; converging ridges, 6; approximating central pockets, 7; irregular loops, 8. External loops: natural, 5; converging ridges, 6; approximating central pockets, 7; irregular loops, 8. Whorls: natural, 5; lateral pockets and twinned loops, 6; elliptical whorls, 7; accidental or irregular types, 8.

E. R. Henry divides all impressions into four types, namely: arches, loops, whorls, composites. (1) In arches, the ridges run from one side to the other without backward turn or twist and, ordinarily, have no delta. (2) Loops have at least one recurving ridge and at least one ridge between the delta and core. In ulnar loops the ridges recurve toward the little finger; in radial loops, the ridges recurve toward the thumb. (3) Whorls have at least one ridge making a complete circuit. (4) Composites are patterns having characteristics of two or more of the foregoing patterns.

The primary classification is arrived at by pairing off the fingers. Beginning with the right thumb they occur on the finger-print sheets thus: first pair, right thumb and index are given a value of 16; second pair, right middle and ring fingers, a value of 8; third pair, right little finger and left thumb, a value of 4; fourth pair, left index and middle fingers, a value of 2; fifth pair, left ring and little fingers, a value of 1; the first of each pair counting as the denominator and the second as the numerator. Only whorls or composites are given a valuation. One is added to the numerator and denominator, thus giving 1 over 1 where all patterns are arches or loops, and 32 over 32 where all patterns are whorls or composites.

Arches, tented arches, radial or ulnar loops occurring in either of the index fingers compose the sub-classification, the right index finger being the numerator and the left index the denominator.

A group classification is obtained by tracing the ridges in the whorls and counting the ridges in the loops of the index and middle fingers of both hands. Arches, tented arches and radial loops, being of relatively infrequent occurrence, are always noted in the formula.

Owing to the fact that it was difficult to discover the identity

of a person from a single finger impression left at the scene of the crime, even though the criminal's finger-prints were filed in the identification bureau, identification experts decided to give attention to the classification of single finger-print impressions. Oloriz, in Spain, was a pioneer in this field, followed by Jorgensen in Denmark, Collins in England, and Crosskey and Larson in the United States. These investigators have succeeded in producing single finger-print systems that are operating in various countries. Their formulae make it possible to identify a criminal from a single digital impression which may be left behind by the criminal, provided that the offender's prints have been previously registered and are in the single finger-print file.

Larson System.—The following is a brief outline of the Larson system. The pattern to be identified is (1) classified according to the gross configurations of characteristic formations; arches are divided into seven types; loops, 9; whorls, 6; twinned loops and lateral pockets, 4; and accidentals, 13. (2) The inclination of the pattern—*i.e.*, the pattern slopes to the right or left, or has no inclination at all—divides all types into three sub-divisions. (3) The pattern is then classified according to the configuration of the ridges which constitute the core. (4) The ridge surrounding the core—called by Larson, the "envelope"—is classified according to its peculiarities or appendages. (5) The first ridge in front of the delta is classified according to its characteristics, such, for example, as abrupt terminations, tented, composite characteristics, dotted ridges, forked, natural or recurving. (6) The delta is then classified according to two basic types: open and closed. These two types are further divided into eight sub-types. (7) The final differentiation is reached by ridge counting and ridge characteristics. Larson says: "The pattern is split into natural divisions and each division may be treated independently. Thus a pattern may be searched for according to type; core; envelope; delta; ridge count; or ridge characteristics."

Factor	Class 1	Class 2	Class 3
I. *Form* If eyed forms are present classify as No. 3; otherwise according to whether angular or rounded.	Angular	Rounded	Eyed
II. *Skill* Legibility, symmetry and pictorial aspect considered.	Poor	Medium	Good
III. *Connections* If small letters show disconnection classify as No. 3; otherwise according to whether capitals are connected or disconnected.	Capitals connected	Capitals disconnected	Small letters disconnected
IV. *Shading* Determined by difference in width of the lightest and heaviest strokes.	Light	Medium	Heavy
V. *Movement* Finger movement lacks freedom, is slow and usually shaded; forearm shows speed, force, dash, freedom and little shading.	Finger	Compound	Forearm
VI. *Embellishment* Determined by degree of ornamentation.	Plain	Intermediate	Embellished
VII. *Terminals* Inclination of terminal strokes.	Upward	Horizontal	Downward
VIII. *Slant* Degree of slant above horizontal.	Less than 60 degrees	60 to 80 degrees	More than 80 degrees

Analysis of Handwriting.—Such a large amount of handwriting in the form of signatures on pawnshop and second-hand store books, hotel registers, writing found on worthless cheques, letters and documents of every character, is connected with criminal cases that it was necessary to find a means of classifying this valuable material. Dr. Hans Schneickert in Germany, several Austrian experts, and Lee and Abbey in the United States have contributed to this important method of identifying criminals.

The chart used by Lee and Abbey is in the adjoining column.

Modern identification bureaux, or divisions, maintain elaborate indexes giving the alphabetical arrangement of names according to the directory guide system; the *modus operandi*, arranged either by index guides or decimal system; a special marks file, in which are kept the anatomical peculiarities that assist in identifying individuals; and the ever-present "rogues' gallery."

In some cities the "rogues' gallery" photographs are pasted in books kept in numerical order; in others, they are kept in books but filed according to crime; and in still others they are placed in books and segregated according to crime, then according to hair colour, eye colour, height and weight. Some departments use the Kardex system and file photographs according to the *modus operandi* of the criminal, and then by the English descriptive method. Others have large wall leafs on which are placed the photographs of active operators, and these are frequently arranged according to description of the individual and his *modus operandi*.

While it is true to-day that not many identifications are made by photographs, they are yet sufficient in number to warrant their continuance as a means of identification.

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INVESTITURE, the formal installation into an office or estate, which constituted in the middle ages one of the acts that betokened the feudal relation between suzerain and vassal. The suzerain, after receiving the vassal's homage and oath of fealty, invested him with his land or office by presenting some symbol, such as a clod, a banner, a branch, or some other object according to the custom of the fief. The sword and sceptre, emblematic respectively of service and military command and of judicial prerogatives, became the usual emblems of investiture of laymen. The word investiture is later than the 9th century; the thing itself was an outcome of feudal society.

It is in connection with the Church that investiture has its greatest historical interest. The Church quite naturally shared in feudal land-holding; in addition to the tithes she possessed immense estates which had been given her by the faithful from early times, and for the defence of which she resorted to secular means. The bishops and abbots, by confiding their domains to laymen on condition of assistance with the sword in case of need, became temporal lords and suzerains with vassals to fight for them, with courts of justice, and in short with all the rights and privileges exercised by lay lords.

Investiture of ecclesiastics by laymen had certain serious effects which were bound to bring on a conflict between the temporal and spiritual authorities. In the first place the lay authorities often rendered elections uncanonical by interfering in behalf of

some favourite, thereby impairing the freedom of the electors. Again, benefices were kept vacant for long periods in order to ensure to the lord as long as possible the exercise of his regalian rights. And, finally, control by temporal princes of investiture, and indirectly of election, greatly increased simony. The main investiture struggle with the empire took place when Hildebrand became Pope Gregory VII. (*q.v.*). To Gregory it seemed intolerable that a layman should invest a churchman with the symbols of office. To the emperor Henry IV. it was highly undesirable that the advantages and revenues accruing from lay investiture should be surrendered; it was reasonable that ecclesiastics should receive investiture of temporalities from their temporal protectors and suzerains. Although the full text of the decrees of the famous Lenten synod of 1075 has not been preserved, it is known that Gregory on that occasion denounced the marriage of the clergy, excommunicated five of Henry IV.'s councillors on the ground that they had gained church offices through simony, and forbade the emperor and all laymen to grant investiture of bishopric or inferior dignity. The struggle was complicated throughout its course by political and other considerations; there were repeated rebellions of German nobles, constant strife between rival imperial and papal factions in the Lombard cities and at Rome, and creation of several anti-popes, of whom Guibert of Ravenna (Clement III.) and Gregory VIII. were the most important. Final settlement of the struggle was retarded, moreover, by the question of the succession to the lands of the great Countess Matilda, who had bequeathed all her property to the Holy See, Henry claiming the estates as suzerain of the fiefs and as heir of the allodial lands. The efforts of Gelasius II. to settle the strife by a general council were rendered fruitless by his death (1119). At length in 1122 the struggle was brought to an end by the concordat of Worms, the provisions of which were incorporated in the eighth and ninth canons of the general Lateran council of 1123.

In France the course of the struggle was somewhat different. As in the empire, the king and the nobles, each within his own sphere of influence, claimed the right of investing with ring and crozier and of exacting homage and oaths of fealty. The struggle, however, was less bitter chiefly because France was not a united country, and it was eventually terminated without formal treaty. The king voluntarily abandoned lay investiture and the claim to homage during the pontificate of Paschal II., but continued to interfere with elections, to appropriate the revenues of vacant benefices, and to exact an oath of fealty before admitting the elect to the enjoyment of his temporalities. Most of the great feudal lords followed the king's example, but their concessions varied considerably, and in the south of France some of the bishops were still doing homage for their sees until the closing years of the 13th century; but long before then the right of investing with ring and crozier had disappeared from every part of France.

England was the scene of an investiture contest in which the chief actors were Henry I. and Anselm. The archbishop, in obedience to the decrees of Gregory VII. and Urban II., not only refused to perform homage to the king (1100), but also refused to consecrate newly-chosen bishops who had received investiture from Henry. The dispute was bitter, but was carried on without any of the violence which characterized the conflict between papacy and empire; and it ended in a compromise which closely foreshadowed the provisions of the concordat of Worms and received the confirmation of Paschal II. in 1106. Freedom of election, somewhat similar in form to that which still exists, was formally conceded under Stephen, and confirmed by John in Magna Carta.

Many documents relating to the investiture struggle have been edited by E. Dümmler in *Monumenta Germaniae historica, Libelli de lite imperatorum et pontificum saeculis xi. et xii.* (3 vols., 1891–1897). *See* Ducange, *Glossarium*, s.v. "Investitura."

On investiture in the empire consult C. Mirbt, *Die Publizistik im Zeitalter Gregors VII.* (Leipzig, 1894); E. Bernheim, *Das Wormser Konkordat* (Breslau, 1906), and *Quellen zur Geschichte des Investiturstreites* (2 vols., 1907); R. Boerger, *Die Belehnungen der deutschen geistlichen Fürsten* (Leipzig, 1901); K. E. Benz, *Die Stellung der Bischöfe von Meissen, Merseburg und Naumburg im Investiturstreite unter Heinrich IV. und Heinrich V.* (Dresden, 1899); H. Feierabend, *Die politische Stellung der deutschen Reichsabteien während des Investiturstreites* (1913); W. Martens, *Gregor VII., sein Leben und Wirken* (2 vols., Leipzig, 1894); H. Fisher, *The Medieval Empire*, c. 10 (London, 1898). B. Schmeidler, *Kaiser Heinrich IV. und seine Helfer im Investiturstreit* (1927); W. Schum, "Kaiser Heinrich V. und Papst Paschalis II. im Jahre 1112; Eine Beitrage zur Geschichte des Investitur-Streites," *Preussische Akad. gemeinnütziger Wissenschaften zu Erfurt.* Jahrb. (1877). For France, *see* P. Imbart de la Tour, *Les Élections épiscopales dans l'église de France du XIe au XIIe siècle* (1891); A. Luchaire, *Histoire des institutions monarchiques de la France sous les premiers Capétiens 987–1180* (2nd ed., 1891); P. Viollet, *Histoire des institutions politiques et administratives de la France* (1898); Ibach, *Der Kampf zwischen Papsttum und Königtum von Gregor VII. bis Calixto II.* (Frankfort, 1884); A. Dantzer, "La querelle des investitures dans les évêchés de Metz, Toul et Verdun de 1075 au Concordat de Worms, 1122," *Annales de l'Est* année 6 (1902). For England, *see* J. F. Böhmer, *Kirche und Staat in England und in der Normandie im XI. und XII. Jahrhundert* (Leipzig, 1899); E. A. Freeman, *The Reign of William II. Rufus and the Accession of Henry I.* (1882); H. W. C. Davis, *England under the Normans and Angevins* (1905); T. Klemm, *Der Englische Investiturstreit unter Heinrich I.* (1880); M. Schmitz, *Der Englische Investiturstreit* (1884).

INVESTMENT. An investment may roughly be defined as the depository of savings. The term is usually applied to money, but strictly speaking it is equally applicable to all kinds of property, such as land, buildings and furniture. In short, the whole of an individual's property, including the debts due to him at any time, may be described as his investments.

In considering the question, a broad distinction must first be drawn, between "forced" or "unconscious" and "voluntary" or "conscious" investment. Forced investments arise in several ways. The chief is that every business man has to grant credit to his customers, and most workers receive their wages or salary "in arrears," that is after they have performed their week's or month's work. Money thus due is clearly part of each man's investments, and the amount thus "invested" is dependent not on his voluntary act, but on the customs of the trade or on his terms of employment. Before considering voluntary or conscious investment, it is necessary to examine the various motives which induce saving and govern the choice of investments. First and foremost comes the desire to provide for old age, sickness and other emergencies. Here safety is the paramount consideration, and the interest on the investment need not be taken into account. To illustrate this, £100 may be a godsend in case of an emergency, but until it is required, it makes little difference to the owner's annual income whether it is earning $2\frac{1}{2}\%$ on deposit in the bank, or 7% in some highly speculative mining shares. Next comes the question of interest, and this arises from the desire of the individual to use his savings to augment his income. In general, the rule is "the greater the yield, the greater the risk," and the application of this rule and the weighing-up of capital safety and income is one of the chief problems of the investor. Next comes the desire for that will o' the wisp, "capital appreciation," when the investor hopes that his property will rise in value. Here the distinction between investment and speculation becomes very thin. Finally come a whole host of motives. One man invests his money in his own business because it is expanding, and will gain for him fresh profits and fresh prestige; another in his business because it is going downhill, and he has still to learn not to throw good money after bad, and another in real and personal property of one kind and another, simply because of the satisfaction the possession of such property will give him. Every investor must bear in mind one general warning. Every investment demands eternal vigilance on the part of the holder. Consols, which, before the World War, were regarded as the soundest of stocks, are themselves a striking warning to the unwary. In 1896 they were quoted at $110\frac{1}{2}$, by 1907 they had fallen to 84, and by 1913 to $73\frac{5}{8}$. Then came the War, and the inflation period, and by 1920 they had fallen to a minimum of $43\frac{5}{8}$. By the end of 1927 they had recovered to 56. It is true that the interest remained constant throughout this period at a steady $2\frac{1}{2}\%$, but £2 10– would buy much less in 1927 than in 1896, so that even this stability possesses a certain unreality.

General Rules.—There are certain general rules governing the course of trade and finance which should be known to every investor. The first has already been quoted, but is repeated again

so as to be presented in compact form with the remainder:—

(1) The greater the yield, the greater the risk.

(2) Where the rate of interest is fixed, a high yield means a low price; therefore, as the risk increases, the price falls.

(3) When money is scarce, interest rates rise, and prices fall.

(4) Rising commodity prices mean active trade and high profits, but ultimately scarce money; and falling prices the reverse.

(5) The capital value or yield on a share is not only its "money" value or yield, but depends also on the purchasing power of money. This and the preceding rule must be read together.

(6) When trade is active and money in demand to the point of scarcity and high interest rates, buy consols, war loan and similar gilt-edged fixed-interest stocks, for these will be cheap under rule (2) and will improve under the second part of rule (4).

(7) When trade is dull and money plentiful, buy ordinary shares whose value rises and falls with the course of business; these, provided the company is sound, will be cheap under rule (2), and will improve under the first part of rule (4).

(8) Last and most important of all, lay a solid foundation. Life insurance comes first, and see that insurance is added to if the cost of living rises or the assured's standard of life improves. A life policy for £500 taken out in 1896 when living was cheap, is only partial protection in 1928 when prices have approximately doubled. If prices rise, more insurance must be taken out to maintain the same degree of protection.

Next in turn for the British investor come savings certificates. Even at 16s./– these are an attractive investment; they are safe, realizable, independent of market fluctuations and free of income tax. These should be bought up to the limit. After that, the investor can consider other openings. These are discussed in detail below.

and there is always the risk of the property standing vacant for a time. Again rents can vary just as much as an "ordinary" dividend. Every time a lease expires, a fresh agreement has to be made, and it is not always the tenant that is the loser. Over and above this comes one important point. Land and house-room are a universal necessity, and the result is that so far as public opinion and legislation are articulate, they are more anxious that the tenant should have adequate housing at a rent he can afford, than that the landlord should earn on his property a net return commensurate with that to be obtained elsewhere. This particularly applies to the smaller class of houses, and the war and post-war Rent Restriction Acts in England are an example of this point. Those who before the War owned houses which were exempt from restriction, found they had an investment with all the advantages of an ordinary share, while those whose property came below the line, found it had many of the disadvantages of a fixed-interest stock. In short, when money depreciates violently and prices rise, the landlord of small property must expect to be debarred by law from raising rents accordingly. Provided that he can raise his rents enough to equal any increase in maintenance costs, so that his net rent remains unchanged, restriction is not inequitable. A landlord has no greater right to claim a larger net rent because of a rise in prices than the holder of 2½% consols has to claim that in future the Government should pay him 4% or 5%. Sufficient has been said to show that house-property is a dangerous possession for the ignorant investor.

British Government and Corporation Stocks.—The first of the rules previously enunciated stated that "the greater the risk, the greater the yield." Here the risk is negligible, so all the investor has to watch is the general rise and fall in interest rates. Rules (3) to (7) inclusive, should be a sufficient guide, but the accompanying table of post-war prices will illustrate their incidence.

Variations in Certain British Gilt-edged Securities 1919–27*

Stock	Nominal interest	1919	1920	1921	1922	1923	1924	1925	1926	1927
Consols	2½%	49⅞– 60	43⅝– 52	41⅝– 50¾	49⅝– 60½	54⅝– 60	54⅜– 58⅞	54¼– 58⅜	53½– 56½	53¾– 56⅛
Funding loan	4%	73½– 78⅞	65 – 76½	67⅛– 76⅝	75¼– 89¾	84⅞– 94¼	84¼– 91½	85 – 91¼	83⅜– 88½	85⅜– 88½
Conversion loan	3½%	..	..	61⅝– 66⅝	65⅝– 78½	74⅜– 81⅞	74¼– 80⅜	74⅜– 80	73⅜– 76⅝	74¼– 77¼
Bradford	3½%	68 –75¾	62 – 69½	62 – 67⅞	67⅞– 82½	80¾– 83⅜	80 – 82⅞	81 – 83½	80¼– 82⅝	81⅜– 83¾
Liverpool*	6%	..	97¼–103⅜	98¾–103¾	102⅞–*110	106 –109¾	105 –108⅝	102⅝–108½	102¼–105⅞	102 –105¾
National war bonds†	5%	96½–100¾	93 –100⅛	94 –101	99¾–106¾	104½–106½	104⅝–106⅝	103 –106	104⅛–105½	104⅝–105¾
Bank rate	..	5–6 (rising)	6–7 (rising)	5–7 (falling)	3–5 (falling)	3–4 (rising)	4 (steady)	4–5 (varying and rising)	5 (steady)	4½–5 (falling)

*Redeemable 1930–50. †4th Series, redeemable 1929.

Land, House-property, etc.—Here is often an obvious case of forced investment, viz., that of the man who has to buy his own house or farm, or else clear out. He, too, often has to pay a forced price. If it is any consolation, he must realize that in post-war days, purchase is often the only means of getting a decent home. Two words of warning may be uttered in this connection. The first is contained in the explanation of a farmer for his action in warning off the local hunt: "I've changed my landlord, and the new one's far harder on me than the old. My new landlord is myself!" The other is that in buying, or making an offer to buy, he must count all the costs, including stamp duties and legal charges. If he buys through an estate agent, it is customary for the vendor to pay the agent's commission, which is considerable on a big transaction. The customary legal scale of charges for both buyer and seller is heavy, and it is always well to make a bargain in advance with the solicitor acting in the matter. As regards land and houses as a medium for voluntary investment, here the investor becomes the landlord. He must realize at once that property of this kind demands special care and knowledge from its owner. Repairs, maintenance, ground rents, rates, legal charges all levy a toll upon the gross rent,

Two short-dated securities have been included. These are both redeemable at 105, and so their market price gradually approximates towards this point. The level and trend of interest rates are also included in the table. The reader can trace for himself the connection between interest rates and prices. He can also see when it was "a good time" to buy or to sell. Finally, he can see that even gilt-edged stocks are subject to wide price fluctuations. The years 1921 and 1922 in particular are commended to his notice.

Foreign Stocks and Bonds.—"The greater the risk, the greater the yield," and here a special risk enters. The interest and principal on foreign stocks are often payable in foreign currency, and even when payable in sterling, the Government concerned has to buy the sterling needed for the service of the debt. In the first case, the interest received by the British holder varies with each fluctuation in exchange, for the interest on Frs. 1,000 5% French Rentes is 50 francs, whether a franc is worth tenpence, twopence or a penny. Exchange fluctuations govern the sterling interest, and also the market price. This is illustrated by the table which will be found on the next page relating to 5% Rentes:

Year	Franc exchange	Sterling interest on Frs. 2,500	Sterling price of Frs. 2,500	Yield (at "middle" price)
1921 . .	Fr. 51·6	£2. 8 6	33–48	6%
1922 . .	Fr. 54·0	£2. 6 4	25–49	6·3%
1924 . .	Fr. 84·5	£1. 9 6	18–28	6·4%
1926 . .	Fr. 150·0	£–.16. 8	7–14	7·9%
1927 . .	Fr. 125·0	£1 0. 0	13–21	5·9%

The "risk" here was the collapse of the franc. This increased up till 1926, and then sharply receded. Hence the rise and fall in the yield. The London market price was determined jointly by the sterling interest and the yield required by the market to compensate for the risk.

Industrial Stocks.—These fall into three main categories: debentures, preference shares and ordinary shares. Each is subject to wide fluctuations, and the buyer should remember this and judge by their past record, whether the shares he is contemplating purchasing stand at a "top" or a "bottom" price. Debentures are governed both by the level of interest rates, and by the risk of loss or default, and this risk is judged usually by the fortunes of the company's shares. Thus the passing of the ordinary dividend will cause a slight fall, and the passing of the preference dividend a heavier fall in the company's debentures. The issue of further (and especially of prior debentures) may also weaken existing debentures, unless it is clear that the company is obtaining the fresh money to finance new and remunerative business. The price of ordinary shares reflects many things, such as current dividends, future dividends, the possibility of bonus share issues or the existence of accrued losses. These are dealt with later. The preference share comes half-way in between. In some ways it has the disadvantages of both. It also is dealt with later. Holders of all three classes of securities should watch price fluctuations, but not be unduly elated by a rise, or dismayed by a fall. A sound share is usually worth holding.

Variations in Certain British Industrial Securities: 1920–27

Stock	1920	1921	1924	1926	1927
Home Rails:					
Gt. Western 4% debs.	64– 76	62 – 72	81 – 89	79 – 84	78 – 84
do. 5% Pref.	69– 86	66 – 83	98 –106	91 – 97	91 –100
do. Ord.	71– 93	57 – 77	104 –113	82 – 92	83 – 97
Metro. Ord.	19– 27	19 – 28	71 – 84	59 – 70	52 – 77
Foreign and Colonial Rails:					
Buenos Aires Gt. Southern Ord.	62– 88	47 – 65	79 – 90	87 –104	101 –115
Canadian Pacific	138–189	135 –165	158 –177	151 –174	170 –222
Banks:					
Midland £12 shares	6– 8	5¾– 7¼	8¼– 9	8½– 9	8½– 9¾
Westminster £20 shares	13– 16½	12¾– 15	16 – 18½	18 – 19½	18 – 19¾
Indust. Debentures:					
Ebbw Vale Steel, 6%	88– 96	84 – 90	90 – 99	89 – 93	82 – 89
Fine Cotton Spinners 4% 1st Debs.	60– 71	62 – 68	78 – 84	75 – 81	75 – 79
Mond Nickel, 5%	80– 88	79 – 83	96 –100	94 – 98	94 – 98
Indust. Pref. Shares:					
Ebbw Vale Steel, 7%	14/3– 20/–	13/– 16/10	11/– 16/–	5/9– 9/11	3/– 8/11
Fine Cotton Spinners, 5%	13/9– 18/1	14/3–17/3	18/– 20/9	17/6–19/9	17/3 – 19/7
Mond Nickel, 7%	18/7– 22/10	16/1–19/10	22/– 26/9	22/–26/1	23/3 – 27/–
Indust. Ord. Shares:					
Ebbw Vale Steel	19/1– 39/6	11/– 21/9	6/3–10/9	4/– 7/–	2/ 7– 6/4
Fine Cotton Spinners	37/6–140/–	30/– 44/3	44/9–60/9	40/– 53/10	40/ 6– 53/–
Mond Nickel	38/9– 87/6	15/– 40/3	32/9–45/9	34/6–45/7	36/10–151/10

Debentures represent money lent to a company, and principal and interest must alike be met, whether or not any profits are earned. Default is equivalent to an act of bankruptcy, so the way to regard them is whether or not the company possesses the required resources. Special points to remember are that as a rule trade creditors rank ahead of debenture-holders, and in many cases a company has the power to issue new debentures ranking ahead of the old ones. These points should be investigated by the prospective purchaser. Preference shareholders are part owners of the business. They only receive a fixed dividend, but in return have first claim to divisible profits, and first claim to repayment on the liquidation of the company. Thus, if things go wrong, the ordinary shareholder has to bear the brunt of the attack, while, if things prosper, the gains go to the ordinary shareholder. The preference shareholder's measure of protection is clearly the size of the ordinary capital and ordinary dividend. If 100,000 £1 preference shares have 100,000 £1. ordinary shares behind them, and the usual ordinary dividend is 10%, the "capital" protection is £100,000, and the "dividend" protection is £10,000. If the ordinary shares are 100,000 of 1s. each, and the ordinary dividend is 50%, the "capital" protection falls to £5,000, and the "dividend" protection to £2,500, both of which figures are dangerously small. In other words, it will not take much of a loss to encroach upon preference dividends while the smaller ordinary capital will receive just as many plums as before.

Ordinary shareholders receive what is left out of profits, after debenture interest, preference dividend and allocations to reserve have been made. When times are bad, they get nothing, and when they are good they may receive much. Many companies try and maintain a constant ordinary dividend, and in good times declare a "cash bonus" which is really an extra dividend. One of the great merits of ordinary shares is that a proportion of the profits are every year "put back" into the business by the directors of the company. This is necessary if the business is to progress, but it also means that a proportion of the ordinary shareholder's income is forcibly saved for him and re-invested by his directors. Hence his shares are steadily appreciating in value all the time. The issue from time to time of bonus shares from reserves is simply the outward and visible sign of this continuous progress. A bonus issue in itself adds nothing to the value or earning power of the property, and the reason why the market hails it as a bull point is that it marks a definite stage in the company's progress, releases to the shareholder some of his forced savings, and is considered by the ignorant to be of the nature of "receiving something for nothing."

The fundamental principle of debentures, preference and ordinary shares, is that the holder of the last-named is first in line for both the "kicks" and "half-pence" distributed by fortune. He also exercises full control over the company, and the debenture and preference shareholder can only intervene when surplus "kicks" start coming his way. It must be realized that this gives great scope for the unscrupulous ordinary shareholder to display his ingenuity. Thus, he can distribute two years' profits in advance to himself by a suitable manipulation of the accounts, and then explain to the others that the company is insolvent and all must make sacrifices. Conversely, he can by a fraudulent conservatism, write down some of the assets to vanishing point, report insolvency, buy up the preference shares cheap, and then restore the assets (and the preference shares) to their true value. Nor need debenture and preference shareholders' rights count for much. They can always surrender their rights, and when the voluntary surrender of their rights is put before them as the only alternative

to bankruptcy, it is hard for the holder to resist.

There are too many cases where a company starts with, say, £10,000 in £1 preference and £10,000 in £1 ordinary shares. A good period ensues, and 10,000 more £1 ordinary shares are issued from reserve by way of bonus, the future being partially mortgaged in the process. Then comes a slump, a loss of £10,000 piled up, and eventually dealt with by writing the preference shares down to 15s. and the ordinary shares down to 12s. 6d. On the face of it, the ordinary shareholder has dropped 7s. 6d. to the preference shareholder's 5s. In reality, adding together the bonus issue and the reconstruction, the ordinary shareholder has taken 5s. from the preference shareholder.

A post-war development, which has nothing to commend it, is the splitting of a company's capital into £1 preferred and 1s. deferred shares. It has already been shown how this weakens the bulwark between the preferred shareholder and disaster. It is also a means of reserving the "half-pence" for the deferred shareholder, and sharing the "kicks" equally between the two classes. Take this case:

100,000 6%	Preferred shares of £1 each	£100,000
100,000	Deferred „ „ 1s. „	5,000
	Total capital	£105,000

The following table shows how the "half-pence" are distributed:

Total dividends	£20,000	£15,000	£10,000	£6,000
Pref. dividend at 6%	£6,000	£6,000	£6,000	£6,000
Def. dividend (amount)	£14,000	£9,000	£4,000	Nil.
Def. dividend (rate)	280%	180%	80%	Nil.

Say these were four years' consecutive results. The deferred shareholders have received £27,000 on their original holding of £5,000, that is, their capital back and £22,000 to boot. They can ask the preferred shareholder to be brave in facing bankruptcy with them with perfect equanimity. Nor is this the whole indictment against the shilling deferred share. In 1927 when it first appeared in Great Britain in obnoxious quantities, the vendors or promoters of a company would often keep half the deferred shares for themselves. The public would be graciously allowed to buy the other half, provided that they also bought all the preferred shares. This was a reincarnation of the founders' share with a vengeance. To show the market's appreciation of the relative worth of £1 preferred and 1s. deferred shares, the following examples may be quoted. The names are suppressed for obvious reasons:

	Share and issue price	Price	Rise or fall from issue price %
Company A	£1	18/–	– 10
„ „	1/–	9/–	+ 800
„ B	£1	12/6	– 37½
„ „	1/–	3/9	+ 275
„ C	£1	16/9	– 16¼
„ „	1/–	7/–	+ 600
„ D	£1	£1	..
„ „	1/–	12/6	+1,150

These figures speak for themselves.

Reading the Balance Sheet.—Every shareholder should be able to read the balance sheet of his company. He must remember that every figure in it represents only the estimates of the board and their advisers—thus, "plant £200,000" and "stocks £50,000" are obviously estimates, and as more intangible items, such as profits and reserves, are deduced from these first, they are equally only estimates. There are three rough tests a shareholder can apply to a balance sheet: (*a*) What are the liquid assets of the company —these equal cash plus any investments in "trustee" stocks plus debtors minus creditors and bank overdraft? If they are diminishing from year to year, the shareholder is put upon his guard. (*b*) What is the net value of the property, *i.e.*, assets (less accrued losses, preliminary expenses, etc.) less creditors? Again, is this increasing? (*c*) Are the directors putting at least £1 to reserves for every £3 distributed in capital? If not, why not, for this is a fundamental principle of sound company finance.

The first two points are illustrated by this balance sheet:—

	£		£
Preference shares	100,000	Plant and stocks	350,000
Ordinary shares	200,000	Debtors	25,000
Reserve fund	150,000	War loan	50,000
Creditors	20,000	Cash	45,000
	£470,000		£470,000

Liquid assets are, therefore, £25,000+£50,000+£45,000–£20,000=£100,000. The total value of the property is £470,000–£20,000=£450,000. Deducting preference shares, this is equivalent to 35s. per £1 ordinary share.

The rate of interest on debentures and preference shares is fixed; even if it falls into arrears, the arrears must be made up in the case of debentures and "cumulative" preference shares. So the potential investor must consider chiefly the risk of default. As regards ordinary shares, he must weigh the risk of no dividends against the chance of high dividends and cash bonuses. Capital appreciation and depreciation are dependent partly on the level of market interest rates, but mainly on the view taken as to the future of the company in particular and the industry in which it operates as a whole. The investor, therefore, must watch these points, accepting all rumours with a large grain of salt. Over and above the fluctuations of trade, ordinary shares in a company with a proper reserve policy should steadily appreciate in value. It is this that accounts for the new theory that ordinary shares are a "safer" investment than gilt-edged stocks. As regards wide changes in the purchasing power of money, to a large extent the ordinary share comes out best of all. When prices are rising, profits and dividends also rise, and the shares appreciate in money value to an amount roughly equivalent to the decline in money's purchasing power. The important point to watch is that the company uses this period to build up a good reserve fund. The reason for this is that a fall in prices operates so unevenly upon a trading company as to involve it temporarily in heavy loss. Once it survives this, the contraction in the money value of its shares is compensated for by the higher purchasing power of money, but this is no consolation to the shareholder if the company fails altogether.

Practical Hints.—One or two practical hints may be given in conclusion:—

(1) As already urged, the small investor should first insure his life for an adequate amount, and then buy (in Britain) savings certificates up to the limit of £500.

(2) The investor who wants to go further, should spread his money between gilt-edged stock, some sound debentures, and ordinary shares with a "good history."

(3) With the return on gilt-edged stock at 4½%, do not aim at more than 5½% on debentures or 7% on ordinaries.

(4) Avoid foreign and specialized shares and also new issues, unless you have personal knowledge of their peculiarities.

(5) Deal through a bank or member of a recognized stock exchange.

(6) Do not put too much into one company, or even one industry. To spread investments is to minimize losses.

(7) Watch your investments, and continue to watch. (*See* also STOCK EXCHANGE; MONEY; BALANCE SHEET.) (N. E. C.)

The United States.—American investment habits are conditioned by the newness of the country and the venturesomeness of the people. Securities which give a semblance of the safety of an investment and at the same time offer the prospect of profit of a speculation, have been in growing favour. Bonds which are convertible into stock, bonds with stock purchase warrants attached, preferred shares which are convertible into common stock and preferred or so-called A shares which participate in profits under specified conditions with the common shares, constitute the chief banking devices for combining investment with speculation. To an increasing extent, the American investor, desiring to have his cake and eat it too, has been indulging in speculative investments.

Before the World War, it was commonly conceded that shares were for speculation and bonds for investment. It is now held that well selected common shares are suitable for long term invest-

ment for individuals who are less concerned with getting back a particular number of dollars than with assuring themselves of given purchasing power or command over commodities in the future. In a steadily growing country, such as the United States, a good case can be made out for the equities—or stock interest—in well managed companies, which perpetually increase their stake in the nation's business.

The growing preference for common stocks for long-term holding was rationalized as a new investment philosophy by Edgar Lawrence Smith in his volume *Common Stocks as Long Term Investments* and by Kenneth Van Strum in *Investing in Purchasing Power*. As investors show a disposition to turn from conservative bonds to more speculative stocks, there has been a growing recognition of the need of timely statistical data and analytical skill. Accordingly, the new profession of investment management has been springing up. Between 1924 and 1928, the American investor, desiring to invest by proxy through experts, showed widespread appreciation of the investment trust idea, a novelty in the United States. According to recent estimates, there were 208 investment trusts in the country, with total resources exceeding $1,000,000,000. Such agencies, which differ widely among themselves, take the form of corporations more frequently than of common law trusts. Such agencies have for the most part built up portfolios consisting largely, if not entirely, of stocks instead of bonds. Moreover, investment counsellors, who sell only advice, have tended to favour a balanced investment list, consisting of stocks as well as bonds.

The amateur, or lay buyer, has become in the last decade an increasingly important factor in the American investment market. Before the war, it was estimated that there were only 400,000 bond buyers in the country. The Liberty Loan campaigns during the World War gave millions of Americans their first experience as security owners. There is no reliable record of the number of security owners in the United States, though estimates run upwards of 10,000,000. Not only have American governmental agencies and private corporations dipped deeply into the reservoir of savings, but an increasing array of foreign governments and foreign private business enterprises have borrowed funds in this market. New York city has accordingly become a world financial capital sharing honors with London. In 1928 New York city stood pre-eminent as a lender of long term capital, whereas London retained the primacy in financing short term foreign trade operations.

The New York money market has become increasingly cosmopolitan in character. The American investor, traditionally provincial in his tastes, gradually developed a wider outlook, and began to buy foreign issues, their higher rate being usually the attracting feature. Also outside of New York city investment banking facilities have been enormously expanded. The South and West, which before the war were virtually without local agencies for cosmopolitan investment, were covered with a network of local investment bankers and branches of nation-wide organizations. Individuals in the hinterland, who had formerly invested surplus funds almost exclusively in farm and urban real estate mortgages, began to diversify their risks. Financial advertising developed enormously in quality and quantity. Recent broadening of activity reflects, in part, the carrying of ticker facilities to parts of the country hitherto uncovered, particularly in the South, the Southwest, the Far West and in Canadian provinces. As recently as 1915, there were only 2,000 stock tickers in the country, compared with more than 7,000 in 1928. The expansion has been extremely rapid since the beginning of 1927.

In American practice, there is a sharp distinction between investing by individuals and investing by institutions. Although individuals are interested primarily in assuring purchasing power in the future, institutions, such as the savings banks and life insurance companies, with huge liabilities measured in dollars, rather than in purchasing power, are interested in assuring a specific number of dollars through their investment programmes. Accordingly, institutions for the most part favour bonds, which promise a given number of dollars at a specified date. The eligible investments for savings banks and life insurance companies are clearly set forth in State laws. In general, the life insurance companies have more freedom than the savings banks. In some States, as also in Canada, insurance companies may purchase common stocks. The New York law respecting life insurance companies has recently been liberalized, permitting the purchase of the highest grade of preferred stocks as well as bonds, though common shares are still ineligible for life insurance companies in that commonwealth. With the growth of the power and light industry in the last decade, numerous States have made public utility bonds eligible for investments for trustees, savings banks and other institutions. Life insurance companies have consistently increased the proportion of their total investable funds placed in public utility securities.

An important new outlet for the investable funds of individuals has come through the conversion of hitherto privately owned close corporations into companies whose securities have been widely distributed. Department stores, chain stores, and other merchandising agencies have been conspicuous in this group. Holding companies have been set up, which have expanded rapidly through taking over local enterprises through an exchange of stock. The absorption has been profitable in most instances, for the public has usually placed a higher value on earning power when taken over by a large company, whose shares are readily marketable, than when reported by an obscure company, whose securities were illiquid.

Before the war, conservative investors favoured railroad securities, shunning all others as too speculative. They have got away from this notion, partly because the railroads, with their rates fixed by public regulatory bodies, have been less spectacularly prosperous than certain unregulated industrial corporations whose profits have been limited only by competition and the capacity of management. Seemingly, no successful product is too trivial or too unessential to win an investment following. As is usually the case when security prices are showing a long term upward trend, the security buyer exaggerates the importance as a determinant of value of current earning power and minimizes the effect of asset worth. (M. S. R.)

INVESTMENT TRUSTS. Although stock exchange dealings as we know them to-day, originated with the Dutch, the investment trust is essentially a British invention. In the early part of the 19th century, following upon the emancipation from Spanish rule of many portions of South America, there was a flood of foreign government and municipal issues in London, offering rates of interest that were very attractive compared with those obtainable on British Government loans. Numerous defaults occurred and within ten years only one-third of this total was in receipt of interest. A few years later followed the great railway boom, which was succeeded by the panic of 1847. The result was that British investors of all types were heavily hit, and in numerous cases ruined; but a comparatively small number of people were conspicuous exceptions. These were persons of considerable wealth who were in a position to command information and expert knowledge, and who had invested largely abroad. The need for some combination of smaller investors who, by co-operation, could secure similar advantages, was evident, and in 1863 (just after an act had been passed limiting the liability on shares in joint stock companies) two investment trust companies were formed in London. Several other companies of the same description were formed, and by the year 1886 these were sufficiently numerous to cause them to be grouped under the heading of "financial trusts" in the official list of the London Stock Exchange. The investment trust is a form of company that appears to have made a strong appeal to Scottish investors, and from the early beginnings of the movement Edinburgh has been the home of many such companies, most of them having been conspicuously successful.

Although not immune from the vicissitudes of the stock and share markets, investment trusts, as a whole, showed that they could pass satisfactorily through bad periods as well as good. It was not, however, until some years after the World War that a movement towards the creation of new investment trusts became apparent in Great Britain. This movement coincided

with one of much greater dimensions that started in the United States. A few new investment trusts were started in London, and older trusts began to form what might be termed sister investment trusts under the same management as themselves.

Conditions were certainly favourable to such institutions. The former belligerent countries, and the new States carved out of the central European empires, were in such need of capital that they were prepared to pay high rates. Most of these new loans were floated in New York, subsequent portions being placed in Amsterdam, London and Stockholm. Issues placed on foreign markets are out of the reach of the ordinary individual investor, but houses with international connections were able to avail themselves of the excellent investment opportunities thus afforded, and this conduced to the formation of new investment trusts, which were able to put their capital to profitable use.

170 British Investment Trusts.—At the beginning of 1929 the number of investment trusts in Great Britain was about 170 with an aggregate capital of approximately £250,000,000. At the same period the number of investment trusts in the United States was over 200 with a paid-up capital of about $800,000,000—a surprising total when it is borne in mind that the first of these was formed so recently as 1921. Switzerland, Holland, France, Germany and Japan have all created investment trusts of recent years, but the tendency in these countries is more in the direction of what Americans aptly name, "specialty trusts," viz., companies investing primarily in the stocks of one class of undertaking, *e.g.*, electric light, power and tramways, shipping, rubber and tea.

It is necessary to make a distinction between the investment trust and the finance company. The investment trust is an organization holding investments in common on behalf of its shareholders and distributing among the latter the income received. Emphasis requires to be placed upon the word "income," for the genuine investment trust never distributes profits made by the sale of its holdings; such profits, according to its statutes, must always be carried to reserve, and are, of course, invested to earn additional income available for distribution. This is the "acid test" of the investment trust. The title of a company is not a sure guide, for, unfortunately, there are many companies, British and others, incorporated under the name of investment trusts, which are but ordinary finance or holding companies. In Britain the inland revenue authorities themselves make this distinction, exempting genuine investment trusts from payment of income tax on "profits" from sales of securities, regarding them as associations of investors pooling their capital for safety and distributing income, that is, investment revenue only. A company that distributes any portion of such profits as dividends is regarded as an ordinary trading concern and pays tax on the total of its net profits, whether it calls itself an investment trust or not.

The ordinary type of British investment trust starts with an issue of capital divided as to 50% (sometimes 60%) in preference stock, and 50% (or 40%) in ordinary stock. After it has been established some time it issues debenture stock to the extent of perhaps its total share capital, so that roughly its capitalization is 20% ordinary stock, 30% preference and one-half debentures. By this method it obtains cheap *permanent* capital, an advantage which cannot be enjoyed by the private investor. The assets behind the debentures of soundly established investment trusts are so considerable as to constitute them practically gilt-edged stocks.

As a result of the excellent method of capitalization adopted by the British investment trusts the ordinary (or deferred, where the ordinary has a fixed dividend) stocks are frequently quoted at a price which represents a market capitalization in excess of what would come to them in the event of a liquidation, based upon the book value of the assets. The reason is that all the advantage arising from the cheap capital provided by the debenture and preference stocks accrues to the ordinary, either in the shape of a steady increase of dividend or bonus shares—or both.

Some British Examples.—The following table summarizes the position of a few typical British investment trusts at the beginning of 1929:

	Total issued deb. and share capital	Divs. on ordinary (or defd.) 1928	Price % Feb., 1929
	£	%	£
Alliance Trust Co. . . .	6,699,805	25	573
British Investment Trust . .	4,750,000	21	455
Industrial and General Trust .	6,000,000	17	335
Investment Trust Corporation .	6,375,000	20	407
Mercantile Investment and General Trust Co.	6,500,000	16	302½

Co-operative investment trusts were started in 1923 and have made remarkable progress. This is a form of company run on exactly the same lines as an ordinary investment trust, but registered under the British Industrial and Provident Societies Acts, whereby the company is exempt from stamp duty on capital and income tax, but against these concessions may not permit any individual to hold more than £200 of share capital. Management is almost everything in the case of an investment trust, and in practice it has been found wise to stipulate in the rules that no single investment shall exceed a fixed proportion (usually 5%) of the share and debenture capital of the trust.

About one-half of the British investment trusts publish with their annual reports full lists of their investments. Others state the percentage held of different groups, but without specifying the individual investments. It is recognised in Great Britain that an investment trust may legitimately distribute income even where the capital is not intact, owing to depreciation of investments. This view was confirmed by judgments in the English courts in 1894. As the investment trust is precluded from distributing profits on the sale of securities, these go to build up a reserve, which is invested and immediately becomes revenue-producing, and herein lies the great strength of the investment trust principle. (A. E. DA.)

The United States.—The investment trust idea, which has decades of experience behind it in England and Scotland, is relatively new in the United States, yet by the end of 1928 there were more than 200 investment trusts in operation with total resources exceeding one thousand million dollars. An investment trust is an instrument for meeting the needs of the great class of small investors, who began for the first time to buy securities in large aggregate amounts at the time of the World War loans. Moreover, with America now in a leading world creditor position, the investment trust forms a useful medium for expert selection and diversification in foreign investments with which the average American investor is himself inexperienced.

The well-managed investment trust offers the advantages of co-operation and of guidance by specialists. Each is of distinct value. By joining with other investors and thus creating a large reservoir of capital, each participates in a fund which can be widely diversified in scores or hundreds of securities. The man with a $1,000 surplus can get a participation in 400 securities, but, if he acted alone, he would have to be satisfied with one or, if he selected "baby" bonds, with ten.

Mere numbers are of distinct importance. Life insurance, for example, depends on them. If a group of six men were to insure themselves cooperatively against the hazard of death, their venture would be dangerously speculative and uncertain. However, if 60,000 men would insure themselves co-operatively the outcome would be certain. The risks would be so well diversified that the group would live in accordance with the established American tables on mortality. Similarly the investor who stakes his fortune in a handful of investment companies without sufficient diversification assumes needlessly grave hazards.

The classic American investment trust of the English type offers the actuarial benefits of heightened diversification through participation in a larger pool of capital than is available to the ordinary investor single-handed; second, the investment trust offers expert knowledge in the original choice of securities for the portfolio of the fund; and third, it assures continuous supervision by experts, in the light of changing conditions, of the investment portfolio. In addition to adapting the English type of investment

trust, American financiers have also created new patterns and variations. Even those trusts which are built on the English plan have set up far more restrictions on management.

In the United States, two schools of thought concerning the latitude that should be granted investment trust management have developed. One adheres to the British example and gives the management discretion, subject to the limiting clauses of the charter of the enterprise. The other virtually deprives management of all discretion after the initial selection of securities. In between, a compromise, semi-fixed type of trust has developed.

Most investment trusts take the legal form of corporations which are in a position to offer a variety of securities, including debentures and common and preferred stocks. The Second International Securities Corporation, which is of this type, discloses that it pays the American Founders Trust ½ of 1% of the value of the corporation's average resources, for management. The International Securities Corporation of America, which is closely allied, makes an annual management charge of 4% of income, which in practice has worked out to about the same. The Mutual Investment Trust, another company, gives holders of its A shares, which are sold to the public, a preferential return of 6%. The management company subscribes 10% in cash against every new certificate sold to an outsider. After the outside investor has received 6%, the company gets 6% on its investment. Then the residue of income is divided equally between the outside investor and the management company.

Competent observers have pointed out that investment trusts are springing up faster than experienced managers are being trained. In some instances the new issues are sold on the basis of high pressure selling ability, rather than because of capacity of investment management. In 1928 several investment trusts were in liquidation, and it is possible that others may undergo a similar fate, or else a process of consolidation, before the pioneer period of experiment, adjustment and competition is over. In 1924 the governing committee of the New York stock exchange passed a resolution that participation by members of the exchange in the formation or management of investment trust corporations was an act held to be detrimental to the interests of the exchange. This resolution did much to prevent at the start abuses and unsound developments of the investment trust idea. The New York State law department has also conducted investigations to determine unsound practices and means of combating them. Since the investment trust has had long trial in England and is founded at bottom on sound principles, namely expert management and diversification, it is expected that it will certainly survive and continue to grow as long as prosperity continues. It is very necessary that prospective investors assure themselves that (a) the people managing the trust are possessed of character, foresight, integrity and responsibility, (b) that the managers have sufficient faith to risk a substantial amount of their own capital in the enterprise, (c) that books and accounts are properly kept with accurate and reasonably frequent reports to investors, (d) and that the companies are true investment trusts and are not merely masquerading under the name in order to secure clients.

Numerous American trusts have been sponsored by houses of issue. This connection raises the possibility that management will not be entirely disinterested. In such cases the trust could be used as a repository for the undigested new securities of the house of issue. An investor should carefully check the character and experience of the management through independent sources, and should examine the conditions of the association. He should seek to learn whether securities have been placed in the trust at cost or whether the managers act as principals and make a profit. Furthermore, he should become fully aware of the ratio of earnings on his capital which will be credited to him. To ascertain this information, he should find out the exact schedule for deductions which the organizers will make for themselves. He should also look into the policy in respect to reserves, and should ascertain the policy in regard to publicity.

See L. T. Grayson, *Investment Trusts* (1928); L. R. Robinson, *Investment Trust Organization and Management* (1926), and *Survey of Investment Trusts* (1926), and *Supplemental Survey* (1928), Securities Bureau of the New York State Law Department. (M. S. R.)

INVISIBLE EXPORTS: *see* EXPORTS, INVISIBLE.

INVOICE, a statement giving full particulars of goods sent or shipped by a trader to a customer, with the quantity, quality and prices, and the charges upon them (originally a plural, *Invoyes* or *Invoys,* of *Invoy,* a variant of "envoy" from the French *envoyer,* to send). Consular invoices, *i.e.,* invoices signed at the port of shipment by a consul of the country to which the goods are being consigned, are generally demanded by those countries which impose *ad valorem* duties.

INVOLUCRE. The whorl of bracts at the base of the inflorescences or general umbel in umbelliferous plants is called a *general involucre;* the similar leafy whorl adjoining the smaller umbels or umbellules being termed an *involcel* or *partial involucre.* In Compositae the name is applied to the bracts surrounding the head of the flower characteristic of this family and Umbelliferae. *See* FLOWER, UMBELLIFERAE and COMPOSITAE.

INVOLUTION, in arithmetic is the operation of raising a number to any power, rolling it up, as it were, by continued multiplication. Before the invention of a satisfactory symbol like a^2 or a^3, the Greeks spoke of the second power as a "tetragon number" (*τετράγωνος ἀριθμός, tetrag' onos arithmos',* four-angled number) or a "power" (*δύναμις, dy'namis,* whence also "dynamo" and "dynamite"). Diophantus (*c.* 275) called the third power a cube (*κύβος, cu'bos, see* CUBE), the fourth power a "power-power" (*δυναμοδύναμις, dynamody'namis*), a fifth power a "power-cube" and so on, using the additive principle.

Involution is the converse of evolution (*q.v.*), which is the operation of finding a root. *See* ARITHMETIC. In geometry, an involution is a one-to-one correspondence between two ranges of points or between two pencils. *See* PROJECTIVE GEOMETRY. The "involute" of a curve is the locus of the end of a string when unwrapped from the curve itself.

IO, in Greek mythology, daughter of Inachus, the river-god of Argos and its first king. Under the name of Callithyia, Io was regarded as the first priestess of Hera. Zeus fell in love with her, and, to protect her from the wrath of Hera, changed her into a white heifer; according to Aeschylus (*Supplices,* 299) the metamorphosis was the work of Hera herself. Hera, having persuaded Zeus to give her the heifer, set Argus Panoptes to watch her. Zeus thereupon sent Hermes, who lulled Argus to sleep and cut off his head or killed him with a stone. But the wrath of Hera still pursued Io. Maddened by a gadfly sent by the goddess, she wandered all over the earth (Aesch. *P.V.,* 561, et seq.), swam the strait known on this account as the Bosporus (Ox-ford), and crossed the Ionian sea (traditionally called after her) until at last she reached Egypt, where she was restored to her original form and became the mother of Epaphus. She was thus identified with Isis, and Epaphus with Apis. He was said to have been carried off by order of Hera to Byblus in Syria, where he was found again by Io. This fable connects Io with the Syrian Astarte. Both legends reflect intercourse with the East and identification of foreign with Greek gods. She was a favourite subject among Greek painters, and many representations are preserved on vases and wall paintings.

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IODINE, a chemical element, belonging to the halogen group, was discovered in 1812 by B. Courtois when investigating the products obtained from the mother-liquors prepared by lixiviating kelp or burnt seaweed. It forms heavy, blackish scales with a violet lustre which gives it a metallic appearance. In 1815 L. J. Gay-Lussac showed it was an element. Iodine (symbol I, atomic number 53, atomic weight 126·92) is not in nature uncombined; it is found very widely but sparingly distributed, chiefly in the form of its sodium and potassium salts. It is also found in small quantities in seawater, in some seaweeds, and in various mineral and medicinal springs. Deep-sea weeds, as a rule, contain more iodine than those which are found in the shallow waters.

Iodine is obtained either from kelp (the ashes of burnt seaweed) or from the mother-liquors obtained in the purification of Chile saltpetre. In the former case the seaweed is burnt in large heaps at as low a temperature as possible, and the product is known either as *kelp* or *varec*. Another method is to heat the seaweed in large retorts, whereby tarry and ammoniacal liquors pass over and a very porous residue of kelp remains. A later method consists in boiling the weed with sodium carbonate; the liquid is filtered and hydrochloric acid added to the filtrate, when *alginic acid* is precipitated; this is also filtered off, the filtrate neutralized by caustic soda, and the whole evaporated to dryness and carbonized, the residue obtained being known as *kelp substitute*. The kelp obtained by any of these methods is then lixiviated with water, which extracts the soluble salts, and the liquid is concentrated, when the less soluble salts, which are chiefly alkaline chlorides, sulphates and carbonates, crystallize out and are removed. Sulphuric acid is now added to the liquid, whereby alkaline sulphides and sulphites present are decomposed and iodides and bromides are converted into sulphates, while hydriodic and hydrobromic acids are liberated and remain dissolved in the solution. The liquid is run into the iodine still and gently warmed, manganese dioxide in small quantities being added from time to time, when the iodine distils over and is collected. In the second method it is found that the mother-liquors obtained from Chile saltpetre contain small quantities of sodium iodate, $NaIO_3$; this liquor is mixed with the calculated quantity of sodium bisulphite in large vats, and iodine is precipitated:—

$$2NaIO_3+5NaHSO_3=3NaHSO_4+2Na_2SO_4+H_2O+I_2.$$

The precipitate is washed and then distilled from iron retorts. Iodine may also be prepared by the decomposition of an iodide with chlorine, or by heating a mixture of an iodide and manganese dioxide with concentrated sulphuric acid. Commercial iodine may be purified by mixing it with a little potassium iodide and then subliming the mixture; in this way any traces of bromine or chlorine are removed.

Iodine's specific gravity is 4·948 (17°/4°), melting at 114·2° C; it boils at 184·35° C under atmospheric pressure (W. Ramsay and S. Young). The specific heat of solid iodine is 0·0541 (H. Kopp). Its latent heat of fusion is 11·7 calories, and its latent heat of vaporization is 23·95 calories (P. A. Favre and J. T. Silbermann). It volatilizes slowly at ordinary temperatures, but rapidly on heating. Iodine vapour on heating passes from a violet colour to a deep indigo blue.

Iodine possesses a characteristic penetrating smell, not so pungent, however, as that of chlorine or bromine. It is only very sparingly soluble in water, but dissolves readily in solutions of the alkaline iodides and in alcohol, ether, carbon disulphide, chloroform and many liquid hydrocarbons. Its solutions in the alkaline iodides and in alcohol and ether are brown in colour, whilst in chloroform and carbon disulphide the solution is violet, and in the latter cases there is some indication of combination with the solvent. Its chemical properties resemble those of chlorine and bromine; its affinity for most other elements, however, is less than theirs. It will only combine with hydrogen in the presence of a catalyst, but combines with many other elements directly; for example, phosphorus melts and then inflames, antimony burns in the vapour, and mercury when heated with iodine combines with it rapidly. It is completely oxidized to iodic acid when boiled with fuming nitric acid. It is soluble in a solution of caustic potash, a dilute solution most probably containing the hypoiodite, which changes slowly into a mixture of iodide and iodate; change is rapid on warming. Iodine is readily detected by the characteristic blue coloration that it immediately gives with starch paste in the presence of soluble iodides; the colour is destroyed on heating, but returns on cooling provided the heating has not been too prolonged. Iodine in the presence of water frequently acts as an oxidizing agent; thus arsenious acid and the arsenites, on the addition of iodine solution, are converted into arsenic acid and arsenates.

Iodine finds application in organic chemistry, forming additional products with unsaturated compounds, the combination, however, being more slow than in the case of chlorine or bromine. It rarely substitutes directly, because the hydriodic acid produced reverses the reaction; this can be avoided by the presence of precipitated mercuric oxide or iodic acid, which react with the hydriodic acid as fast as it is formed, and consequently remove it from the reacting system. As a rule it is preferable to use iodine in the presence of a carrier, such as amorphous phosphorus or ferrous iodide or to use it with a solvent. It is found that most organic compounds containing the grouping $CH_3{\cdot}CO{\cdot}C—$ or $CH_3{\cdot}CH(OH){\cdot}C—$ in the presence of iodine and alkali give iodoform, CHI_3 (*q.v.*).

Hydriodic Acid, HI, is formed by passing hydrogen and iodine vapour through a hot tube, but the reaction is reversible, $H_2+I_2\rightleftharpoons 2HI$. On shaking iodine with a solution of sulphuretted hydrogen in water, a solution of hydriodic acid is obtained, sulphur being at the same time precipitated. The acid cannot be prepared by the action of concentrated sulphuric acid on an iodide on account of secondary reactions taking place, which result in the formation of free iodine and sulphur dioxide. The usual method is to make a mixture of amorphous phosphorus and a large excess of iodine and then to allow water to drop slowly upon it; the reaction starts readily, and the gas obtained can be freed from any admixed iodine vapour by passing it through a tube containing some amorphous phosphorus. It is a colourless sharp-smelling gas which fumes strongly on exposure to air. It readily liquefies at 0° C under a pressure of four atmospheres, the liquefied acid boiling at −34·14° C (730·4 mm.); it can also be obtained as a solid melting at −50·8° C. It is readily soluble in water, one volume of water at 10° C dissolving 425 volumes of the gas. The saturated aqueous solution is colourless and fumes strongly on exposure to air; after a time it darkens in colour owing to liberation of iodine. When boiled the solutions lose either acid or water until a solution containing 58% of HI is obtained, which distils unchanged at 127° C. This has a specific gravity of 1·7 and is used in the Zeisel method of determining methoxyl groups. The gas is readily decomposed by heat into its constituent elements. It is a powerful reducing agent, and is frequently employed for this purpose in organic chemistry; thus hydroxy-acids are readily reduced on heating with the concentrated acid, and nitro-compounds are reduced to amino-compounds, etc. It is preferable to use the acid in the presence of amorphous phosphorus, for the iodine liberated during the reduction is then utilized in forming more hydriodic acid, and consequently the original amount of acid goes much further. It forms addition compounds with unsaturated compounds.

It has all the characteristics of an acid, dissolving many metals with evolution of hydrogen and formation of salts, called *iodides*. The iodides can be prepared either by direct union of iodine with a metal, from hydriodic acid and a metal, oxide, hydroxide or carbonate, or by action of iodine on some metallic hydroxides or carbonates (such as those of potassium, sodium, barium, etc.; other products, however, are formed at the same time). The iodides as a class resemble the chlorides and bromides, but are less fusible and volatile. Silver, mercurous, mercuric and cuprous iodides are insoluble in water; lead iodide is sparingly soluble, whilst most of the other metallic iodides are soluble. Cupric iodide is unstable and breaks down to cuprous iodide and iodine. Strong heating decomposes the majority of the iodides. Nitrous acid and chlorine readily decompose them with liberation of iodine; the same effect is produced when they are heated with concentrated sulphuric acid and manganese dioxide. The soluble iodides, on the addition of silver nitrate to their nitric acid solution, give a yellow precipitate of silver iodide, which is insoluble in ammonia solution. Hydriodic acid and the iodides may be estimated by conversion into silver iodide.

Iodine combines with chlorine to form *iodine monochloride*, ICl, which may be obtained by passing dry chlorine over dry iodine until the iodine is completely liquefied. It is readily decomposed by water. The *trichloride*, ICl_3, results from the action of excess of chlorine on iodine, or from iodic acid and hydrochloric acid, or by heating iodine pentoxide with phosphorus

pentachloride. It crystallizes in long yellow needles and decomposes readily when heated into the monochloride and chlorine. It is readily soluble in water, but excess of water decomposes it. Iodine monochloride in glacial acetic acid solution is used for obtaining the "iodine value" of fats and oils in the Wijs method.

Iodine pentoxide, I_2O_5, the best known oxide, is obtained as a white crystalline solid when iodic acid is heated to 170° C; it is easily soluble in water, combining to regenerate iodic acid; and when heated to 300° C it breaks up into its constituent elements. It is used in the detection of carbon monoxide (*see* CARBON), which it oxidizes with liberation of iodine: $I_2O_5+5CO=I_2+5CO_2$. *Iodine dioxide*, IO_2 or I_2O_4, is a lemon-yellow solid obtained by acting on iodic acid with sulphuric acid, or by grinding iodine with cold fuming nitric acid.

Although *hypoiodous acid* is not known, it is extremely probable that on adding iodine or iodine monochloride to a dilute solution of a caustic alkali, hypoiodites are formed, the solution obtained having a characteristic smell of iodoform, and being of a pale yellow colour. It oxidizes arsenites, sulphites and thiosulphates immediately. The solution is readily decomposed on the addition of sodium or potassium bicarbonates with liberation of iodine. The hypoiodite disappears gradually on standing, and rapidly on warming, being converted into a mixture of iodide and iodate.

Iodic Acid, HIO_3, can be prepared by dissolving iodine pentoxide in water; by boiling iodine with fuming nitric acid, $6I+10HNO_3=6HIO_3+10NO+2H_2O$; by decomposing barium iodate with the calculated quantity of sulphuric acid, previously diluted with water; or by suspending iodine in water and passing in chlorine, $I_2+5Cl_2+6H_2O=2HIO_3+10HCl$. It is a white crystalline solid, dissolving readily in water to give an acidic solution. It is a most powerful oxidizing agent, readily changing phosphorus to phosphoric acid, arsenic to arsenic acid, silicon at 250° C to silica, and hydrochloric acid to chlorine and water. It is readily reduced, with separation of iodine, by sulphur dioxide, hydriodic acid or sulphuretted hydrogen, thus:—

$$HIO_3+5HI=3H_2O+3I_2;\quad 2HIO_3+5SO_2+4H_2O=5H_2SO_4+I_2;$$
$$2HIO_3+5H_2S=I_2+5S+6H_2O.$$

The salts, known as the *iodates*, can be prepared by the action of the acid on a base, or sometimes by the oxidation of iodine in the presence of a base. They are mostly insoluble or only very slightly soluble in water. The iodates of the alkali metals are, however, readily soluble in water (except potassium iodate). They are decomposed on heating, with liberation of oxygen, in some cases leaving a residue of iodide and in others a residue of oxide of the metal, with liberation of iodine as well as of oxygen. It is noteworthy that, although chlorine or bromine will displace iodine from an iodide, yet in these highly oxygenated acids the reverse obtains and iodine displaces chlorine (*see* the preparation of periodic acid).

Periodic acid, $HIO_4{\cdot}2H_2O$, is only known in the hydrated form. It can be prepared by the action of iodine on perchloric acid, or by boiling normal silver periodate with water: $2AgIO_4+4H_2O=Ag_2H_3IO_6+HIO_4{\cdot}2H_2O$. It is a colourless, crystalline, deliquescent solid which melts at 135° C, and at 140° C is completely decomposed into iodine pentoxide, water and oxygen. A remarkable feature of iodic and periodic acids is the ease with which they give complex salts, *e.g.*, $KH(IO_3)_2$, $KH_2(IO_3)_3$, K_5IO_6 (compare $HIO_4{,}2H_2O$), etc.

Iodine has extensive applications in volumetric analysis, being used more especially for the determination of copper in virtue of the reaction: $2CuSO_4+4KI=2K_2SO_4+Cu_2I_2+I_2$.

In *medicine* iodine is frequently applied externally as a counter-irritant, having powerful antiseptic properties. In the form of certain salts iodine is very widely used, for internal administration in medicine and in the treatment of many conditions usually classed as surgical, such as the bone manifestations of tertiary syphilis. The most commonly used salt is the iodide of potassium; the iodides of sodium and ammonium are almost as frequently employed, and those of calcium and strontium are in occasional use. The usual doses of these salts are from five to thirty grains or more. Their pharmacological action is as obscure as their effects in certain diseased conditions are consistently brilliant and unexampled. Our ignorance of their mode of action is cloaked by the term *deobstruent*, which implies that they possess the power of driving out impurities from the blood and tissues. Most notably is this the case with the poisonous products of syphilis. In its tertiary stages—and also earlier—this disease yields in the most rapid and unmistakable fashion to iodides; so much so that the administration of these salts is at present the best means of determining whether, for instance, a cranial tumour be syphilitic or not. No surgeon would think of operating on such a case until iodides had been freely administered and, by failing to cure, had proved the disease to be non-syphilitic. Another instance of this deobstruent power—"alterative," it was formerly termed—is seen in the case of chronic lead poisoning. The essential part of the medicinal treatment of this condition is the administration of iodides, which are able to decompose the insoluble albuminates of lead, which have become locked up in the tissues, rapidly causing their degeneration, and to cause the excretion of the poisonous metal by means of the intestine and the kidneys. The following is a list of the principal conditions in which iodides are recognized to be of definite value: metallic poisonings, as by lead and mercury, asthma, aneurism, arteriosclerosis, angina pectoris, gout, goitre, syphilis, haemophilia, Bright's disease (nephritis) and bronchitis.

A minute proportion of iodine in the diet appears to be essential for health. This was formerly supplied as an accidental impurity in table salt, but the highly purified article now used as a condiment is free from iodides, and in certain States (*e.g.*, some cantons of Switzerland) iodides are added to the drinking water. The deficiency is of greater significance in the case of small children, for the iodine is required for the synthesis of thyroxine, the active principle of the thyroid gland, which, however, has been artificially prepared by C. R. Harington and G. Barger (*Biochem. J.*, 1927, 21, p. 169).

IODINE-BUSH (*Allenrolfea occidentalis*), a North American plant of the goosefoot family (Chenopodiaceae), native to moist alkaline clay soil from western Texas to central California. It is an erect, diffusely branched shrub, 2 ft. to 5 ft. high, with alternate, fleshy, green, apparently leafless, jointed branches, the leaves being reduced to minute pointed scales or wanting. The numerous small flowers are arranged spirally by threes in crowded cylindrical spikes, $\frac{1}{4}$ in. to $\frac{3}{4}$ in. long, borne in the axils of fleshy bracts near the ends of the branches. In appearance the plant is suggestive of a tall, much-branched form of the glass-wort (*q.v.*) or samphire, to which it is closely allied.

IODINE VALUE, of an oil or fat, is the percentage of iodine it absorbs when dissolved in chloroform or carbon tetrachloride and treated with iodine chloride. This furnishes one of the most important methods of identifying an oil or fat; it gives a measure of the unsaturated fatty acids (*q.v.*) present, which gives a basis for the classification of oils, fats and waxes (*q.v.*).

IODOFORM, a valuable antiseptic discovered by G. S. Sérullas in 1822. Iodoform, CHI_3, is formed by the action of iodine and aqueous potassium hydroxide on ethyl alcohol, acetone, acetaldehyde, isopropyl alcohol and most compounds containing the group $CH_3{\cdot}CO{\cdot}C—$. It crystallizes in yellow hexagonal plates, melting at 119–120° C, and is readily soluble in alcohol or ether, but insoluble in water. It has a characteristic odour and is volatile in steam. On reduction with hydriodic acid, it yields methylene iodide, CH_2I_2.

Iodoform is also prepared by electrolysis of a solution of potassium iodide in the presence of alcohol or acetone. A solution of potassium iodide and sodium carbonate in water with the necessary alcohol is contained in a porous cell fitted with a lead anode, whilst the cathode compartment contains a solution of caustic soda and a nickel electrode. The electrolysis is carried out at a temperature of 70° C, with a current density of one ampère per square decimetre. After three hours the yield is 70% of the calculated quantity.

From its formula it can be seen to be strictly analogous with chloroform, $CHCl_3$, which is trichloromethane, while iodoform is

tri-iodomethane.

IOLA, city, south-eastern Kansas, U.S.A., on the Neosho river; the county seat of Allen county. It is on Federal highways 54 and 73W, and is served by the Missouri-Kansas-Texas, the Missouri Pacific and the Santa Fe railways. The population in 1925 was 7,990. It is the trade centre of one of the leading dairy districts of the State. Its industries include a milk condensery with a capacity of 150,000 lb. daily, large creameries, a cement plant, iron works and a pearl-button factory. Iola was founded in 1859, by a company that was dissatisfied with the location of the county seat at Humboldt. It became the county seat in 1865, and was chartered as a city in 1870. Natural gas was discovered here on Christmas Day, 1893, and a period of rapid development followed. The city has a commission form of government.

IOLITE: *see* CORDIERITE.

ION, of Chios, Greek poet, lived in the age of Pericles. At an early age he went to Athens, where he made the acquaintance of Aeschylus. He was an admirer of Cimon and an opponent of Pericles. Later he met Sophocles in Chios at the time of the Samian war. Aristophanes' *Peace,* 830 ff., seems to show that he died before 421. His first tragedy was produced between 452–449 B.C.; and in 429 he was third to Euripides and Iophon. In a subsequent year when he gained both the tragic and dithyrambic prizes, he gave a jar of Chian wine to every Athenian citizen (Athanaeus p. 3). According to the scholiast on Aristophanes (*loc. cit.*) he composed comedies, dithyrambs, epigrams, paeans, hymns, scolia, encomia and elegies. He also wrote an account of the antiquities of Chios and *ἐπιδημίαι,* recollections of visitors to the island.

See C. Nieberding, *De Ionis Chii vita* (1836, containing the fragments); F. Allègre, *De Ione Chio* (1890), an exhaustive monograph; and Bentley, *Epistola ad Millium.*

IONA or **ICOLMKILL,** island, Inner Hebrides, Argyllshire, Scotland, 6½ m. S. of Staffa and 1¼ m. W. of the Ross of Mull, from which it is separated by the shallow Sound of Iona. Pop. (1921) 234. It is about 3½ m. long and 1½ m. broad; its area being some 2,200 acres, of which about one-third is under cultivation, oats, potatoes and barley being grown. In the rest of the island grassy hollows, yielding pasturage for a few hundred cattle and sheep and some horses, alternate with rocky elevations, which culminate on the northern coast in Duni (332 ft.), from the base of which a stretch of white shell sand, partly covered with grass, stretches to the sea. To the south-west the island is fringed with precipitous cliffs. There is a ferry to the Ross of Mull. The inhabitants depend partly on agriculture and partly on fishing. Near the S.E. point is a marble quarry.

The original form of the name Iona was Hy, Hii or I, the Irish for Island. By Adamnan in his *Life* of St. Columba it is called *Ioua insula,* and the present name Iona is said to have originated in some transcriber mistaking the *u* in Ioua for *n*. It also received the name of Hii-colum-kill (Icolmkill), that is, "the island of Columba of the Cell," while by the Highlanders it has been known as Innis nan Druidhneah ("the island of the Druids"). This last name seems to imply that Iona was a sacred spot before St. Columba landed there in 563 and laid the foundations of his monastery. After this date it developed into the most famous centre of Celtic Christianity, the mother community of numerous monastic houses, whence missionaries were despatched for the conversion of Scotland and northern England, and to which for centuries students flocked from all parts of the north. After St. Columba's death his relics rested here until they were removed to Ireland early in the 9th century. Pilgrims came to die in the island, in order that they might lie in its holy ground; and from all parts of northern Europe the bodies of the illustrious dead were brought here for burial. Several times the monastery was plundered and burnt and the monks massacred by the heathen Norse sea-rovers, attracted by the wealth of the foundation. Late in the 11th century the desecrated monastery was restored by Queen Margaret, wife of Malcolm Canmore, king of Scotland; and in 1203 a new monastery and a nunnery were founded by Benedictine monks who either expelled or absorbed the Celtic community. In 838 the Western Isles, then under the rule of the kings of Man, were erected into a bishopric of which Iona was the seat. When in 1098 Magnus III., "Barefoot," king of Norway, ousted the jarls of Orkney from the isles, he united the see of the Isles (Sudreyar, "the southern islands," Lat. *Sodorenses insulae*) with that of Man, and placed both under the jurisdiction of the archbishopric of Trondhjem. About 1507 the island again became the seat of the bishopric of the Isles: but with the victory of the Protestant party in Scotland its ancient religious glory was finally eclipsed, and in 1561 the monastic buildings were dismantled by order of the Convention of Estates. (For the political fortunes of Iona *see* HEBRIDES.)

The cathedral church of St. Mary dates from the 13th century; a great portion of the walls with the tower are still standing. The choir and nave have been roofed, and the cathedral has in other respects been restored, the ruins having been conveyed in 1899 to a body of trustees by the eighth duke of Argyll. The remains of the conventual buildings still extant, to judge by the portion of a Norman arcade, are of earlier date than the cathedral. The small chapel of St. Oran, or Odhrain, the oldest building on Iona, which was built by Queen Margaret on the supposed site of Columba's cell, was in process of restoration in 1927. Of the nunnery only the chancel and nave of the Norman chapel remain, the last prioress, Anna (d. 1543), being buried within its walls. The cemetery, called in Gaelic *Reilig Oiran* ("the burial-place of kings"), is said to contain the remains of forty-eight Scottish, four Irish and eight Danish and Norwegian monarchs, but most of the monumental stones were thrown into the sea at the time of the Reformation. Those that remain have been restored and enclosed. The finest, those of Maclean and St. Martin, are still almost perfect, and are richly carved.

IONIA, in ancient geography, the name given to a portion of the west coast of Asia Minor, adjoining the Aegean Sea and bounded on the east by Lydia. It consisted of a narrow strip of land near the coast, which together with the adjacent islands was occupied by immigrant Greeks (Ionians), and thus distinguished from the interior district, inhabited by the Lydians. According to the universal Greek tradition, the cities of Ionia were founded by emigrants from the other side of the Aegean (*see* IONIANS), and their settlement was connected with the legendary history of the Ionians in Attica, for the colonists were led by Neleus and Androclus, sons of Codrus, the last king of Athens. Modern thought tends to support the popular Greek idea that Ionia received its main Greek element rather late—after the descent of the Dorians, and, therefore, after the Aegean period. Herodotus tells us (i. 146) that the colonists comprised settlers from many different tribes and cities of Greece (a fact indicated also by the local traditions of the cities), and that they intermarried with the native people.

The cities called Ionian in historical times were twelve in number—an arrangement copied as it was supposed from the constitution of the Ionian cities in Greece which had originally occupied the territory in the north of the Peloponnese subsequently held by the Achaeans. These were (from south to north) —Miletus, Myus, Priene, Ephesus, Colophon, Lebedus, Teos, Erythrae, Clazomenae and Phocaea, together with Samos and Chios. Smyrna (*q.v.*), originally an Aeolic colony, was afterwards occupied by Ionians from Colophon, and became an Ionian city —an event which had taken place before the time of Herodotus. But at what period it was admitted as a member of the league is not known. Like the Amphictyonic league in Greece, the Ionic was rather of a sacred than a political character; every city enjoyed absolute autonomy, and, though common interests often united them for a common political object, they never formed a real confederacy like that of the Achaeans or Boeotians.

Ionia was a mountainous country, 90 m. long from north to south, with a breadth varying from 20 to 30 m.; to this area must be added that of the peninsula of Mimas, together with that of two large islands. Among the outstanding peaks were Mimas and Corycus, situated on the peninsula which stands out to the west, facing the island of Chios; Sipylus, to the north of Smyrna; Corax, extending to the south-west from the Gulf of Smyrna, and descending to the sea between Lebedus and Teos.

The strongly marked range of Mycale, a continuation of Messogis in the interior, forms the bold headland of Trogilium or Mycale, opposite Samos. None of these mountains attains a height of more than 4,000 feet. The district comprised three extremely fertile valleys; the Hermus in the north, flowing into the Gulf of Smyrna; the Caÿster, which flowed under the walls of Ephesus; and the Maeander, which in ancient times discharged its waters into the deep gulf that once came up to the walls of Miletus, but which has been gradually silted up by deposits brought down by the river. In ancient times Ionia was considered the most fertile of all the provinces of Asia Minor. It still produces an abundance of fruit of all kinds.

The colonies naturally became prosperous. Miletus especially was at an early period one of the most important commercial cities of Greece; and in its turn became the parent of numerous other colonies, which extended all around the shores of the Euxine and the Propontis from Abydus and Cyzicus to Trapezus and Panticapaeum. The mariners of Phocaea extended their influence to the shores of the western Mediterranean. Ephesus, though it did not send out any colonies of importance, from an early period became a flourishing city.

History.—About the middle of the 7th century B.C., the Cimmerii (*see* SCYTHIA) ravaged a great part of Asia Minor, including Lydia, and sacked Magnesia on the Maeander, but failed to take Ephesus. About 700 B.C. Gyges, first Mermnad king of Lydia, invaded the territories of Smyrna and Miletus, and is said to have taken Colophon as his son Ardys did Priene. But it was not till the reign of Croesus (560–545 B.C.) that the cities of Ionia successively fell under Lydian rule. The defeat of Croesus by Cyrus was followed by the conquest of all the Ionian cities. They became subject to the Persian monarchy with the other Greek cities of Asia. They continued to enjoy a considerable amount of autonomy, but were subject to local despots. It was at the instigation of one of these, Histiaeus (*q.v.*) of Miletus, that in about 500 B.C. the principal cities broke out into insurrection against Persia. They were at first assisted by the Athenians, with whose aid they penetrated into the interior and burnt Sardis, an event which ultimately led to the Persian invasion of Greece. But the Ionian fleet was defeated off the island of Lade, and the destruction of Miletus after a protracted siege was followed by the reconquest of all the Asiatic Greeks.

The Greek victories during the Persian war had the effect of enfranchizing their kinsmen on the other side of the Aegean; and the battle of Mycale (479 B.C.), in which the defeat of the Persians was in great measure due to the Ionians, secured their emancipation. They henceforth became the dependent allies of Athens (*see* DELIAN LEAGUE), though still retaining their autonomy, which they preserved until the peace of Antalcidas in 387 B.C. once more placed them as well as the other Greek cities in Asia under the nominal dominion of Persia. They appear, however, to have retained a considerable amount of freedom until the invasion of Asia Minor by Alexander the Great. After the battle of the Granicus most of the Ionian cities submitted to the conqueror. Miletus, which alone held out, was reduced after a long siege (334 B.C.). From this time they passed under the dominion of the successive Macedonian rulers of Asia, but continued, with the exception of Miletus (*q.v.*), to prosper both under these Greek dynasties and after they became part of the Roman province of Asia.

Ionia was the home of the Ionian School of Philosophy (*q.v.*) and it led the way also for the brilliant artistic development of Athens in the 5th century. Ionian art flourished in the 8th, 7th and 6th centuries, and is distinguished by the fineness of workmanship and minuteness of detail with which it treated subjects, inspired to some extent by non-Greek models. (*See* GREEK ART.)

See D. G. Hogarth, *Ionia and the East* (1909).

IONIA, city, Michigan, U.S.A., on the Grand river, 34m. E. of Grand Rapids; the county seat of Ionia county. It is served by the Grand Trunk and the Pere Marquette railways. The population was 6,935 in 1920 (89% native white) and was estimated locally at 10,000 in 1928. Behind the city is an irregular semicircle of hills commanding extensive views of the valley. Ionia is the trade centre of a rich farming district, and the seat of the State reformatory and a State hospital for the insane. The Pere Marquette maintains repair-shops, and the manufactures include automobiles, reed chairs, florists' pots, porcelain tiles, wire and furniture. Ionia was settled in 1833 by colonists from German Flats, near Herkimer, New York. It was incorporated as a village in 1857, and was chartered as a city in 1873.

IONIAN ISLANDS, the collective name for the Greek islands of Corfu, Cephalonia, Zante, Santa Maura, Ithaca, Cythera (Cerigo) and Paxo (*q.v.*), with their minor dependencies. These islands, though often described as the *Heptanesus* ("Seven Islands"), have no geographical unity. The name "Ionian" is obscure, but is probably due to ancient Ionian colonies, for example in Corfu from Eretria. The political unity of the islands is comparatively modern; their independence as a separate state lasted only seven years (1800–7).

The Ionian islands consist almost entirely of Cretaceous and Tertiary beds, but in Corfu Jurassic deposits have been found. The oldest beds which have yet been recognized are shales and hornstones with Liassic fossils. These are overlaid conformably by a thick series of platy Vigläs limestone, representing the rest of the Jurassic and the lower Cretaceous. Then follow dolomites and unbedded *Hippurites* limestones evidently Upper Cretaceous age. The Eocene beds are folded with the Cretaceous. Both occasionally assume the form of Flysch. Miocene beds are found in Corfu and Zante, and Pliocene deposits cover much of the low ground. (X.)

HISTORY

Mediaeval and Venetian Periods.—The beginning of Heptanesian history dates from the 9th century. Leo the Philosopher (*c.* A.D. 890) formed all or most of the islands into a distinct province of the Eastern empire under the title of the Thema of Cephallenia. Robert Guiscard captured Corfu (1081) and Cephalonia, but his early death prevented the establishment of a Norman dynasty. When the Latin empire was established at Constantinople in 1204 the Venetians received Corfu. After defeating the Genoese corsair Leon Vetrano, the senate granted fiefs in Corfu to ten noble families in order that they might colonise it (1206). The Greek "Despot" of Epeiros, however, captured the first Venetian colony in 1214, and a long period of Epeirote, Sicilian and Neapolitan-Angevin rule followed till in 1386 the people of Corfu made voluntary submission to the Venetian republic.

Paxo, created a barony, was treated as part of Corfu. The County Palatine of Cephalonia (with Zante), seized by Matteo Orsini in 1194, owned the suzerainty first of Venice, then of Achaia, to which it was annexed in 1324. In 1357 it was bestowed upon the Tocco family of Benevento, and was united with Santa Maura and Ithaca (called Val di Conspare) in the Duchy of Leucadia. In 1479 the Turks annexed these four islands. But they gradually became Venetian; Cephalonia and Ithaca 1483–85, and from 1500 onwards; Zante 1482 and from 1485, and Santa Maura 1502–03 and from 1684. Cerigo, a Venetian Marquisate of the Venier family from 1207, became a Venetian colony in 1363, but was parcelled out between Venice and the Venier in 1393.

The Venetians, who exacted heavy contributions from the islands, won the adherence of the principal native families by the bestowal of titles and appointments; the Roman Catholic Church was established, and the Italian and Greek races were largely assimilated by intermarriage; Greek ceased to be spoken except by the lower classes, which remained faithful to the orthodox communion. On the fall of the Venetian republic in 1797 the Treaty of Campo Formio annexed the Ionian islands to France; but a Russo-Turkish force drove out the French at the close of 1798; and in the spring of 1799 Corfu capitulated. By treaty with the Porte in 1800, the Emperor Paul erected the "Septinsular Republic," but the Treaty of Tilsit (1807) declared the islands an integral part of the French empire. They were incorporated with the province of Illyria (*q.v.*); but British forces under General Oswald took Zante, Cephalonia and Cerigo in 1809, and Santa Maura in 1810; Colonel (afterwards Sir Richard) Church

(*q.v.*), reduced Paxo in 1814; and after the abdication of Napoleon, Corfu, which had been defended by General Donzelot, was, by order of Louis XVIII. surrendered to Sir James Campbell. By the Treaty of Paris (Nov. 9, 1815) the contracting powers (Great Britain, Russia, Austria and Prussia) agreed to place the "United States of the Ionian Islands" under the exclusive protection of Great Britain.

British Protectorate.—The constitutions, voted by a constituent assembly in 1817 and applied in the following year, placed the administration in the hands of a senate of six members and a legislative assembly of 40 members; but the real authority was vested in the high commissioner, Sir Thomas Maitland ("King Tom") (1815). The successive British commissioners, General Sir Frederick Adam (1823), Lord Nugent (1832) and Sir Howard Douglas (1835–41) did much for the administration, justice, education and communications of the islands, but their firm, often despotic rule was resented by the natives, the principal exponent of the opposition being the historian Andreas Mustoxidi (d. 1861). A complete change of policy was inaugurated by Mr. Mackenzie (1841–43), and Lord Seaton (1843–49) was induced by the European disturbances of 1848 to initiate a number of important reforms. But the party in favour of union with Greece was rapidly growing. Serious insurrections of the peasantry, especially in Cephalonia, had to be put down by military force, and the parliament passed a resolution in favour of immediate union with Greece.

Cession to Greece.—Contrary to the expectations of the Greeks, Mr. Gladstone, who toured the islands as high commissioner extraordinary, did not propose the abolition of the protectorate, and his successor, Sir Henry Storks, seemed indifferent or blind to the popular feeling, but on the abdication of King Otho of Greece in 1862 the British Government declared to the provisional government of Greece that the selection of Prince William George of Glücksberg would be followed by the cession of the Ionian islands. After the prince's election by the national assembly in 1863 the high commissioner laid before the Ionian Parliament the conditions of the cession. The rejection of one condition (the demolition of the fortifications of Corfu) led to a new prorogation, but on March 29, 1864, the plenipotentiaries of the five great Powers signed the treaty by which the protectorate was ended. Neutrality was confined to Corfu and Paxo. On May 3, 1864 Sir Henry Storks left Corfu with the British troops and men-of-war. King George made his entry into Corfu on June 6.

Since their annexation to Greece the history of the Ionian islands has been uneventful; their prosperity has somewhat declined. Corfu with Paxo; Cephalonia; Santa Maura (Levkas) with Ithaca and Zante (Zacynthos) each form separate monarchies or departments; Cerigo (Cýthera) forms part of the monarchy of Laconia. The islands retain the exemption from direct taxation which they enjoyed under the British protectorate; in lieu of this there is an *ad valorem* tax of 20½% on exported oil and a tax of 6% on wine exported to Greek ports; these commodities are further liable to an export duty of 1½% which is levied on all agricultural produce and articles of local manufacture for the maintenance and construction of roads.

See Lunzi, Περὶ τῆς πολιτικῆς καταστάσεως τῆς Ἑπτανήσου ἐπὶ Ἐνετῶν (Athens, 1856); Ansted, *The I.I.* (1863); Viscount Kirkwall, *Four Years in the I.I.* (1864) vol. i.; F. Lenormant, *La Grèce et les iles ioniennes* (1865); P. Chiotis, Ἱστορία τοῦ Ἰονίου κράτους (Zante, 1815–64); Mardo, *Saggio di una descrizione geografico-storica delle Isole* (Corfu, 1865) (mainly geog.); De Bosset, *Description des monnaies d'Ithaque et de Céphalonie* (London, 1815); Postolakas, Κατάλογος τῶν ἀρχαίων νομισμάτων τῶν νήσων Κέρκυρας, Λευκάδος κ. τ. λ. (Athens, 1868); Wiebel, *Die Insel Kephalonia und die Meermühlen von Argostoli* (Hamburg, 1873); Tsitselis, Γλωσσάριον Κεφαλληνίας (Athens, 1876); J. Partsch, *Die Insel Corfu: eine geographische Monographie* (Gotha, 1887); *Die Insel Levkas* (Gotha, 1889); *Kephallenia und Ithaka* (Gotha, 1890); *Die Insel Zante* (Gotha, 1891); *Della condizione politica delle Isole Ionie sotto il Dominio Veneto* (Venice, 1858); *Storia delle Isole Ionie sotto il reggimente dei Republicani Francesi* (Venice, 1860); *Della Republica Settinscilare* (Bologna, 1863); G. E. Mavrogiennes, Ἱστορία τῶν Ἰονίων νήσων, 1797–1815, 2 vols. (Athens, 1899); E. R. Rangabé, *Livre d'or de la Noblesse Ionienne* (3 vols. Athens, 1925–27); A. M. Andreades Περὶ τῆς οἰκονομικῆς διοικήσεως τῆς Ἑπτανήσου ἐπὶ Βενετοκρατίας (2 vols. Athens, 1914); A. M. Hidromenos, Ὁ ὑπὲρ τῆς ἐθνικῆς ἀποκαταστάσεως τῶν Ἑπτανησίων (Corfu, 1889); W. Miller, *The Latins in the Levant* (1908); *Essays on the Latin Orient* (Cambridge, 1921). (J. D. B.; W. M.)

IONIAN MODE: *see* HARMONY and PLAINSONG.

IONIANS. This name was used in classical times for one of the four divisions of the Greek world, the remaining three being Aeolic, Doric and Arcado-Cypriote or Achaean. This is strictly a linguistic division, and the Greeks did not recognize it in an exact sense. Aeolian, Dorian and Ionian were well-marked divisions socially as well as linguistically. There was also a strong race antipathy between Dorian and Ionian, manifested particularly in the Peloponnesian War, in which Athens and Sparta were the protagonists. Each was inclined to regard the other as not fully Hellenic. The Ionians claimed that the Dorians were the descendants of non-Greek northern invaders commingled with an earlier Greek population of the Peloponnese. The Dorians asserted that the Ionians were pre-Greek or Pelasgian, standing much in the same relationship to true Greeks as do the Welsh and other Britons to the Anglo-Saxons.

Attica was the centre of Ionic culture on the mainland. Euboea and the Cyclades were also regarded as Ionic with the exception of the Dorian islands of Melos and Thera, but the name Ionia itself in classical times was confined to the tract of land on the coast of Asia Minor that contained the Ionic cities. This lay between Aeolis on the north and Doris on the south, and extended from Smyrna to Miletus. The twelve cities, while retaining their independence in true Greek fashion, formed a league for social and religious purposes, their central cult being that of Poseidon carried on upon Mt. Mycale. The Ionians claimed that this worship derived from Achaia in the Peloponnese, but it at least contained elements that were Anatolian in origin. The Ionian cities were energetic, thriving and opulent. Their wealth made them luxurious and they had a name for effeminancy. They were subdued by Croesus, king of Lydia, in the middle of the sixth century and passed at his subjugation under the Persian empire. In 500 they revolted but were conquered by King Darius and a higher tribute was imposed upon them. After the successful termination of the Persian wars they were set free by the Greeks of the mainland under the leadership of Athens, but later fell again under Persia when that empire recovered its strength. They remained nominally subject to Persia till its overthrow by Alexander the Great. There were various Ionic colonies on the coast of the Euxine and in Sicily and Magna Graecia.

The chief characteristics of the Ionic dialect to which Attic was closely akin were: (i.) the representation of an original long *ā* by *ē*, for example in the word *μήτηρ* for Doric, etc., *μᾶτηρ*, Lat. *mater;* (ii.) the lengthening of the vowel before a nasal or liquid that preceded a lost digamma, *e.g.*, *ξεῖνος*, *κοῦρη* for Attic *ξένος*, *κόρη*; (iii.) the nom. plur. of the personal pronouns in *-εις* instead of *-ες*, *e.g.*, *ἡμεῖς* for Doric *ἀμές*; (iv.) the termination *-ου* for pronominal adverbs of place (*ποῦ*, etc.) for West Greek *-ει*; the third person plural of certain aorist forms in *-σαν* (*ἔθεσαν*, *ἔδοσαν*) by analogy from an *s*-aorist; (v.) the very early loss of digamma, etc. Ionic-Attic with Aeolic formed loosely an eastern group of dialects as opposed to Doric and North-West Greek. The turning of the original dialect of the Homeric poems, Aeolic or otherwise, into Ionic where possible, *i.e.*, where the exigencies of the metre, vocabulary, and other considerations permit, produced the artificial Epic dialect.

The name Ionians had probably a more extensive use in early times than in historical. In the Pentateuch, in the 15th or 16th century B.C. (Gen. x. 2), Javan appears as a son of Japheth. To the Hebrews the name represented the whole Greek race. To the Persians the Greeks were known as Yauna. It does not follow from this fact that the Greeks knew themselves by this name, for the case may be parallel to the Italians and Illyrians later applying to them the name of Graeci, that of the small Epirote tribe with whom they first came in contact. In view of the name of the

Ionian sea, which was ancient, it is possible that the mainland of Greece was once known as Ionia or its inhabitants as Ionians. No Ionian Greeks lived in historical times on the shores of the Ionian sea.

The Homeric Ionians were inhabitants of Attica (*Il.* xiii. 685). In the Hesiodic genealogies Ion was son of Xuthus and brother of Achaeus. According to Herodotus the original home of the Ionians was in north-east Peloponnese in the region around Troezen. Hence they were expelled by the Achaeans and occupied Attica, from which they later spread to the Cyclades and to Asia Minor. This traditional history of the Ionians is feasible and need not be dogmatically contradicted. We may perhaps regard the Ionians as pre-Achaean inhabitants of the Peloponnese disturbed by Achaean invaders from the eastern Aegean. This is the view of Kretschmer and of N. P. Nilsson, except that they bring the Achaeans as a second wave of Greek-speaking peoples from the north. Nilsson regards the Ionians as the foremost wave of Greek-speaking peoples to reach Greece and as the originators of the Mycenaean culture. Later came the Dorian invasion of the Peloponnese, consisting perhaps of two coincident elements, an irruption of Illyrian and Epirote tribes from the north-west and an invasion by sea from Crete. The Ionians when they emerge into history are a recognized integral part of the Greek world, distinguished like the Dorians by a well-marked dialect and a common cult. (*See* DORIANS; ACHAEANS: GREECE: *History.*)

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IONIAN SCHOOL OF PHILOSOPHY. Under this name are included a number of philosophers of the 6th and 5th centuries B.C. Mainly Ionians by birth, they are united by a local tie and represent all that was best in the early Ionian intellect. It is a most interesting fact in the history of Greek thought that its birth took place not in Greece but in the colonies on the west coast of Asia Minor. But not only geographically do these philosophers form a school; they are one in method and aim. They all sought to explain the material universe as given in sensible perception; their explanation was in terms of matter, movement, force. In this they differed from the Eleatics and the Pythagoreans who thought in the abstract, and explained knowledge and existence in metaphysical terminology. In tracing the development of their ideas, two periods may be distinguished. The earliest thinkers down to Heraclitus endeavoured to find a material substance of which all things consist; Heraclitus, by his principle of universal flux, took a new line and explained everything in terms of force, movement, dynamic energy. The former asked the question, "What is the substratum of the things we see?"; the latter, "How did the sensible world become what it is; of what nature was the motive force?"

The first name in the list of the Ionian philosophers—and, indeed, in the history of European thought—is that of Thales (*q.v.*). He first, so far as we know, sought to go behind the infinite multiplicity of phenomena in the hope of finding an infinite unity from which all difference has been evolved. This unity he decided is Water. It is impossible to discover precisely what he conceived to be the relation of this unity to the plurality of phenomena. Later writers from whom we derive our knowledge of Thales attributed to him ideas which seem to have been conceived by subsequent thinkers. Thus the suggestion preserved by Stobaeus that he conceived water to be endowed with mind is discredited by the specific statement of Aristotle that the earlier physicists (*physiologi*) did not distinguish the material from the moving cause, and that before Anaxagoras no one postulated creative intelligence. Again in the *De anima* (i. 5) Aristotle quotes the statement that Thales attributed to water a divine intelligence, and criticizes it as an inference from later speculations. It is probably safest to credit Thales with the bare mechanical conception of a universal material cause, leaving pantheistic ideas to a later period of thought.

The successors of Thales were Anaximander and Anaximenes, who also sought for a primal substance of things. Anaximander postulated a corporeal substance unlike any of the known substances. This substance he called "the Indeterminate" (τὸ ἄπειρον). He felt that all determinate things have emerged from primal unity (first called ἀρχη by him) into which they must ultimately return. Change, growth and decay he explained on the principle of mechanical compensation.

Anaximenes, pupil of Anaximander, seems to have rebelled against the extreme materialism of his master. Perceiving that air is necessary to life, that the universe is surrounded by air, he was convinced that out of air all things have resulted. The process by which things grow is twofold, condensation (πύκνωσις) and rarefaction (ἀραίωσις), or, in other words, *heat* and *cold.* From the former process result cloud, water and stone; from the latter, fire and aether. This theory is closely allied to that of Thales, but it is superior in that it specifies the processes of change. Further, it is difficult not to accept Cicero's statement that Anaximenes made air a conscious deity; we are, at all events, justified in regarding Anaximenes as a link (perhaps an unconscious link) between crude Hylozoism (*q.v.*) and definitely metaphysical theories of existence.

We have seen that Thales recognized change, but attempted no explanation; that Anaximander spoke of change in two directions; that Anaximenes called these two directions by specific names. From this last, the transition to the doctrine of Heraclitus is easy. He felt that change is the essential fact of experience and pointed out that any merely physical explanation of plurality is inherently impossible. The Many is of Sense; Unity is of Thought. Being is intelligible only in terms of Becoming. That which is, is what it is in virtue of its perpetually changing relations (πάντα ῥεῖ καὶ οὐδὲν μένει). By this recognition of the necessary correlation of Being and Not-being, Heraclitus is in a very real sense the father of metaphysical and scientific speculation, and in him the Ionian school of philosophy reached its highest point. Yet there is reason to doubt the view of Hegel and Lassalle that Heraclitus recognized the fundamental distinction of subject and object and the relations of mind and matter. Like the early Ionians he postulated a primary substance, fire, out of which all things have emerged and into which all must return. This elemental fire is in itself a divine rational process, the harmony of which constitutes the law of the universe. Human knowledge consists in the comprehension of this all-pervading harmony as embodied in the manifold of perception; the senses are "bad witnesses" in that they report multiplicity as fixed and existent in itself rather than in its relation to the One. This theory gives birth to a sort of ethical by-product whose dominant note is Harmony, the subordination of the individual to the universal reason; moral failure is proportionate to the degree in which the individual declines to recognize his personal transience in relation to the eternal Unity. From the same principle there follows the doctrine of Immortality. The individual, like the phenomena of sense, comes out of the infinite and again is merged; hence on the one hand he is never a separate entity at all, while on the other hand he exists in the infinite and must continue to exist. Moreover, the soul approaches most nearly to perfection when it is least differentiated from elemental fire; it follows that "while we live our souls are dead within us, but when we die our souls are restored to life." This doctrine is at once the assertion and the denial of the self, and furnishes a striking parallel between European thought in its earliest stages and the fundamental principles of Buddhism. Knowledge of the self is one with knowledge of the Universal Logos (Reason); such knowledge is the basis not only of conduct but of existence itself in its only real sense.

Thus far the Ionian philosophers had held the field of thought. Each succeeding thinker had more or less assumed the methods of Thales, and had approached the problem of existence from the empirical side. About the time of Heraclitus, however, there sprang up a totally new philosophical spirit. Parmenides and Zeno (*see* ELEATIC SCHOOL) enunciated the principle that "Nothing is

born of nothing." Hence the problem becomes a dialectical a priori speculation wherein the laws of thought transcend the sense-given data of experience. It was therefore left for the later Ionians to frame an eclectic system, a synthesis of Being and Not-being, a correlation of universal mobility and absolute permanence. This examination of diametrically opposed tendencies resulted in several different theories. It will be sufficient here to deal with Anaxagoras, Diogenes of Apollonia, Archelaus and Hippo, leaving Empedocles, Leucippus and Democritus to special articles (*q.v.*). The latter three do not belong strictly to the Ionian School.

Anaxagoras (*q.v.*) elaborated a quasi-dualistic theory according to which all things have existed from the beginning. Originally they existed in infinitesimal fragments, infinite in number and devoid of arrangement. Amongst these fragments were the seeds of all things which have since emerged by the process of aggregation and segregation, wherein homogeneous fragments came together. These processes are the work of Nous (*νοῦς*) which governs and arranges. But this *Nous* or Mind, is not incorporeal; it is the thinnest of all things; its action on the particle is conceived materially. It originated a rotatory movement, which arising in one point gradually extended till the whole was in motion, which motion continues and will continue infinitely. By this motion things are gradually constructed not entirely of homogeneous particles (the homoeomerê, *ὁμοιομερῆ*) but in each thing with a majority of a certain kind of particle. It is this aggregation which we describe variously as birth, death, maturity, decay, and of which the senses give inaccurate reports. His vague dualism works a very distinct advance upon the crude hylozoism of the early Ionians (*see* Atom), and the criticisms of Plato and Aristotle show how highly his work was esteemed. The great danger is that we should credit him with more than he actually thought. His *Nous* was not a spiritual force; it was no omnipotent deity; it is not a pantheistic world-soul. But by isolating Reason from all other growths, by representing it as the motor-energy of the Cosmos, in popularizing a term which suggested personality and will, Anaxagoras gave an impetus to ideas which were the basis of Aristotelian philosophy in Greece and in Europe at large.

In Diogenes of Apollonia we find a return to Anaximenes. Diogenes (*q.v.*) began by insisting on the necessity of there being only one principle of things, herein contradicting the pluralism of Heraclitus. This principle is that of the universal homogeneity of nature; all things are at bottom the same, or interaction would be impossible. This universal substance is Air. But Diogenes went much farther than Anaximenes by attributing to air not only infinity and eternity but also intelligence.

Another pupil of Anaxagoras was Archelaus of Miletus (*q.v.*). His work was mainly the combination of previous views, except that he is said to have introduced an ethical side into the Ionian philosophy. "Justice and injustice," he said, "are not natural but legal." He endeavoured to overcome the dualism of Anaxagoras, and in so doing approached more nearly to the older Ionians.

The last of the Ionians whom we need mention is Hippo (*q.v.*), who, like Archelaus, is intellectually amongst the earlier members of the school. He thought that the source of all things was moisture, and is by Aristotle coupled with Thales (*Metaphysics*, A 3).

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IONIC ORDER, one of the classic orders (*q.v.*), usually listed as the second Greek or the third Roman. It is characterized especially by the capital whose most important feature is a horizontal band terminating at either end in large spiral scrolls or volutes.

IONIC THEORY: *see* Chemical Action and Electrolysis.

IONIZATION POTENTIAL: *see* Resonance Potential.

IONS, CATALYTIC ACTION OF. The fact that many reactions are accelerated by acids and bases has been generally associated with the idea that the hydrogen and hydroxyl ions are unique in the possession of catalytic qualities. The term hydrogen ion is here understood to refer to the hydrated form $\overset{+}{H}\cdot H_2O$ or oxonium ion $\overline{OH_2}$. In the case of acid catalysis, the simple hydrogen ion theory met for a long time with almost universal acceptance for the reason that it served to correlate with a fair degree of precision a large body of experimental facts. More recent studies, in which new reactions have been subjected to minute examination indicate, however, that there is in general no simple proportionality between the catalytic activity of an acid and either the concentration or the thermodynamic activity of the hydrogen ion. On the other hand, the observations show clearly that catalytic activity is by no means peculiar to the hydrogen and hydroxyl ions, but that similar qualities must be attributed to other positive and negative ions and also to electrically neutral molecules. The catalytic effects produced by a weak acid HA, when admixed with the corresponding salt for the purpose of reducing the preponderating influence of the hydrogen ion, require, indeed, for their representation an equation of the form

$$v=k_h[\overset{+}{H}]+k_m[HA]+k_w[H_2O]+k_a[\bar{A}]+k_{OH}[\overline{OH}]$$

in which the total observed catalytic action is expressed as the sum of the joint effects due to the positive hydrogen ion, the neutral molecules HA and H_2O and the negative ions $\bar{A}$ and $\overline{OH}$. The relative magnitudes of the individual catalytic effects depend on the nature of the reaction and also on the solvent medium. As might have been anticipated, the values of k_m, k_w, and k_a are usually very small compared with the values of k_h and k_{OH}.

If for a given reaction, the values of k_m and k_a for a series of different acids are compared, it is found that with increasing ionisation constant of the acid, the magnitude of k_m increases whilst that of k_a diminishes. The high efficiency of the hydroxyl ion as a catalytic agent is thus connected with the fact that water is an acid with a very small ionisation constant.

If certain secondary effects which depend on variations in the reaction medium are ignored, the results of recent work indicate that the catalytic effects which are produced by the positive and negative ions resulting from the dissociation of the acid HA may be expressed in terms of the hydrogen ion concentration in the form of a general relation which is independent of the nature of the acid and of its concentration. The relation in question, which may be put in the form $r=\frac{1}{2}(n+\frac{1}{n})$ where r is a measure of the catalytic effect of the ions, and n a measure of the hydrogen ion concentration, is also independent of the temperature, of the nature of the solvent medium and even of the nature of the catalysed reaction. The catalytic effects associated with the hydrogen and hydroxyl ions conform closely to the requirements of this generalisation.

As the result of catalytic observations, it is now recognised that the traditional conception of the relations between acids and bases is inadequate and requires modification. The modern view assigns to the free hydrogen ion or proton the rôle of the connecting link between the acids and bases as represented by the formula: acid $\rightleftarrows$ base$+\overset{+}{H}$. In accordance with this view $\overset{+}{OH_3}$, $\overset{+}{NH_4}$, HCl and CH_3CO_2H are acids, and NH_3, $\overline{Cl}$, $CH_3\overline{CO_2}$ are bases. The water molecule affords an example of an amphoteric substance in that it may act as a proton donator (acid) or as a proton acceptor (base) in accordance with $H_2O\rightarrow\overset{+}{H}+\overline{OH}$ and $\overset{+}{OH_3}\rightarrow H_2O+\overset{+}{H}$ respectively. (H. M. D.)

IOPHON, Greek tragic poet, son of Sophocles. He gained the second prize in 428 B.C., Euripides being first, and Ion third. In the *Frogs* of Aristophanes (405) he is spoken of as the only good Athenian tragic poet. He wrote 50 plays, of which only a few fragments remain. It is said that Iophon accused his father of being incapable of managing his affairs and that Sophocles was

triumphantly acquitted, on reading the famous chorus of the *Oedipus at Colonus* (688 ff.).

See Aristophanes, *Frogs*, 73, 78, with scholia; Cicero, *De senectute*, vii. 22; Plutarch, *Moralia*, 785, B; O. Wolff, *De Iophonte poëta* (Leipzig, 1884); A. Nauck, *Tragicorum Graecorum fragmenta* (1889).

IOTA, the ninth letter of the Greek alphabet corresponding to the ninth letter of the English alphabet. *See* I.

I.O.U. ("I owe you"), a written acknowledgment of a debt. It usually runs thus:

To——. I. O. U.——pounds
(Signed)——. Date——.

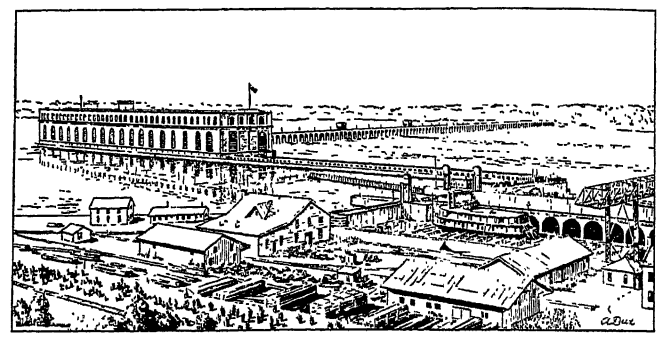
An I.O.U., if worded as above, or even if the words "for value received" are added, does not require a stamp, as it contains no term of agreement. If any such words as "to be paid on such a day" are added it requires a stamp. An I.O.U. should be addressed to the creditor by name, though its validity is not impaired by such omission. Being a distinct admission of a sum due, it is *prima facie* evidence of an account stated, but where it is the only item of evidence of account it may be rebutted by showing there was no debt and no demand which could be enforced by virtue of it. An I.O.U. is not negotiable in the technical sense. (*See* NEGOTIABLE INSTRUMENT.)

IOVILAE or JOVILAE, a latinized form of *iŭvilas*, the name given by the Oscan-speaking Campanians in the 5th, 4th and 3rd centuries B.C. to an interesting class of monuments, not yet fully understood. They all bear crests or heraldic emblems proper to some family or group of families, and inscriptions directing the annual performance of certain ceremonies on fixed days. While some of them are dedicated to Jupiter (in a special capacity, which our present knowledge of Oscan is insufficient to determine), others were certainly found attached to graves.

See the articles OSCA LINGUA, CAPUA, CUMAE and MESSAPII. The text of all those yet discovered (at Capua and Cumae), with particulars of similar usages elsewhere in Italy and other historical and archaeological detail, is given by R. S. Conway in *The Italic Dialects* (Cambridge, 1897, pp. 101 ff.). (R. S. Co.)

IOWA (Ī'ọ-wą), known as the "Hawkeye State," is a north central State of the United States of America, situated between 40° 36′ and 43° 30′ N. and 89° 5′ and 96° 31′ W. It is bounded north by Minnesota, east by the Mississippi river, which separates it from Wisconsin and Illinois, south by Missouri, and west by the Missouri and Big Sioux rivers, which separate it from Nebraska and South Dakota. The State's total area is 56,147 sq.m., of which 561 sq.m. are water surface.

Physical Features.—Topographically, Iowa lies wholly in the prairie plains region, part of it having been overrun by the great ice sheet of the glacial epoch. For the most part the surface is that of a prairie tableland, moderately rolling, and with a general but scarcely perceptible slope, which in the eastern two-thirds is from north-west to south-east, and in the western third from north-east to south-west. Elevations above the sea range from between 1,200 to 1,600ft. in the north-west to 500ft. and less in the south-east, the highest point being in Osceola county, the lowest at Keokuk. In the southern half of the State the height of the crests of the divides is very uniform. The northern half, because of glaciation, is more broken and irregular. Elevations, usually rounded, mingle with depressions, some of which are occupied by small shallow lakes or ponds. But the most marked departures from the prairie surface are in the north-east and south-west. In the north-east the whole of Allamakee and parts of Winneshiek, Fayette, Clayton, Delaware, Dubuque and Jackson counties form the only driftless area of the State. In that region cliffs frequently rise almost vertically from the banks of a river to a height of from 300 to 400ft.; and from the summit of the cliff to the crest of the divide, a few miles distant, there is another ascent of 300ft. or more, terminating occasionally in knob-topped hills crowned with small cedar. Moreover, the largest streams have numerous tributaries flowing circuitously between steep if not vertical cliffs or in deep craggy ravines overlooked by distant hills. In the west, southward from the mouth of the Big Sioux river, extends a line of moundlike bluffs, usually free from rocks, rising abruptly from the flood plain of the Missouri to a height varying from 100 to 300 feet. A broad water-parting extending from Spirit lake, on the northern border, nearly south to within 60m. of the southern border, and thence south-east to Wayne county in the south central part of Iowa, divides the State into two drainage systems. That to the east, comprising about two-thirds of the whole area, is drained by tributaries of the Mississippi, of which the Des Moines,



BY COURTESY OF THE CHAMBER OF COMMERCE, KEOKUK, IOWA

KEOKUK DAM, IN IOWA, 4,360 FT. IN LENGTH, OPENED IN 1913

the Skunk, the Iowa with its tributary the Cedar, and the Wapsipinicon are the largest. These streams of long courses and easy fall are frequently pebbly in the north, but muddy in the south. Their valleys are broad at their sources, well drained, and gently sloping in the middle of their courses, but becoming narrower and deeper towards their mouths. The region to the west of the divide is drained by tributaries of the Missouri, mostly short streams taking their rise from numerous rivulets, flowing quite rapidly over muddy beds through much of their courses, and in the bluff belt along the Missouri having steep but grassy banks 200ft. in height or more.

Climate.—The climate is one of great extremes of heat and cold, with a dry winter and a usually wet summer, the prevailing wind of winter being north-west, while in summer it not infrequently blows from the south-west. Both the midwinter isotherm of Montreal and the midsummer one of Washington, D.C., pass through the State. The mean annual temperature is 48° F; the average range of extremes per year is about 136° F; while the greatest extremes recorded are from −47° F in 1912 to 113° F in 1901, a difference of 160 degrees. The average mean annual temperature at Cresco in Howard county, near the north-east corner of the State was 44·3°, while at Keokuk in the south-east corner it was 52·2 degrees. As the isotherms cross the State, especially in the north, their tendency is to move south-west. The rainfall is also very unequal in distribution throughout the year, as between the same periods of different years, and as between the different parts of the State. While the mean annual precipitation is 31·97in., about 71% of this falls during the six months from April 1 to Oct. 1, or 10% in winter, 23% in autumn, 28% in spring and 39% in summer. May, June and July are the three wettest months. At the same time extremes during the four most critical crop months, from May 1 to Sept. 1, have ranged from 6·75in. to 27·8 inches. Within any one year the precipitation is in general usually less in the western part of the State than in the eastern; the western part also is marked by having a still greater percentage of its rain in spring and summer than has the eastern. The unequal distribution throughout the State is in large measure caused by local showers. Though the average frost-free growing season is from May 31 until Oct. 1, killing frosts may occur later or earlier. Injury to crops from drought and hot winds has occurred about two or three times in a decade, but liability to injury of the crops from excessive rainfall and hailstorms is greater than that from a deficiency of moisture.

Soil.—Its depth, together with its porous nature, makes the fertile soil of Iowa capable of withstanding the extremes of wetness and dryness remarkably well, and it is perhaps true that, taken as a whole, no other State in the Union has a superior soil for agriculture. Certainly no other has so many acres of improved land, or so large a proportion—from 85% to 90%—of its land subject

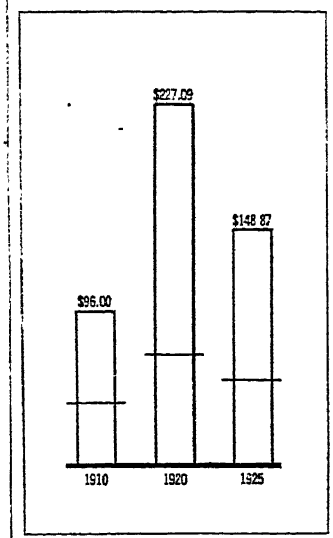
to cultivation. The soil is of four kinds: till or drift, alluvial, loess or bluff, and geest. The dark drift, composed chiefly of clay, sand, gravel, boulders and lime, is both the soil and subsoil of the greater part (about 66%) of the State, being especially predominant in the north and north-west. The alluvial soil, composed of what has been washed from other soils, together with decayed vegetable matter, covers about 6% of the surface of the State, and is found in the river bottoms, particularly in the Missouri; it varies much in fertility. The loess soil, chiefly a mixture of porous clay and carbonate of lime, forms the bluffs bordering the bottom lands of the Missouri and is common in the north-east. Its fertility is not inferior to that of the better drift. Geest is found particularly in the north-eastern part of the State; it covers less than 1% of the area of the State.

ADMINISTRATION

Constitution.—There is comparatively little in the political institutions of Iowa dissimilar to those of other States of the Union; they show in recent years a tendency towards greater centralization—in boards, however, rather than in individual officers. The Constitution now in force was adopted in 1857, the Constitution of 1846 having been superseded chiefly on account of its prohibition of banking corporations. The present one admits of amendment by a vote of a majority of the members of both houses of the legislature, followed by a majority vote of the electors in the State voting on the amendment; and by this process it was amended in 1868, 1880, 1884, 1904, 1908, 1916 and 1926. The present Constitution also provides that the question, "Shall there be a convention to revise the Constitution and amend the same?" shall be submitted to the people once every ten years (beginning with 1870); but the vote taken in accordance with this provision was never in the affirmative until 1920, when it was—yes: 279,652; no: 221,763. The 39th general assembly, however, failed to provide for a Constitutional convention. The suffrage now belongs to all citizens of the United States at least 21 years of age who shall have resided in the State for six months, and in some one county 60 days preceding an election, except idiots and persons insane or convicted of some infamous crime. The franchise was conferred on negroes by an amendment adopted in 1868, and on women by the Federal amendment adopted in 1920. Prior to 1904 elections were annual, but by an amendment of that year they became biennial.

The central executive and administrative authority is vested in a governor, a lieutenant governor, an executive council, several boards and a few other officers. The governor and the lieutenant governor, who are elected for a term of two years, shall be at least 30 years of age and shall have been for two years immediately before their election residents of the State. Under the territorial Government when first organized the governor was given an extensive appointing power, as well as the right of an absolute veto on all legislation. This resulted in such friction between him and the legislature that Congress was petitioned for his removal, with the outcome that the office has since been much restricted in its appointing power, and the veto has been subjected to the ordinary United States limit; *i.e.*, it may be overridden by a two-thirds vote of both houses of the legislature. The superintendent of public instruction and the three railroad commissioners are elected for terms of four years; the attorney general for a term of two years. Most of the heads of the numerous boards and commissions are appointed by the governor with the approval of the executive council or the senate. The governor, however, is himself a member of the executive council as well as of some important boards or commissions, and it is in this capacity that he often has the greatest opportunity to exert power and influence. His salary is $5,000 per annum (with $600 for house rent and $1,200 as a member of the executive council). The executive council, composed of the governor, secretary of State, auditor of State and treasurer of State, all elected by the people for a term of two years, has extensive powers. It supervises and audits the accounts of State departments, directs the taking of the census, transfers cities from one class to another in accordance with census returns, constitutes the board for canvassing election returns, classifies railways, assesses railway and other companies, constitutes the State board of equalization for adjusting property valuations between the several counties for taxing purposes, supervises the incorporation of building and loan associations, appoints the board of examiners of mine inspectors, and has many other powers.

In 1911 the office of commerce counsel was created, the incumbent to be appointed by the board of railway commissioners and to serve as expert counsel for that board. In 1913 the department of insurance was created, and in 1917 a State banking department and the office of superintendent of banking. In 1915 a State board of audit and a State board of accountancy were created, and the office of document editor was established to relieve the secretary of State. The road administration was reorganized in 1913 when the general assembly established a highway commission consisting of the dean of engineering of the State college of agriculture and mechanical arts, and two appointed members. The highway commission was again altered in 1927 by increasing the number of its members to five and by giving it complete control over the primary road system. Highway legislation in 1919 divided the highways into primary and secondary systems, and arranged for the distribution of Federal and State aid funds for the hard surfacing of primary roads.



FARM VALUES (LAND AND BUILDINGS) PER ACRE OF LAND IN FARMS. THE LINE ACROSS EACH COLUMN SHOWS THE AVERAGE VALUE FOR THE UNITED STATES

The State legislature, or general assembly, composed of a senate and a house of representatives, meets in regular session the second Monday in January in odd numbered years at Des Moines. Senators are elected for a term of four years, one from each of 50 senatorial districts, the term of one-half expiring every two years. Representatives are elected for a term of two years, one from each of the 99 counties, with an additional one from each of the counties (not exceeding nine) having the largest population; the ratio of representation and the apportionment of the additional representatives from the larger counties are fixed by the general assembly.

Judiciary.—The judiciary consists of a supreme court of 7 judges, and a district court of 69 judges, from one to five in each of 21 districts. The supreme court has three sessions a year, and each district court judge is directed to hold at least one session a year in each county of his district. No two district court judges may sit together on the same case. The supreme court has original jurisdiction in certiorari and mandamus cases, and appellate jurisdiction in cases sent up from the lower courts. It also has the power to pass on the constitutionality of State laws. The district court has general, original and exclusive jurisdiction in all matters civil, criminal and probate not expressly conferred on an inferior court, and may hear appeals from inferior courts, boards or officers.

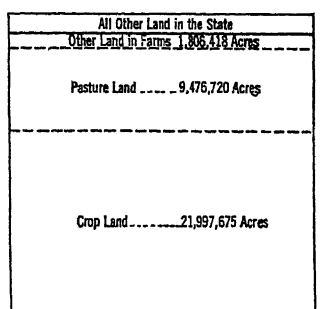
For purposes of administration and local government the State is divided into 99 counties, each of which is itself divided into townships that are usually 6m. square. The township may be divided into school districts and highway districts, but in these matters option has resulted in irregularity. Each county has its own administrative boards and officers. The board of supervisors, consisting of not more than seven members, elected for a term of three years, has the care of county property and the management of county business, including highways and bridges; it fixes the rate of county taxes within prescribed limits and levies the taxes for State and county purposes. Other officers of the county are: auditor, treasurer, clerk, recorder, sheriff, attorney, engineer, coroner and superintendent of schools. All are elected for a term of

two years, except the engineer and superintendent of schools, who are appointed. The officers of the township are three trustees, a clerk, an assessor, two justices of the peace and two constables. The trustees are elected for a term of three years, the other officials for two years. All taxable property of the State, that of corporations for the most part excepted, is assessed by the township assessor.

The municipal corporations are civil divisions quite independent of the county and township system. They are divided into cities of the first class, cities of the second class and towns, besides a few cities with special charters. Cities of the first class are those having a population of 15,000 or more; cities of the second class, a population of at least 2,000 but less than 15,000; all other municipal corporations, except cities with special charters, are known as incorporated towns. The commission plan of government, authorized in 1907 for cities of 25,000 or more inhabitants, was extended to cities of 2,000 or more inhabitants. According to the *Iowa Official Register 1927–28,* eight cities had organized under the commission plan: Burlington, Cedar Rapids, Des Moines, Fort Dodge, Keokuk, Mason City, Ottumwa and Sioux City. Commissioners are elected on a non-partisan ticket for a term of two years. In 1915 the general assembly passed acts allowing cities not exceeding 25,000 inhabitants to organize their municipal government under the city manager plan. By 1927, 12 municipalities had organized under this plan. The four cities Camanche, Davenport, Muscatine and Wapello are governed under special charters. All other municipalities are governed under the mayor-city council plan.

Under the laws of Iowa a wife enjoys property rights equal to those of her husband. The expenses of the family, including the education of the children, are chargeable alike upon the property of either or both. Otherwise, the wife may control her property as if single, and neither is liable for what are clearly the debts of the other. In case of the death of either, one-third of the property of the deceased becomes that of the survivor. A homestead cannot be conveyed or encumbered without the consent of both husband and wife, if held by a married man; and a homestead, to the value of $500, is exempt from liability for debts post-dating the purchase, unless for improvements on the property.

Population.—The population of Iowa (State census) was 2,419,927 on July 1, 1925, and, according to the U.S. census estimate, 2,428,000 on July 1, 1928. The native whites of native parentage, in 1920, numbered 1,528,553; those of foreign or mixed parentage, 629,981; and the foreign-born whites, 225,647. The larger foreign groups in the order of their numerical strength were: Canadians, Italians and Mexicans. The negro population was 19,005. There were in 1920 43·2 inhabitants per square mile as against 40 in 1910. In 1920 the urban population was 36·4% of the whole. There were 18 cities having a population of 10,000 or more in 1920.



PROPORTION OF TOTAL LAND AREA IN FARMS (1925) AND DIVISION OF THE FARM LANDS

Finances.—The taxing system of Iowa includes a general property tax, an inheritance tax, a tax on insurance companies, a cigarette sales tax, a gasolene tax of two cents per gallon and other taxes for special purposes. The auditor's report for the fiscal year from July 1, 1925, to June 30, 1926, showed balances of $1,642,608 in the general fund and $2,324,982 in the trust fund on July 1, 1925. The receipts to the trust fund were $11,650,157 and to the general fund $16,407,850. The disbursements from the two funds, for the fiscal year, were $28,026,002. The balances in both funds on June 30, 1926, were $3,984,340. The chief expenditures from the general fund were for educational and charitable institutions. By far the greater part of the trust fund was expended on the primary road system. The assessment of property for 1925 showed real estate and town lots having an adjusted actual value of $3,294,922,534, personal property other than moneys and credits valued at $376,725,254 and live stock valued at $155,333,113. On June 30, 1926, the floating debt was $141,497.89 and the bonded debt $18,700,000, incurred to pay a bonus to World War veterans.

Education.—The first step toward establishing a system of public schools dates from the first session of the territorial legislature in 1838, but owing to the lack of funds for support the system was not established on a working basis until after 1850.

At the head of the whole system is the State superintendent of public instruction, assisted by a board of educational examiners. The county administration is in the hands of a board of education and a superintendent. The county superintendent is elected for a term of three years by a convention of presidents of each school township, consolidated independent and city independent school districts. The county board of education consists of six members elected for a term of six years and the county superintendent. Each school district has its separate board of education or trustees. The school revenue is derived from the State's permanent school fund, which grew out of land granted to the State by the Federal Government and from local or district taxation. School attendance was first made compulsory by legislative action in 1902. Subsequent acts have extended the period of school attendance to 24 consecutive weeks every year for children between the ages of seven and sixteen. State aid became an important factor in the development of public schools in the period following 1910. Legislation granted such aid to large centrally located, consolidated schools, which replaced small scattered ones. At the close of 1920 there were 430 consolidated districts, including about 25% of the area of the State and taking care of approximately 50,000 pupils. In 1911 State aid was granted by law to high schools organizing normal training of rural teachers. In 1917 a State board for vocational education was established to take advantage of the provisions of the Smith-Hughes law offering Federal aid for vocational education. A law, enacted in 1919, provided for part-time schools for the benefit of children between the ages of 14 and 16 working on employment certificates. The establishment of these schools was required where there were 15 eligible pupils in the district, and attendance became compulsory.

The total school population between five and seventeen years of age, inclusive, in 1926, was 601,283, of whom 556,270, or 86·1%, were enrolled in public, and 45,013, or 7·7%, were in private and parochial schools. In the public schools 444,376 were enrolled in the kindergarten and elementary schools; and 111,894 in secondary schools. The total number of teachers employed was 25,206. The average number of days attended per pupil enrolled had increased from 121·4 in 1910 to 148·3 in 1924. The total school expenditure for 1926 was $57,288,000; a sum per caput based on population 5 to 17, inclusive, of $94.38.

For advanced education Iowa has 26 universities and colleges. The State-supported institutions of higher education are the State university of Iowa at Iowa City (1847), the Iowa State college of agriculture and mechanical arts at Ames (opened in 1869) and the Iowa State teachers' college at Cedar Falls (1876). The State also maintains a school for the deaf at Council Bluffs, and a school for the blind at Vinton. The enrolment for the academic year 1923–24 (nine months) was as follows:—State university, 6,151; Iowa State college, 4,147; Iowa State teachers' college, 2,933; Iowa School for the Blind, 113; Iowa School for the Deaf, 292. All of the State-supported educational institutions are under the management of a single board of control known as the State board of education. The members of the board, nine in number, are appointed by the governor for six-year terms, subject to approval by the senate. The board chooses from outside its own members a finance committee of three members. The committee selects its chairman and secretary.

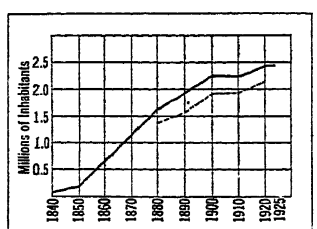
Educational institutions not supported by the State include: Iowa Wesleyan university (Methodist, 1842) at Mount Pleasant; Grinnell college (opened in 1848 as Iowa college, Congregational) at Grinnell; Coe college (1880) at Cedar Rapids; Drake university (1881) at Des Moines; Cornell college (Methodist, 1857) at Mount Vernon; Upper Iowa university (Methodist, 1857) at Fayette; Luther college (Norwegian Evangelical Lutheran, 1861)

at Decorah; Des Moines university (Baptist, established in 1865 as Des Moines college) at Des Moines; Penn college (Friends, established in 1873) at Oskaloosa; Parsons college (Presbyterian, established in 1875) at Fairfield.

Charities and Corrections.—The charitable, penal and reformatory institutions of the State are all under a board of control of State institutions, composed of three members appointed by the governor and approved by two-thirds of the senators, careful provision being made also to prevent the board from becoming subject to either political party. The institutions under its charge include a Soldiers' Orphans' home at Davenport; a Soldiers' home at Marshalltown; an institution for feeble-minded children at Glenwood; an industrial school for boys at Eldora; an industrial school for girls at Mitchellville; a State sanatorium for the treatment of tuberculosis at Oakdale; Mount Pleasant State hospital at Mount Pleasant; Independence State hospital at Independence; Clarinda State hospital at Clarinda; Cherokee State hospital at Cherokee; hospital for female inebriates at Mount Pleasant; hospital for male inebriates at Independence; State penitentiary at Fort Madison; men's reformatory at Anamosa; women's reformatory at Rockwell City; hospital for epileptics and school for feeble-minded at Woodward; and a juvenile home at Toledo. The board of control of State institutions has supervisory and inquisitorial powers over all county and private institutions in the State in which the insane are kept, and over homes for friendless children maintained by societies or institutions. In 1907 the general assembly passed a law under which the indeterminate sentence was established in the State, and the governor appoints a board of parole of three members, of whom one must be an attorney and not more than two are to belong to the same political party.

THE STATE'S PRODUCTS

Industry, Trade and Transportation.—The superior qualities of the soil, together with the usually warm and moist months of spring and summer, make Iowa one of the foremost States in the Union in agriculture and stock raising, especially in the production of Indian corn, oats, hay and eggs, and in the raising of hogs, horses, dairy cows and poultry. Of the State's 858,698 persons engaged in profit-earning occupations in 1920, 327,124 were engaged in agriculture, 176,522 in manufacturing and mechanical industries and 169,201 in trade and transportation. Of the total farm acreage of 34,094,075 in 1925, 21,470,564ac., or about 63%, were in actual cultivation. The average size of Iowa farms was 162 acres. The tenure distribution for the State's 210,899 farms was as follows:—owners 100,714, relative renters 31,298, renters 63,323, both own and rent 14,664, unclassified 900. According to estimates of the Iowa weather and crop bureau, the total value of farm products in 1925 was $1,054,225,378; the distribution being $513,953,000 for crops of all kinds, $121,000,000 for dairy products, $75,000,000 for eggs and poultry, $2,215,000 for wool and $342,057,378 for live stock shipped out in excess of the amount shipped in.



GROWTH OF POPULATION, 1840–1925, SHOWING ALSO (DOTTED LINE) THE NATIVE WHITE POPULATION

Indian corn is by far the chief crop, more than half of the cultivated area being devoted to its culture. In 1925, the 11,130,000ac. planted in Indian corn had an average yield of 43 bushels per ac., the total yield being 478,590,000bu. valued at $268,010,000. The grain second in importance was oats, which, from 6,089,000ac. and an average yield of 40·5bu. per ac., produced 246,604,000bu. valued at $78,913,000. Both winter and spring wheat are raised, but wheat is a minor crop, its total value in 1925 being about $8,500,000. As a producer of cultivated hay, Iowa ranks among the leading States. The yield from the 3,152,000ac. devoted to all varieties of cultivated hay was 4,098,000 short tons valued at $55,323,000. Other crops that had a value in excess of $1,000,000 in 1925 were: barley, $3,251,000; timothy seed, $2,300,000; clover seed, $1,216,000; potatoes, $12,288,000; wild hay, $3,150,000; pop-corn, $2,280,000; sweet corn, commercial crop, $2,036,000; fruit crop, $7,500,000 and garden truck, $5,750,000. Iowa is not only a great feeding State for live stock shipped into the State, but ranks high as a breeding State. In 1925, Iowa led the other States of the Union in the number of swine and horses raised. There were marketed that year 10,940,322 native swine valued at $236,739,507; 1,539,555 native cattle valued at $97,305,961; 441,247 native sheep valued at $5,419,826; 35,508 horses valued at $2,592,084.

Iowa's first settlement was a mining camp, but this event proved to be no index to her future importance as a mineral producing State. The early worked lead and zinc mines about Dubuque are little worked at present, and these products are of small significance in comparison with the State's total mineral output. The value of all products, in 1925, gave the State the rank of 26th among the States of the Union, or ·77% of the total mineral wealth of the Nation. Coal, mined in 20 counties extending from the south-east along the Des Moines river and three counties in the south-west, was the chief mineral product. The total production for the State in 1925 was 4,714,843 short tons, valued at $14,807,000. The product second in importance was cement, 4,856,849bbl. valued at $8,674,563 having been produced in 1925. Clay products were manufactured to the value of $5,703,537. In the production of gypsum the State ranked second, its output for 1925 having been 800,127 short tons valued at $6,734,271. The producing area is confined to about 50 sq.m. in the vicinity of Fort Dodge in Webster county. Other products of commercial value were sand and gravel and building stone. The total value for all mineral products in 1925 was $38,420,203.

The manufactures of Iowa deal chiefly with the products of the farm. Meat packing is the most important, the product of this industry amounting in 1925 to $213,741,084 or an increase of 610·7% compared with the $30,074,070 product in 1905. Next in importance is the manufacture of dairy products, the value of which in 1925 was $78,110,309, or a gain of 419% from the products in 1905. The manufacture of food preparations was the industry third in importance, its value in 1925 having been $42,532,872. The State's great railway systems gave rise to the industry next in importance—the construction and repair done in steam railway shops. In 1925 the work done in 61 railway shops was valued at $31,529,993. Other industries which had a product in excess of $10,000,000, in the order of their importance, were:—printing and publishing, $30,903,936; washing machines, clothes wringers, etc., $25,447,152; corn syrup, oil, starch, $22,600,279; bakery products, $22,193,496; foundry and machine-shops, $21,345,826; planing mills, $20,995,214; flour and grain-mills, $15,138,899; canned and preserved fruits and vegetables, $14,056,368; poultry killed and dressed, $11,441,891. Manufacture of lumber, once the chief industry of Clinton and other cities along the Mississippi, dropped to minor importance when log rafts ceased to be floated down from Wisconsin and Minnesota. The State ranked first in the product of pearl buttons, with Muscatine the centre of the industry. The chief shell supply came from the Mississippi and tributary Iowa rivers. In 1925 the industry gave employment to 2,284 persons working at 43 plants, and had a value of $5,679,112. The 1925 census of manufactures identified 83 separate industrial groups within the State. The 3,270 industries engaged 74,976 wage-earners and had a product valued at $757,771,477.

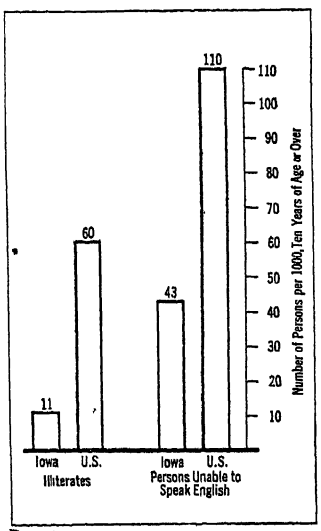
Transportation is afforded chiefly by steam railways, of which the State had 9,814m. in 1925. Scarcely a farm is more than 6 or 8m. from a railway station; and only three other States have a greater mileage—Texas, Illinois and Pennsylvania. The great period of railway building in Iowa came during the 25 years immediately following the close of the Civil War, the railway mileage being only 655 in 1860. The several roads are under the management of 22 companies, but the chief systems are the Chicago, Burlington and Quincy; the Chicago and Northwestern; the Chicago, Milwaukee and St. Paul; the Chicago, Rock Island and Pacific; the Atchison, Topeka and Santa Fe, the Great Northern, the Illinois Central, the Union Pacific and the Wabash. Electric interurban railways are of importance for freight and passenger service. In 1908 about 225m. of such railways were in operation; and

in 1926 the mileage was 518·87, a slight decrease from the years immediately previous. Including the street railways, there were 22 companies, operating 958 miles of track, in 1925. Transportation facilities by water are afforded by the Mississippi river. With the canal constructed by the U.S. Government between Keokuk and Montrose and the channel improvements at Clinton, there has been a revival of river traffic. Iowa has long had a State highway system, but it was not until 1919 that the highways were classified as primary and secondary. At the end of 1926 the highway commission controlled 6,653·7m. of road, of which 3,469·6m. were surfaced. During that year 498·7m. of new surfacing were laid. The Lincoln highway traverses the State, passing from Clinton in the east to Council Bluffs in the west, where it passes into Nebraska.

HISTORY

Iowa, as a part of the Mississippi valley, was taken into the formal possession of France in the year 1682; in 1762 as a part of the western half of that valley it was ceded to Spain; in 1800 it was retroceded to France; in 1803 it was ceded to the United States. From 1804–05, as a part of the District of Louisiana, it was under the government of Indiana Territory; from 1805 to 1812 it was a part of Louisiana Territory; from 1812–21 it was a part of Missouri Territory; from 1821–34 a part of the unorganized territory of the United States; from 1834–36 a part of Michigan Territory; from 1836–38 a part of Wisconsin Territory. In 1838 Wisconsin Territory was divided, the western portion being named Iowa, and out of this the State with its present bounds was carved in 1846.

The name Iowa was taken from a tribe of Siouan Indians (probably of Winnebago stock) which had dwelt in that part of the country for some time and were still there when the first white men came—the Frenchmen, Marquette and Joliet, in 1673, and Hennepin in 1680. Early in the next century the Sacs and Foxes, vanquished by the French in Michigan, retreated to the westward and largely supplanted the Iowas.



RELATIVE PROPORTION OF ILLITERATES AND OF PERSONS UNABLE TO SPEAK ENGLISH

Thither also came Julien Dubuque, a French Canadian, to trade with the new occupants. He discovered lead mines, on and near the site of the city which now bears his name. In 1788 he obtained an Indian grant of about 21 sq.m., established a settlement of miners, and continued his mining operations, together with a trade in furs, until his death in 1810. The Indians would not allow others to work the mines, and were upheld in this by the United States troops, especially from 1830 to 1832. But the war which Black Hawk instigated was concluded in 1832 by a cession to the United States of nearly 9,000 sq.m., embracing much of this region. In spite of the act of Congress of 1807 prohibiting such settlements, the frontiersmen rushed in to mine and to farm, and established a Government through voluntary associations. Proceedings of these associations which related to claims to land were later recognized by the United States authorities; those relating to the establishment of schools were tolerated for a time by the State Government. Iowa separated from Wisconsin in 1838 on account of lack of courts for judicial relief, and the question of applying for admission into the Union as a State was voted on as early as 1840, the Territory in that year having a population of 43,112. The measure was defeated then, as it was again in 1842, by those who most wished to avoid an increase of taxes. In 1844, however, a convention was called, a Constitution framed and application for admission made. The question of boundaries, raised by the question of slavery, then caused delay, but the territory became a State in 1846.

The Whigs had steadily opposed applying for admission, but the Democrats carried it through, and remained in power until 1854. Since 1857 the State has been preponderantly Republican in all national campaigns except in 1912, when a split in the party gave the electoral vote to Wilson, the Democratic candidate. With two exceptions, in 1889 and 1891, when liquor and railroad legislation were the leading issues, Iowa has elected a Republican State Administration. Within the dominant party, however, there has been a tendency towards the formation of two opposing elements, the more radical seeking the promotion of the "Iowa Idea," which in substance was to further the expansion of the trade of the United States with the rest of the world through the more extended application of tariff reciprocity, and at the same time to revise the tariff so as to prevent it from "affording a shelter to monopoly."

In 1882 an amendment to the Constitution was passed prohibiting the manufacture and sale of intoxicating liquors within the State. The supreme court, in April 1883, pronounced this amendment invalid on the ground of irregularity in recording it, whereupon the legislature provided for a like prohibition in an ordinary statute. Attempts to execute this were, however, so unsuccessful that it was succeeded by a law imposing the "mulct tax," which required the payment of $600 in quarterly instalments for a licence to sell liquors, and placed a lien for the whole amount on the real property in use for the business. The vital portions of the "mulct tax" law were repealed by the general assembly in 1915, thus restoring statutory prohibition in Iowa, but a prohibitory amendment to the State Constitution was voted down by the election in Oct. 1917. The 18th (Prohibition) Federal amendment was, however, ratified by Iowa Jan. 15, 1919. In 1916 a constitutional amendment extending suffrage to women was submitted to the electors, but was defeated. The Federal suffrage amendment was adopted by the legislature in 1920.

The general assembly in 1913 passed an employers' liability and workmen's compensation act, and a mothers' pension act, providing for the granting to widowed and indigent mothers of sums not to exceed $2 per week for each child under 14. In 1915 the Perkins law was passed, providing free treatment for crippled children of poor parents. In 1917 an appropriation was made by the general assembly for the erection and equipment of a hospital at Iowa City for such children. Two years later the general assembly provided that indigent adults as well might be sent to Iowa City for free medical and surgical treatment. In 1917 the general assembly established at Iowa City a child-welfare station.

The farm bureau movement in Iowa was an important development. By 1917 organizations among farmers were numerous, and in that year the general assembly passed an act providing that where a farm-improvement association in any county had among its members 200 farmers or farm owners and had raised $500 in annual subscriptions, the county board of supervisors could contribute $2,500 for the employment of a county agent. A law in 1919 modified the amount and terms of payment by the county, and made the contribution mandatory. The movement gained rapid headway, county associations being established for the betterment of both social and economic conditions and the improvement of agricultural methods. In 1920 there was a farm bureau in each county and two in Pottawattamie county, and a membership of over 100,000. There was also considerable growth within the State of a farmers' educational and co-operative union which had more than 20,000 members in 1920.

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The Annals of Iowa, published by the historical department of Iowa (Des Moines, 1893–); *Iowa Historical Record* (Iowa City, 1885–1902); *Iowa Journal of History and Politics* (Iowa City, 1903, *seq.*); and G. T. Flom, *Chapters on Scandinavian Immigration to Iowa* (Iowa City, 1907). An elementary work on Iowa Government is *Iowa and the Nation* (1915, rev. ed., 1926), by George Chandler and John L. Cherny. *See* also B. F. Shambaugh, *History of the Constitution of Iowa* (1902); Jesse Macy, *Institutional Beginnings in a Western State* in *Johns Hopkins University Studies in Historical and Political Science* (Baltimore, 1894); and the *Iowa Official Register*. Other facts regarding the administrative system can be had from the *Reports* of the various departments, commissions and boards. For population, occupations, etc., see *Fourteenth U.S. Census* and *1925 State Census*. For weather, geology, etc., see *Reports* of the Iowa weather and crop bureau (1889, *seq.*) and the *Publications of the Iowa Geological Survey* (1868) and subsequent reports. (W. A. J.)

IOWA, STATE UNIVERSITY OF, an institution of higher learning, situated in Iowa City, Ia. It was organized by an act of the legislature in 1847. Instruction was begun in the spring of 1855, but the first regular collegiate session did not open until the autumn of 1856. Because of financial reasons, the university maintained only a normal department during the two years 1858–60. Since that time new departments, schools and colleges have been added to the original college of liberal arts. The law department was established in 1868, the medical department in 1870, the dental department in 1882 and the department of pharmacy in 1885. All these are now colleges. The graduate college was added in 1900 and the college of engineering in 1905. The school of education, created in 1907, became the college of education in 1913; and a school of commerce, established in 1914, became the college of commerce in 1921. In addition to these nine colleges now functioning, a preparatory department was maintained from the organization of the university until 1879; a homeopathic medical department, later a college, from 1876 to 1919; and a college of fine arts from 1911 to 1915. Within the college of liberal arts is the school of music and the school of journalism. Within the college of medicine is the school of nursing. A summer session, begun in 1900, has become an important part of the university. The extension division was organized in 1913; the Iowa Child Welfare Research Station in 1917; and the division of physical education in 1924. Enrolment in the reserve officers' training corps maintained at the university is compulsory for men students in the colleges of liberal arts, engineering and pharmacy during their freshman and sophomore years.

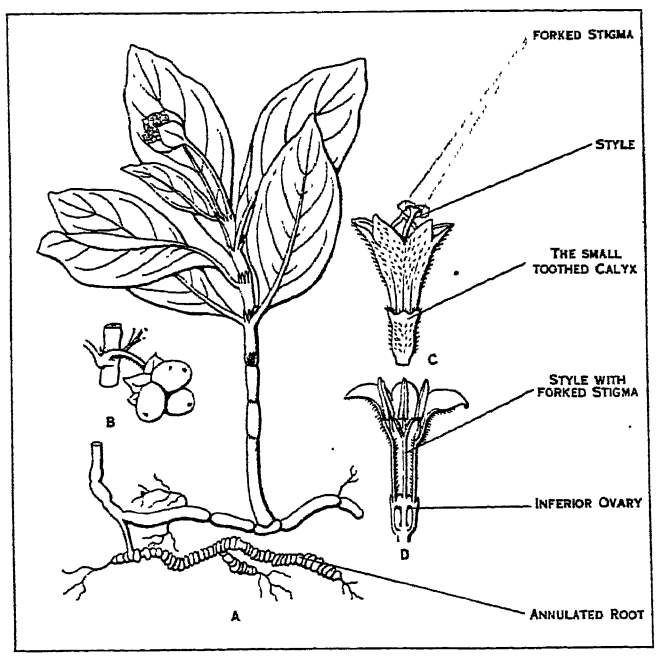
The university is the capstone of the public school system of the State. It is under the direction of a State board of education of nine members appointed by the governor, with the approval of the senate, for a period of six years. The faculty contains more than 500 men and women and the student enrolment for 1927–28 was 9,249. Funds for the institution are derived to some extent from the sale of lands originally donated for its support by the U.S. Government, but the greater part of its support comes from the appropriations made biennially by the general assembly. For the biennium 1927–29, the amount set aside for the university was $4,091,003.20.

The central building of the university campus is the beautiful Old Capitol, which was begun in 1830 and served as the capitol of Iowa from 1841 until 1857, when Des Moines became the capital of Iowa and the capitol building was turned over to the university. Around this building are grouped some 50 buildings on a campus of over 300 ac. lying on both sides of the Iowa river. The latest additions to the material equipment of the university are the medical laboratories and hospital, built by the joint contribution of the State of Iowa and the Rockefeller Foundation at a cost of nearly $5,000,000. The university library contains more than 360,600 volumes. Closely associated with the work of the university is the State Historical Society of Iowa, with a library of over 74,000 titles. (W. A. J.)

IOWA CITY, a city of south-eastern Iowa, U.S.A., on the Iowa river, 12om. E. of Des Moines; the county seat of Johnson county. It is on Federal highways 32 and 161; is served by the Cedar Rapids and Iowa City (electric) and the Rock Island railways, and is a station on the transcontinental air-mail route from east to west, with an airport that is brilliantly illuminated at night. The population in 1925 (State census) was 15,289. The city lies in a natural amphitheatre, almost surrounded by hills and bluffs. It has various manufacturing industries, and is the seat of the University of Iowa (*q.v.*), of the library of the State Historical Society, and of the State sanatorium for the treatment of tuberculosis. In 1839 Iowa City was selected as the seat of government of the newly created Territory of Iowa, and it remained the capital until 1857, when Des Moines was chosen in its stead, because of its more central position. The old State capitol is now the headquarters of the administration of the university.

IPECACUANHA. The root used in medicine under this name is obtained from *Psychotria* (or *Uragoga*) *Ipecacuanha*, a rather small shrubby plant of the family Rubiaceae. It is a native of Brazil, growing in clumps or patches in moist shady forests from 8° to 22° S., and is also found in Colombia and probably in Bolivia. The great value of the drug in dysentery led to attempts to acclimatize the plant in India. Like other dimorphic plants, ipecacuanha ripens seeds best when cross-fertilized, and presents various forms.

Ipecacuanha root occurs in pieces about two or three lines in thickness, of a greyish-brown or reddish-brown tint externally, having a ringed or annulated surface (*see* illustration), and exhibiting a white or greyish interior and a hard wiry centre. It has a faint rather musty odour and a bitterish taste. The variety imported from Colombia and known as Cartagena ipecacuanha differs only in its larger size and in being less conspicuously annulated. Ipecacuanha owes its properties to the presence of rather more than 1% of the alkaloid emetine, which occurs only in the cortical portion of the root. It is a white amorphous substance, with the formula $C_{30}H_{40}NO_5$. It has a bitter taste, no odour, and turns yellow when exposed to air and light. There are also present a volatile oil, starch, gum and a glucoside, which is a modification of tannin and is known as ipecacuanhic acid. The dose of the powdered root is ¼ to 2 grains when an expectorant action is desired, and from 15 to 30 grains when it is given as an emetic, which is one of its most valuable functions.



IPECACUANHA (PSYCHOTRIA IPECACUANHA)
A. Plant showing annulated root
B. Fruits
C. Long-styled flower
D. Longitudinal section through a short-styled flower

Ipecacuanha powder is a powerful cutaneous irritant, even causing pustulation. When inhaled it causes violent sneezing and a mild inflammation of the nasal mucous membrane, resembling a common cold in the head. Small doses stimulate the secretions of the mouth, stomach, intestine and liver. The drug, therefore, increases appetite and aids digestion. Toxic doses cause gastro-

enteritis, cardiac failure, dilatation of the blood-vessels, severe bronchitis and pulmonary inflammation closely resembling that seen in ordinary lobar pneumonia. In this respect and in its action on the skin, the drug resembles tartar emetic. Ipecacuanha is very frequently used as an expectorant in cases in which the bronchial secretion is deficient. Its diaphoretic properties are employed in the *pulvis ipecacuanhae compositus* or Dover's powder, which contains one part of ipecacuanha powder and one part of opium in ten.

Other plants to which the name of ipecacuanha has been popularly applied are American ipecacuanha (*Gillenia stipulacea*), wild ipecacuanha (*Euphorbia Ipecacuanha*), bastard ipecacuanha (*Asclepias curassavica*), Guiana ipecacuanha (*Boerhavia dècumbens*), Venezuela ipecacuanha (*Sarcostemma glaucum*), and ipecacuanha des Allemands (*Vincetoxicum officinale*). All these possess emetic properties to a greater or less degree.

IPEK, one of the two largest towns in Montenegro, Yugoslavia. Pop. (1921) 14,762, almost entirely Albanian. The town lies in a fertile plain on which tobacco is cultivated. Ipek is surrounded by trees and gardens, while a pleasant stream runs through it. Nearly every house is provided with a watch-tower. It is situated on the road from Jakova to Prizren, and from its position, it is destined to form a connecting link for trade with Serbia. Ipek was formerly the centre of the Serbian Church, the archbishop having been raised to the patriarchate by Stephen Dushan (1331–55). It was suppressed in 1459, restored in 1557 and finally abolished by the Turks in 1767. On the heights above the town stands the 13th century monastery, the seat of the patriarchs until 1690, and the church, which dates from the 16th and 17th centuries. Here are the marble tombs of many church dignitaries, and the marble throne of the patriarchs. After the fall of Belgrade in 1521 many of the inhabitants migrated to Hungary, and in 1690 there was a second migration there led by the patriarchs. The town was captured by the Montenegrins in the Balkan Wars (1912–13) and ceded to Montenegro by the Treaty of Bucharest (1913). In the World War thousands of refugees fled here. It was here too, that on the long march to Scutari, the broken Serbian army called a halt to destroy their guns, which they rolled over a precipice.

IPHICRATES, Athenian general, son of a shoemaker, flourished in the earlier half of the 4th century B.C. He is chiefly known for the use he made of lightly armed troops (peltasts); he increased the length of their weapons, and improved their mobility by reducing their defensive armour. He also paid special attention to discipline, drill and manoeuvres. With his peltasts Iphicrates seriously injured the allies of the Lacedaemonians in the Corinthian War, and in 392 (or 390) dealt the Spartans a heavy blow by almost annihilating a battalion of hoplites (Diod. Sic. xiv. 91; Plutarch, *Agesilaus,* 22). He was later transferred from Corinth to the Hellespont, where he was equally successful. After the peace of Antalcidas (387) he assisted Seuthes, king of the Thracian Odrysae, to recover his kingdom. About 378 he was sent with a force of mercenaries to assist the Persians to reconquer Egypt; but a dispute with Pharnabazus led to the failure of the expedition (Diod. Sic. xv. 29–43). On his return to Athens he commanded an expedition in 373 for the relief of Corcyra, which was besieged by the Lacedaemonians (Xenophon, *Hellenica,* vi. 2). On the peace of 371, Iphicrates returned to Thrace, and fought for Cotys in a war against Athens for the possession of the Chersonese. The Athenians, however, soon pardoned him and gave him a joint command in the Social War. He and two of his colleagues were impeached by Chares, the fourth commander, because they had refused to give battle during a violent storm. Iphicrates was heavily fined. He died about 353.

There is a short sketch of his life by Cornelius Nepos; *see* also C. Rehdantz, *Vitae Iphicratis, Chabriae et Timothei* (1854); Bauer, *Griech. Kriegsaltert.* in Müller's *Handbuch,* 4, § 49; and histories of Greece, *e.g.,* Holm, Eng. trans., vol. iii.

IPHIGENEIA, daughter of Agamemnon (*q.v.*); not mentioned in Homer, but by some absurdly identified with the Iphianassa of Il. ix, 145, who was alive and well some ten years after Iphigeneia's supposed death. As she is constantly represented as connected in some way with Artemis, and as Iphigeneia ("mightily born," *i.e.,* "great princess") is a title of the goddess; as, moreover, she has substituted for her one of Artemis' beasts (*see* below), it is in no way impossible that originally she was a by-form of the goddess herself; but the question is obscure. Agamemnon had vowed to sacrifice to Artemis the fairest thing that should be born in a certain year, meaning the handsomest beast; but in that year Iphigeneia was born. Another story is that he or Menelaus had offended Artemis in some way. As a result, Artemis stayed the Greek fleet at Aulis on its way to Troy, by calm or contrary winds, and Calchas discovered that only the sacrifice of Iphigeneia would appease the goddess. Iphigeneia therefore was sent for on pretence of marrying her to Achilles; at the last moment the goddess relented and substituted a hind, bear, or bull for the victim, whom she spirited away to the land of the Tauri (Crimea). Here she became priestess of Artemis and as such had to sacrifice all strangers. At last Orestes (*q.v.*) and Pylades arrived; by a stratagem, she fled with them taking the image of Artemis, which Orestes had been sent to fetch. They left it somewhere in Greece; among places claiming to have the true statue and some remnant of the old rites of human sacrifice were Brauron in Attica, where a pretence was made of cutting a man's throat before the goddess, and Sparta, where boys were beaten till the blood came, in the ritual of Artemis Orthia.

Iphigeneia was variously said to have died and been buried at Brauron or Megara, and to have been transported to Leuce, where she was wedded to Achilles, or even to have been transformed into the goddess Hecate (*q.v.*).

See Stoll in Roscher's *Lexikon* (bibl.); L. R. Farnell *Greek Hero-Cults* (1921); H. J. Rose *Handbook of Greek Mythology* (1928).

IPOMOEA, a large genus of mainly climbing herbs or shrubs of the convolvulus family (Convolvulaceae, *q.v.*), containing about 400 species. It includes the sweet potato (*I. Batatas*), the cultivated morning glory (*I. purpurea*) and the jalap (*I. purga*).

IPSUS, BATTLE OF, 301 B.C. This, named "the battle of the kings," was the great clash in the wars of Alexander the Great's "Successors," which shattered Antigonus's attempt to reconsolidate the Macedonian empire. Hard-pressed in Thessaly by Demetrius, the son of Antigonus, Cassander turned the tables by a stroke of true genius. Keeping only a minimum of force, he despatched his ally, Lysimachus, to invade Asia Minor and arranged with Seleucus to advance from Babylon on Antigonus's rear. The combination and concentration against the heart of the opposing power succeeded, and forced Demetrius to evacuate Greece and sail home to his father's aid. The armies of Antigonus and Demetrius on the one hand, and of Lysimachus and Seleucus on the other met at Ipsus in Phrygia. Antigonus had 70,000 foot, 10,000 horse and 75 elephants; the allies only 64,000 foot, 10,500 horse, but 480 elephants. At the outset of the battle Demetrius with the cavalry charged and dispersed the opposing cavalry, but, pressing the pursuit too far, found himself cut off by the enemy's elephants. But instead of assaulting Antigonus's army, thus stripped of his cavalry, Lysimachus demoralized it by threat of attack and by fire until it began to melt—part going over to the allies. Then only did Seleucus launch a strong body at the position occupied by the enemy's command. Borne down by this charge, Antigonus died, crying vainly "Demetrius will come and save me." If the victory is memorable in military history as one of the outstanding triumphs of the war elephant, its greater political consequence was to ensure the disappearance of any central power and the dismemberment of the Graeco-Macedonian world. (*See* DIADOCHI, WARS OF.)

IPSWICH, a town of Stanley county, Queensland, Australia, on the river Bremer, 23½ m. by rail W. by S. of Brisbane. Pop. (1926) 20,526. It is the centre of a rich and populous agricultural mining and manufacturing district. Coal outcrops on the surface and is worked on the banks of the river. There are woollen factories, saw-mills, and foundries and large railway workshops at North Ipswich. The first settlement was made here in 1829; the town was incorporated in 1860. It has

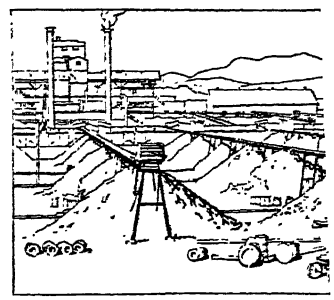
grown immensely during the first quarter of the 20th century.

IPSWICH, municipal, county and parliamentary borough and county town of Suffolk, England, 69 m. from London by L.N.E.R. Pop. (1921) 79,371. It stands on the left bank of the river Gipping. In the lower and older portion of Ipswich are a few antiquarian remains. Sparrowe's house (1567), and Archdeacon's Place (1471) are two old gabled houses, while Wolsey's Gateway (1528), a Tudor brick building, is the only remnant of the Cardinal's foundation to supply scholars to his great college (Cardinal's College, now Christ Church) at Oxford. The older churches are all towered flint-work structures, wholly or mainly Perpendicular in style, with the exception of St. Peter's, which is principally Decorated, with a Norman font of marble. They include St. Margaret's with a beautiful oak Tudor roof, elaborately painted *temp.* William and Mary; St. Mary-at-Key (or Quay), with a similar roof, St. Lawrence and St. Clement's. The museum is of some importance. The grammar school, dating at latest from 1477, was refounded by Queen Elizabeth in 1565. There is a picture gallery in the Tudor mansion (1549) in Christchurch Park. Industries include engineering and agricultural implement works, railway plant works, electrical apparatus, paper, furniture and the making of artificial manures, and clothing. Imports are principally grain, timber, petroleum and coal; exports agricultural machinery, railway plant, artificial manures and oil cake. There is an Anglican bishopric of St. Edmonsbury and Ipswich. The parliamentary borough returns one member.

Prehistoric finds include a Roman villa, and a Saxon settlement. In 991 the town (*Gipeswic, Gipeswich*) was sacked by Vikings. It owes its prosperity to its situation on a harbour admirably suited for trade with the Continent. In 1200 King John granted the burgesses their first charter, the town to be held at fee-farm, with a gild-merchant. The burgesses were definitely incorporated in 1464 and re-incorporated in 1665 under a charter which remained in force up to its modification by the Municipal Act of 1835. The cattle market and provision market are the prescriptive right of the corporation. A September fair, still held in 1792, was in the hands of the corporation in the 17th century. Large ironworks were established late in the 18th century. The wool and cloth trade of the 14th and 15th centuries was superseded by the manufacture of sailcloth, now represented by the sacking industry.

IPSWICH, a town of Essex county, Massachusetts, U.S.A., 28m. N.N.E. of Boston, on both sides of the Ipswich river and fronting on Ipswich bay; served by the Boston and Maine railroad. The population was 6,055 in 1925 and is increased in the summer by some 2,000 seasonal residents. The town was settled under the name of Aggawam in 1633 and was incorporated in 1634 as Ipswich. During the early days of the colony it was little inferior to Boston in wealth and influence, and frequently took an opposing position on public questions. Ipswich was the home of several of the leading writers of the colonial period, including the Rev. Nathaniel Ward (1578–1652). A number of houses date from the 17th and 18th centuries. In the oldest, the John Whipple House, is the interesting collection of the Historical society. The Choate bridge, built in 1764, is the oldest arched bridge in America.

IQUIQUE, a city and port of Chile, capital of the province of Tarapacá, 82om. N. of Valparaiso, in 20° 12′ 15″ S., 70° 11′ 15″ W. Population (1920) 37,421. The coast here runs due north and south and the city is built on a narrow level plain between the sea and bluffs, the latter rising steeply 2,000ft. to the level of the great desert plain of Tarapacá, celebrated for its rich deposits of nitrate of soda. Facing the city is the low barren island of Serrano, or Iquique, which is connected with the mainland by a stone causeway 1,500ft. long, and shelters the anchorage from southerly storms. A mole extending from the north-eastern end of the island affords further protection. The city is laid out on the rectangular plan, with broad streets and large squares. Water is brought by pipes from Pica, 50 miles distant. Iquique is a city of much commercial importance and is provided with banks, substantial business houses, newspapers, clubs, schools, railways, tramways, electric lights, telephone lines, and steamship and cable communication with the outside world. It exports iodine and immense quantities of nitrate of soda obtained from the desert region of the province. A larg in the nitrate trade, and Iquiqu ports of Chile in the aggregate It is connected by rail with th various mining centres, and th Pisagua on the north, and Patill insignificant Peruvian fishing s



BY COURTESY OF W. R. GRACE & CO.

LARGE NITRATE FACTORY OF W.

export of nitrate began. In 1868 by an earthquake, in 1875 by fir quakes, a fire and a tidal wave. I in 1879 in the war between Chi Chile by the treaty of Oct. 20, 1

IQUITOS, a tribe of South A into many branches, some on the r Missionary efforts have failed anc ping figures carved in the shape c the Indian fermented liquor *ch* neighbouring tribes, flavouring it which has the effect of an opiate.

IQUITOS, a city and river po great department of Loreto, on th zon near the mouth of the Rio Nan 73° 11′ 25″ W., 3° 45′ 23″ S. D boom (1906–1912) the populatio clined to less than 10,000. Iquito level, on the low wooded banks of and damp. As a Peruvian, not In when the first government buildi buildings are the prefecture, cust churches, schools, clubs and barrac military region. Houses are mostly tile, streets wide, but with few exc

The city has regular service fron River Steamship Co., Ltd., control the distributing point for all up-stre Iquitos by smaller craft. The city munication with Lima and other st to San Ramón (Junín) one day f until recently the basis of the cit Exports include tobacco, cotton, vanilla, gold and Panama hats. Tile and there are a few other small ind lights, steam tram, cinemas and te the wireless station at Itaya, a subur are under construction. Iquitos dat it had a population of 431, though t ment there for more than half a c Amazon to navigation added immens city and made it the commercial ent

IRAN, the great plateau betwee the west and the valley of the Indus and the Turanian desert in the nort the Indian Ocean in the south, surr mountain ranges with a great salt de ern name Iran (in middle-Persian, E cient *Aryāna,* "the country of the Ar the name of Ariana to the south-easte Persia, Media and Bactria, and there

Balkan wa the attack Arab prov bsidy from of the cons r to expose aspirations the Shi'ah nationalist conference called the ce against the three against the

The Me nni shaikhs followed osidiary in- Resident petitioning Turkey ha the heat and prome agitation Great Brit e Council liberty or subject to fied. Befo mbly. On efforts as paying an solidated ession was centrated anded and the British it was ansoil, he is ous attack Turkish Aary. Thus the Ottony was left preaching who promen and t situation, position wo of the refinery o 10, 1922, secure. Ox and the name of 'Iraq published). Ratifi- Turkish r subsidiary friend an greeted wi he north- administr Mahmud cer under bourhood, followed s kuk. and ually esta onference

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In the elections cupation was con- tutions sl aq. Mr. realized sider the nobles, e in Jan. was esser ir Henry made wh mmission missioner Govern- death fr n the re- distinguis 20 to a and adm ace with Marshall prospect 1917 the ld lapse March 1 Nations. incident back by Karbala both the ad again divines t sh threat The Hol ausanne when th with the check th il, by a neered f ks were the new nmakam way hon feasible situation maniyah (later Si ance of

(ii. 78, 130, xv. 720 ff.; Pomp. Mela i. 3; Pliny, *Nat. Hist.* vi. 113, 116, xii. 33). Pliny (*Nat. Hist.* vi. 93) confounds it with Aria, Areia, Pers. Haraiva, *i.e.*, the district of Herat; but Strabo himself says (xv. 724) that some extended the name to the Persians, Medes, Bactrians and Sogdians, as they all spoke the same language with slight variations. (*Cf.* xv. 727 and i. 66, xi. 523.)

For the ethnography and history of Iran *see* PERSIA.

IRANIAN LANGUAGES AND PERSIAN. Three successive stages in the history of the Iranian languages, viz., ancient, middle and modern, in Persian, the principal branch of the group, correspond with epochs of national vicissitudes. Old Persian was used on the monuments of the Achaemenian dynasty (558–339 B.C.) destroyed by Alexander the Great. Middle Persian is known from the Parthian, or Arsacid period (250 B.C.–A.D. 225), even more from the Sassanian times (A.D. 225–651), terminated by the Arab conquest and domination. With the Persian Renaissance (ninth century A.D.) modern Persian, with some unsubstantial changes, appears again as still a living language. Other Iranian idioms passed through stages similar to those of Persian.

Ancient Iranian Languages.—Of the Median language we know only one word (δπάκα, "dog") preserved by Herodotus (I., 110) and several personal names. This material suffices to place Median among Iranian (northern Persian) idioms. Of the Old Scythic group of languages (Scythic and Sarmatian) only personal names in Greek inscriptions, found in South Russia, have come down to us. The only ancient Iranian languages really known to us are Avestic and Old Persian.

The former is the language of the Zoroastrian sacred books. By earlier European scholars it was improperly called Zend, which term designates only the commentary to the Avesta, written in Middle Persian (*see* below). The age of the Avesta is dubious. Two parts of it are clearly distinct: the so-called Gāthās are more or less at the same linguistic stage as the most ancient Vedic hymns of Old Indian. These archaic fragments, though perhaps not directly or not wholly emanating from Zoroaster (*q.v.*), are authentic documents of the religious reform brought about by the Prophet of Iran. The greater part of the Avesta, the so-called "recent or younger Avesta," is a collection of texts of varying antiquity and is characterised by a gradual simplification and a lax use of the grammatical forms. The Avesta when codified (towards A.D. 379) had long been a dead language known to the priests alone. In its present state the Avesta has the size of the *Iliad* and *Odyssey* put together. The original home of Avestic is doubtful.

Some scholars regarded it as the old Bactrian language but no decisive arguments can be drawn from the text itself. Others (Darmesteter, and recently, on linguistic evidence, Tedesco) place the home of Avestic in north-western Persia (Media), though, even in this case, Avestic could not be simply identified with Old Medic. The alphabet of the Avesta has no claim to antiquity, being the late Pahlavi script (*see* below) reformed by the addition of the missing signs. For linguistic purposes these late characters are in some cases definitely misleading.

Old Persian was used in the cuneiform inscriptions of the Achaemenian kings. The text is usually accompanied by translations into Elamitic and Akkadian (Assyro-Babylonian). The most important document is the famous inscription of Darius the Great (522–486 B.C.) on the rock of Bīhistūn, near Kermanshah, which was first read and published by Sir H. Rawlinson in 1846–47.

Aryan Languages.—Within the Indo-European family of languages, Old Iranian and Sanskrit form the division of "Aryan" languages. (The terms Aryan and Īrān have a common origin.)

How near Old Iranian is to Sanskrit is seen from the comparison of a phrase translated from Avestic into Sanskrit:

Avestic:	yō	vō	āpō	vanguhīš	yazāitē	ahurānīš	ahurahe
Sanskrit:	yō	vō	āpō	vasvīṣ	yajātē	asurāṇīs	asurasya
Avestic:	vahištābyō			zaoθrābyō		sraēštābyō . . .	
Sanskrit:	vasiṣṭhābhyō			hōtrābhyō		srēṣṭhābhyo . . .	

The original Avestic words, undisguised by the alphabet, would be still nearer to Sanskrit.

The principal phonetic distinctions of Iranian from Indian are: 1. original *s* becomes *h* in Iranian; 2. to Indian voiced and voiceless aspirates correspond respectively Iranian voiced stops or spirants; 3. Iranian has *z*, absent in Indian; 4. Iranian diphthongs *ai*, *au* are found in Indian as *ē*, *ō*, etc. *See* above and the following examples:

Sanskrit	Avesta	Old Persian	Modern Persian
Sindhu (Indus)	*Hindu*	*Hindu*	*Hind*
Asura Medhās	*Ahura Mazdāh*	*Ahuramazdā*	*Hurmuzd*
bhūmī (earth)	*būmī*	*būmī*	*būm*
kratu (insight)	*xratu*	. .	*xirad*
hasta- (hand)	*zasta-*	*dasta-*	*dast*
açva- (horse)	*aspa-*	*asa-*	*asp*

Later on the two branches, Indian and Iranian, have diverged widely.

Middle Persian.—Until the beginning of the 20th century only "Pahlavi," among the Iranian languages, was known at the stage of linguistic development, where the original wealth of forms had disappeared but the language had not finally simplified its characteristics. This Sassanian Middle Persian was chiefly known under two aspects: *a.* as scarce rock-inscriptions, and *b.* as a written language.

a. The former are cut in an uncouth but sufficiently clear script. The earliest of them (before +A.D. 300) gives usually two versions of the same text: the one is identical with the "book-Pahlavi"; the other, considerably different, was surnamed "Chaldaeo-Pahlavi," an ill chosen term which was vaguely supposed to cover the surviving dialect of Parthian times.

b. The written Pahlavi ("book-Pahlavi") is the language of the later Zoroastrian literature coming down to the ninth century A.D., when the language was certainly dead. Pahlavi literature consists mainly of commentaries on the Avesta and treatises on religious subjects (in all some 587,000 words), and only to a much smaller degree (41,000 words) treats of historic and other lay matters. This literature is written in an exceptionally ambiguous and unsuitable alphabet in which many characters are confused (one sign for *g*, *d*, *y*; one sign for *v*, *n*, *r*, etc.). Owing to such complications the name of the Supreme Deity Ōhrmazd was long read by error Anhōmā. Further difficulties are created by the use of numerous Semitic ideograms: it has long been discussed, whether *yōm* ("day" in Semitic) was to be read as it stood, or replaced by its Persian equivalent *rōzh* (as the Latin *viz.*, is read in English *namely*). This latter opinion was accorded universal recognition only after 1900. The defects of the Pahlavi alphabet caused the Zoroastrians to transcribe some of their texts in later Avestic characters, in which case these writings are called Pāzand.

Discoveries After 1900.—Of exceptional importance have been the Middle-Persian documents (Christian and Manichaean) found, chiefly by the German expeditions in Turfan (Chinese Turkestan) and deciphered by Prof. F. W. K. Müller. All these fragments are written in a special alphabet, derived, as usual, from Semitic (Aramean), but clearly distinguishing single characters. The words formerly known only in Semitic disguise are here written in plain Persian. Besides many additions to vocabulary and grammar, the new texts have fully confirmed the existence in Middle Persian of two parallel dialects. The one, the descendant of Old Persian, was spoken in the south (Fars) and the other probably in the north-west (or north and west) of Persia. This latter has some special traits in common with Avestic but is not its lineal offspring. The southern dialect must have been originally called Pārsīk, while the term Pahlavīk (another form of the name Parthian) belonged specially to the north-western dialect. The divergence of the dialects can then be traced down to modern days. Some differences will appear from the table on page 593.

In 1924 Professor Herzfeld published an entirely revised text of the largest of all Sassanian inscriptions, that of the ruins of Pai-Kuli, near Sulaimaniya. Meanwhile, an original Middle Persian document of the earlier Arsacid times was found in Avroman (Persian Kurdistan), together with some important Greek parchments of that epoch (published by E. H. Minns in 1915). The Persian document was finally deciphered by H. S. Nyberg (1923).

Middle Persian		Modern languages	
North-Western	Southern	N.-W. dialects	Persian
zān- (know)	*dān*	*zān* (Kurdish)	*dān-*
zhan (woman)	*zan*	*zhin* (Kurdish)	*zan*
das (ten)	*dah*	*das* (Simnani)	*dah*
puhr (son)	*pus*	*pūr* (Persian doublet)	*pus-ar*
ẓisd (heart)	*dil*	*purd* (Kurdish)	*pul*
		zir (Kurdish)	*dil*

The existence of a different branch of the Middle Iranian languages has now been demonstrated. To it belongs the Sogdian language of which the documents were chiefly discovered and deciphered by the French scholars, and another called by some German scholars (Leumann) "nordarisch," but now supposed to be Sacian, *i.e.*, the language of the people Sacae. These two languages possess some traits in common; moreover, Sogdian has particularly close affinities with the "Scythic" group of the Iranian languages (*see* above).

Modern Languages.—All present Iranian languages display in different degrees a tendency towards an analytic stage (simplification of the sounds and in morphology, to the use of new auxiliary tenses, etc.).

Of these languages by far the most important is the literary Persian, as found in the extensive Persian literature and in the present day speech of the more educated classes of the Persian-speaking countries. Modern Persian is a direct descendant of the southern middle Persian, but it has borrowed many words in the north-western form, and numerous Arabic and Turkish elements. It is written in Arabic characters. Though Modern Persian is one and the same language, local variations, spoken in Persia, Afghanistan, India and Russian Turkestan (Tājīkī), are considerable.

Parallel to literary Persian, in most Persian towns, and especially villages, special dialects are in use. The dialects of Fars, Luristan, Khorasan and perhaps Kerman, belong to the same southern (south-western?) group as the literary Persian. On the other hand, very numerous and different vernaculars represent the remains of former north-western idioms. Such are the local dialects of the Caspian provinces, the language of the Kurds (spread over a vast area and sporadically found in northern Syria and even close to Angora in Asia Minor), the language of the Baluches and of isolated groups (as those of Kashan, Simnan, etc.).

Among modern Iranian languages of the "eastern" and "northern" group are the Afghan language (Pushtu [*q.v.*]), Ōrmurī, the various dialects of the Pamir group (Shughni, Wakhi, Munjani, etc.), Yaghnobi (a modern descendant of the Middle Sogdian), Ossetic (spoken in the heart of the Caucasian mountains south of Vladikavkaz, survivor of the once powerful "Sarmatian" group [*see* above] spoken in South Russia). In 1927 some new written material was found in the Khvārizmian language which seems to have been in use in the oasis of Khiva as late as the 14th century A.D. This Khvārizmian must be a survival, or a descendant, of a sister-language of the Middle Sogdian.

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IRANIAN RELIGION: *see* ZOROASTER and ZEND AVESTA.

'IRAQ. The modern mandated Arab kingdom of 'Iraq was formed after the World War out of the former Turkish vilayets of Mosul, Baghdad and Basra. It includes an area of over 140,000 sq.m. with a population according to the census of 1920 of 2,849,282. Of this number 1,146,685 were Sunni Mohammedans, 1,494,015 Shi'ah Mohammedans, 87,488 Jews, 78,792 Christians and 43,302 of other religions. The capital is Baghdad, pop. 1920, 145,000. Basra, the chief port, 70 m. up the Shatt el Arab from the Persian Gulf, has about 50,000 inhabitants. The region embraces not only the valley of Mesopotamia but also an important desert corridor stretching westwards to the boundaries of Transjordan. 'Iraq is bounded on the north by Turkey, on the west by Syria and Transjordan, on the south-west and south by Nejd and Kuweit and on the east by Persia. Owing to the nature of the country, the difficulties of water rights and raiding proclivities of the desert tribes the western and southern boundaries are by no means clearly defined. Cotton here is an irrigation crop. Before 1921 none was exported. No spectacular development has taken place, but a steady, healthy progress is shown. The whole of the cotton passes through the hands of the British Cotton Growing Association, who possess the only ginnery. The 1926 crop was 3,500 bales, of the value of £77,000. (For physical and economic geography *see* MESOPOTAMIA.) The British Empire is the mandatory power.

The terms of the mandate were never formally laid down by the League of Nations, but the relations between Great Britain and 'Iraq were defined in terms of a treaty concluded on Oct. 10, 1922, originally for a period of 20 years. This, however, was modified by a protocol dated April 30, 1923, in which it was agreed that the treaty should terminate upon 'Iraq being admitted to membership of the League of Nations and in any case not later than four years from the date of the ratification of peace with Turkey, when it was contemplated that the parties would conclude a fresh treaty for the regulation of their future relations. On Sept. 24, 1924, the League of Nations accepted this instrument as properly fulfilling the provisions of Art. 22 of the Covenant. By a further treaty ratified on March 30, 1926, and resulting from the decision of the League on the Mosul question, the period was again altered to 25 years (from Dec. 16, 1925), unless before the expiration of that period 'Iraq should be admitted to membership of the League of Nations.

The 'Iraq Government is a limited monarchy on the Egyptian model, with a king, a senate of 20 nominated members and a lower house of 88 deputies. The country is divided into three vilayets (provinces) comprising in all 14 liwas (divisions), the administration being represented in each liwa by a Mutessarif, who is assisted by a British official with advisory powers. The liwas are: *Mosul Vilayet:* Mosul, Arbil, Kirkuk and Sulaimaniyah; *Baghdad Vilayet:* Baghdad, Karbala, Diyala, Kut, Diwaniyah, Hillah and Dulaim; *Basrah Vilayet:* Basrah, Amara and Muntafik.

HISTORY

Nationalist Movement.—During the years from 1911 to the outbreak of the World War the Ottoman regime in the distant vilayets of Turkish Arabia showed marked deterioration. The last hope that any efficient administrative system might be established in Mesopotamia vanished with the fall in 1911 of Nazim Pasha, an energetic man of singular integrity, who had set himself to the intricate task before him with all the rude strength of a Turkish soldier of the old order. The Italian and

Balkan wars had weakened the central Government, while in the Arab provinces in particular the disappointment of hopes born of the constitution of 1908 was leading to a recrudescence of racial aspirations. Damascus and Beirut had long been centres of nationalist movements, and by the end of 1913, the secret society called the Ahd (the League) had extended its activities also to the three Mesopotamian vilayets.

The Mesopotamian Campaign.—The declaration of war was followed on Oct. 31, 1914, by a proclamation by the Political Resident in the Persian Gulf to local Arab rulers explaining that Turkey had entered the war only at the instigation of Germany and promising the chiefs who had enjoyed the protection of Great Britain that no act of that country should threaten their liberty or their religion. With these assurances they were satisfied. Before military operations had begun, Sir Percy Cox, whose efforts as British Resident during the previous decade had consolidated the British position on the Gulf, joined the force concentrated at Bahrein as chief political officer and on Nov. 6 when the British took Fao Fort and made their first landing on Turkish soil, he issued a proclamation in similar terms to the Arabs of Turkish Arabia. At this stage a determined attempt was made by the Ottoman Government to arouse Muslim fanaticism by the preaching of a Jihad, but it met with no response from the tribesmen and by Nov. 21 the Turks had abandoned Basrah, the British position on the Shatt-el-Arab was established and the valuable refinery of the Anglo-Persian Oil Company at Abadan rendered secure. On Nov. 22 British troops entered Basrah and, in the name of the general officer commanding in chief, Sir Percy Cox published a third proclamation assuring the inhabitants that Turkish rule was dead and that Great Britain came as their good friend and protector. The British arrival in Basrah was in fact greeted with acclamation by the terror-stricken populace and civil administration was at once inaugurated by the chief political officer under the orders of the G.O.C. In the same way, as success followed success, a large measure of civil law and order was gradually established close in the wake of the army.

The advance from Basrah to Baghdad is described under MESOPOTAMIA. A period of grave anxiety preceded the victory of Shu'aiba, on April 12, 1915, when a reverse would in all probability have involved the evacuation of 'Iraq by the British expeditionary force. After the retreat from Ctesiphon (Nov. 25, 1915) and the fall of Kut (April 29, 1916), the fate of 'Iraq again hung in the balance, but the vigorous re-organization of the force, now under the command of General Sir Stanley Maude, restored the foundations of victory, and Baghdad was occupied on March 11, 1917.

In the proclamation which General Maude issued on the occupation of Baghdad a definite promise was given that alien institutions should not be imposed, that Arab aspirations should be realized and that on those grounds the collaboration of Arab nobles, elders, and representatives, with British political officials, was essential. A further development of civil administration was made when in July 1917, Sir Percy Cox was appointed civil commissioner. The army and his country suffered great loss in the death from cholera on Nov. 19, 1917, of General Maude, whose distinguished powers as a military leader had earned the respect and admiration of 'Iraqis, but under Lieut.-general Sir W. R. Marshall, the success of British arms continued. Late in Nov. 1917 the northern Euphrates was occupied up to Ramadi, and in March 1918 up to Ana. In the same month, however, a serious incident occurred on the middle Euphrates. The holy towns of Karbala and Najaf were not only racked by internal feuds but both they and the adjacent tribesmen owned the sway of Persian divines to whom the secular interest of 'Iraq counted nothing. The Holy Places thus presented a fertile field for intrigue and when the Government of Occupation showed a determination to check the rapacity of the local headmen at Najaf, a plot, engineered from without, came to a sudden head with the murder of the newly appointed political officer. Sir Percy Cox was on his way home at the time to attend a conference in London but the situation was handled successfully by his locum tenens Colonel (later Sir Arnold) Wilson and the G.O.C. in chief. Though Najaf was blockaded not a shot was fired, but the pressure exerted resulted in the handing over of the guilty by May 19. A court of specially qualified members condemned 13 of the accused to death, while over 100 were sentenced to transportation for life or shorter periods, but all of these latter were ultimately amnestied.

North-east of Baghdad, progress was hindered by the Russian débâcle, but when, at the end of June 1917, the upheaval which was taking place in Russia obliged the Russians to retire, the British force gradually drove the Turks from the vacated positions, occupying Khanaqin in Dec. 1917 and Kifri in April 1918. Kirkuk was reached in May and immediately a provisional Government under a local magnate, Shaikh Mahmud-al-Barzanji, was set up voluntarily in Sulaimaniyah in friendly co-operation with the British. But the exigencies of the Persian situation made it impossible for the general staff to maintain the position effectively and it was not until the final advance took place in Oct. 1918 that the occupation of the whole of the Mosul vilayet was effected.

THE ANGLO-FRENCH DECLARATION

Liberation of 'Iraq.—On Nov. 7, 1918, ten days after the signature of the Turkish armistice at Mudros, the British and French Governments issued a joint declaration of vital importance to the occupied Arab territories, stating their aims in the East to be:—

To complete the final enfranchisement of the peoples so long oppressed by the Turks, and the establishment of national governments and administrations, drawing their authority from the initiative and free choice of native populations.

The proclamation went on to promise encouragement and help in the establishment of native governments and administrations, alike in Syria and Mesopotamia. In the case of General Maude's earlier pronouncement made on the occupation of Baghdad, when the upshot of the war was still doubtful, the flamboyant sentiments expressed therein had been to a great extent discounted by the public as a natural form of propaganda, but the Anglo-French declaration, published after victory had been achieved, was taken in all seriousness. Had an early peace made it possible to give early effect to the policy therein enunciated all would have gone well. Unfortunately the inordinate delay which ensued over the peace negotiations and the wide promulgation of President Wilson's 14 points, with the potent element of self-determination, gave unbridled play to political speculation and stimulus to nationalist feeling. This was further encouraged by enquiries which the civil commissioner set on foot under instructions from H.M. Government, whether:—

(i.) The people of 'Iraq were in favour of a united Arab State from the northern boundary of the Mosul vilayet to the Persian Gulf.
(ii.) It should be under British tutelage.
(iii.) It should be under an Arab amir.
(iv.) In the latter case, whom would they suggest?

On the first point their replies were unanimously in the affirmative. In regard to the other three every variety of opinion was given. Unfortunately the conflicting character of the response had the effect of delaying a definite pronouncement of policy, and meanwhile other factors came into play. All this time the administration had remained patently alien; British forces had been cut down to a minimum and when in May 1920 the British Government announced their acceptance from the League of Nations of a Mandate over 'Iraq, the Damascus Government had already, in the absence of the Amir Feisul and contrary to his orders, begun encroachments. In answer to objections raised against the Mandate by a self-chosen committee in Baghdad, it was announced (June 20) that Sir Percy Cox would return in the autumn to establish a provisional Arab Government and call an Assembly, freely elected by the people, in consultation with which he would prepare an Organic Law. But nothing would then have satisfied the claims of the nationalist leaders, and on June 2, 1920, the turbulent Shiah tribes, encouraged by their religious leaders, broke into open revolt.

To restore peace and order was the first necessity. Troops were drafted in from India, and when Sir P. Cox reached Basrah on his return as High Commissioner (Oct. 1) the rebellion in its

main centres, the middle Euphrates, the Diyala and the adjacent part of Kirkuk district was already doomed to failure. By Nov. 10 it was found possible to establish, as a first step towards national government, a Council of State under the presidency of the venerable Naqib of Baghdad. This body represented all classes and sects of society. It gave immediate attention to the repatriation of 'Iraqi officers from Syria and the Hejaz; to the re-organization of civil government under 'Iraqi officials, greatly facilitated by the return of many experienced men from Turkey; and to the preparations of an electoral law and the formation of an army. It was the arrival of 'Iraqi officers who had served under the Amir Feisul which set on foot a specific movement in his favour in 'Iraq. He had been expelled from Syria by the French authorities in July 1920 and had since resided in England.

In March 1921 Mr. Winston Churchill, who had now become secretary of State for the Colonies, convened a conference at Cairo to which all British representatives in the Middle East were summoned. The first result of the conference was the publication of a general amnesty in May and at the same time an attempt was made to ascertain the wishes of the Kurdish provinces about their inclusion or non-inclusion in the 'Iraq State. The net result was that Sulaimaniyah elected to remain under the control of the High Commission, but the rest of the Kurdish population was content to look to the 'Iraq Government, subject to the promise of Kurdish officials and the local use of the Kurdish language.

Choice of King.—It was not until June that H.M. Government were in a position to make any clear announcement of policy as the result of the Cairo deliberations and towards the end of that month the Amir Feisul arrived in 'Iraq to offer himself to the inhabitants as a candidate for the throne. He was received with acclamation, and on July 11, the Council of Ministers passed a resolution declaring him king of 'Iraq, on condition that his government should be constitutional, representative, and democratic. But Sir Percy Cox thought it necessary to fortify himself by consulting the people and a referendum was carried out through the Ministry of the Interior, throughout the country, with the exception of Sulaimaniyah, with the result that 96% of the votes were cast in favour of the Amir Feisul, most of the townships and districts stipulating for the continuance of the British Mandate. The Amir Feisul was crowned king on Aug. 23, 1921, and entrusted the Naqib with the formation of his first cabinet.

TURKISH HOSTILITY

Troubles on Turkish and Arabian Frontiers.—The early years of King Feisul's reign were troubled without and within. To the north Turkish nationalism adopted an attitude distinctly hostile to 'Iraq. Turkish garrisons on the frontier were increased, the tribes flooded with propaganda, and the whole of Southern Kurdistan was kept in a ferment until finally in the spring of 1923 the Turks were ejected.

On the Arabian frontier, since the beginning of 1921, the operations of Ibn Sa'ud against Ibn Rashid had profoundly disturbed the nomad tribes. As early as April 1921 the Shammar of Ibn Rashid began to seek safety in 'Iraq, where a large section of the tribe resides. Their presence embittered relations between 'Iraq and Nejd, and after the fall of Ibn Rashid's capital, Hail, in Nov. 1921, Ibn Sa'ud's pretensions increased, and he claimed the allegiance of the Anizah on the eastern side of the Syrian desert, who had always been attached to 'Iraq. In March 1922, he permitted the leaders of his Akhwan, or Brethren, to attack the 'Iraq desert camel corps and the shepherd tribes grazing under its protection about 30m. south of the railway between Baghdad and Basrah. Heavy loss was inflicted.

Anti-Mandate Agitation: the Preliminaries of the 'Iraq Treaty.—These dangers on the frontier coincided with a serious divergence of views between the British and 'Iraq Governments as to the nature of their relations with one another. King Feisul and his prime minister asked for the complete abrogation of the unpopular "mandatory" relation and its substitution by a treaty of alliance, whereas the British Government were contemplating a treaty within the scope of the Mandate. The difference was largely technical, but it gave rise to great misunderstanding and embittered controversy. It was even suggested that the attack by Ibn Sa'ud, who at the time was in receipt of a subsidy from Great Britain, had been instigated by the latter in order to expose the weakness of the 'Iraq Government. At this point the Shi'ah divines took a hand in the matter and summoned a conference at Karbala; nominally to consider measures of defence against the Akhwan, but really with the object of protesting against the British Mandate. The conference assembled, but the Sunni shaikhs held aloof, the wiser among the Shi'ahs nipped any subsidiary intentions in the bud, and the meeting confined itself to petitioning King Feisul to take steps against the Akhwan. But the heat engendered was not extinguished, and the anti-Mandate agitation continued throughout the summer, though in June the Council of Ministers accepted the treaty with Great Britain, subject to its acceptance in due course by the Constituent Assembly. On Aug. 16 the cabinet resigned, and Sir Percy Cox when paying an official visit to the king on the anniversary of his accession was greeted by an anti-Mandate demonstration. He demanded and received an instant apology, but at the same moment it was announced that the king was struck down with a dangerous attack of appendicitis and an immediate operation was necessary. Thus by a singular combination of circumstances, the country was left with no authority but that of the High Commissioner, who proceeded to use it. He issued a proclamation explaining the situation, arrested and deported certain agitators, and induced two of the Shi'ah divines to leave voluntarily for Persia. By Sept. 10, 1922, all agitation had died out and on Oct. 10 Sir Percy Cox and the Naqib signed a treaty of alliance between Great Britain and 'Iraq for a period of 20 years (British Treaty Series No. 2). Ratification, however, was delayed and negotiations over the subsidiary agreements dragged on until 1924.

No sooner was the internal situation stabilized than the north-eastern frontier again demanded attention. With Shaikh Mahmud in Sulaimaniyah and the Turks in Ruwandiz and its neighbourhood, effective administration had ceased east of Erbil, Kirkuk, and Kifri. In Oct. 1922 a measure decided on at the Cairo Conference was put into force and the air marshal, Sir John Salmond, assumed charge of all imperial forces in 'Iraq, ground troops, levies and air force. By his vigorous action he forced the Turks to retire to Ruwandiz. But the autumn of 1922 was the period of Mustafa Kemal's great triumph over the Greeks. It influenced both the Shi'ahs of the Euphrates and the tribes of the North. On Oct. 21, 1922, the king issued an Iradah ordering elections for the Constituent Assembly to begin; it was countered by a fatwah, signed by the Shi'ah divines of Karbala and Kadhimain forbidding participation in elections. In Nov. the Naqib resigned, and Abdul Muhsin Beg al Sa'dun formed a new cabinet. In the same month elections were held in Great Britain, during which a campaign was conducted against the fulfilment of British pledges to 'Iraq. Mr. Bonar Law's cabinet came in under obligation to consider the question, and Sir Percy Cox was summoned to London in Jan. 1923 to take part in the discussion. He left in charge Sir Henry Dobbs, who had come out as Counsellor to the High Commission in the previous December. The position of the British Government was extremely difficult, but a solution was found in the reduction of the term of the yet unratified treaty from 20 to a maximum of four years after the ratification of peace with Turkey (which took place on Aug. 6, 1924), with the prospect of renewal at the end of that period. The treaty would lapse in the event of 'Iraq becoming a member of the League of Nations. The protocol embodying this agreement was brought back by Sir Percy Cox on March 31, 1923, and signed on April 30.

Operations in Mosul.—Meantime, in March 1923, it had again become necessary to take vigorous steps against the Turkish threat in the north. The strong stand taken by Lord Curzon at Lausanne reacted on 'Iraq. Shaikh Mahmud, who was in league with the Turkish band at Ruwandiz, was dealt with, and in April, by a brilliant movement supported by air action, the Turks were ejected from Ruwandiz, and a Kurdish chief put in as Kaimmakam under the Mutasarrif of Erbil. As it was not considered feasible for the time being to set up a local administration in Sulaimaniyah it was decided to give Shaikh Mahmud another chance of

rehabilitating himself, but in 1924 his intrigues made his expulsion again necessary. The Sulaimaniyah liwa became included in 'Iraq in March 1924 and sent representatives to the Constituent Assembly.

Settlement with Nejd.—In the winter of 1923–24 an attempt was made to settle the growing differences between 'Iraq and Nejd by a conference of representatives held at Kuwait under Colonel Knox. The main point of difference was the repatriation of Nejd tribes which had taken refuge in 'Iraq. The 'Iraq representatives rightly pointed out that apart from the violation of tribal custom involved, they had not the requisite force to constrain these unwelcome guests to return to their own country but they agreed to abide by stipulations considered satisfactory by the British Government. Though on lesser matters agreement was reached Ibn Sa'ud proved obdurate on the major issue, and just as the conference was about to reassemble, in March 1924, his followers carried out a brutal raid on the 'Iraq shepherd tribes. The conference thereupon broke up. Other raids occurred during 1924–25, and as a result, the 'Iraq Government made a determined effort to remove the tribes from the vicinity of the frontier.

Ibn Sa'ud likewise gave orders to his Akhwan leaders to desist from their raids. Finally, at the conference held at Bahra in the Hejaz between the Sultan and Sir Gilbert Clayton in Nov. 1925, a treaty was drawn up between 'Iraq and Nejd on the lines proposed by H.M. Government and the 'Iraq Government, at Kuwait.

Ratification of Treaty.—Sir Henry Dobbs and the 'Iraq Government had been engaged during the winter of 1923 in discussing the details of the agreements subsidiary to the treaty. These agreements were signed on March 25, 1924, and the instrument of alliance being thus complete, the Constituent Assembly was opened by the king on March 27.

THE TREATY ACCEPTED

The debates on the treaty and agreements continued until June 10. There was much misrepresentation but undoubtedly some solid ground for dissatisfaction at the heavy burdens imposed on 'Iraq by the obligation simultaneously to expand the army, redeem the capital cost of the railways, and shoulder a large share of the Ottoman debt. H.M. Government gave an undertaking that after the ratification of the treaty they would be prepared to reconsider certain of the financial obligations of 'Iraq towards Great Britain, and the debates were brought to a close by the announcement of the determination of the British Government to raise, at the June session of the League of Nations, the whole question of the continuance of their Mandate, and by the warning that failure to pass the treaty through the 'Iraq Assembly by June 10 would be regarded as a rejection. King Feisul and his Government clearly discerned the attendant risks, the cabinet called on its followers for support, and the treaty and agreements were accepted before midnight on the appointed date. The instrument was accepted by the League on Sept. 27, 1924, and was ratified by King George and King Feisul in the winter of 1924. The Constituent Assembly then passed the Organic and Electoral Laws, and was dissolved on Aug. 2, 1924. The question which now overshadowed all others was the settlement of the northern frontier with Turkey (*see* LEAGUE OF NATIONS; MOSUL).

It had not been considered advisable to disturb the proceedings of the Frontier Commission sent by the League of Nations to Mosul in the spring of 1925 by the holding of elections; on March 21, 1925, however, the Organic Law was promulgated and elections for the first parliament began. Yasin Pasha's cabinet had previously passed four notable measures, vital for the further prosperity and stability of 'Iraq. The first was the signature with the Anglo-Persian Oil Company of an agreement for the dredging of the Shatt-el-Arab. The second was a trade transit-agreement with Syria. The third was the granting to an international group, known as the Turkish Petroleum Company, of a concession for the development of oil in the Baghdad and Mosul vilayets; while the fourth was the signature of long term contracts with over a hundred experienced British advisers and technical officials.

The visit in April 1925 of the secretaries of State for the Colonies and Air gave opportunities for frank and valuable exchange of views, and also resulted in the adoption of a scheme which would provide for the speedier training of the 'Iraq army so that it may eventually assume responsibility for internal security and external defence.

Elections were completed by June 23, 1925, and Parliament met on July 16 in extraordinary session to consider the budget and certain necessary amendments to the Organic Law.

(G. BE.; P. Z. C.)

Second Treaty, Jan. 1926.—The award of the Council of the League on the Turco-'Iraq frontier question (*see* LEAGUE OF NATIONS) was accepted by 'Iraq with considerable relief, and in response to the Council's invitation to the British Government, negotiations for the conclusion of a new treaty were initiated towards the end of 1925. This instrument was to endure for a period of 25 years, or until such time as 'Iraq should become a member of the League. It was signed by the representatives of the two Governments on Jan. 13, 1926; accepted by the 'Iraq parliament on Jan. 18, by the British parliament on Feb. 18; and recognized by the Turkish Government in the preamble to a tripartite treaty concluded at Angora on June 5, 1926, between the representatives of Great Britain, 'Iraq and Turkey (Cmd. 2679). This latter treaty records the acceptance by the parties of the boundary-line adopted by the Council of the League; provides for the despatch of a boundary commission to trace it on the ground; lays down procedure for the amicable settlement of boundary disputes and the maintenance of tranquillity on the frontier; and finally provides for the payment to Turkey by the 'Iraq Government, for a period of 25 years, of 10% on all royalties received by the latter from the Turkish Petroleum Company and its subsidiaries. It may be mentioned that this important company reported its first successful boring experiment in the neighbourhood of Kirkuk in Oct. 1927 and promises to have a prosperous future.

Third Treaty, Dec. 1927.—The boundary commission provided for in the above instrument having successfully completed its labours by the autumn of 1927, the 'Iraq Government were encouraged to hope that the conditions necessary for admission to membership of the League of Nations, under Art. 1 of the Covenant, would now be considered fulfilled. King Feisul and his prime minister, Jaafar Pasha, accordingly journeyed to London in Nov. 1927 for the purpose of approaching the British Government as to the possibility of their supporting an application from the State of 'Iraq for admission, at the meeting of the League in Sept. 1928. The questions involved in this proposition were fraught with no little difficulty, relating mainly to the problem of national defence; King Feisul's Government considering that full military responsibility could only be met at the present juncture by the adoption of some form of conscription, a measure to which the British Government found it difficult to promise their support. On the whole, the British Government considered that it would not be possible for them to support 'Iraq's application for admission at such an early stage with the least chance of success. Short of that, however, some readjustment of the relations between 'Iraq and her Mandatory was adjudged to be possible, having regard to the undoubted progress made by the 'Iraq administration during the past two years, and this took the form of yet another treaty to replace that of Jan. 1926. While the main principles of the second treaty underwent little change therein, another step was taken towards the satisfaction of 'Iraqi aspirations by the formal recognition of 'Iraq as an independent State (Art. 1), and Great Britain further agreed, provided that the present rate of progress be maintained, to support the candidature of 'Iraq for admission to the League in 1932 (Art. 8). At the same time it was recognised that the existing military and financial agreements admitted of some revision of the progress made, and negotiations were accordingly opened for that purpose. Unfortunately, as they progressed, considerable divergence became apparent between the modifications pressed for by the more advanced nationalists in 'Iraq and the views of H.M. Government as to what would be safe and feasible. The main difficulty arose in connection with the fundamental question of national defence. Was the state of 'Iraq already capable, as her government claimed,

of taking full responsibility for national defence? If not, should she be called upon to bear the extra cost involved to H.M. Government by the necessity for keeping forces in 'Iraq?

Since the restoration of law and order progress has been made in archaeological exploration and research. Two important expeditions are at work, one on the site of Ur of the Chaldees, and the other at Kish, and in connection with them an archaeological museum has been established at Baghdad. (*See* also MESOPOTAMIA.)

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(P. Z. C.)

Defence.—The military history of 'Iraq is bound up with that of Turkey (*q.v.*). British responsibility for the defence of the country is a legacy of the World War and the Covenant of the League of Nations under which a mandate for the well-being of the people formerly under the Turkish yoke was allotted to Great Britain on the conclusion of peace. The close of the World War found a British army, mostly of Indian troops, of a ration strength of over 204,000 in the country, pitted against about 29,500 Turks. The British troops were hastily withdrawn, and at the same time (1919) a frontier force of 'Iraq levies was raised with headquarters at Mosul. These levies were reorganized and redistributed in 1921, March 1922 and again in 1924. The cavalry were disbanded in 1927, and most of the infantry have already followed, leaving only 2 battalions, both of Assyrians, and a depot (March 1928). The 'Iraq levies number about 3,000 in all.

The present-day problem of the military defence of 'Iraq under treaties with Great Britain is of unique interest, in that defence has been entrusted mainly to British aircraft, thus minimizing the number of troops, and the whole placed under the control of the air force commander. The British garrison has been reduced to 2 battalions of Indian infantry. In addition to the 'Iraq levies, an 'Iraq army is in process of formation under British officers. The strength (1928) may be taken at about 10,300, organized in 3 cavalry regiments, 2 field and 3 pack batteries, and 7 battalions of infantry, with the usual military departments and details. There is a ministry of defence with an army headquarters working therewith, and the troops are distributed in 3 military areas, northern, eastern and southern. The Royal Air Force has 8 sections of armoured cars.

See also the British *Army list* and *Royal Air Force list*.

(G. G. A.)

'IRAQ, a province of Persia, situated south of Hamadan and west of Qum. The district is an agricultural one—producing much grain, and grapes and raisins are of particularly good quality. The revenue in 1926–27 amounted to 1,450,876 krans (£ St.=45 krans). Sultanabad, the administrative centre, is situated 34° 6′ N. and 49° 42′ E., at an elevation of nearly 6,000 ft. on the Tehran-Qum-Khurramabad road, which is suitable for motor traffic, and it is also connected by a similar road with Hamadan.

IRBIT, a town of the Uralsk Area of the R.S.F.S.R. in lat. 57° 38′ N., long. 63° 6′ E., at the junction of the Irbit and Niza rivers which drain into the Tura, a tributary of the Irtish. The Niza is navigable as far as Irbit in spring. It is famous for its fair held since 1643 from Feb. 8 to March 10, the clearing house for Siberian furs, wools and hides, and for tea from the east. A large proportion of the fur comes from west of Lake Baikal and of the wool from the Kirghiz steppe: what is not sold is sent on to the fair at Nizhni-Novgorod. The skins include squirrel, rabbit, sable, ermine, brown bear, kolonok, grey wolf, fox, badger, black cat, Orenburg marmot, Petchora, Yenisei and Obdorsk white fox, reindeer, mink and marten, and sales amount to £730,000 to £830,000 per annum. Until Jan. 1917 the town was 80 m. from the railway, but in that year a branch from Sverdlovsk (Ekaterinburg) to the Tavda river was opened, which will ultimately link up with Tobolsk. The Irbit fair was the first to be reopened (1922) after the 1914–21 war and civil war. The population was 20,064 in 1897, dropped to 9,647 in 1920, was 11,719 in 1926.

IRELAND, JOHN (1838–1918), American Roman Catholic prelate, was born at Burnchurch, County Kilkenny, Ireland, on Sept. 11, 1838. In 1849 he was taken to the United States by his parents, who settled at St. Paul, Minnesota Territory. After being educated in France for the priesthood, he returned to the United States in 1861; he was ordained at St. Paul and in the following year he accompanied the 5th Minnesota Volunteer Infantry south as chaplain. Subsequently he became rector of the cathedral at St. Paul. His appointment in 1875 as bishop of Nebraska was changed at the urgent request of Bishop Grace so that he might remain at St. Paul as bishop-coadjutor with the right of succession; at the same time he was made titular bishop of Maronea.

His liberal views gave him a wide influence and reputation both within and without the church, and he came to be looked upon as a leader of the "American" as distinguished from the "Roman" party in the clergy. Several of his administrative acts, notably his plan for the partial taking over of control of the parochial schools by the local authorities, were strenuously attacked. He was prominently identified with the planting of Catholic communities or colonies in the North-west, with the establishment of the Catholic university at Washington, and with the Catholic total abstinence movement. He published *The Church and Modern Society* (1896). He died at St. Paul on Sept. 25, 1918.

IRELAND, JOHN (1879–), English composer, was born at Bowdon, Cheshire, on Aug. 13, 1879, the son of Alexander Ireland, editor and proprietor of the *Manchester Examiner*. He studied at the Royal College of Music. His pianoforte trio (1908) was followed by the sonatas in D minor and A minor for violin and piano and a second trio in one movement. In 1913 appeared an orchestral work, *The Forgotten Rite*. His other works include *Decorations* (1914), and *Rhapsody* (1915), for piano; Four Preludes for pianoforte (1915); a trio in E minor (1917); a piano sonata in E (1919) and a series entitled *London Pieces* (1917–20) together with songs and church music.

IRELAND, WILLIAM HENRY (1777–1835), forger of Shakespearian manuscripts, born in London, was the son of Samuel Ireland, an engraver and author, and dealer in rare books and curios. In 1794 young Ireland, with his father, visited Stratford, where he met John Jordan, a local poet who had forged the will of Shakespeare's father. Seeing his own father's credulous interest, Ireland copied, in ink which had all the signs of age, Shakespeare's style and handwriting, and produced leases, contracts with actors, notes, receipts, a profession of faith and even a love letter to Anne Hathaway with an enclosed lock of hair, to the delight of his unsuspecting father, and the deception of many scholars. Ireland invented an ancestor "William Henrye Irelaunde," to whom the documents had been bequeathed by Shakespeare in gratitude for rescue from drowning. At last the discovery of a whole new play named *Vortigern* was announced. Sheridan purchased it for Drury Lane theatre, and an overflowing house assembled on April 2, 1796, to sit in judgment upon it. But its one representation was greeted with shouts of laughter. Samuel Ireland the elder had published in 1795 the *Miscellaneous Papers and Legal Instruments under the Hand and Seal of William Shakespeare; including the Tragedy of King Lear and a small fragment of Hamlet* (dated 1796). He had the fullest belief in their authenticity, but the hostile criticism of Malone and others, and the unsatisfactory account of the source of the papers, made him demand a full disclosure from his son. Ireland at last confessed his fraud, and published (1796) an *Authentic Account of the Shakespearian MSS.*, and in 1805, a more elaborate *Confession,* entirely exculpating his father and making a full admission. The disgrace seems to have hastened the elder Ireland's death (July 1800). Ireland died on April 17, 1835.

The more interesting publications on the Ireland forgeries are: *Inquiry into the authenticity of certain Papers, etc., attributed to Shakespeare,* by Edmond Malone (1796); the elder Ireland's *Vindication of his Conduct* (1796); *An Apology for the Believers in the Shakespeare Papers* (1797), and a *Supplemental Apology* (1799), both

by George Chalmers. *Vortigern* was republished in 1832. The elder Ireland's correspondence with regard to the forgeries is preserved in the British Museum, with numerous specimens of his son's talent.

IRELAND, an island to the west of Great Britain, extending from 51° 26′ to 55° 21′ N., and from 5° 25′ to 10° 30′ W. The 100 fathom line lies a short distance beyond its western coast and leaves it in structural affinity with western Europe. The north channel between the Mull of Kintyre (Scotland) and Torr head has a width of only 13½ m.; in the south, St. George's channel has a width of 69 m. between Dublin and Holyhead (Wales), and of 47 m. at its southern extremity; in the centre the Irish sea attains a width of 130 miles. The area is 20,360,601 ac., and the population (1926), 4,229,124.

GEOLOGY

Ireland, rising from shallow seas on the margin of the submarine plateau of western Europe, records in its structure the successive changes that the continent itself has undergone. The first broad view of the country shows us a basin-shaped island consisting of a central limestone plain surrounded by mountains; but the diverse modes of origin of these mountains, and the differences in their trend, suggest at once that they represent successive epochs of disturbance. The north-west highlands of Donegal and the Ox Mountains, with their axes of folding running north-east and south-west, invite comparison with the great chain of Leinster, but also with the Grampians and the backbone of Scandinavia. The ranges from Kerry to Waterford, on the other hand, are clearly parts of an east and west system, the continuation of which may be looked for in South Wales and Belgium. The hills of the north-east are mainly the remnants of lava-plateaux, which carry the mind towards Skye and the volcanic province of the Faeroe Islands. The two most important points of contrast between the geology of Ireland and that of England are, firstly, the great exposure of Carboniferous rocks in Ireland, Mesozoic strata being almost absent; and, secondly, the presence of volcanic rocks in place of the marine Eocene of England.

The fact that no Cambrian strata have been established by palaeontological evidence in the north and west of Ireland has made it equally difficult to establish any pre-Cambrian system. The great difference in character, however, between the Silurian strata at Pomeroy in county Tyrone and the adjacent metamorphic series makes it highly probable that the latter masses are truly pre-Cambrian. The other metamorphic areas of the north and west present even greater difficulties, owing to the absence of any overlying strata older than the Old Red Sandstone. They are generally referred to as "Dalradian," a convenient term invented by Sir A. Geikie for the metamorphic series of the old kingdom of Dalriada. The oldest rocks in this large area are a stratified series of mica-schists, limestones and quartzites, with numerous intrusive sheets of diorite, the whole having been metamorphosed by pressure, with frequent overfolding along axes with a north-easterly or Caledonian trend.

Following on these rocks of unknown but obviously high antiquity, we find fossiliferous Ordovician (Lower Silurian) strata near Killary harbour on the west, graduating upwards into a complete Gotlandian (Upper Silurian) system. Massive conglomerates occur in these series, which are unconformable on the Dalradian rocks of Connemara. In the Wenlock beds of the west of the Dingle promontory there are contemporaneous tuffs and lavas. Here the Ludlow strata are followed in apparent conformity by a thick series of barren beds (the Dingle Beds), which have been variously claimed as Upper Silurian and Lower Devonian. No certain representative of the Dingle Beds has been traced elsewhere throughout the south of Ireland, where the Old Red Sandstone succeeds the uptilted Silurian strata with striking unconformity. The folds which distort these Silurian rocks, including the Dingle Beds, have a north-easterly trend parallel to those which affect strata of the same age in the southern uplands of Scotland and thus belong to the Caledonian system. The best example of these folds is the axis of Leinster, its core being occupied by granite which is now exposed continuously for 70 m., forming a moorland from Dublin to New Ross. On either flank the Silurian shales, slates and sandstones, which are very rarely fossiliferous, rise with steep dips. They are often contorted, and near the granite pass into mica-schists and quartzites.

In south-eastern Wexford, in northern Wicklow (from Ashford to Bray), and in the promontory of Howth on Dublin Bay, an apparently earlier series of green and red slates and quartzites forms an important feature. The quartzites, like those of the Dalradian series, weather out in cones, such as the two Sugar-loaves south of Bray, or in knob-set ridges, such as the crest of Howth or Carrick Mt. in county Wicklow. The radial or fan-shaped markings known as *Oldhamia* were first detected in this series, but are now known from Cambrian beds in other countries; in default of other satisfactory fossils, the series of Bray and Howth has long been held to be Cambrian.

Extensive denudation followed the Caledonian folding and on the land-surface thus formed the Devonian lakes gathered, while the rivers poured into them enormous deposits of sand and conglomerate. Large areas of Old Red Sandstone have been brought up from beneath the denuded Carboniferous along the Hercynian folds of the south. The conglomerates, moreover, appear at intervals through the limestone covering of central Ireland, and usually weather out as conspicuous scarps or "hogs'-backs." The Slieve Bloom mountains are thus formed of a dome of Old Red Sandstone folded on a core of unconformable Silurian strata; while in several cases the domes are worn through, leaving rings of Old Red Sandstone hills, scarping inwards towards broad exposures of Silurian shales. Further north an extensive area of Old Red Sandstone is preserved within the rift valley, which is continued from central Scotland, beneath the North Channel and the basalt plateau, and comes to light again south-west of Lough Neagh. The Old Red Sandstone shows local evidence of contemporaneous volcanic activity.

The highest beds of Old Red Sandstone type pass up conformably in the south of Ireland into the Lower Carboniferous, through the "Yellow Sandstone Series" and the "Coomhola Grits" above it. The Yellow Sandstone contains *Archanodon*, the oldest known fresh-water mollusc, and plant-remains; the Coomhola Grits are marine, and are sometimes regarded as Carboniferous, sometimes as uppermost Devonian. In the south, the Carboniferous deposits open with the Carboniferous Slate, in the base of which the Coomhola Grits occur. Its lower part represents the Lower Carboniferous Shales and Sandstones of the central and northern areas, while its upper part corresponds with a portion of the Carboniferous Limestone of the central plain.

The Lower Carboniferous Sandstones are conspicuous in the region from Milltown near Inver Bay in southern Donegal to Ballycastle in county Antrim. In the latter place they contain workable coal-seams. The Carboniferous Limestone often contains black flint (chert), and at some horizons conglomerates occur, the pebbles being derived from the pre-existing ridges of the "Caledonian" land. A black and often shaly type called "calp" contains much clay derived from the same land-surface. While the limestone has been mainly worn down to a lowland, it forms fine scarps and tablelands in county Sligo and other western regions. Contemporaneous volcanic action is recorded by tuffs and lavas south-east of Limerick and north of Philipstown. The beds above the limestone are shales and sandstones, the true stratigraphical horizon of which is as yet ill defined, but which certainly range in places into the Middle Coal Measures. No beds equivalent to the Upper Coal Measures of England have yet been proved South of the line between Galway and Dublin the coal is anthracitic, while north of this line it is bituminous.

The "Hercynian" earth-movements, which so profoundly affected north-west and north-central Europe at the close of Carboniferous times, gave rise in the south of Ireland to a series of east and west folds and in the centre to a series of lesser folds deflected along Caledonian trend lines. The uplift which followed upon this folding led as in England to extensive denudation. It is however only in the north-east of Ireland that the subsequent history can be traced. Here the succeeding Permo-Triassic beds lie unconformably across the Carboniferous and older strata.

The Permian sea has left traces at Holywood on Belfast Lough

and near Stewartstown in county Tyrone. Certain conglomeratic beds on which Armagh is built are also believed to be of Permian age. The Triassic sandstones and marls, with marine Rhaetic beds above, are preserved mainly round the basaltic plateaux of the north-east and extend for some distance into county Down.

The Jurassic system is represented in Ireland by the Lower Lias alone, and it is probable that no marine beds higher than the Upper Lias were deposited during this period. From Permian times onward, in fact, the Irish area lay on the western margin of the epicontinental seas that played so large a part in determining the geology of Europe. Denudation, consequent on the renewed uplift of the country, affected the Jurassic beds until the middle of Cretaceous times. The sea then returned, in the north-east at any rate, and the first Cretaceous deposits indicate the nearness of a shore-line. Dark "green-sands," very rich in glauconite, are followed by yellow sandstones with some flint. These two stages represent the Upper Greensand, or the sandy type of the English Gault. Further sands represent the Cenomanian. The Turonian is also sandy, but in most areas was not deposited, or has been denuded away during a local uplift that preceded Senonian times. Even the succeeding Senonian chalk, where it rests in the extreme north on Trias or even on the schists, is often conglomeratic and glauconitic at the base, the pebbles being derived from the old metamorphic series. This chalk appears to underlie nearly the whole basaltic plateaux, appearing as a fringe round them, and also in an inlier at Templepatrick.

No records of late-glacial submergence such as characterize Scotland and Fennoscandia are known in Ireland. The earliest post-glacial deposits are the submerged forests and the marls at the base of the peat bogs. In Early Neolithic (Campignian) times a slight submergence with a maximum of some 20 ft. affected the north-east of Ireland, and the fauna of the deposits dating from this period shows a temperature several degrees higher than that of the present day. Wide-spread growth of mountain peat has occurred since the bronze age.

After the Irish chalk had been elevated and worn into gently rolling downs, on which flint-gravels gathered, the great epoch of volcanic activity opened, which was destined to change the character of the whole north-west European area. Fissure after fissure, running with remarkable constancy north-west, broke through the region now occupied by the British Isles, and basalt was pressed up along these cracks, forming thousands of dikes, from the coast of Down to the Dalradian ridges of Donegal. One of these on the north side of Lough Erne is 15 m. long. Most of the igneous region became covered with sheets of basaltic lava, which filled up the hollows of the downs, baked the gravels into a layer of red flints, and built up, pile upon pile, the great plateaux of the north. There was little explosive action, and few volcanic vents can now be traced, so that it is thought that the lavas originated in fissure eruptions like those of Iceland. After a time, a quiet interval allowed of the formation of a deep zone of lateritic weathering represented by 50 to 90 ft. of lithomarge capped by pisolitic iron ore and bauxite. The plant-remains associated with these beds form the only clue to the post-Cretaceous period in which the volcanic epoch opened, and they have been placed by Mr. Starkie Gardner in recent years as early Eocene. During this time of comparative rest, rhyolites were extruded locally in county Antrim. A renewal of the basaltic eruptions produced the Upper Series of plateau lavas, beneath which this old subtropical land surface is preserved. There was then a second long period of weathering which produced a soil comparable in thickness with that of the Interbasaltic zone. Warping led to the denudation of this soil, and its concentration in the centre of the basin now occupied by Lough Neagh. Thus were formed the Lough Neagh Clays, the plant remains of which are identical with those of the Interbasaltic Zone, and which must therefore be regarded as also of Eocene age. The whole plateau was subsequently greatly modified by faulting during the diastrophism of the Miocene period, but no further volcanic activity supervened, and no deposits of this period or of the later Pliocene are preserved to us. A well developed peneplain and still later deep cut fjords are all that remain as records of the history of Ireland between the end of the Eocene and the beginning of the Glacial periods.

Along the whole south coast of Ireland occurs a preglacial shoreline buried beneath the glacial drifts and lying some 10 ft. above present sea-level. This runs up the sides of the fjords and proves their submergence in preglacial times. Overlying scree deposits from the degradation of the sea-cliff, descend below sea-level and prove emergence before the advent of the land ice.

During the Glacial period Ireland was covered by ice-sheets, which extended from sea to sea and with the exception of some of the higher hills, which no doubt had their own snow-fields there was no actually unglaciated area. The Newer Drift probably does not cover as wide an area as the older, but its limits are not yet known. Boulder clay and glacial gravels cover large regions in the central plain and moraines occur around the mountains. The main centres of snow accumulation lay in the hill areas of the north-west and west but the whole eastern coast was at one time invaded by ice, which came south from Scotland along the basin of the Irish sea and carried with it the highly characteristic riebeckite-eurite of Ailsa Craig in the Firth of Clyde. Wide-spread moraines and esker ridges mark the stages of retreat of the ice, and systems of marginal drainage are developed round the hills.

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PHYSICAL GEOGRAPHY

The central plain which reaches the east coast between Dundalk bay and Dublin bay and extends westward to the highlands of Connaught, separates the mountains of the north with their Caledonian trend-lines from the ranges of the south, where remnants of Hercynian folds predominate. The Leinster chain belongs structurally to the north. Lough Neagh occupies a depression in a region of warped basaltic rocks. To the north-east is the Antrim plateau, capped with lava and with no height exceeding 2,000 feet. The Sperrin mountains, to the north-west, attain a height of 2,240 ft. in Sawel mountain, whilst to the south-east several peaks exceed 2,000 ft. in the mountains of Mourne. This rim is pierced by the river Bann, which drains Lough Neagh to the north by the river Lagan, which enters Belfast lough to the east; by tributaries of the Upper Bann and by the river Newry to the south, and to the west by the gap partly occupied by the river Blackwater and the Ulster canal.

The highlands of the rim, favoured by settlers in late Neolithic times, but abandoned for the fertile land which replaced the lowland swamps and forests in later periods, are now given over to pasturage. Villages seek the shelter of the valleys. The shores of Lough Neagh and the valleys of the Bann and the Lagan, sheltered from excessive rains, provide good agricultural land and rich meadows for the fattening of cattle. Corn and root crops, flax and potatoes predominate. The Congested Districts Board from 1891 onwards did a great deal to help the small-holder. Co-operative creameries and agricultural credit societies have also been important economic influences. Coleraine is a small port on the Bann; Ballymena, Antrim and Portadown are market towns with rural industries and secondary railway centres. In the sheltered bays of the north-east coast are fishing villages, frequented by tourists in summer. Larne is a packet station and has aluminium works. Belfast dominates the industrial activity of the region. It has brought to an area rich in flax, and to a people born to the making of linen, coal and iron from Scotland, and thus has made possible the development of large-scale industries. Along Belfast lough are large residential areas.

To the west of the river Foyle are the mountains of Donegal, rising in Mt. Errigal to a height of 2,466 ft., and in Slieve Snaght to 2,240 feet. Blocks of hills running from north-east to south-west, separated and cut across by many deep, narrow valleys,

some of which are occupied by elongated lakes, isolate the coastal lowlands of the north-west, where habitation has persisted at least since the end of Neolithic times. Villages nestle along the creeks. Agriculture is hindered by exposure to strong rain-bearing winds from the west and away from the coast, by the height of the land and by the thin soil. Unification under a central authority has been a difficult process. Settlement has been largely confined to the valley of the Foyle and Donegal bay. Lifford, although but a suburb of Strabane (in Tyrone), acts as the county town of Donegal. Londonderry, near the head of Lough Foyle, is a port with a small ship-building industry.

Beyond Loughs Conn, Mask and Corrib are the ice-worn masses of Mayo and Galway, exceeding 2,000 ft. in height at several points. Submergence and marine erosion help to account for the much-indented and island-studded coast. Agriculture is limited, as along the Donegal coast, and fishing in the sheltered waters is an important occupation. Hardy ponies are reared on the mountains of Connemara. Descendants of early types and groups survive in the hills, and the influence of the organization of the eastern plains has penetrated slowly. Between Galway bay and the mouth of the Shannon is the promontory which comprises Co. Clare. Here the mountains are lower and more rounded, exceeding 1,000 ft. only in a few isolated peaks. The coast is more regular and the percentage of low land is higher. Kilkee, Kilrush and Miltown Malbay are seaside resorts.

To the south of the Shannon estuary lies the remarkable country of Co. Kerry and south-west Co. Cork. Parallel ribs of high land form steep-sided promontories separating the long, narrow rias which characterize this coast. Slieve Mish (Baurtregaum, 2,796 ft.), Dingle bay, Macgillycuddy's Reeks (Carrantouhill, 3,414 ft.), Kenmare river, Slieve Miskish and the Caha mountains (Knockowen, 2,169 ft.), Bantry bay, Sheep's head and Dunmanus bay illustrate well the rapid alternation of land form. Isolated groups cling to the narrow shores of the rias and earn a precarious living by fishing and sheep-rearing. Modern communications show the forced seclusion of the area. A line runs from Castlemaine along the south side of Dingle bay. Kenmare, on Kenmare river, and Bantry, at the head of Bantry bay, both have connections with towns to the east, but have not easy communication with one another. A line following a gap to the north-east of Macgillycuddy's Reeks serves Killarney and adjacent places. Castlemaine is in touch with Kenmare.

Between the mountains of the south-west and the Leinster chain lies a region of broken country which deserves special attention. Greatly influenced by Armorican fold movements, the area is composed largely of east to west lines of sandstone hills separated by limestone synclines. A general slope towards the south led to consequent drainage across rocks of varying hardness. "Subsequent" tributaries limited their valleys to the softer limestone and captured the headwaters of many of the "consequent" streams. The present drainage pattern, therefore, presents long east-to-west lines connected by short north-to-south corridors. The sea has invaded the lower reaches of the Bandon, the Lee, the Blackwater and the Suir, and their estuaries provide good harbours. Between the Suir and the Blackwater are the Ballyhoura hills (Glenosheen 1,696 ft.), the Galtee mountains (Galtymore 3,015 ft.) and, slightly to the south of these ranges, the Knockmealdown mountains (2,609 ft.), and the Comeragh mountains (Knockanaffrin 2,478 ft.). The Boggeragh mountains (Musheramore 2,118 ft.), continued by lower ranges to the east, separate the Blackwater from the Lee. Agriculture in the lowlands and sheep-rearing on the hills are the chief occupations in this diversified country. The structural pattern facilitates communication for some distance to the west, and also provides routes to the north. Cork and Waterford are packet stations which have benefited by these advantages, and Cork, on its fine natural harbour with Cobh (Queenstown) on an island, is the effective capital of the south.

Caledonian trend-lines prevail in the Leinster range which, rising steeply to the south of Dublin, runs south-westward and overlooks the lower valley of the Barrow. Several heights exceed 2,000 ft. and Mt. Lugnaquilla reaches 3,039 feet. Rain-soaked basins favour the formation of peat bogs, and give rise to sluggish streams which later cut rocky gorges down the steep sides. The windward slopes of the west are less steep than the eastern edge, and provide good pasturage. The coastal plain facing the Irish sea is sheltered from excessive rains, but is too narrow to be employed extensively for agriculture. It widens considerably, however, to the south, where the foothills of the Wicklow mass die away; arable land is estimated at 33% in Co. Wexford, whereas it only comprises 18% of Co. Wicklow. The Wicklow valleys were once exploited for their gold.

The Central Plain.—Enclosed by this girdle of highlands lies the central plain, consisting largely of limestone and covered, particularly towards the east, by drifts of sands and gravels deposited during the retreat of the ice-sheets. Between the Shannon and Loughs Mask and Corrib are extensive exposures of limestone, providing, in a region of abundant rainfall, good pasturage for cattle. Rising at the foot of Cuilcagh mountain, the Shannon flows in a general southerly and south-westerly direction. It winds through a marshy, rain-soaked area, and swells out into many broad, shallow lakes (Lough Ree, Lough Derg). At Killaloe, on the southern extremity of Lough Derg, it has a gorge between Slieve Bernagh and the Arra mountains, and from this point to Limerick, at the head of its estuary, its flow is more rapid. In this section it is proposed (1928) to harness the Shannon for the generating of electricity. (*See* SHANNON.) The Siemens-Schückert scheme aims at keeping the waters of Lough Derg at winter level, and diverting the river via O'Briensbridge to the generating station at Ardnacrusha, where the river will return to its natural course. It was anticipated that the Leinster circuit would be completed and served during 1929. Later, it is planned to erect further works at the outlet of Lough Ree. Overhead cables have been erected (1928) to Dublin, to various parts of Leinster, to Waterford and to Cork.

The marshy line of the Shannon has long been a barrier to communication. Athlone developed as a ford town where firm land approached the river banks, and has continued as a railway centre. Banagher and Shannon Bridge functioned similarly, but have lost much of their importance in recent times. To the east of the Shannon is an area of limestone and boulder clay studded with shallow lakes and peat-bogs. It has provided many obstacles to movement and settlement throughout history, and despite natural desiccation and drainage many of its disadvantages continue. Early roads follow the dry ridges of the eskers above the marsh, and one starting from Tyrrellspass undoubtedly added greatly to the early importance of Athlone. The wet lowlands of Meath, Westmeath, Kildare and Dublin provide pasture.

The extension of the plain to the eastern coast between Dundalk and Dublin provided one of the historic entries into Ireland. Control of this coastal strip has always been recognized as of great strategic importance, and Dublin (*q.v.*), in which this power has been vested, has developed as the administrative centre of central and southern Ireland. The Royal canal and the Grand canal connect it with the Shannon, and a branch from the latter links it with Waterford and the river Suir. The Great Northern railway runs northwards along the coast to Drogheda and Dundalk, and lines of the Great Southern system run westward and southward. Kingstown is a packet station in communication with Holyhead, Wales. Dublin imports sugar, grain, timber and general merchandise, and exports grain, whisky, beer and linen, but its function as a government centre is most important.

Climate.—Its girdle of high land and its insular position in the track of south-westerly winds are factors governing the climate of Ireland. The south-western and western coasts are comparatively warm in winter, Valencia having a January temperature of 44·6°. Numerous inlets increase the maritime influence. The central plain and the east coast, in the lee of the mountains, are more continental. Birr has a January temperature of 39·7°, and Dublin one of 41·7° F. Maritime influences delay the summer maximum temperatures in the south-west. Valencia records 59° in July and 59·3° in August, the corresponding figures for Birr and Dublin being 59·1° and 58·6° and 60·5° and 59·7° respectively. The autumn temperatures also are much more evenly graded in the west than in the centre and east. The distribution

of rainfall may be closely correlated with the orographical features. The heaviest falls occur on the mountains of Galway and Kerry, where considerable areas receive over 80 inches. Most of the mountainous areas around the coasts receive over 40 in., but averages for various localities on the central plain run between 30 in. and 40 in., whilst the east coast around Dublin receives under 30 inches. Maximum rainfall occurs at Valencia in winter (October and November 5·5 in., December 6·5 in., and January 5·6 in.); but the fall is steady throughout the year, May, the driest month, recording 3·1 inches. The mean annual rainfall at this station is 56·0 inches. Dublin (mean annual rainfall 27·7 in.) has its maximum in late summer and in autumn. The average fall in August is 3·1 in. and in October 2·9 in.; February, with 1·9 in., is the driest month.

Flora and Fauna.—Insularity retarded the recovery of Ireland's flora and fauna after the Ice age. Whereas Germany has 90 species of land mammals, Britain has 40 and Ireland 22. In western Ireland are some plant species, including members of the heath family, not found in other parts of the island. South-eastern Ireland has many species in common with south-west England. A few plants are found only in Ireland and America, and have been classed as an American group. Similar distributions can be traced in the fauna. Some fresh-water sponges in western Ireland are connected with American types. The arbutus, or strawberry tree, is now confined to the south-west corner of Ireland and to the Mediterranean. This is one illustration of a Lusitanian element in the flora, probably persisting from a time before Ireland was separated from Europe, and when an Atlantic coastal flora lived along the shores of the ocean from the Iberian peninsula to Ireland. There are also connections with the north, the mountain or Arctic hare being common to Ireland and Scotland. Remains of reindeer, Arctic fox, and Arctic lemming are found in Irish caves.

People and Settlement.—The retreat of the ice sheets left the central plain a marshy waste, with thick forest growth on drier patches. The moorlands and some coastal strips alone seem to have remained to early man. A limestone shore, rich in flints, and protected from excessive erosion by a capping of basalt, favoured early settlement in Antrim and Down. At Larne flints showing human workmanship have been found, with sea-shells, at from 20 to 25 ft. above the present sea-level. Similar evidence has been obtained from other sites in the north-east and in the south. The arrival of new peoples from the south-west marks the closing phase of the Neolithic period.

With these newcomers are associated large stone monuments, the distribution of which may help to define the chief centres of population at that time. Dolmens, generally consisting of several upright stones capped by large stone slabs, occur frequently in western Ireland. The eastern half of Co. Clare, the upper basin of the Lee in the south-west, and the shores of Donegal bay and Lough Swilly in the north-west, appear to have been important centres. At Carrowmore, in Co. Sligo, occurs a group of 65 dolmens. In the north-east, the numbers decrease from the coasts towards the interior, but no district here appears to have had the importance of the centres already mentioned. In the east, a few occur to the south of Dublin.

Rich deposits of copper in the counties of Wicklow, Waterford, Cork and Kerry added greatly to the importance of Ireland in the Bronze age; southern Wicklow was also rich in gold. Thus the coasts retained their importance, and the lowlands of the interior were still avoided. The finding of gold lunulae of Irish origin in western France, southern Scotland and central Europe suggests that there was commercial intercourse with the Baltic as well as with south-west Europe. The chambered tumulus of New Grange, near Drogheda, with its fine corbelled roof, resembles Maes Howe in Orkney, as well as graves in Brittany and the south of the Iberian peninsula. Many amber beads of Baltic origin have been found in Ireland, whilst the distribution of objects showing a spiral ornamentation has also been cited by some as evidence of contacts with the Baltic, and by others as evidence of southern links. Types of copper weapons and some contemporary pottery are related to Iberian types.

The very early peoples were, no doubt, long-headed (dolichocephalic) and dark and of short stature, resembling the people who inhabited Britain at the same period. Dark, strongly-built, broad-headed men have been located on coastal patches in Wales, Cornwall, Brittany, Spain and southern France, and it has been suggested that they may indicate an anthropological type which spread around the western coast of Europe during the period of commercial expansion in the Bronze age. These elements have been noted in the people around the coasts of Co. Wicklow, and with further investigations may be found in other parts of Ireland. The Rhenish beaker-peoples who are thought to have introduced a broad-headed element into Britain, seem to have had little influence in Ireland. Specimens of the pottery associated with them have been found only at Moytura, Co. Sligo, and at Mount Stewart, Co. Down, and they may be otherwise interpreted. We cannot estimate what may have been the effects on the population of contacts with the Baltic in the Megalithic and Early Bronze period. In the Early Iron age intruders from the Continent gained a footing.

Scandinavian Raiders.—Ireland, untouched by Roman organization, fell a prey to Scandinavian raiders. Norsemen, followed by Danes, raided the coasts and penetrated along the rivers. At the beginning of the 9th century they ascended the Shannon, and later had strongholds around the shores of Lough Ree. Another group progressed along the river Bann and established themselves around Lough Neagh, whence they devastated the neighbouring territory. About the middle of the 9th century Dublin, Limerick and Cork were founded. All three are at the head of estuaries and command good water-ways into the interior. The end of the 10th century and the beginning of the 11th saw a revival of the native tribes, which culminated in the overthrow of the Norse forces by the men of Munster and Connaught at the battle of Clontarf in 1014. During their régime the value of the coast lands and the valley-ways for settlement had again been accentuated. They doubtless strengthened the fair, long-headed element in the population, and their raids tended to drive the darker elements to the shelter of the hills.

The Anglo-Norman invasion accentuated divisions of long standing in Ireland. Strongbow landed near Wexford in 1169, and took advantage of inter-tribal struggles to extend his own power. Later, the Anglo-Normans obtained a firm hold around the coasts and gradually took possession of the fertile lowlands. The mountains became more and more the strongholds of the Irish, whence they periodically raided the intruders on the plain. In the reign of James I. an attempt to make the English land system universal aroused the chiefs of the north-west and north-east to revolt. They were defeated and their land confiscated. English and Scottish colonists received grants in Tyrone, Donegal, Armagh, Cavan, Fermanagh and Derry. The citizens of London were granted the site of Derry, which they garrisoned and fortified, Londonderry becoming the stronghold of the new settlers. In the time of Cromwell, a ruthless policy of extermination was followed, and the native peoples beyond the Shannon were evicted from their holdings. The land was parcelled out among adventurers; many of the original holders remained as serfs, others preferred a precarious independence in the mountains.

The potato, introduced early in the 17th century, provided a large crop which needed little attention and encouraged a rapid increase of population. In 1845 its dependents numbered over 8,000,000; then came the terrible famine of 1846–48, from which the country has not yet recovered. In 1851 the population had fallen to 6,500,000 and, as a result of wholesale emigration, largely to the United States of America, the figure continued to fall. Between 1847 and 1852 over 1,200,000 people emigrated, and of these more than 1,000,000 went to the United States of America. Between 1851 and 1905 over 4,000,000 left the country. The loss of population was borne chiefly by the agricultural districts. In 1841 the rural population was returned as 7,052,973, and the urban as 1,143,674, while the corresponding figures in 1901 were respectively 3,073,846 and 1,484,929. The increase in the urban population has been accentuated by the development of certain large centres. The population of Belfast was, in 1891,

273,079; in 1901, 349,180; and, in 1926, 415,007; the corresponding figures for Dublin are 268,587; 289,108, and 316,471.

The areas and populations of the counties and county-boroughs of Northern Ireland were estimated in 1926 as follows:—

Counties and county boroughs	Area in statute acres (exclusive of water)	Males	Females	Total
Antrim	702,850	92,600	99,018	191,618
Armagh	312,772	53,635	56,448	110,083
Belfast C.B.	14,797	195,588	219,419	415,007
Down	608,859	101,238	107,941	209,179
Fermanagh	417,912	30,094	27,891	57,985
Londonderry	512,495	47,127	47,384	94,511
Londonderry C.B.	2,198	20,783	24,381	45,164

For the Irish Free State the figures are:—

Counties and county boroughs	Area in statute acres*	Population in 1926		
		Males	Females	Total
Province of Leinster:				
Carlow	221,485	17,802	16,702	34,504
Dublin County	218,873	87,378	101,870	189,248
Dublin C.B.	7,911	151,739	164,732	316,471
Kildare	418,645	31,982	26,053	58,035
Kilkenny	509,457	37,033	33,932	70,965
Leix (Queen's)	424,838	27,205	24,344	51,549
Longford	257,770	20,804	19,027	39,831
Louth	202,181	31,668	31,019	62,687
Meath	577,735	33,005	29,904	62,909
Offaly (King's)	493,263	27,499	25,022	52,521
Westmeath	434,665	30,114	26,682	56,796
Wexford	580,950	48,561	47,251	95,812
Wicklow	499,958	28,903	28,680	57,583
Total of Leinster	4,847,731	573,693	575,218	1,148,911
Province of Munster:				
Clare	788,337	50,064	44,964	95,028
Cork County	1,841,035	145,853	141,401	287,254
Cork C.B.	2,681	37,306	41,162	78,468
Kerry	1,161,752	77,589	73,276	150,865
Limerick County	661,573	51,656	48,588	100,244
Limerick C.B.	2,386	19,329	20,361	39,690
Tipperary	1,051,304	72,867	68,079	140,946
Waterford County	453,051	26,755	25,137	51,892
Waterford C.B.	1,438	12,645	14,001	26,646
Total of Munster	5,063,557	494,064	476,969	971,033
Province of Ulster (part of):				
Cavan	467,025	43,485	38,962	82,447
Donegal	1,193,641	78,060	74,451	152,511
Monaghan	318,990	33,240	31,903	65,143
Total of Ulster (part of)	1,979,656	154,785	145,316	300,101
Province of Connaught:				
Galway	1,467,850	88,462	80,849	169,311
Leitrim	376,510	29,232	26,656	55,888
Mayo	1,333,356	86,749	85,912	172,661
Roscommon	608,290	43,283	40,221	83,504
Sligo	442,205	36,648	34,745	71,393
Total of Connaught	4,228,211	284,374	268,383	552,757
Total of Free State	17,019,155	1,506,916	1,465,886	2,972,802

*Exclusive of larger rivers, lakes and tideways.

Vital Statistics. *Northern Ireland.*—The following table gives the number of marriages, births and deaths for four years:—

Year	Marriages	Births	Deaths
1923	7,974	30,097	18,790
1924	7,514	28,496	20,299
1925	7,682	27,686	19,784
1926	7,228	28,162	18,827

The number of births per 1,000 of the population in 1926 was 22·42, and the number of deaths per 1,000 of the population 15·82. The high birth rate, a considerable fall in the emigration figures, and industrial developments are important factors in the maintenance of the population.

Irish Free State.—The number of marriages, births and deaths for four years are given in the following table:—

Year	Marriages	Births	Deaths
1923	15,632	61,690	42,217
1924	14,822	63,402	45,180
1925	13,820	62,069	43,650
1926	13,570	61,176	41,740

The number of births per 1,000 of the population in 1926 was 20·58, and the number of deaths per 1,000 of the population was 14·04. In 1924 the corresponding figures were 20·06 and 14·29. In England and Wales the birth rate has fallen from 25·5 in 1920 to 16·6 in 1927. This fact makes the Irish figures stand out as particularly high.

Religions.—(*See* IRELAND: *Mediaeval History*, and IRELAND, CHURCH OF.) In Northern Ireland, the principal religious professions, as recorded at the census of 1911, were: Roman Catholics, 430,161; Protestant Episcopalians, 327,076; Presbyterians, 395,039; Methodists, 45,942; others, 52,313; giving a total of 1,250,531. For the Irish Free State, the figures (1911) were: Roman Catholics, 2,812,509; Protestant Episcopalians, 249,535; Presbyterians, 45,486; Methodists, 16,440; others, 15,718. The Roman Catholic Church is governed in Ireland by four archbishops, whose sees are in Armagh, Dublin, Cashel and Tuam, and by 23 bishops. The Presbyterian Church, whose adherents are found principally in Ulster and are largely the descendants of Scottish settlers, was originally formed in the middle of the 17th century, and in 1840 a reunion took place of the two divisions into which the Church had separated. The Methodist Church in Ireland was formed in 1878 by the union of the Wesleyans with the Primitive Methodists. (O. J. R. H.; X.)

AGRICULTURAL CO-OPERATION

The main interest and importance of the co-operative movement in Ireland since the beginning of the World War consists in the struggle of its promoters to preserve and develop it as the chief agency for implementing a certain philosophy of rural life and evolving an agricultural policy consonant therewith. The movement had been initiated a quarter of a century before the War by men who were not themselves farmers, and its inspiration has ever since come from practical idealists. These men realized that in a country dependent upon a sound agricultural economy for the well-being of every section of the population, a technically educated and efficiently organized rural community was of the first importance.

In countries highly industrialized, agriculture could be neglected without disaster; in a country predominantly agricultural the efficient production and economical distribution of food was what mattered most. Yet those who saw that these ends could best be obtained by the application of the co-operative principle and system to the occupation of farming were chiefly concerned for the building of a rural civilization which would provide intellectual interests and social amenities calculated to counteract "the lure of the city." For the solution of the modern rural problem as they saw it, they invented the formula: "Better Farming, Better Business, Better Living." To use a New World phrase, the "pivotal" thing was Better Business and Better Business was co-operation.

Agricultural Organization Society.—The post-war civil disturbances in Ireland might well have wrecked the movement. War prices and a demand which ignored quality had considerably demoralized the dairy societies. The movement was in no condition to meet the sudden decline in prices which set in in 1920–21. It became clear that its future success—perhaps even its survival—would depend upon the ability of the Irish Agricultural Organization Society to continue its service as guide, philosopher and friend of the societies. This central body had always derived from

the farmers it served and from philanthropic individuals a large part of its funds. In the circumstances of the country, these subscriptions were bound to fall off. While the Development Commission, which was authorized by its act to treat "the organization of co-operation" as one of the ways of "aiding and developing agriculture," functioned in Ireland it subsidized the I.A.O.S. for this purpose. Under the Anglo-Irish Treaty, the Commission transferred its functions and a proper proportion of its funds to the two Irish Governments. The I.A.O.S. had to be partitioned, an Ulster A.O.S. being formed to operate in the six north-eastern counties.

The Government of the Irish Free State has from year to year continued the grants to the I.A.O.S. and for its first year the Government of Northern Ireland continued it to that part of the organization movement which came within its territory. This, however, was not renewed, except for a grant of £200 in 1927, increased to £700 in 1928, and in Northern Ireland the movement consequently had greatly to restrict its work. But that the farmers there have come to realize its value is evident from the fact that most of its funds come from the societies' contributions and the movement is thus able, through its own practical public spirit, supplemented by that of a few friends, to carry on without incurring a deficit.

The new Free State Government, from the start, made every effort to reconstitute the agricultural policy of the country. This was to be expected in a land which, itself purely agricultural, had just obtained independence from a union of countries mainly industrial. The department was merged in a new Ministry of Lands and Agriculture, and a commission on Agriculture was set up which made many far-reaching recommendations, especially emphasizing the importance of agricultural education and commending the development of co-operation as well as an increased subvention to the I.A.O.S. A grant of £10,000 was voted by Dail Eireann for the year 1926–27, and £8,500p.a. for the four following years.

Position of the Societies.—A movement, started in the autumn of 1926, to market the butter of the co-operative creameries in common, under a new trade organization (Irish Associated Creameries, Ltd.) proceeds *pari passu* with the decision of the State to enable bodies of farmers (organized into registered co-operative societies by the I.A.O.S.) to take over, by the utilization of Government credit, the machinery, buildings and trading interests of the principal creamery proprietors in Southern Ireland. A "holding body," consisting of civil servants, has been registered under the Industrial and Provident Societies Act to serve as a temporary "bridge" between existing proprietors willing to sell and prospective co-operative farmers organizing to purchase. More than three-fourths of the existing co-operative dairying societies have already voluntarily signed agreements to market their butter through Irish Associated Creameries Ltd., and it is anticipated that, with the additional trade passing into co-operative hands through the scheme for purchasing new premises and plant, and acquiring existing business, the creamery industry of the Irish Free State will be virtually run for the future by and in the interests of the organized dairy farmers. In Irish Co-operative Meat Ltd. (Waterford), another co-operative enterprise has been successfully launched and, while the promoters in its earlier years are pursuing a cautious policy, it is hoped that a considerable part of the pig and cattle business of the principal counties in Munster and Southern Leinster will be placed on a sound basis whether the animals are marketed as live stock or dead meat, and a number of subsidiary industries developed through the utilization of by-products.

Credit societies have largely developed in recent years. The Commission on Agriculture had recommended that this aspect of co-operative business be specially endowed; and in 1925 the Dail, at the instance of the Minister for Agriculture, passed a vote for loans not to exceed £100,000, for restocking of lands, to be advanced to credit societies approved by the I.A.O.S., to whom the administration of the scheme was entrusted. The Agricultural Credit Act 1927 also makes provision for similar loans and for loans to co-operative societies of agricultural producers. Thus were re-established satisfactory relations between the State aid and the self-help parts of a movement which may encourage other countries to adopt the device of an "organization society," working in close co-ordination with the governmental Departments of Agriculture.

The organization of about 150,000 farmers, mostly heads of families and, therefore, representing over 600,000 persons (in a country containing about 4,250,000 people), into a movement whose aggregate business for the decade 1914–23 (inclusive) was well over £80,000,000—to which creameries contributed about one-half—is not an unimportant factor in Irish economics.

Education.—The need of all co-operative movements is always education, and the higher the development the greater is that need. The hampered condition of the Central Organization society is probably the true cause of the halt of the movement as a whole. Up to the present, the I.A.O.S. has had to render many services, notably technical advice to creameries and other societies, which the Government, through the Ministry, are now rendering under the Dairy Produce Act and the Agricultural Produce (Eggs) Act. To ensure the future of co-operation, technical instruction in itself is not the chief desideratum. When it can leave that to the Ministry, the Organization society will concentrate on educating the farmers not only in credit and the technique of co-operation, but in the co-operative spirit.

The Government of Northern Ireland, like that of the Free State through its Department of Agriculture, enforces egg-grading; but the Ulster Organization society, with its small staff, cannot do the work necessary to educate the farmer up to a standard which the Government can only punish him for failing to reach. The work, therefore, cannot be expected to show immediate spectacular results, but that, it must be understood, is as much due to the width of the aim as to the narrowness of the resources. And these two have another connection. To-day the central society's funds are largely drawn from the fees the farmers will willingly pay it for technical instruction, which is not a co-operative but a manufacturing technique. When that function is transferred to Government and the Organization society is restricted to its educational but less remunerative purposes, the farmers' financial support will for some time be considerably lessened.

Nevertheless, the founders of the movement were convinced that nothing less than a continual extension of the study of the rural problem—the regarding of agriculture as an *industry*, as a *business* and as a *life*—could bring the country population to a standard of efficiency demanded by modern economic conditions. The next step, therefore, in this concerted advance was to gather and distribute knowledge of every side of agricultural co-operative evolution the world over, and to provide a centre at which students and organizers could study and compare the progress of local developments. To provide this, the Co-operative Reference library had been founded in Dublin in 1913. One of the founders of the Irish movement has endowed a trust (which the trustees christened the Horace Plunkett Foundation) for the purpose of extending the Irish philosophy of rural life throughout the British Commonwealth.

Under its auspices there was convened at Wembley in July 1924 a conference on agricultural co-operation in the British empire. The delegates, who were thoroughly representative of agriculture in this vast area, approved the Irish policy, and called upon the Foundation to establish an office in London to act as a clearing-house for the exchange of experiences and opinions of all organizations which were putting the co-operative principle into practice. This has been begun by opening a London centre which, when the Carnegie United Kingdom Trust promised to defray the cost of maintenance, naturally offered hospitality to the Co-operative Reference Library, an offer which the Carnegie United Kingdom Trust approved. Thus the Foundation is in a favourable position to see that Ireland is kept fully informed of the progress of similar movements in other countries.

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HISTORY

Earliest Inhabitants.—The earliest known remains of human habitation in Ireland are assigned by archaeologists to the period of the transition between the early and the late stone age. This period, it is held, was preceded by intense glacial conditions, covering the whole island and extending also over Britain as far south as the estuaries of the Severn and the Thames. The Neolithic and Copper periods which follow are well represented in Ireland, but their data belong rather to archaeology than to history. The bronze age in Ireland, though it has no documents, native or extraneous, has left evidences sufficiently abundant and vivid to be considered historical. To it belong numerous tombs of massive structure, surmounted by great tumuli of earth or stones, the stone slabs in some of them being carved with a great variety of designs, symbolic or ornamental—evidence of a settled population under opulent rulers. Bronze was abundant. There were rich copper mines, but no tin mines, and the tin which was needed to make bronze must have been an article of import, no doubt from Cornwall, during the whole of the bronze age and later. The distinctive feature of this period in Ireland was the production of native gold, of which it is certain that there were comparatively rich deposits in the Wicklow mountain region. Irish gold ornaments of the bronze age have been found in various parts of Britain, in northern France, in Luxembourg, Hanover and Denmark. In Ireland, the principal finds have been in districts far away from the gold-producing region. Finds of the ancient apparatus of bronze-founding are likewise recorded in places far away from copper mines and from seaports through which tin could be obtained. The facts point to a development of commerce, internal and external.

To the Celts of Gaul, and through them to the Greeks, the ancient inhabitants of Britain and Ireland appear to have been known by the common name of Pretani. The two islands, Albion and Iverna, are called in Greek the Pretanic islands. In Latin and first, so far as is known, by Julius Caesar, the name *Brittani* (becoming later *Britanni* and *Brittones*) is substituted for *Pretani* and used distinctively of the people of the larger island, to which the name Brittania (Britannia) was given. *Pretani*, represented in early Irish by *Cruithin*, was the name of the people who in later times are known as *Picti*, Picts. Hence it may be inferred that during the bronze age the Picts were the chief people of Ireland as well as of Britain, and this inference is amply confirmed by ancient Irish traditions.

Celtic Colonization.—The earliest Celtic migrations to Ireland cannot be dated earlier than 400 B.C. The Celts were a people of Nordic type, fair haired and tall, physically akin to the Germanic peoples, and speaking a language closely related to the Germanic and Italic languages. At the time of their first immigration, they were in what is known as the "La Tène" stage of material culture. By them iron was introduced into general use in Ireland. They are likely to have arrived in small colonies, settling first in maritime districts and along the larger rivers. The later Celto-Germanic or Belgic migratory movement also extended to Ireland. Ptolemy, about A.D. 150, shows the Manapii and the Cauci settled on the eastern coast, and these are to be identified with the Menapii, a Belgic people, and the Chauci, a Germanic people, on the coast of the North Sea. This later phase of immigration is reflected in various ancient Irish traditions.

The Early Celtic Régime.—The Celts established small states, the nucleus of each state (*tuath*) being a convenient place of assembly to which the freemen could resort, like country people to a local market, without having to lodge away from home. The chief who presided over such an assembly was entitled king. He also performed the functions of judge and leader in war. Besides the common assembly of freemen (*oinach*), there was a curia or senate (*aireacht*) of nobles, which met in the king's house. The nobles who composed it were known as the companions (*celi*) of the king—we may compare them with the king's *hetairoi* in Homer. In ancient theory, a *tuath* provided an armed levy of 3,000 men, but in the period of contemporary documents much smaller states are indicated. Each *tuath* formed a separate jurisdiction. A freeman was a citizen (*urrad*) in his own *tuath*, but a non-citizen (*deorad*) in any other *tuath*, having, however, a legal status which did not belong to a foreigner (*allmurach, muirchuirthe*). Common jurisdiction (*cairde*) for legal proceedings could be made operative by agreement between states. It was the tendency of these small states to group together under hegemonies, the king of one state of the group having a certain authority over the kings of the other states. Such groupings could become permanent. The chief salient feature of the early Celtic régime is the division into five major groups of states, "the Five Fifths of Ireland," so firmly fixed in tradition that in later times, when the country was divided into four "provinces," these were called and are called at present by the Irish word meaning "fifths." The five fifths were:—

Ulster (*Coiced Uloth*, "the fifth of the Uluti"), extending on the west as far south as Loch Boderg on the Shannon, on the east as far south as Drogheda; much larger thus than the later province. Its capital, *i.e.*, the seat of the chief king, was Emain, "the Navan," close to the city of Armagh.

North Leinster (*Coiced Lagan Tuad-Gabair*, "the fifth of the Lageni north of Gabair"). Capital: Temuir, "Tara."

South Leinster (*Coiced Lagan Des-Gabair*, "the fifth of the Lageni south of Gabair"). Capital: Dinn Rig, on the Barrow.

Munster (*Coiced Muman*, "the fifth of Muma") nearly coextensive with the counties of Limerick, Cork and Kerry, with part of Waterford. Capital: Temuir Erann, near Ardpatrick, Co. Limerick.

Connacht (*Coiced Connacht*, "the fifth of the Connachta"), including the present Clare but not extending east of the Shannon. Capital: Cruachain, "Rathcroghan" in Co. Roscommon.

Social Order.—The population consisted of free, unfree and slaves. The freemen in the main were the freeholders of land, but their franchise extended also to the men of certain professions and skilled crafts. In the early Christian period, all ecclesiastics and all who received education in the schools of Latin were free. From this and from Caesar's statement of the immunities of the Gallic Druids and their pupils, it may be inferred that the Irish Druids and their pupils were freemen. The unfree were tenants of land, labourers and craftsmen of inferior kinds. Among the landed freemen, the nobles were distinguished by a higher measure of wealth and by having a sufficient number of clients (*celi*, "companions"). The nexus between chief and client was formed by a personal contract which was terminable by either and was terminated by the death of either, differing thus from the hereditary connection of feudal lord and vassal. The clients were freeholders and retained their ownership of land. The chief advanced capital, usually in the form of cattle, to the client, protected his interests in court or assembly, was his leader in war. The client repaid the capital with large interest, attended on the chief at the assembly, and followed him to war, supplied him with labourers for certain works, and rendered him certain reliefs and fixed dues of hospitality. There were two classes of clients, free (*soercheli*) and subject (*doercheli*). A subject client received from the chief, in addition to an advance of capital, his own "honour-price," that is, the legal valuation of his franchise or status, and so ceased temporarily to be a freeman; he paid a tribute in meat, vegetables and malt for the support of the chief's house.

Normally, each freeman was a member of a *fine* or joint family, consisting of descendants of the same great-grandfather—in other words, extending to second cousins. For some purposes, a wider extension of the joint family, as far as fourth cousins, was recognized. If a man died without issue, his property was divided in regulated shares among the members of his *fine*. In case of homicide, the compensation fixed by law was divided in like manner.

A *fine* could be made liable for the undischarged liabilities of any of its members. When a kingship became vacant, any man whose father, grandfather or great-grandfather had been king was eligible to succeed. The power of election belonged to the freemen in assembly, but it seems to have been usual for them to accept a choice made first by a meeting of the nobles.

The Druids.—Druidism, known only in Transalpine Gaul, Britain and Ireland, but not recorded in Britain outside of Anglesea

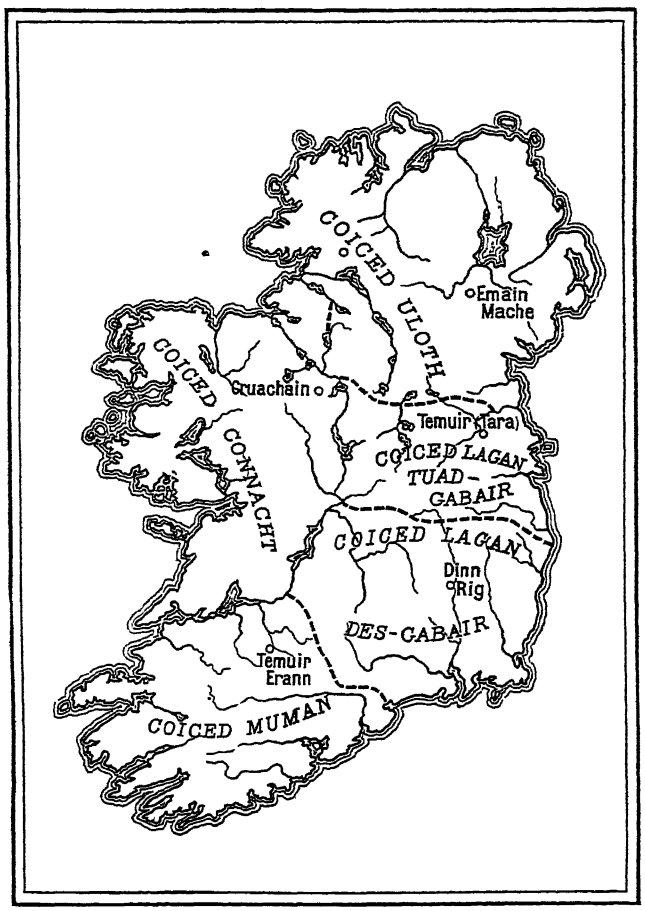


FIG. 1.—ANCIENT IRISH HISTORY. THE "FIVE FIFTHS" OF IRELAND ABOUT THE BEGINNING OF THE CHRISTIAN ERA

Ancient Ireland was divided into fifths, each ruled by its own king; Coiced Uloth (Ulster), with Emain Mache as capital; Coiced Connacht (Connaught), with Cruachain as capital; Coiced Lagan Tuad-Gabair (North Leinster), with Temuir (Tara) as capital; Coiced Lagan Des-Gabair (South Leinster), with Dinn Rig; and Coiced Muman (Munster), with Temuir Erann as capital

and the northern Pictland, is likely to have originated in Ireland. Pokorny's view seems reasonable and is supported by Irish tradition—that among the pre-Celtic inhabitants there existed a class of seers and sorcerers from which, under the Celtic régime, the Druids were developed. The Druids may be described as an association of professional wise men, philosophers in the early Greek sense, claiming to be experts in all the higher branches of knowledge. They professed special knowledge of the gods, the other world, the future life, the form and measurement of the earth, the movements of the heavenly bodies, the history of men; and they were accepted as authorities in matters of religion and law. They also claimed occult and prophetic powers. In the Roman world, after their suppression by the State, and in Ireland, after its conversion to Christianity, they were chiefly remembered as prophets and magicians. The notion that they were the priests of a particular religion is of modern growth. In Christian Ireland the Druids continued to exist, but with a change of name and with limited scope. They were called *filid*, a name which in time became restricted to the meaning of "poets" but which originally, signifying "seers," denoted one of the functions of the Druids. They no longer had authority in matters of religion but they long continued to practise occult rites of divination. In matters of learning they were displaced from the ground covered by the Latin teaching of the ecclesiastical schools. They remained the authoritative exponents of the national history, literature and law. In Gaul, notwithstanding the division of the country into so many independent states, the Druids formed a single society, with annual conventions and an elected president. In Ireland, the filid do not present this organized form, but they maintain an effective unity through a long course of centuries. They provide a single code of law for the whole country. They follow a common literary usage in writing, and in minutely regulated rules of prosody which they all accept. What Caesar tells of the long course of education of the Gallic Druids and of the instruction given orally and in verse is paralleled in the filid. Like the Druids, they enjoy civil immunities. Their persons are sacred. The influence of Druidism remains operative and distinctive in Irish history throughout mediaeval times. It can be traced in the conversion of the Irish to Christianity, in the development of the monastic schools, in Irish law, in the form and content of Irish literature, in lasting pedantic tendencies, but chiefly in a sense of national unity not dependent on political coherence.

Origin of the Monarchy.—The sagas of the "Ulster Cycle" point to a rivalry for the hegemony of Ireland between the Ulster and the Connacht kings. In time the Connacht dynasty gains ground. Its kings cross the Shannon and occupy Uisnech, dominating the fertile midland plain, probably in the 2nd century. In the 3rd century they annex the Boyne valley and make Tara their capital. These conquests break up the pentarchy and give a decided headship to the kings of Tara. Of them the most celebrated in tradition is Cormac, perhaps the first clearly historical personal figure in Irish history, reigning between the years 250 and 300. About this time, taking advantage of the disorder of the Roman empire, the Irish undertake plundering incursions into Roman Britain. A panegyric of the emperor Constantius in 290 speaks of the Britons already "accustomed" to Irish raids. Contact with the Roman military power has effects in Ireland. In imitation of the Roman walls in northern Britain, the Ulster kings protect their diminished territory by a massive earthwork, of which the remains are traced extending, with intervals of lake and forest, across the island from Dundalk bay to Donegal bay. A great quadrangular earthwork called the Dorsey, anciently *Doirse Emna*, "the Gates of Emain," built no doubt in imitation of a Roman legionary camp, guarded the main road leading from Tara to the Ulster capital. The Roman military organization seems to have led to the formation of the *Fiana*, permanent bodies of professional soldiers, peculiar in Ireland to this period. In the earlier heroic tradition there is no military organization. Later, the Irish law does not recognize at all the military profession, and no permanently formed Irish military forces are seen until the introduction of the "galloglasses" from western Scotland in the 13th century. About A.D. 350, the Connacht-Tara dynasty captured Emain and annexed the greater part of Ulster. It reached the height of its power under Niall of the Nine Hostages at the beginning of the 5th century. His sons took possession of the western part of Ulster, and their kindred now ruled all the northern half of Ireland except the eastern strip from the mouth of the Bann to the mouth of the Boyne. The chief kings of this kindred Dall Cuinn, were recognized as kings of Ireland until 1002.

The high-kingship or monarchy was an acknowledged primacy, symbolic of the sense of national unity, rather than a politically operative institution. Its powers are nowhere found defined. It claimed no tributes from the suffragan kings except from the kings of Leinster, who denied the legality of the claim and yielded the tribute only to superior force. The assembly over which the high-kings presided was held annually at Taillte, in the Boyne valley, and was regarded in a sense as national, but there is no instance recorded of its acting as legislative or administrative authority for all Ireland, in the manner in which the assembly of Carman, for example, acted for all Leinster.

In Munster, the 4th century sees the rise of a strong dynasty, of the Eoganacht sept, whose traditions indicate a relatively late immigration from Gaul. Under its rule, the bounds of the older fifth are pushed out and reach in the 5th century an extent

approximately the same as the modern province of Munster.

From the 5th century onward, the five major kingdoms of earlier tradition are replaced by seven. Of these, the older Ulster forms three, the kingdom of Ailech on the west, the kingdom of Airgialla ("Oriel") in the middle, the kingdom of the Ulaid ("Ulidia" or "Ultonia") on the east. The others are Connacht and Munster, both nearly co-extensive with the modern provinces, Mide ("Midia," "Meath"), comprising the greater part of older North Leinster and a small part of Ulster, and Leinster, consisting of the remainder of the two ancient Lagenian fifths. This division subsists with little change down to the 11th century, and is described in detail in the "Book of Rights" (10th century). The grouping, however, is in some particulars theoretical rather than actual. Eastern Ulster is to be regarded as containing three kingdoms of equal status, Dalriada, of which the kings ruled also in Scotland; Ulaid, the successor of the ancient Uluti; and Dal Araidi, a kingdom of the Picts. Osraige ("Ossory"), nominally in Leinster, does not appear subject to the king of Leinster. In each major kingdom or group-kingdom, the component states or petty kingdoms are of two kinds, tributary and non-tributary. The non-tributary states are those whose kings are of the same sept as the superior king, though their pedigrees may have branched apart for centuries. In Munster, for example, about half the number of component states were ruled by kings of Eoganacht lineage, and these were not tributary to the king of Munster, who was also of that lineage. Distributed all over the country were remnants of ancient subjugated tribes, the *Aithech-thuatha,* made tributary and held in political subjection.

Oversea Raids and Migrations.—From about the middle of the 3rd century, Latin writings bear constant evidence of Irish raiding expeditions, and the older Latin name *Hiberni* or *Iverni* is almost wholly replaced by a new name, *Scotti,* which appears to be a Celtic word meaning "raiders." Linked with the Scotti are found the *Atecotti,* also a Celtic word meaning "the very ancient folk," and probably distinguishing the Irish of pre-Celtic origin from the dominant Celts. Towards the end of the 4th century, large bodies of Atecotti were enlisted in the Roman service under the emperor Honorius. Irish tradition fully reflects the evidence of Latin writers. As the Roman power weakened in Britain, Irish raids were followed by migratory settlements. There is abundant evidence of Irish settlers all along the western seaboard of Britain from Argyle to Devon. Irish dynasties sprang up in Wales and lasted there for centuries. In the 5th century, the kings of Dalriada, a small kingdom in the north-eastern angle of Ulster, extended their power over the Irish settlers in Argyle and the neighbouring islands, their descendants ultimately, in the 9th century, becoming kings of Scotland. Crimthann, king of Munster, is said to have held a fortress in Britain. Branches of his sept settled in Wales and Cornwall. Niall of the Nine Hostages is identified by Ridgeway with "the Scot" who, in Claudian's poem, "mobilized all Ireland" against Roman Britain. In this reign, St. Patrick was carried to Ireland a captive and with him in the same raid, as his confession says and his epistle repeats, "so many thousands of men." At the head of a later expedition, Niall was killed at sea by a Leinster prince. His successor, Nath-i, heading another raid, died on the Continent.

Introduction of Christianity.—There is evidence of Irish Christians, apart from the thousands of enslaved Christian captives, before the first Christian mission to Ireland. In 429, at the instance of Palladius, deacon of the Roman church, St. Germanus, bishop of Auxerre, was sent by the pope, St. Celestine, to combat the Pelagian heresy in Britain. It was doubtless in answer to an appeal made through Germanus that, in 431, "Palladius was sent, their first bishop, to the Scots believing in Christ." After a short stay in Ireland, Palladius passed over to northern Britain, where he died soon after his arrival. In 432, Patrick, a disciple of Germanus, was sent as bishop to Ireland. He was a Briton, son of a decurion under the Roman government, and probably a native of Gwent in Monmouthshire. He was carried off a captive in the reign of Niall and became a slave in north-eastern Ulster. After six years he escaped. His birth may be dated in 385, his capture in 401, his escape in 407. His mission in Ireland succeeded rapidly. In 438 he was favourably received at the court of the high-king, Loiguire, son of Niall. In 439, doubtless in answer to a request sent to his patron Germanus, three bishops were sent to his assistance, Secundinus, Auxilius and Iserninus, the last also a disciple of Germanus. Patrick chose for his own see Armagh, beside the ancient Ulster capital. Secundinus had his church near Tara, the seat of the high-king; Auxilius, near Naas, also a royal seat in Leinster; Iserninus, driven out at first by Enda, king of Leinster, was restored later by Enda's son Crimthann, a Christian convert, and fixed his see at Aghade, near Rathvilly, where Crimthann lived. There is evidence that Patrick chose Baislex (Basilica Sanctorum), near Cruachain, the capital of the kings of Connacht, as the see of a bishop for that kingdom.

In the story of St. Patrick's reform of Irish law we may perhaps see an influence transformed by tradition into an event. A druid foretold to Loiguire: "He shall free slaves, he shall raise up men of lowly kin." In the written laws, two centuries later, a slave class no longer exists. St. Patrick's epistle condemns the enslavement of Christians. The earlier racial distinctions between conquerors and conquered, between Pict and Celt, survive only in antiquarian tradition, and all become known by the common name Goidil, "Gaels," or Fir Erenn, "Men of Ireland."

Political Events, A.D. 450–1000.—The descendants of Niall, Ui Neill, acquired territories in the regions annexed by conquest

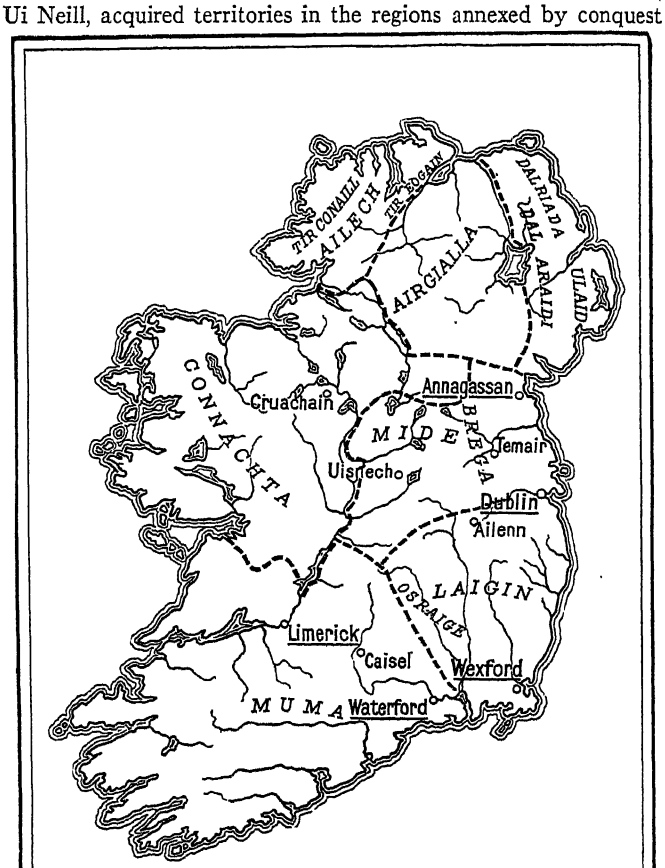


FIG. 2.—MAP OF THE SEVEN MAJOR KINGDOMS OF IRELAND, A.D. 500–900

These were Tir Conaill (Donegal); Airgialla (Londonderry, Armagh and Monaghan); Ulaid (Antrim and Down); Connachta (Connaught); Muma (Munster); Mide and Brega (Meath); and Laigin (Leinster)

to their ancestral kingdom, Connacht. The other branches of their kin remained in Connacht. Loiguire was succeeded as high-king by Aillill Molt of a Connacht branch. Niall's descendants combined against Aillill, who was defeated and killed in the battle of Acha; A.D. 483. Thenceforward, until 1002, the high-kingship was held exclusively by the line of Niall. One group of his descendants, the "northern Ui Neill," held western Ulster. Another group, the "southern Ui Neill," dominated Mide, the main part of the old

north Leinster fifth. In 563, the Pictish territory west of the river Bann was annexed by the northern Ui Neill. In 575, the high-king, Aed, son of Ainmeri, held an assembly at Druim Ceta, on the border of that territory, and decisions were adopted limiting the privileges of the *filid* and regulating the relations of the kingdom of Dalriada in Ireland to the kings of Dalriada in Scotland and to the kings of Ireland. In 637, Domnall, king of Dalriada, invaded Ireland from Scotland. He was defeated in the battle of Mag Roth ("Moira") by Domnall, king of Ireland.

After the battle of Octa, the high-kingship passed without any regularity from one branch to another of the Ui Neill, being held by descendants of five of his sons. In 734, Flaithbertuch, of the line of Conall, son of Niall, was deposed by Aed Allan, of the line of Eogan, son of Niall. Thenceforward the succession was confined to two branches, the kings of Ailech, descendants of Eogan, and the kings of Mide, descendants of Colman, these being respectively chief kings of the northern and southern Ui Neill, and the high-kingship was held by the kings of Ailech and Mide in a regular alternation, interrupted twice only, by the reigns of Congalach, king of Brega, 944–956, and of Brian Borama, 1002–14.

ECONOMIC AND CULTURAL DEVELOPMENT

Development of Monastic and National Culture.—The great development of Latin learning and of the monastic schools takes its origin from St. David's school of Menevia in Wales about A.D. 500. The kingdom of Dyfed ("Demetia"), in which this school was situate, had originated as an Irish colony, and remained in close intercourse with Ireland. St. David was of partly Irish ancestry and his school attracted many from Ireland. Among its earliest pupils was St. Finnian, who founded the monastery and school of Clonard, about 520. Clonard became the parent of other noted monasteries, notably Clonmacnois and Bangor, and, through its most famous pupil, St. Columban, of Derry, Durrow, Kells and other foundations in Ireland, as well as of Iona.

The language of these schools was Latin. The Latin classics were held in high esteem, and in some instances their survival is due to Irish zeal. When Theodore set up the teaching of Greek in Canterbury, he was beset by students from Ireland "like a wild boar surrounded by a troop of furious wolves." Scribes were continually at work providing copies of books. In the decoration of the more precious books, the art of illumination was highly developed. On the humanistic side, monastic learning was influenced by the traditions of Druidism. In the 7th century a fusion of the two cultures came about. In its early years a monastic chronicler introduced a framework of Irish history into his redaction of the Chronicle of Eusebius. A young noble, Cennfaelad, of the line of Niall, wounded in the battle of Moire (637), became a student in Tuaim Regon, where schools of the monks and the *filid* existed side by side. He broke away from the old druidical tradition by writing down the mnemonic formulae of Irish law. Cennfaelad, who died in 679, wrote also a number of poems on historical events and a short tract on the grammar of Irish. During the 7th century, an Irish written literature in prose and verse was extensive.

The Irish Missionaries.—In 563, Columban, then in his 43rd year, a descendant of Niall and a pupil of Clonard, having already founded the monastery of Derry on the site of the present city, led a colony of monks to the island of I ("Iona"), granted to him by the king of Dalriada. This was the beginning of the Irish missions oversea, the "surplus product" of the monastic schools. The work of Irish missionaries among the Picts, Angles and Saxons, belongs to the history of Britain. The continental missions began with Columban of the monastery of Bangor in Ulster, who, with a few companions, arrived in France about the year 574. Their range extended in time over a large part of France, the Netherlands, Germany, Austria, Switzerland and Italy.

The early missionary movement had its natural sequel in the sphere of learning. The part taken by Irishmen in the Carolingian revival of learning belongs to Irish history inasmuch as it exhibits the mental training given in Irish monastic schools and the scope and character of their studies. Clement the grammarian had a knowledge of Greek. Dichuil wrote a geography of the world in which he shows that his countrymen had travelled as far as Egypt and had discovered Iceland. Dungal, theologian and grammarian, wrote for Charlemagne an explanation of the solar eclipse of 810. Virgilius taught the existence of the Antipodes. Eriugena, for his knowledge of Greek and the boldness of his philosophical speculation, is the most prominent intellectual figure of his time. At Glastonbury, under Irish masters, St. Dunstan studied arithmetic, geometry, astronomy and music. Irish monasteries, in Ireland and abroad, were prominent in the cultivation of music.

Rural Economic Development.—The Irish laws point to a large development of rural industry in the period in which they were first written, preceding the Norse incursions. They deal minutely with the enclosure, subdivision and fencing of lands for tillage, the measurement and valuation of land, the management of crops and domestic animals, and innumerable details of husbandry, including milling, dyeing, spinning and weaving, dairying, malting, meat-curing, etc. The principal crops were wheat, barley, oats, flax and hay. Dye-stuffs were grown. Irish hounds were in high repute. St. Patrick, in his escape from captivity, joined a company of Irish traders whose chief merchandise was hounds. Watermills were owned and worked jointly by landholders.

The Paschal Controversy.—The Irish Church, in the dating of the Easter festival, followed a method introduced by its founders. Irish missionaries abroad found a different method under papal authority. About 631, the Roman computation was introduced in the southern parts, in northern Ireland somewhat later. Iona held out longest for the Irish tradition, even in opposition to its abbot, the celebrated Adamnan, and did not adopt the Roman Easter until 716, 12 years after his death.

Norse Invasions and Settlements.—The first appearance of the Norsemen on the Irish coast is recorded in 795, their first inroad in 807. Thenceforward there are frequent plundering raids, sometimes far inland. By degrees the Norsemen took possession of all the islands of Scotland, of Caithness, Argyle, Galloway, and the Isle of Man. In 841 they seized and fortified two ports, at Annagassan, between Dundalk and Drogheda, and Dublin. About the same time a fleet under Thorgest passed up the Bann to Lough Neagh. He afterwards sailed round to the Shannon and took possession of Lough Ree in like manner. Thorgest was captured in 845 and put to death by Mael-Sechnaill, king of Mide, who in 846 became king of Ireland. Large invading forces were defeated in 847. The turning point of these invasions was reached in the reign of Aed Findliath, high-king from 862 to 879, who forced the Norsemen to abandon all their stations in the northern parts of Ireland. At the same time the Norse kings of Dublin reached the height of their power, waging war in England and Scotland, and so nearly dominating Ireland that in the years 873, 876 and 878 the high-king was unable to hold the assembly of Tailtiu. Waterford in 914 and Limerick in 920 were occupied by the Norsemen without opposition. In 917, Niall Glundub, high-king, endeavoured to dislodge them from Waterford but they defeated a Leinster army coming to his assistance and forced him to withdraw. In 919, Niall led an army against Dublin, and in a battle where the Phoenix park is now he was defeated and killed. The permanence of the Norse settlements in Dublin, Waterford and Limerick became assured. Landed colonies spread out from Dublin and Waterford. Without quite abandoning piracy, the Vikings became traders in close intercourse with the Irish, and their commercial towns form a new element in the life of the country, typified in Wexford, which does not appear in warfare until the siege of 1169. The combination of war and commerce led to a recrudescence of slavery, and imported slaves are mentioned in the "Book of Rights" (about A.D. 900).

About 964, Mathgamain, king of Dal Cais, one of the petty kingdoms of Munster, became king of Munster, displacing the ancient Eoghanacht line. In 968 he defeated the Norse of Limerick and captured their city. In 976, he was captured and put to death by two Eoghanacht princes, one of whom, Mael Muaid, became then king of Munster. In 978, Mael Muaid was defeated and put to death by Brian, brother of Mathgamain. Brian, having gained the kingdom of Munster, kept steadily increasing his power. His claim to suzerainty over Leinster forced the Leinster king into close alliance with the Norse of Dublin. In 999 their

united forces were defeated by Brian at Glen Mama, near Dublin, and they agreed to become his allies and supporters. In 1002, Brian became king of Ireland by the submission of the high-king Mael Sechnaill II. The Irish and Norse accounts agree in bearing witness to the high character and good government of Brian. The kings of Dublin and Leinster, however, chafed under his suzerainty. In 1013, Sigurd, earl of the Orkneys, had for a Christmas guest the Norse king of Dublin, Sigtrygg, and a compact was made between them. Sigurd was to gather from all parts the greatest possible host of Norsemen and to bring them before Easter to Dublin, where they were to be joined by the forces of Dublin and Leinster to give battle to Brian and, if they were victorious, Sigurd was to have the kingdom of Ireland. Brian learned of these preparations, met the Norse army at Clontarf, near Dublin, on Good Friday, 1014. He was joined by the deposed high-king, Mael Sechnaill. The Norsemen and their Leinster allies were defeated and Earl Sigurd was slain, but a Viking chief, who had taken refuge in a wood, sallied out in the rear of the Irish army and killed Brian in his tent.

Though the battle of Clontarf removed the prospect of a Norse conquest it brought a period of unsettlement. All the chief dynasties had lost their prestige, and, except in Connacht, new rivalries and fresh pretensions to power, based on force and careless of tradition, arose everywhere. Brian's son, Murchad, who had already gained a reputation hardly less than his father's, had fallen in the battle. Of the sons who survived, none was able to sustain Brian's power. Mael Sechnaill was restored to the high-kingship and held it until his death in 1022. After him, for half a century there was no acknowledged king of Ireland.

Then followed the period of the high-kings "with opposition," *i.e.*, not acknowledged by a minority of the provincial kings: Toirdelbach, grandson of Brian, 1073–86; his son Muirchertach, 1086–1114; these were kings of Munster; in opposition to Muirchertach, Domnall Ua Locklainn, king of Ailech, who died in 1121; Toirdelbach Ua Conchubair, 1118–56, king of Connacht; Muirchertach Ua Lochlainn, 1156–60, king of Ailech; Ruaidri Ua Conchubair, 1166–74, king of Connacht. The centralized feudalism established in England by William the Conqueror had an apparent influence on the policy of these kings. One after another they sought, for the most part without success, to set aside the ancient tradition of local autonomy and to exercise direct authority outside of their hereditary jurisdictions. Thus Toirdelbach Ua Briain about 1075, appointed a kinsman of his own to be king of Tulach-Og in Ulster. Toirdelbach Ua Conchubair, in 1118, divided Munster into two coequal kingdoms; in 1125, deposed the king of Mide and appointed three kings in his stead; in 1126, made one of his sons king of Dublin and Leinster; in 1129, built the first castle in Ireland, commanding the passage of the Shannon at Athlone.

The last effort to establish Norse domination was made by Magnus, king of Norway, who in 1098 came with a strong fleet and restored the Norwegian sovereignty over the Scottish islands, Cantire, and the Isle of Man. In 1102, Magnus, then in Man, threatened an invasion of Ireland but agreed to a year's truce. In 1103 he landed on the Ulster coast where he was killed.

The period of political ferment which followed the success of Brian over the ancient chief dynasties was also a period of new growth in religion, literature and the arts. The movement for religious reform, mainly in the direction of a Catholic uniformity and the removal of abuses in matters of ecclesiastical discipline and observance, was led by Gillebert, bishop of Limerick, and Cellach (Celsus), bishop of Armagh and primate, in the beginning of the 12th century, and by the successor of Cellach, Maelmaedoc Ua Morgair, better known as St. Malachy. The outstanding feature of the abundant literary output of this time is enthusiasm for ancient national tradition. It became customary to compile tomes, each forming a kind of library of traditional lore, comprising sagas, poems, genealogies, etc. A number are still extant.

BIBLIOGRAPHY.—Macalister's *The Archaeology of Ireland* (1928) summarizes and explains the archaeological data. The data from Greek and Latin writers are given under appropriate headings in Holder's *Altceltische Sprachschatz*. For ancient Irish traditions bearing on the predocumentary period, the chief book of reference is Best's *Bibliography of Irish Philology and of Printed Irish Literature* (1913), which also gives particulars of the published chronicles. Irish contemporary chronicling begins towards the end of the 6th century and continues thenceforward until modern times. (E. MACN.)

HISTORY FROM 1166 TO 1485

The Anglo-Norman Invasion, 1166–1175.—Early in his reign, 1155, Henry II. of England had, through his envoy, John of Salisbury, received from Adrian IV. the grant of Ireland "as an inheritance," on condition that he should reduce to order the Irish Church and State. The so-called "Bull," *Laudabiliter*, which defines this grant, rests on the sole authority of Giraldus Cambrensis; how far it is genuine is one of the puzzles of history, but the general submission of the Irish to Henry later would imply that some such papal privilege was in the air.

Henry had to put his project aside for the time, and when the invasion came, it was a feudal one and directed from south Wales which was full of Norman adventurers. The first invaders, Maurice Fitzgerald, Robert FitzStephen, Raymond "le Gros" de Carew and others were sons or grandsons of the famous Welsh princess Nesta, and vassals of Richard FitzGilbert de Clare, called "Strongbow" in Irish tradition, earl of Pembroke.

Their opportunity came when Dermot MacMurrough, king of Leinster, expelled by his enemies, decided to seek aid in England and arrived in Bristol with his beautiful daughter Eva (Aoife) in Aug. 1166. He was there referred to Henry, found the king in France, was graciously received and given permission to raise forces in Britain. Returning to Wales, he won FitzGilbert over by the offer of his daughter's hand with apparently the succession to Leinster. He also enlisted "the sons of Nesta" in his cause and they found volunteers among the Welsh and Flemings of South Wales and Pembroke. Returning to Leinster, where his son Donal Kavanagh, whom Giraldus calls illegitimate, was holding out for him, he held his ground until successively Fitzgerald, FitzStephen, Raymond and finally Earl Richard himself arrived, the latter landing at Waterford in Aug. 1170 with 200 knights and 1,000 men-at-arms.

The successes of Dermot, backed by these professional fighters, were rapid; Danish Waterford was taken; the marriage of Eva and the earl celebrated; and by a rapid march Dublin also was captured and a relieving force under the high-king scattered, late in 1170. Leinster and Ossory were reduced, but the death of Dermot the following May made the situation difficult. The Irish regarded his son Donal as the true heir, but FitzGilbert considered himself king of Leinster, and anyway in feudal theory was, in virtue of his wife, lord of the province. But he was hemmed up in Dublin in mid-summer by a national levy raised by Rory O'Connor, king of Connacht, and though this attack was repelled, it was uncertain whether he could hold his own. Therefore when Henry, fearful lest a new Norman State should arise across the Irish channel, resolved to come to Ireland, Strongbow placed his conquests at his suzerain's feet.

Henry landed near Waterford on Oct. 17, 1171, with an imposing army, but a conquest in arms was not necessary, and in fact the peaceful submission of the Irish leaders was prompt and widespread. The king marched to Lismore and Cashel and finally to Dublin, where he spent the winter, leaving Ireland on April 27, 1172. Into this short period he packed the rough essentials of a government. At Dublin and elsewhere he received the homage of all the kings of Ireland except those of Connacht and Ulster. To Strongbow he granted the "Land of Leinster," confirmed the Geraldines and others in their fiefs, and annexed to the Crown the Danish kingdom of Dublin. He gave the capital to "the men of Bristol," took the Ostmen under his protection, and appointed Hugh de Lacy governor of the colony. He did not scruple to confer on De Lacy the whole of Meath, though its native king, O'Melaghlin, had recently submitted, and the grant illustrates the inevitable clash of feudal and Irish law. Meanwhile during the winter the Irish bishops met at the Council of Cashel and, after enacting various reforms, declared (according to Giraldus): "Divine offices shall be celebrated according to the forms of the Church of England, for it is just and right that as Ire-

land has received her lord and king from England, she should accept reformation from the same source." This of course was an inspired assurance of the task with which the papacy had commissioned Henry. The submission of the Church was complete, nor was it a packed assembly, for though Christian, bishop of Lismore and papal legate, seems to have been on Henry's side, Laurence, archbishop of Dublin, and the native prelates of Cashel and Tuam were present. Thus was Ireland presented to the English Crown as a papal fief; such was the basis of its authority till 1541, and the Irish themselves accepted the fact.

Meanwhile the adventurers were attacking Desmond, though its king had submitted to Henry; De Lacy was organizing Meath; and John de Courcy conquered in Antrim and Down a principality for which he could show no royal patent. Strongbow enfeoffed Leinster deeply with Normans, giving for instance the barony of Naas to Maurice Fitzgerald. Strongbow died in 1176, leaving only a daughter, who later married William the Earl Marshal and brought to him "the land of Leinster." Ulster and Connacht were still unconquered, and in 1175 by the Treaty of Windsor, Henry acknowledged Rory O'Connor as king of Connacht under him.

John as Lord of Ireland, 1175–1216.—At the Council of Oxford in 1177 Henry created his son John *Dominus Hibernie* and granted Desmond to FitzStephen and Milo de Cogan. Eight years later (1185) John himself visited Ireland. A fresh series of grants were made, and William de Burgh and Theobald Walter "le Botiller" got wide lands in north Munster, and Theobald de Verdun about Dundalk. The resentment of the Irish was shown in the assassination of Hugh de Lacy, and the lesson was taken to heart later in John's reign when Cathal Crovderg O'Connor, brother of Rory, was confirmed in the kingdom of Connacht and Donnchad O'Brien in that of Thomond west of the Shannon.

With John the lordship of Ireland was united with the English Crown, and to this king belongs the credit of first establishing a civil government at the expense of the conquistadors. He dispossessed De Courcy, and gave the earldom of Ulster to Hugh, brother of Walter de Lacy, earl of Meath, but soon repented of making this family too great, and in a personal campaign in Ireland in 1210 expelled them both. During his short stay in Dublin he organized a permanent government under a justiciar, and "with the common consent of all men of Ireland ordained that the laws and customs of the realm of England should be kept therein."

After his defeat over Magna Carta, John had to restore the Lacys, and the feudal caste under Henry III. bent its energies upon the subjection of Ireland. When Richard de Burgh got a grant of all Connacht in despite of the claims of Felim O'Connor, conquered it and divided it among his followers (1235), and Maurice Fitzgerald acquired a claim to Tyrconnell, a complete conquest seemed probable. But during this period two great native dynasties arose in Ulster, the O'Neills and O'Donnells, and they repelled the Norman attacks, finding a new and potent weapon in those professional fighters, the "Galloglaigh" or "galloglass" (a word meaning "foreign soldiers"), Hebrideans of mixed Gaelic-Norse blood who now began to flock into the north. On Connacht, however, the De Burghs kept firm hold, leaving to the O'Connors only a few cantreds of Roscommon. The power of this family was increased when in 1264, after the extinction of the Lacys, Walter de Burgh was created earl of Ulster. The native race, though only partly successful, now broke the spell of Norman victory. Brian O'Neill was elected high-king and raised a Gaelic confederacy, but was defeated and slain at Downpatrick in 1260. But the next year the MacCarthys overthrew a colonial army at Callann, and henceforth ruled undisturbed over south-west Munster, their chief taking the name MacCarthy More. So when Edward I., in 1276, granted to Thomas de Clare the "Land of Thomond," Turloch O'Brien took up arms, and the De Clares were finally expelled in the war which ended in 1318.

In the early years of Henry III. the central Government was steadily built up. Magna Carta was sent over, the whole framework of English law was introduced, and Ireland had an administration under the justiciar and a parliament of peers and prelates, while the county organization was extended over the planted areas.

Great numbers of the Gaels had fallen under Norman lords, and while some were already villeins ("betaghs") under the old system, and remained so on the new manors, many of the colonists tried to reduce all Irishmen to the same level. Those living among the English and suffering from a denial of English law strove to procure it, but though the Government was not unwilling, the colonists opposed emancipation. The Irish who lived under Brehon law had less desire to exchange it for English law, but under the pressure of the new domination they naturally aspired to have its legal advantages. The chiefs especially sought to have their tenures legally established under the Crown, a benefit which, except in a few minor cases, had been denied them. The royal Government was to blame for not embracing the Irish within the law by edicts rigidly enforced, but, indeed, to reconcile and blend two races so far apart in language and tradition was a huge task which only a resident monarchy could have achieved.

English Lordship at its Height, 1272–1307.—Under Edward I. a second attempt was made to create a real central authority, and a series of justiciars, of whom John Wogan, viceroy from 1295 to 1307, was the ablest, extended the area of common law and did something to reduce the feudal liberties. The baronial interest, however, was too strongly entrenched, and Edward had to placate it, so he added to the ranks of the magnates by giving "the land of Decies and Desmond" to Thomas, head of the Munster Fitzgeralds. Wogan's greatest achievement was to summon a parliament in 1297 in which knights and the common clergy were included, and nine shires and five liberties sent representatives. In 1310 the towns also sent deputies, and thus Ireland received a legislative body which lasted till 1800. It was an Anglo-Irish assembly in which the native race had no spokesmen.

A series of disasters now shook the ill-founded State to its very base. Fresh from his victory at Bannockburn, Robert Bruce despatched his brother Edward to win the Crown of Ireland, which a league of Irish chiefs under Donal O'Neill, *Rex Ultonie*, offered to him. When Edward Bruce landed with an army of veterans near Larne in May 1315, almost all the native race rose in arms, and not a few of the older stock of the Englishry joined Bruce. He defeated Richard the "Red Earl" of Ulster at Connor. On May day, 1316, he was crowned king of Ireland on a hill near Dundalk, "the Gaels of Erin proclaiming him king of Ireland," says the annals of Loch Cé.

The English cause was at last saved: Bruce failed to take Dublin, Felim O'Connor, at the head of a great Irish confederacy, was defeated and slain by a colonial levy at Athenry in Aug. 1316, and a new viceroy, Roger Mortimer, put spirit and energy into the Government. Bruce himself was overwhelmed at Faughart, near Dundalk, by an army under John de Bermingham and fell in the battle (Oct. 1318). The Scottish fire was thus quenched and Edward II. recovered a kingdom he deserved on every count to lose. Little or no vengeance was taken, and Mortimer was instructed to admit the aggrieved Irish to English law and liberty, an edict again without much effect.

The Irish Revival.—For a time all seemed fair and the peerage between 1316 and 1329 was strengthened by the creation of new earldoms, that of Kildare, given to John, head of the Leinster Geraldines, that of Desmond, given to Maurice, head of the Munster Geraldines, and that of Ormond, given to James Butler. In Ulster, the true key of the colony, the power of the earls now covered the whole coast from Carlingford to Derry. But an element of discord was found in the older colonists who resented the dominance of the great lords, claimed that succession should go to heirs male instead of heiresses who conveyed lands to English absentees, and began to form clans of their own (*naciones et cognomina*). In 1333 the young earl of Ulster, William, was murdered by his own tenants, the Mandevilles, near Belfast, leaving only a daughter who later was married to Lionel, duke of Clarence. The O'Neills became supreme in mid-Ulster and the greater part of Antrim and Down, where they founded a new State, Clandeboy.

Connacht was at the same time lost to the English interest. Two cousins of the murdered earl, Ulick and Edmund de Burgh,

seized on the family lands and founded respectively the Burkes of Clanrickard and Mayo, known to the Irish as MacWilliam Uachtair, "the upper MacWilliam," and MacWilliam Iochtair, "the lower MacWilliam." Though they maintained a certain English tradition of law and land-tenure, spoke French, and boasted their Continental descent, they were obliged amid so Irish a population to speak Gaelic and marry Irish wives.

As a result of such events an Irish revival alike in arms, language, law and civilization, displayed itself in every part of the island, and the Gaelic race recovered large parts of Ulster, the midlands, Connacht and Leinster. Even in the latter province the MacMurroughs became the terror of the lowland English and the descendants of Donal Kavanagh resumed the title "king of Leinster." Absenteeism here had left the lordships of Carlow and Wexford open to Irish attack.

Efforts to Restore English Lordship, 1333–1399.—Only a great army led by the king in person could have reconquered Ireland, and the young Edward III. had thoughts of coming over, but soon abandoned it for Scotland and France. The colony dwindled, and an Anglo-Irish parliament at Kilkenny in 1341, summoned without leave by the earl of Desmond, expressed its resentment against "the English by birth" who misgoverned Ireland, and complained of the decay of the revenue and the loss of

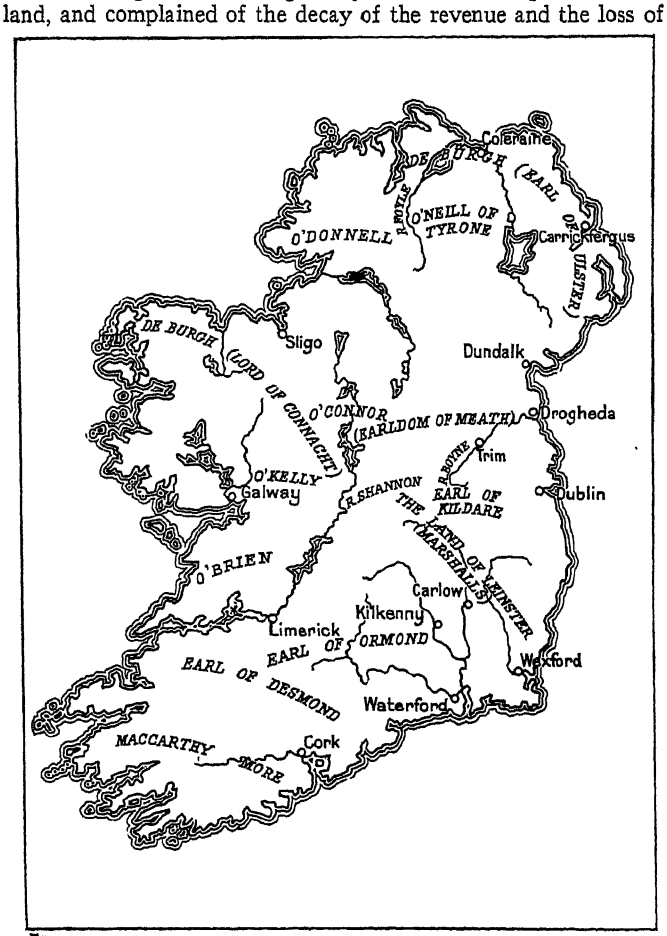


FIG. 3.—MAP OF MEDIAEVAL IRELAND, SHOWING THE LANDS OF THE RULING FAMILIES WHEN THE ENGLISH POWER WAS AT ITS HEIGHT, c. 1330

In addition to the counties governed directly from Dublin, several great earldoms had been created at this date; but that of Meath, belonging to the Lacys, had, owing to the extinction of this family, fallen into two portions, that of W. Meath (De Verdun) and that of Trim (Mortimer)

a third of the land to the Irish. The capacity of this "middle nation," "Irish to the English and English to the Irish," to turn into temporary rebels was often to puzzle England.

Finally at last a royal prince was sent, and Lionel, duke of Clarence, ruled as viceroy for six years (1361–67). The Statutes of Kilkenny are the one memorial of his rule. These enactments defined the "English" or "obedient" land as the counties and liberties of Louth, Meath, Trim, Dublin, Carlow, Kildare, Kilkenny, Wexford, Waterford and Tipperary. The decay of the colony was attributed to a general lapse into Irish language, law and habit, intermarriage and fostering, and the maintenance of Irish bards. Therefore the English were forbidden to make such alliances with the Irish or to use Brehon or "March" law, and along with the Irish who dwelt peaceably among them, were ordered to take English surnames, speak English, and follow English law and custom.

The purpose of these statutes was to preserve as large an area as possible for England at the cost of abandoning the rest. The king's sovereignty over the whole island was not renounced, but the independent Irish were henceforth treated as "Irish enemies," outside the pale of English law and loyalty, and unable to plead in or profit by the civil courts, to marry, purchase, possess or inherit land among the English. Up to the end of the 16th century the chiefs were held to have no right to their lands except by prescription and usurpation.

But nothing could recall the "degenerate English" from friendly intercourse with the *meri Hibernici*. The old Gaelic civilization, badly shattered in the 13th, recovered much of its strength in the 14th century, and with its music and poetry, the charm of its language and its women, and the aptness of its law, laid an irresistible spell on the older Englishry.

Lionel's only daughter marrying Edmund Mortimer, earl of March and lord of Trim, carried to him the earldom of Ulster, and this great lord came over as viceroy in 1380, but died prematurely. To buy off the Irish chiefs with Black-rents was now the poor device of the colonists, whose most dreaded foe was Art MacMurrough, king of Leinster. More than anything else, this chief's activities brought about the first royal visit since 1210. Richard II. arrived at Waterford in Oct. 1394 with a large army, attended by Roger Mortimer and other peers, and stayed in Ireland till May 15, 1395. His general policy for the "Irish enemies" was to secure their homage and confirm them in such lands as they had not "usurped," but with one exception; Art and his Leinster "urraghts" or vassals were to be induced to evacuate Leinster for other parts of Ireland and leave the province open to a new English plantation. This was achieved in both cases as far as paper went; almost all the ruling chiefs, headed by Niall O'Neill, *Princeps Hibernicorum Ultonie*, came in and did liege homage and entered into indentures with the king.

But on Richard's departure MacMurrough refused to fulfil his extraordinary bargain. Roger Mortimer, left behind as viceroy, was slain by the Wicklow Irish in 1398, and Richard in fury hurried over to Ireland again in 1399. His armies could do nothing against the light-armed Irish in their forests, and the unfortunate king returned to England only to meet his own doom.

The Great Earls, 1399–1452.—There is little of importance to record of the dwindling "English land" during the Lancastrian age. An occasional strong viceroy, such as John Talbot, afterwards the famous earl of Shrewsbury, could do little against the "Irish enemy," the "degenerate English," and the "English by blood," who resented government from Westminster. A hope of uniting the Celts and Englishry was found in Edmund Mortimer, now earl of Ulster, who came over as viceroy and received the homage of O'Neill and other chiefs, but died of the plague in 1425. The old English and the Gaels transferred their affections to his nephew, Richard, duke of York, and in the wars of succession in England were almost to a man for the White Rose.

In reality three great earls now ruled Ireland. James of Desmond brought the greater part of counties Limerick, Cork, Kerry and Waterford with their towns under his absolute rule, James "the White," earl of Ormond, was equally dominant in Tipperary and Kilkenny, and Kildare in Leinster. The three worked together, dominated the Dublin Government in spite of an "English interest" headed by Talbot, took the lead of an Anglo-Irish "Home Rule" party and built up a rampart of feudal independence which it took the Tudors later almost a century to break down.

Ireland and the Wars of the Roses.—"Aristocratic Home Rule" may till 1495, and indeed till 1532, be written over Anglo-Irish history. The Wars of the Roses were to the Old English an occasion to secure colonial independence. Richard, duke of York,

who came over as lord lieutenant in 1449, played up to the enthusiasm that was at once displayed for his person and name. All Ireland believed him to be the true heir to the English Crown and greeted with enthusiasm the hereditary claimant, who in return was expected to rule Ireland by Irish ideas. Hence, when he arrived as a defeated refugee in 1459, the Irish parliament greeted him almost as a king, but proceeded to declare that the land of Ireland was bound only by the statutes of her own estates. When his son Edward ascended the English throne Ireland seemed to have the king of her choice, and the earldom of Ulster was merged in the Crown.

James, earl of Ormond, taking the Lancastrian side, was executed after Towton, and his house attainted. His two brothers, successively earls, spent their lives in England, and a junior branch of the Butlers took practical possession of the Ormond lands.

King Edward had little love for an oligarchy which ruled Ireland under the guise of Yorkist loyalty, and all Ireland was appalled when a new viceroy, John Tiptoft, earl of Worcester, got Thomas, earl of Desmond, attainted "for treasons, alliances and fosterages with the Irish enemies," and had him beheaded (1468). But Edward was not in a position to go further, and after this exhibition of blood-letting, the government had to be left to the Anglo-Irish, and Thomas, earl of Kildare, ruled till his death in 1477.

Under his son, Gerald, called by the Irish "Garret More," the Kildare supremacy reached an almost royal height. Although only deputy for English princes who bore the empty titles of lords lieutenant, Gerald was, in effect, actual ruler of Ireland. The Old English were for him, his sister was wife to O'Neill, various daughters of his married Irish chiefs, and the Dublin parliament was at his beck and call. He had the revenues of Ireland and the appointment to offices; these went to his supporters and Irishmen ruled Ireland. So things stood when Richard III. fell at Bosworth.

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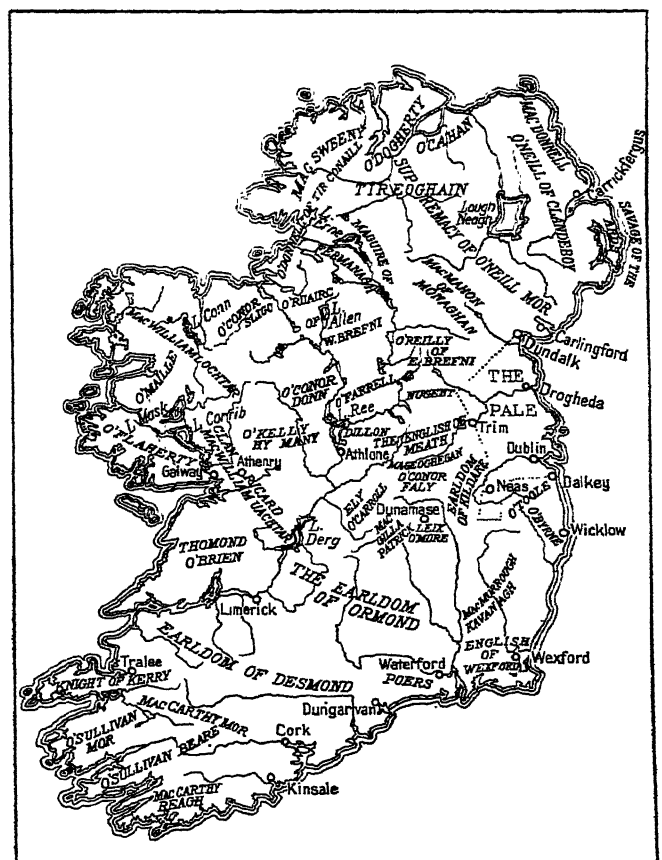
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(E. Cu.)

FROM 1485 TO 1800

The Kildare Supremacy, 1485–1534.—To the Ireland of 1485 the victor of Bosworth seemed a pure usurper, and a Plantagenet restoration was long hoped for. But by the year 1499 Henry was strong enough to attack the Anglo-Irish oligarchy. He removed Kildare and sent as deputy, in Oct. 1494, Sir Edward Poynings, who had Kildare attainted in a parliament at Drogheda and then proceeded to the task of restoring the royal power. The Acts of the Irish Estates of 1460, which proclaimed the legislative autonomy of Ireland, were annulled, and in their stead was passed the famous measure known to history as "Poynings' law," enacting that no parliament might meet in Ireland till the king, notified by the Irish Council of the necessity and the measures proposed, gave his approval under the Great Seal of England.

Among other acts of the parliament of Drogheda, one directed a ditch to be made around the nearer parts of Meath, Dublin,



FROM CURTIS "HISTORY OF MEDIAEVAL IRELAND"

FIG. 4.—IRELAND, CIRCA 1500, AS DIVIDED AMONG THE CHIEF LORDS, ENGLISH AND IRISH. THE PALE, OR AREA OF ENGLISH GOVERNMENT, IS INDICATED BY A DOTTED LINE

Kildare and Louth. Within this "Pale" alone, and in the towns and a few strips of coast elsewhere, were English law, speech and loyalty regarded as secure. Outside were the great earldoms, the "degenerate English" and the "Irish enemy." To break the power of the first, to recall the second to their allegiance, and to conquer or conciliate the third was to be the threefold task of the Tudors in Ireland. But it could not be undertaken yet. When Poynings departed in 1496, Kildare was restored and a general pardon was issued.

"This people of Ireland," said a later observer, "did ever, both English and Irish, love to be ruled by great persons." Garret More, who ruled Ireland till his death, in 1513, was such a personage. As deputy he controlled Dublin and the Pale, his earldom made him supreme in Leinster, and by vassalage, fee or marriage, he attached numbers of Irish chiefs to him, of whom the greatest were Conn O'Neill and Hugh O'Donnell. But his loyalty was dubious, and in his later years he was intriguing with Scotland against the young Henry VIII. His son Gerald, called "Garret Oge" ("the younger"), succeeded to this hereditary power, but to maintain it became an ever harder task. To the hostility of the Butlers was added that of Wolsey, who urged Henry against so overgrown a subject as "the king of Kildare." Gerald was again set aside, and the earl of Surrey came over as lord-lieutenant, for two years, in 1520–22. His reports, backed by such tracts as D'Arcy's *Decay of Ireland,* told the same tale; Kildare, "using the sword the king had committed to him to extinguish the fame and honour of any other nobleman within the land"; the Irish speech and habit universal, even in the Pale; the "March English" everywhere imposing on their tenants coyne and livery, quarterings of kern and galloglass and other such "Irish exactions"; the Irish, independent under their chiefs. Though Gerald was restored once again, the Butler-Wolsey alliance grew more dangerous, and when the divorce question began and Henry conferred the vacant earldom of Ormond on Sir Thomas Boleyn, grandson of the last earl, and made Sir Piers Butler earl of Ossory, it seemed impossible for him to escape. Yet so astute a man might have weathered through even yet but for a young and foolish son. Recalled to London in 1534, Gerald instructed his heir, Thomas, Lord Offaly (called "Silken Thomas"), to be ruled by the wise heads of the council. The Butler faction spread the rumour that Kildare had been done to death, and Offaly at once flew to arms. His father did, indeed, die in the Tower, but with mortification and dismay; a new deputy, Skeffington, arrived, and Thomas, while barring himself from pardon by offering Ireland to the emperor and declaring himself of the pope's sect against the heretic Henry, had finally to surrender at discretion, and in 1535 was executed at Tyburn with five uncles.

The Reformation of the Irish Church.—The new policy in Church and State could now be carried through, and henceforth English viceroys and obsequious Anglo-Irish officials directed the Government. Grey summoned a parliament in 1536–37, which declared Henry supreme head of the Church and voted the dissolution of the abbeys. It is certain that almost no desire for such "reformation" existed in Ireland; lords and chiefs might accept bribes of monastic lands, but even at the end of the reign scarcely any abbeys had been dissolved outside Leinster, and not till 1607 could those of Ulster be confiscated. Within the region of the Pale the abbeys were centres of English education, speech and civility; outside, they were the home of Gaelic culture, and civilization in general suffered by their extinction. George Browne, an Englishman, was sent over as archbishop of Dublin, to preach the royal supremacy and, before the end of the reign, some 14 or 15 of the older bishops temporized and accepted it, in the belief that the Church was still Catholic.

On its civil side the new policy had much support, not only in Piers Rua, who was at last created earl of Ormond, but in great numbers of the rural tenantry, desirous of being released from the exactions of the great lords. To recall the Old English to their natural allegiance was no insuperable task, and had the Tudors never abandoned the old faith it is probable that they would have commanded the entire loyalty of the "first conquerors." When, however, the Reformation began in earnest the Old English grew steadily alienated, and the introduction of new colonies became the royal policy.

Towards the Gaelic chiefs Henry adopted the plan of surrender and re-grant, by which they could surrender the lands they held and receive them back on tenure of knight-service to the Crown. To the great ones he offered to grant titles, but in return they must accept him as supreme in Church and State. St. Leger, who came as deputy in 1540, pointed out that a new title must be found for the Crown in Ireland, "for of long continuance Irishmen have supposed the regal estate of this land to consist in the bishop of Rome and the lordship of the kings of England here to be but a governance under the obedience of the same." Accordingly a parliament was summoned in June 1541, and six Gaelic chiefs approved the act that made Henry king of Ireland.

By the skilful handling of St. Leger, Manus O'Donnell accepted Henry as his lord and king, renounced the pope's authority, consented to serve the deputy with an agreed number of horse and foot, and to accept whatever title the king should give him. Conn O'Neill surrendered his ancestral claims, accepted Henry as king, and in 1542 was made earl of Tyrone; Murrough O'Brien became earl of Thomond, and Ulick Burke, earl of Clanrickard.

Ireland Under Edward VI. and Mary.—Under the two Protectors the Reformation was pushed on apace, and the anger of the common people at the destruction of monasteries and the plunder of the Church was now shared by the great. Dowdall of Armagh, though one of Henry's bishops, defended the mass, and only five Protestant bishops held their ground, of whom most active was the Englishman, John Bale of Ossory, a Genevan reformer.

On her accession, the Catholic Mary retained the title of queen of Ireland, but had to leave the abbey lands to the grantees. St. Leger became deputy again, Dowdall returned, and, as a part of the general reconciliation, the exiled Gerald was restored to the earldom of Kildare. But in spite of religious unity, there was little peace. Henry had begun the policy of trying to rule the further provinces through the new earls, but these were opposed by the vested interests of those who preferred the old order, in which the O'Brien or MacWilliam was but an elected captain of his "nation," holding for life, not an hereditary official landlord. This was especially seen in the North, where Shane O'Neill, claiming to be Conn's eldest legitimate son, came out as champion of the old Gaelic order, preferred being "the O'Neill" to any English title, and opposed his brother Matthew, baron of Dungannon, whom he declared to be a bastard. The conflict of State feudalism and Gaelicism became general. In Leix and Offaly, where O'More and O'Connor Faly were sovereign, a determined stand was made against the extension of English law, and after a long border war the Government decided to annex and partly plant these areas. Lord FitzWalter, afterwards earl of Sussex, replaced St. Leger in 1556, and with him a policy of confiscation and plantation was adopted. The two lands were shired as King's and Queen's counties and divided into an eastern more fertile area, in which Englishmen were to be planted, and a western area, which was to be left to the natives holding by common law tenure.

The Elizabethan Reformation.—Elizabeth succeeded to the throne in Nov. 1558, and under the earl of Sussex the State religion was finally established. In a parliament of 1560, which represented ten counties and 28 towns, the Acts of Supremacy and Uniformity were passed and recusancy fines were imposed. Outside Dublin the supporters of the Established Church were a handful, and it soon became clear that the Old English were even more determinedly Catholic than the Irish. As loyal subjects their position was strong, and a constitutional resistance was successfully waged by the lawyer class, who were strong in the Commons, the town corporations and even the Government.

Ireland, with its feudal and Gaelic lordships, was a standing offence to a centralizing monarchy, and to extend the shireland and introduce sheriffs, garrisons and English law became the avowed object of the Tudor Government. But every such extension, which had to proceed piecemeal, met the opposition, alike of the chiefs and the Old English lords; and the resistance of the Gaelic population was the more deadly of the two, for their military resources were greater, their native civilization was dearly cherished, and their hatred of the Saxon was deeply rooted. The greatest of these captains, Shane O'Neill, was, in native eyes and, almost, in fact, king of Ulster. From the four counties, Tyrone, Derry, Armagh and Antrim, where he was overlord, his ambition was to rule the whole province, and after Matthew, baron of Dungannon, had fallen in an affray, and his son Hugh was taken to be educated with the earl of Leicester

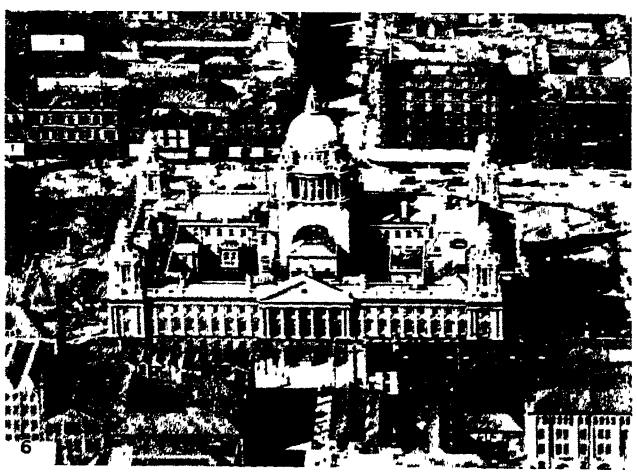












BY COURTESY OF (1, 3) LONDON, MIDLAND AND SCOTTISH RAILWAY; PHOTOGRAPHS, (2, 4) E. M. NEWMAN, FROM PUBLISHERS PHOTO SERVICE, (5) EWING GALLOWAY, (6) AEROFILMS FROM EWING GALLOWAY

RURAL AND URBAN SCENES IN IRELAND

1. View of Glendalough, "The Glen of Two Lakes," Co. Wicklow, Ireland. Known as the "Town with the seven churches," because of the group of early Celtic churches established here by St. Kevin
2. The Giant's Causeway, about three miles from Dunluce, Ireland. Cliffs of basalt make a bay from the centre of which shoots out this natural mole, compacted of huge basalt crystals
3. O'Connell street, Dublin. Formerly the thoroughfare was known as Sackville street but when the O'Connell monument was erected in 1880 the name was changed
4. Working in the peat bogs of central Ireland
5. Kilmessan Village, near the hill of Tara, County Meath, in the province of Leinster
6. Air view of Belfast, the metropolis of Northern Ireland, showing the City Hall

and in Elizabeth's court, Shane had the field to himself. He proceeded to subject O'Donnell on one hand and the Scots of Antrim on the other, and having been invited over to court in 1562, he so flattered the queen with his Irish tongue that he returned in triumph as "The Lord O'Neill." When Sir Henry Sidney arrived as deputy in 1565 the power and influence of Shane overshadowed all Ireland, but in a rash attack on Hugh Duv ("the Black"), chief of Tyrconnell, he was routed at Farsetmore, and, flying to his enemies, the MacDonnells, was by them murdered in 1567.

The Desmond Wars.—Desmond was an "Old English" regality as Tyrone was a Gaelic State. The new earl, Gerald, was deeply suspicious of the "forward policy" which menaced his palatine authority. He and Thomas, earl of Ormond, were hereditary enemies, and after a pitched battle at Affane, in 1564, they were summoned to London, where Desmond spent many years of semi-captivity till 1573. The Geraldines, therefore, took as captain the earl's cousin, James "FitzMaurice" FitzGerald, who planned a league which should defend at once the earl's "liberties" and the Catholic faith. Exclusion from office under the Oath of Supremacy was now alienating the "English of the Pale," and religious discontent was fanned by the Jesuit missions, which, from 1561, were many and determined. Catholic Ireland had its colleges at Douai, Salamanca and Louvain, and if rebellion needed the highest sanction it was found in the papal bull of 1569, which excommunicated Elizabeth and released her subjects from obedience. It was unfortunate that at such a time the Government allowed Sir Peter Carew, a Devon gentleman, to get legal possession of wide lands in Carlow and Cork in virtue of very musty pedigrees. With him began the age of the adventurers and land-speculators, the Raleighs and the rest, and Old English and Irish now felt that even their property was insecure. FitzMaurice was accordingly able, in 1569, to kindle a widespread revolt in Munster and Leinster, which Sidney, Carew and Gilbert stamped out with a severity that set the note for future "pacifications," and FitzMaurice submitted in 1573.

Six years later he was the leader of a new war in Munster. The Continental side of it was organized by the Spaniard, Oviedo, later "titular" archbishop of Dublin, but though the pope offered spiritual assistance, Philip gave little or no material aid, and FitzMaurice had but a small band with him when he landed in Kerry in 1579. With him was the English Jesuit, Sanders, who proclaimed a plenary indulgence for all who would fight against "Elizabeth, pretended queen of England." There was a widespread rising, but the only man who could have made it formidable disappeared when FitzMaurice fell in a petty affair at Castleconnell. The earl himself was driven into rebellion, and 800 Italians, sent by the pope, were besieged at Smerwick by the deputy and, after surrender, pitilessly massacred. Desmond was hunted down and killed and the South was pacified by the usual methods. Confiscation was henceforth to follow the horrors of war, and while the earl and his chief followers were attainted, some 600,000 acres were declared forfeit. In the end only some 200,000 were granted to newcomers like Raleigh.

Ireland was now so "pacified" that even in the year of the Armada she scarcely moved. Sir John Perrot, deputy from 1584 to 1588, encountered in the parliament of 1585 a strong and well-led "Recusant" party, but though Archbishop Loftus urged enforcement of the penal laws, the gallant and tolerant viceroy refused to force men's consciences. He was empowered by this parliament to make, with the chiefs and gentry of the West, "the composition of Connacht," by which they were confirmed in their immediate demesnes with rents from the rest of their "countries" in lieu of feudal and Irish regalities, and to serve the deputy in arms, pay rent to the Crown and hold by English tenure. The result was that Connacht, under its Gaelic and Norman proprietors, remained, on the whole, loyal up to 1640.

The Tyrone War, 1594–1603.—One of the last acts of Perrot was to have the young Red Hugh (Aodh Ruadh) O'Donnell kidnapped and sent to Dublin Castle as a hostage for the loyalty of his father, Hugh "Duv." The results were disastrous, for, up to now, the O'Donnells had been allies of the State, but the alliance was now shattered. After five years Red Hugh escaped to become "the O'Donnell" and the hero of Gaelic Ireland. Ulster was the last stronghold of the Celtic order which the State had determined to extirpate, and the northerners had always been the proudest and most warlike of the Irish, and when, therefore, under the new shiring order, a sheriff was set over Fermanagh it was not long before his "firm" methods drove Maguire into revolt, whereupon this chief was proclaimed traitor.

Red Hugh was naturally for Maguire, but it was uncertain what part Hugh O'Neill, now earl of Tyrone, would take. He, too, had to fear the extension of "English order," which would menace his hereditary lordship; he resented the religious and civil oppression of his country, and when, finally, he threw in his lot with O'Donnell, in 1594, the Government had to face the greatest opponent and the most formidable rising it had yet met. Tyrone and O'Donnell talked mainly of their ancestral rights and of religious tolerance, but at the same time they wrote to Philip asking for 6,000 men, and begging that an archduke might be sent as king.

Finally, the victory of the Blackwater, in Aug. 1598, over Marshal Bagenal, made O'Neill a hero of the Counter-Reformation. While Red Hugh overran Connacht, Tyrone descended into Munster, the new colony vanished like a dream, and a league of Irish and Old English, under James Fitzgerald, the so-called *sugan* (straw-rope) earl of Desmond, took the field. In 1600 the insurgents throughout all Ireland were reckoned at nearly 20,000, but O'Neill knew they could not take cities or hold the sea without Spanish aid.

After the failure of Essex in 1599, Charles Blount, Lord Mountjoy, proved the Scipio to the Irish Hannibal, and the tide was turned less by battles than by devastation and massacre. At last Don Juan d'Aguila arrived with 4,000 men, the Ulster chiefs marched to meet him, and the issue was decided at Kinsale. A rash attack by O'Donnell ended in the rout of the Irish, D'Aguila surrendered, O'Donnell sailing to Spain for more aid, died there, and O'Neill cut his way back to the North. Finally, he submitted to Mountjoy in April 1603, and going over to court was pardoned and restored by the new monarch, James, while Rory O'Donnell, brother of Hugh, was created earl of Tyrconnell.

With this fight Celtic and Norman Ireland passed. A new Irish nationality had emerged, Catholic by conviction, a blend of English and Irish in race, and in the upper ranks, English-speaking. How to reconcile this with a Protestant Government was the problem.

James I., 1603–25.—On the religious question the policy of James was a guarded toleration in the spirit of *"quieta non movere."* The royal prerogative was still supreme, especially in Ireland, and a series of viceroys, such as Chichester (1605–15), exercised it in the interests of that large majority which it seemed now almost hopeless to convert. The opposition of the Catholic party, led by "the lords of the Pale," and the lawyers, was constitutional and loyal; it was impossible to debar "Recusants" from parliament, even if the oath of supremacy barred them from government, and in the older towns this party was so strong that up to 1624 every one had a Catholic mayor. Could James and this moderate element have had their way all might have been well, but the ultramontane spirit on one hand and the Puritan on the other made plain sailing difficult. The Established Church in Ireland was for "strong measures," and, on the other hand, when James proposed a simple oath of allegiance for Recusants, by which they should repudiate the supposed right of the papacy to depose heretic kings, two papal briefs in 1606 declared the proposed oath unlawful for Catholics.

Roman opposition also made the success of the new university at Dublin, founded by Elizabeth in 1591, but a partial one. A centre of disinterested learning would have been a force for reconciliation; but that it was not so intended became the general belief, and it was spoken of as "the college of the heretics near Dublin," and though at first there were no tests, Catholics preferred to seek education abroad. The statutes of Archbishop Laud confined its advantages to members of the Established Church, and though a few Catholics frequented it, disabling tests till 1793 barred them

from fellowships and degrees. As an active centre of learning, however, Trinity college could not fail to illuminate the country which it belonged to and from which it was richly endowed.

The Plantation of Ulster.—Though the earls of Tyrone and Tyrconnell had been restored in 1603, their new position was full of difficulties, for Ulster was now shireland, subject to sheriffs and garrisons hateful to its ancient lords, and Tyrone, involved in disputes with bishops, officials, grantees and his former vassals, complained that strong forces at Dublin were against him. At last the aged chieftain resolved to quit the field. Whether he and O'Donnell were guilty of plots to raise a new rebellion cannot be proved. In Sept. 1607, along with Tyrconnell and nearly 100 more chiefs of the North, he left Ireland for ever. The "flight of the earls" was a mortal blow to the Catholic interest and the old Gaelic tradition. Celtic Ulster was now to become the most British of the provinces, and the lament of the Four Masters over the passing of the earls is indeed the swan-song of the Gaelic world. With these devoted scholars, who laid down their pens in 1616, were silenced also the voices of the Gaelic brehons, poets and historians, and by 1700 only the Irish language, which the gentry were then forsaking, remained a visible memorial of a world that went back 2,000 years.

A plantation of Ireland was now urged on the ground that, without a strong Protestant population, neither would the State be safe nor the State Church have congregations. The earls and their adherents were found guilty of treason, and by legal processes six counties were declared "escheated." By the final plan (1609) the escheated lands were divided between undertakers, servitors, and "natives." Undertakers, mainly English, were to lease only to English and Scottish tenants, and take the oath of supremacy. Servitors, mainly Scots, might take Irish tenants, but if so their rents to the Crown were increased. Native Irish grantees were to pay quit-rents twice as large as the undertakers, but need not take the oath. Of these a good number received grants of thousands of acres, and several junior branches of the O'Neills and Magennises, etc., survived as large landlords, though no longer as "Irish chiefs." But the colonists entered upon the best lands, and the lesser ranks of Irish were reduced to the position of tenants-at-will, for Sir John Davies, the solicitor-general, found, by a most iniquitous decision, that they had had no freehold rights under their attainted lords. The town of Derry was given to the City of London, and the London companies received grants which gave them practically all that county.

The practical success of the plantation was great, and for the first time a large part of Ireland was not merely owned by Saxon landlords, but was tilled and farmed by Scottish and Protestant farmers. The Irish population were numerous in the mountainous parts, and their natural disaffection was kept alive by hopes that Tyrone or another would return, but on the surface, at least, they seemed no longer a danger. (*See* also PLANTATION.)

The success of the Ulster scheme led to plantations in North Wexford, Longford, Leitrim and elsewhere, where, though the natives were treated with more equity, again the object of the Crown lawyers was to find that most of the Irish were not freeholders but tenants-at-will. The new English were dominant; adventurers and speculators such as Boyle, earl of Cork, and other moneyed men, displaced the old aristocracy; 39 new boroughs, carefully rigged, could be counted to offset the old towns, and several of the Old Irish, such as the earl of Thomond, had become Protestant.

In the parliament of 1613–15, summoned by Chichester to ratify the Ulster plantation, the Government engineered a small majority, partly through the new close boroughs, but the minority could claim that they spoke for 21 counties and 28 ancient boroughs in this first general representation of the kingdom. After failing to get their choice as speaker, the Opposition petitioned the Crown, and James saw a deputation of Old English peers and commoners, who complained of religion, the new boroughs, and the rigging of elections. James thoroughly enjoyed himself and declared "What if I had created 40 noblemen and 400 boroughs?—the more the merrier," and, as regards religion, "the pope is your father *in spiritualibus* and I *in temporalibus* only; you are but half-subjects and therefore only entitled to half privileges." The upshot was that 11 boroughs were disfranchised; James spoke some fair words and continued the *laissez faire* policy on religion, and parliament voted a large subsidy. The Recusants, though called "Old English Irelandized," were, in fact, loyalists with a religious grievance, but they had their left wing, and this veered steadily towards armed protest. The Continent was full of Irish exiles, soldiers and priests, and among these both the Old English and the Old Irish had their heroes. In spite of her troubles, economically Ireland benefited from a period of peace. Agriculture recovered; the settlers brought in their skill and enterprise; and the manufactures started by men like the earl of Cork made Ireland something of an industrial country.

Charles I., 1625–49.—With the second Stuart came the idea of raising men and money in return for religious concessions. The deputy, Falkland, was allowed by "the Graces" to promise various concessions, such as that Catholics might practise at the bar, and that where land-titles, like those of the Connacht gentry under the Composition of Connacht, were lacking in legal confirmation 60 years' possession was to be held good against the Crown. From agents of the Catholic party Falkland secured a pledge of subsidies amounting to £120,000. But when the agents reached London they found a strong anti-papist spirit there, under pressure of which Charles gave way. He dropped the "Graces" but exacted the subsidies, though no parliament was called to ratify them.

To make Ireland first prosperous and then to use her in the royal interest against Puritan opposition was the idea of Wentworth, later earl of Strafford, viceroy from 1633 to 1640. He set himself to break the power of the great and the monopolists, making the Court of Castle Chamber into a Star Chamber for Ireland. While he wrested power from the anti-Irish clique in Dublin, he had no sympathy with Irish or Catholic complaints, and looked on religious concessions merely as policy. Similarly, his aim in making Ireland rich and prosperous was that out of a surplus revenue he might enrich his royal master, and the first-rate army that he raised largely from Catholics and natives was destined, if need be, to serve in Britain. Among the strongest measures of this satrap were the extracting subsidies of £50,000 from parliament, and then denying all but the least important of the "Graces," forcing the juries of Connacht to find a title there for the king, with a view to a fresh plantation, and attacking the London companies. But the policy of "Thorough" ultimately failed, and when Strafford was assailed in England all the interests he had offended in Ireland joined in the general impeachment that brought him to the scaffold in May 1641. His army was disbanded and the control of the Government passed under Puritan lords justices.

The War in Ireland, 1641–49.—A rising in Ulster was inevitable. The Irish there had local leaders of the old stock, such as Sir Phelim O'Neill, and still more abroad, where Owen Roe O'Neill, nephew of Tyrone, was in Spanish service. In the South the native party found a leader in Rory O'More, who planned a union of Old English with their religious grievances, and the Irish who had lost vast estates. A plot to seize Dublin Castle failed, but the rising in Ulster was general (Oct. 1641) and thousands of colonists were murdered, died of ill-treatment, or fled.

For the suppression of "the Irish war," the English parliament at once voted an army, but in order to find the money offered to the adventurers or subscribers of £1,000,000 the pledge of two and a half million acres of profitable lands which were to be confiscated. Naturally, the dread of confiscation, coupled with a belief that the Puritans meant to extirpate their religion, drove more and more Irish into arms. A Catholic confederacy was formed at Kilkenny in May 1642 "to defend religion and the king against sectaries, and establish the Catholic religion as fully as at any time since Henry VII.," and soon after Preston and Owen Roe arrived from abroad, the first to lead the confederates, and the second the Ulster forces.

The history of the next seven years is a complicated one. There were forces for the parliament in Ulster and the south, Scots under Monroe in the north-east, an Ulster army under O'Neill, the confederates in Leinster, and Protestant loyalists under Charles' lieutenant-general, James, marquess of Ormonde. As Charles'

cause declined, he offered the confederates terms hardly meant to be kept, and while a moderate party at Kilkenny favoured him, an ultramontane party, backed strongly from abroad, preferred foreign aid, and brought in Rinuccini, bishop of Fermo and papal nuncio, in 1645. This Italian priest's intervention stung English opinion into pitiless fury, but for a time his was the stronger party, especially after O'Neill, whom he favoured, defeated Monroe at Benburb in June 1646. The "Ormonde peace" of that year offered the confederates wide concessions, but Charles' cause was already lost and the nuncio's party denounced the peace, so Ormonde, who preferred "to surrender Dublin to English rebels than Irish ones," finally handed the capital over to Col. Jones, commander for the parliament, and left Ireland in 1647. The nuncio departed in Feb. 1649, and, on the execution of the king, Ormonde returned in the hope to rally all Ireland for the young Charles. But in an attempt to recover Dublin he was defeated by Jones, and when Cromwell himself landed as lord-lieutenant for the parliament his victorious campaign broke the back of the Irish resistance, though it lingered on till 1652. O'Neill died in November, and part of the Ulster army, under his nephew, Hugh, gallantly repulsed Oliver at Clonmel, but other armies won little credit and Ormonde left Ireland finally in Dec. 1650.

The Cromwellian Régime.—Ireland had been conquered by an English faction to whom Irish papists were odious, both in race and religion, and she had now to pay for her own conquest. Not only the "adventurers," but the conquering army also were to be paid in Irish land. Under the rule of Fleetwood and by an Act of Settlement at first ten counties were appropriated to soldiers and adventurers and later others were added. The English parliament, which disavowed any intention to "extirpate that whole nation," divided the population into ten classes, of which the first five were excepted from pardon for life or estate and even "Innocents" found it hard to retain more than a portion of their estates. But such a plan involved a removal of the occupiers and by a scheme of transplantation the former landowners with their families and retainers were ordered to move into Connacht, where land was provided for them, generally though not always of inferior quality. The chief effect of the Cromwellian plantation was to impose a new English and Puritan landlordry on Ireland.

Charles II. and James II.—The monarchy was restored in Ireland by the Cromwellians Broghill and Coote, and this gave the keynote to the resettlement. The Irish had lost all at the hands of sectaries and republicans and supposed that theirs would be the favoured side, but the real division was now between English and Irish, and Charles had to say to them "my justice I must afford to you all, but my favour must be placed upon my Protestant subjects." Ormonde as lord-lieutenant made a great fight for his fellow-countrymen, and finally by the English Act of Settlement the Cromwellian party consented to surrender one-third of the lands in dispute, but 5,000 claims were left unheard. Roughly the old proprietors now held one-third of Ireland; in population the Catholics were about 800,000 to 150,000, but in the corporations, parliament and Government they scarcely counted at this time. Much, however, was done to restore Catholics to the corporations, and their numbers and influence steadily grew. The "popish plot" of 1678 brought on a terrorism to which Archbishop Plunkett fell a victim, but on the return of reason toleration was resumed and the Irish later looked back on Charles' reign as a golden age.

In James II. Ireland found a king who could be trusted to restore the faith and might be induced to repeal the detested Act of Settlement. For over a year the earl of Clarendon acted as viceroy, but his royal brother-in-law balanced him by Richard Talbot, whom he created earl of Tyrconnell, an Irishman and Catholic who first as lieutenant-general and then as sole lord deputy increased and remodelled the Irish army, officered it with Catholics, secured the garrisons and admitted his co-religionists into the Council, the corporations, the shrievalty and the highest legal offices. Ireland for a time was truly a Catholic kingdom and Tyrconnell planned an independent parliament to repeal at once the penal laws and the Act of Settlement. From the military point of view his mistake was in not securing Ulster, and so when James' cause collapsed at the end of 1688, though a great Irish army was in the field, Derry, Enniskillen and other places became cities of refuge for a Protestant population ready to fight for William.

William III.—In March 1689 James himself landed from France, with officers, money and arms from Louis XIV., but no men. Catholic Ireland could provide these in plenty, but only on terms. When James, in May 1689, summoned what was practically a Catholic parliament to Dublin he announced liberty of conscience for all and some relief for sufferers by the Act of Settlement, but parliament totally repealed the hated act and so restored the heirs of those dispossessed since 1641. An act of attainder was passed which included some 2,400 persons supposed to be supporters of the prince of Orange. As for religion, Catholics and Protestants were to pay their tithes to their own clergy.

The successful stand and relief of Derry was a prelude to the wider operations in which first Marshal Schomberg and then William himself landed at the head of professional armies. On the other hand, a French force arrived to help the Irish. The battle of the Boyne was won and lost on July 1, 1690, and James returned to France, leaving the Irish to ruin themselves in his cause. At least the gallantry of Sarsfield and the heroic stand of Limerick illuminated the last fight of Catholic Ireland as a nation in arms. At Aughrim in July 1691 the issue long hung in the balance until the French commander, St. Ruth, fell, and Ginkel carried the hill. Tyrconnell died, and Sarsfield finally capitulated on terms at Limerick on Oct. 13. By "the Articles of Limerick" the Irish Catholics were guaranteed the religious liberty they had enjoyed under Charles II. and all officers in arms and those under their protection in the five western counties covered by the terms were to retain their estates and professions under a simple oath of allegiance "and no other." William was to have the terms ratified by parliament and do his best to get those who had been attainted restored to their estates; this latter clause was omitted in the signed articles but restored by William. Officers and men who would not take the allegiance oath might depart for France; 7,000 did so, and among the flower of the Irish aristocracy who sailed away was Sarsfield. William was a tolerant man and, after all, the Irish had but served the king *de jure;* but he had now to divide his prerogative with parliament, and while he strove to keep the spirit of the treaty, the parliaments of both islands ratified it in less than the letter: Irish opinion has always called it "the violated treaty." The English Whigs meant to keep the Irish Protestants in the saddle and a Test Act of 1691 was extended to Ireland which excluded Catholics from the Dublin parliament. In 1697 this body ratified what remained of the treaty, but William had to drop the "omitted" clause and abandon the stand he had made for justice. Finally, in 1699, the English Houses confirmed the settlement by which some three-quarters of a million acres passed to new owners. Thus the third conquest of Ireland within a century was achieved. The most illustrious names of the Irish nation disappeared from their country by attainder, death or voluntary exile. Those that remained owned only about a seventh of the soil. The middle classes suffered exclusion from the corporations, trades and professions and the penal laws began with acts of the Dublin parliament in 1695 and 1698, which debarred conscientious papists from wearing arms, teaching publicly, and practising the law.

English arms and statutes had given the Protestant ascendancy the title-deeds of Ireland but at the cost of their own political and economic subjection. Under Charles II. English acts had debarred Ireland from the colonial trade and prohibited the import of Irish cattle into England. Now an act of 1699 ruined the export trade in Irish woollens; Ireland retained the provision trade with Europe and America, and William encouraged the linen industry.

The Penal Laws.—The new ascendancy, full of memories of '41 and '89, was bent on treating the Jacobites like a beaten enemy. The land settlement as made under Charles II. and William was final, and Catholic landowners must keep what little they had and no more. The penal code, by which the majority was rendered powerless to rise again, was mainly passed in the years 1702–15. The acts that concerned the landowners forbade them to acquire freehold other than by inheritance or to take leases of more than 31 years at a crushing rent. By the "Gavelling Act" if the eldest son conformed he succeeded to the whole estate, other-

wise it was equally divided, and this, more than anything else, served to extinguish this class, who either conformed or were impoverished by subdivision. The Catholics in general were barred from trades and professions, education, office (great or small), juries, the electoral vote, the right to arms and a horse.

Feeling against the Presbyterians of the North was hardly less strong in the Episcopalian ascendancy. A Test Act was passed against them in 1703, but after the accession of George I. the "Regium Donum" was restored to their ministers and a Toleration Act allowed them to worship freely and hold petty offices. Though this Protestant democracy was debarred from parliament and from the government of the country, their lot could not be compared in severity to that of the papists, with whom, however, they shared the grievance of riches paid to a Church they both detested.

George I. and II.—With the Hanoverian succession the last hopes of the Jacobites faded away. For the old Irish nation the next half century was a time of oppression, despair and decay: the great exodus of the gentry and the more adventurous spirits to join the Continental armies was balanced by emigration of the poorer Protestants ruined by heavy rents and the commercial acts. The penal laws steadily crushed the upper classes and by 1780 some 4,000 of them had conformed. The old landlords had been the protectors of the Gaelic poets and scholars and naturally as they decayed or joined the ascendancy the old native culture declined, but a new race of poets took the place of the old aristocratic *literati*, using popular language and sharing the lives of the peasantry. Such histories as Lecky's, however excellent on Anglo-Ireland, fail to discern the strong current that ran, half underground, among the Gaelic-speaking people of poetic memories and hopes for a future in which now the Stuarts, now the French, would come over to restore "the Dark Rosaleen." Such feelings were not merely poetic; they were kept alive by unjust laws and what was perhaps the worst land-system anywhere in Europe. Hence those embittered agrarian movements of the "Whiteboys" and the like, which were not all confined to the Catholic peasantry.

The Protestant ascendancy of Ireland now began to resent their political and economic subjection to English interests. The constitutional and legal benefits of "the glorious revolution" had not been extended to Ireland, and while in England the sovereignty of parliament had been established, that of Ireland was shackled by Poynings' law; ministers were responsible only to England, and in 1719 by the Declaratory Act the imperial parliament affirmed its right to legislate for the sister island. The Dublin legislature became a mere dependency, hardly representative even of the Anglican minority.

How to keep Ireland at once dependent and secure was a question the Imperial Government solved for 50 years by putting power successively into the hands of such men as Archbishops Boulter and Stone, both Englishmen, who "managed" the country in the "English interest." The régime had its merits; government was cheaply run, the national debt kept low, and the surplus revenue used to beautify Dublin and develop the country. Economic progress made itself visible, an influential class of rich Catholic merchants appeared, and the wane of Protestant bigotry on the one hand and the ultramontane spirit on the other made toleration possible.

The "Patriot" Movement, 1760–82.—A political party now appeared among the Protestants, inspired by Locke, Molyneux, Swift and Berkeley, which found its leaders in Flood and Grattan. On the other hand, the British Government was ready to make concessions. The viceroy Townshend (1767–72) was instructed to offer an Octennial bill limiting the duration of parliament, and Harcourt continued the policy with the purpose of procuring troops from Ireland for the American War. After Saratoga, the "restrictive acts" had to go; at the same time the Imperial Government encouraged the Irish Protestants to relax the penal code and in 1778 the Catholics were allowed on a simple form of oath drawn up by the Catholic Association to inherit land and take leases like Protestants, while the "Gavelling Act" was repealed. The events of the American War put Ireland for the first time into Irish hands, but now it was a "Protestant nation," and 80,000 volunteers raised under Charlemont boasted themselves "the armed property of the nation." Free trade with the colonies was won by Flood, and Grattan moved the famous declaration: "no power on earth but the king, lords and commons of Ireland is competent to bind Ireland." The volunteer convention at Dungannon emphasized these demands and the view was general that without legislative autonomy there was no security for Irish rights. The Imperial Government gave way and an act of the Irish parliament was confirmed, amending Poynings' law and providing that bills duly enacted and sent to England should be returned without alteration under the great seal and receive the viceroy's assent. At the same time the Test Act for Protestant Dissenters was repealed and by Gardiner's Relief bill of 1782 Catholics were allowed to purchase lands freely and have their own schools.

The Irish Constitution 1782–1800.—The "Constitution of 1782" was completed by the Renunciation Act of the next year, by which England admitted the claim of the people of Ireland to be bound only by their own laws and courts. But Irish ministers were still appointed by and were responsible to the imperial authority; they could not be turned out by vote of the majority, and though Fitzgibbon and the rest were Irishmen, Grattan, Flood and their party remained a mere Opposition, and legislative autonomy without responsible government and electoral reform proved vain.

Popular support was needed for the new constitution and Flood and Charlemont sought it in a reform bill which would have created a Protestant democracy, while Grattan aimed at an extension of the franchise to Catholics and the admission of their gentry to parliament. But both were thwarted by the narrow clique which under Fitzgibbon (Lord Clare) controlled the Government and resisted pressure alike from Ireland and England. Pitt's attempt to carry a commercial treaty and the Regency dispute emphasized the difficulties created by the constitution, but it might have survived long (for Ireland as a result of commercial freedom, bounties and Foster's corn law was progressing rapidly in wealth, manufactures and agriculture), had not the war with France brought on a situation which grew ever tenser. "French principles" spread among the Presbyterians, the Catholic Association passed into the hands of bold politicians and agrarian discontent vented itself in the "Defenders." Clare held that either the Protestant ascendancy must remain intact or give way to a union, for general enfranchisement would fill parliament with disloyal Dissenters and Catholics and imperil the imperial connection. The British Government preferred Catholic relief to reform, but finally, faced with the question of how to hold Ireland against the French menace, Pitt chose to buttress up the unreformed Irish House which Clare and Beresford could "manage," and after 1798 decided on a union. The approaching crisis was accentuated in 1795 when, after British pressure had compelled the Irish Government in 1793 to admit Catholics to the electoral franchise, the viceroy, Fitzwilliam, failed to carry final emancipation and to break the Clare-Beresford junta. The "Society of United Irishmen," formed originally by Wolfe Tone on constitutional lines, now became revolutionary and entered into negotiations with France for an Irish republic, while the founding of the Orange Society intensified the religious feud. Insurrection acts and the suspension of *habeas corpus* bridled a country which was becoming an armed camp and the peril of a French invasion had to be faced. The Brest expedition of 1796 and that of Bantry bay in 1797 both failed, but Tone still hoped for foreign aid, and a determined French invasion would undoubtedly have set Ireland ablaze. The Ulster Presbyterians were more feared by the authorities than was the Catholic south, and when in 1797 Gen. Lake "disarmed the North" by the most savage methods the back of a national rising was broken. The military forces were small, but 30,000 yeomanry led by the gentry sufficed to break the rebellion when it came. It was but a partial one, for the Government had seized the leaders, and though June 1798 witnessed a Presbyterian rising in Down and Antrim and a far more dangerous one of the Catholic peasantry in Wexford, both failed, and Tone, surrendering with the "Hoche," ended his life by his own hand in prison.

After "ninety-eight" the Union was inevitable. Many of the ascendancy became convinced that only such a measure could save them from the Catholic-Jacobin majority; the Presbyterians were disillusioned by the events of the rebellion and the Catholic population had been cowed into submission. Pitt and his Irish agents, Clare, Castlereagh and Cornwallis, had effective arguments for all—the Catholics could only be sure of emancipation from the Imperial Assembly, only union could save the Protestant establishment, and free trade would compensate the commercial classes. Several Catholic bishops declared for union in the inspired belief that emancipation would follow it, but it is very doubtful how far they spoke for their whole people. There was little to fear from the Irish parliament, where the majority was corrupt and unrepresentative, where the ministry could survive defeat after defeat and where patronage and bribery were at the Government's disposal. Grattan and the poor remnant of "the patriots" made a brave fight, but the Union became law by acts of both parliaments in May 1800.

Thus ended the experiment of a "Protestant Irish nation." The ascendancy created by the revolutions of the 17th century had ruled their fellow-countrymen firmly rather than generously, but in their later stages at least they contributed noble names to the annals of literature, thought, political idealism and religious freedom. They made Dublin a city of noble buildings, and modern Irish civilization is almost entirely their memorial.

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(E. CU.)

THE UNION, 1800–1921

The fiscal fusion of the two islands was not complete until (1) the two exchequers were united in 1817 and (2) a tariff of 10% in favour of Irish industries disappeared in 1821 and (3) the two currencies were amalgamated in 1821. From 1817 the taxation in the two countries was the same, subject to certain exemptions and abatements in favour of Ireland which at one time were not inconsiderable but which had almost ceased in 1921, when the Union was dissolved.

The allegation that Ireland was overtaxed under the Union is not true. The terms of the agreement embodied in the Act of Union were strictly kept. It may be noted that from 1800 to 1817 Ireland paid nothing for Imperial services; that from 1817 to 1877, according to the estimate of a competent authority (J. G. Mulhall, writing in the *Contemporary Review* in 1882) the yield from Ireland did not exceed the cost of Irish services by more than £500,000 a year; and that in the opinion of the late John E. Redmond, speaking in parliament in 1912, Ireland was run at a loss from 1886 onwards. Taking the whole period from 1800 to 1914, the surplus of Ireland's revenue over Irish expenditure was small, probably much less than £1,000,000 a year on an average. For this sum Ireland was defended and had all the advantages, consular and otherwise, of the British empire. From 1914 to 1921 war taxation brought a considerable surplus which in its peak year came to £25 millions.

Condition of Ireland in 1800.—The population, which in 1800 was 4,500,000, was composed of several elements, whose violent discords are at least intelligible:—the Catholic Irish, numbering 3,150,000; the Protestant Anglo-Irish, numbering 450,000; the Presbyterian Scoto-Irish, numbering nearly 900,000, with a small sprinkling of Methodists and other dissenters. The Anglo-Irish were at the top of the social ladder. They comprised the landlords, the official classes, the bishops and the clergy of the Protestant State Church, the few large farmers and the retinue of an aristocratic establishment. The Scoto-Irish were the business men and farmers of the north-east corner. With few exceptions, the Irish Catholics were the peasants and labourers of the country.

The few industries that existed were of no considerable character. The chief of these were the brewing industry, the output of which was about 500,000 barrels a year; the distilling industry, with an output of 4,000,000 gallons; and the cotton industry, which employed some 13,500 hands. Irish exports in 1800 were valued at £5,650,853; imports at £5,275,063. The population of Dublin was 172,000, and of Belfast 25,000.

The condition of the land workers, who formed the great bulk of the population, was in general deplorable. When the population was more scanty, the land was mostly parcelled out in large grazing farms, occupied by Anglo-Irish Protestant farmers. The pressure of population and the stimulus given to tillage by an Irish corn law of 1784 led to the breaking up of the old ranches and to the conversion of the grazier into a middle landlord. The small tillage farmer thus created had little capital or knowledge, and his standard of living was not much higher than that of the cottiers whom he employed. The rent roll of the country was about

ten millions, which was about the average until 1881, when the first great Land Act started the process of reducing rents. The relations between landlord and tenant were of a most unhappy kind. The Protestants had a monopoly of every office. A Catholic could not be a member of parliament; or a king's counsel or a judge—not to mention other positions. Tithes, amounting to about £500,000 a year, were exacted for the upkeep of a State Church for a small minority of the people. The burden of the tithes fell upon the tillagers, who were almost all Catholics.

Catholic Emancipation.—Pitt gained the support of most—and perhaps all—of the Catholic bishops and of many responsible Catholic laymen by promising to do his best to remove Catholic disabilities. The king was bitterly hostile, and Pitt resigned in 1801, to take office, however, again in 1804. Irish Catholics conceived they had been tricked, and the situation was much worsened. The Robert Emmet rebellion of 1803, though of no consequence in itself—for it was little more than a Dublin street riot—indicated the growth of popular resentment. It is not without interest that Grattan severely condemned this rebellion and that Daniel O'Connell armed himself to help to put it down. Henry Grattan, who in the Irish parliament had been the foremost advocate of the Catholic claims, became a member for an English constituency in 1805 and devoted himself till his death (1821) to the championship of the Catholic claims at Westminster. Also in 1805, a Catholic Association was formed in Dublin and was joined by Daniel O'Connell, a young barrister who believed in mass agitation in the country. In parliament, Grattan's eloquence made considerable way. In the five parliaments from 1807 to 1829—1807, 1812, 1818, 1820 and 1826—with one exception, the House of Commons showed a majority for the Catholic cause. But it was a great movement inaugurated by O'Connell in 1823 that carried the day. The country was brought to the verge of a revolution, and in face of this demonstration of popular feeling, an act was passed in 1829 which removed the main Catholic disabilities.

O'Connell, who entered the British parliament as member for Clare, then turned his attention to the repeal of the Act of Union. He attempted the same methods as were successful in the Catholic Emancipation campaign. A vast organization was established; great meetings were called, at one of which, held at Tara, the seat of the Ard-Righ, the Irish newspapers put the numbers present at 500,000. But O'Connell misjudged the forces against him. A later meeting called in 1843 at Clontarf, the site of the battle in which Brian Boru defeated the Danes, was proclaimed. O'Connell was prosecuted for sedition, convicted and sent to prison, but was released through an appeal to the House of Lords. He died in 1847.

Growth of Population and the Famine.—While these agitations were being conducted with such vigour, Ireland in many respects was making progress. Her exports and imports increased from £10,000,000 in 1800 to £40,000,000 in 1840; the excise revenue from £475,000 in 1800 to more than £2,000,000 in 1840. Commerce had increased, agriculture had improved, and the value of land had risen. Grinding, malting, brewing and distilling had greatly increased, while there was a thriving linen manufacture and linen trade. These signs of manufacturing and commercial growth more than outbalanced the disappearance of some small industries which, in Ireland as well as elsewhere, found it impossible to stand the competition of the large scale concerns.

The real troubles of Ireland, however, arose from an increase of population which far outstripped production. The population in 1700 was only 1,250,000. It was 4,500,000 in 1800, and this rapid rate of increase continued for nearly the first half of the 19th century. Early marriage was encouraged, and emigration was denounced. Irish political leaders favoured the subdivision of holdings, contrary to the policy of all British Governments, which sought, by various pieces of legislation, to keep the process within reasonable bounds. The corn laws which, until 1846, put a heavy bounty upon the production of corn tended to increase tillage and to stimulate population increase. The population grew to 8,175,124 in 1841. In that year, the population density of Ireland per sq.m. was 251; England and Wales, 272. There were 685,000 farms in all. Of these, 300,000 were under 3 ac. in extent; and 250,000 were from 3 to 15 ac. As might be expected, the conditions of the vast majority of land workers was miserable.

The potato blight appeared in North America in 1844; it reached Europe in 1845, attacking Belgium, Hungary, Germany, Holland, and the United Kingdom. The United Kingdom felt its worst effects, scarcely a district escaping. 1846 and 1847—especially the latter—were its worst years. In a few weeks the abundant potato harvests in Ireland became a waste of putrifying vegetation. The British Government took active measures to relieve the distress. Relief works were instituted on a large scale, and great doles of maize were given out. In 1846, as many as 285,000 hands were employed on relief works and in 1847, 734,000. The Government imported in the first six months of 1847, 2,849,508 quarters of maize worth, at then current prices, nearly £9,000,000, a great part of which was distributed gratis. The United States sent substantial supplies across the Atlantic. Nevertheless, there were many deaths from sheer starvation, totalling from 1841 to 1851, 21,770. The total Irish mortality for the five years that ended in 1851 was close upon a million. In the decade that followed 1847 more than 1,500,000 persons emigrated.

The famine was followed by the Young Ireland rebellion of 1848. The chiefs of the Young Ireland movement were men of lofty idealism and considerable intellectual attainments. But they were not practical men of affairs and, with little or no previous preparation, they started an insurrection in Tipperary in the hopes that an unorganized peasantry would rise to support it. In the result, some 30 rebels were fired on by a squad of constabulary and fled, leaving some dead and wounded behind. A remarkable temperance movement in 1849 is an interesting study in national psychology. Inaugurated by Father Mathew, it brought down the consumption of spirits from 12,000,000 to 5,000,000 gallons. The movement collapsed with Father Mathew's death in 1856.

The tithe was a burning question until 1838 and many bloody conflicts had taken place in the collection of it. In 1838 the tithes were converted into a rent charge payable by the landlords, and in 1868 the Irish State Church was disestablished.

Land Reform.—An agitation which commenced with the formation in 1850 of an association demanding "the three F's"—Fair rent, Free sale, Fixity of tenure—pursued its inevitable course until it finally extinguished landlordism altogether. An act of 1870 gave a tenant a right to compensation for disturbance and for improvements if, without fault on his part, he was evicted. A world wide depression in agriculture combined with three wretched harvests (1877–8–9) brought about the great Land Act of 1881 which conceded "the three F's." This law and amending statutes of 1887, 1891, and 1896 had the effect of lopping upwards of £2,000,000 a year off the landlords' rental. The real solution, however, was begun in 1885, when the first great Land Purchase Act was passed. Under that act when a landlord and a tenant agreed upon the purchase price of the landlord's interest, the State would advance the money to finance the transaction and would be re-paid by annuities for a period of years. Thus, on a farm rented at £50, if the landlord agreed to sell at 18 years' purchase (which was in general the normal figure), that is at £900, the State would pay the landlord that amount; the tenant would repay the State by annual instalments of 4% or £36 a year; these instalments would cease in 49 years. Other laws were passed, under one of which the State undertook to provide a bonus to help the transaction—this bonus in certain cases amounting to 12% of the purchase money. In 1921, when the Irish treaty was signed, about two-thirds of the land in Ireland had passed to the tenants under voluntary transactions of this sort. The remainder has since been transferred by one great compulsory statute.

This great reform was not achieved without much agitation in parliament and outside it, and much crime. In the worst years, 1877–80, to use the words of a historian of the period, "it rained outrages." It is however, usually forgotten that the real land problem was not the landlord and tenant problem, but the multiplication of small farms and the congestion of the people upon them. In 1881, there were about 600,000 farmers, giving an average of about 30 ac. of cultivable land.

The Home Rule Movement.—The misery of the people gave great strength to the secession from England movement. Propagandists in the '50s announced that under a home Government with power to impose tariffs, Ireland instead of having a population of 8,000,000, as the figure then was, of destitute people, would support a very much larger population (put by some at 25,000,000) in comfort if not affluence. Similar arguments were used by the leaders in the Home Rule movement (1870–1916) and the Sinn Fein movement (about 1900 to 1921). Arthur Griffith, the founder of the latter movement, put Ireland's true population at 20,000,000. The contrast between their actual position and their potential position under a Dublin parliament inflamed the people, instilled in them a hatred of Westminster rule, and kept them steady in the struggle for political independence.

That struggle took two forms. From the formation by Isaac Butt of the Home Rule party in 1870 down to the rebellion of 1916, it was mainly constitutional. But side by side with the constitutional movement, the physical force men kept up their secret associations for the establishment of an Irish republic, and now and then broke cover in violence of one sort or another. The most extreme Irish revolutionaries were in the United States of America, where the Fenian association was formed in 1863. (*See* FENIANS.) Irish-American newspapers founded a skirmishing fund in 1880, one of the objects of which was openly stated to be the burning down of London on a windy night. This extreme section were responsible for a petty attempt at a rebellion in Dublin and Kerry in 1867, and for the Phoenix Park murder in 1882 of Cavendish and Burke, the chief secretary and under secretary for Ireland. In the main, however, the physical force men were content, while advocating violence if opportunity should permit, to give adherence to the constitutional Home Rule movement which aimed at legislative and administrative control of Ireland by Irishmen themselves, without entirely severing the imperial link.

Butt's Home Rule Association for a time made little headway, and a Home Rule bill introduced by its leader in 1874 found only eight supporters in the House of Commons. The driving force of the movement came with the establishment of the Land League by Michael Davitt in 1879, which became a secession-cum-agrarian movement, under the leadership of an impoverished Irish squire, Charles Stewart Parnell. The Land League dominated the country and boycotting of farmers and shopkeepers who were not prepared to obey it proceeded on an extensive scale. Strong counter measures were adopted by the Government, under one of which the executive were empowered to put and keep in jail as "suspects" any person at their discretion. Parnell and many of his followers were imprisoned under this drastic code.

Ultimately Gladstone sought to solve the Irish problem by his Home Rule bill of 1886. It was a very modest measure, which transferred Irish administration to an executive appointed by an Irish parliament, but left most of the taxing power at Westminster. It was, however, accepted by Parnell as a settlement; though he fully recognized, to use his own language, that it set up a "subordinate parliament." Such as it was, it met with a furious opposition both in England and in Ulster. Many of Gladstone's followers seceded from him. Ulster threatened violent resistance. The bill was rejected in the House of Commons by 343 to 313. The situation was further complicated by the law case of O'Shea v. O'Shea and Parnell a divorce petition in which Captain O'Shea, an Irish member of parliament, alleged adultery between his wife and Parnell. The facts were clear and a divorce was granted (Nov. 15, 1890). The heads of the Catholic Church in Ireland called for Parnell's retirement. He refused, and his hitherto united party was split into two factions. The breach was not healed by Parnell's death (Oct. 7, 1891).

In 1893 Gladstone, again in office, introduced a Home Rule bill which passed the Commons (301 to 267) but was rejected in the Lords by an overwhelming majority (419 to 41). Another attempt to settle the question was made by the Irish Council bill of 1907, which was intended to establish a purely Irish body to spend in Ireland the proceeds of Irish taxation. This bill, however, was unacceptable to the Irish people and was withdrawn. H. H. Asquith introduced his Home Rule bill in 1912. It passed the House of Commons in Jan. 1913 (367 to 267) and was rejected by the Lords. The bill included Ulster and if passed again in three successive sessions by the House of Commons, would automatically, pursuant to the provisions of the Parliament Act 1911, become law without the assent of the House of Lords. Ulster prepared to resist it, and the Ulster Volunteers, headed by Sir Edward (Lord) Carson, aided and abetted by many prominent men in both countries, armed themselves and undertook to set up a separate Government in Belfast should the bill become law. The bill passed the House of Commons in May, 1914; the Lords excluded Ulster; an attempt at accommodation by the king at a conference held in July failed. The outbreak of war altered the whole situation. The bill, without resistance, passed and became law for all Ireland in Sept., 1914, but a contemporaneous act was passed which provided that it should not come into force until after the war, the Government giving an undertaking to bring in a bill dealing with the Ulster situation. The bill never came into operation.

Ireland in 1914.—When the World War came, the position of Ireland was in most respects very satisfactory. The landlord and tenant question, for all practical purposes, had disappeared. The country was free from serious crime. Emigration had brought the population within reasonable limits. The process of *morcellement* that had been the real economic curse of the country, had ceased. Imports in 1913 were valued at £74,000,000; exports at £73,000,000. Comparing the periods 1895–1899 with the year 1913, the average increase in yield per acre was not less than 25%, the additional money value to the country being £15,000,000 per year, and the money value increase in stock on the land was not less than £20,000,000. In 1913 the money on deposit in the Irish banks was £60,000,000 in addition to which the Irish people had large sums of money invested in England.

One of the most important and beneficial statutes ever passed for any country, was the Labourers (Ireland) Act 1883, which enabled comfortable cottages to be built at local expense (aided by a small State subsidy) for agricultural labourers, who received in addition from half an acre to an acre of land as well. The schemes under this act worked so well that Ireland is provided with 50,000 well built cottages which, with the half acre or acre patch adjoining, are let to a labourer at from 8d. to 1/6 a week.

The population was divided according to religious creed as follows:—Catholics 3,242,670; Protestants 576,611; Presbyterians 440,525; Methodists 62,382; Jews 5,148; other persuasions 60,504; indeterminate 2,379. The population of Dublin had increased from 172,000 in 1800 to 304,000 in 1911; that of Belfast in the same period from 25,000 to 386,000.

The position of the Catholics had enormously improved. The primary school system established in 1831, had from the first been a success. An Intermediate Education Act of 1879 which indirectly subsidized intermediate education, was of great and lasting benefit. The national university was founded in 1908 and became substantially a Catholic university. The Local Government Act of 1898 transferred all county power and patronage from the landlord classes, represented by the grand jury, to elected county councils. A strong Catholic middle class had grown up.

Ireland was well equipped with railways, having a mileage of 2,940 miles; in addition to 15 light railways established by State subsidy. There was an admirable judicial system in the country modelled upon the British, but containing features specially adapted to Irish requirements. In the British legislature, Ireland had 103 members while England, Scotland and Wales had 567 all told. The population ratio of Ireland to Great Britain was 1 to 10; while in 1914, taxation was £2. 10. 0 per head of the Irish population and £4. 8. 3. per head of the British population. A Congested Districts Board, set up in 1891 endeavoured to solve the small holding problem by migration and was slowly succeeding. The Department of Agriculture established in 1900, was so admirable that a commission sent over by the Canadian Government to study European agricultural conditions, specially recommended that the Irish model should be followed. The best feature of all was the success of the Irish Agricultural Organization Society,

established by Sir Horace Plunkett in 1889, to organize and educate the farmers in the methods best calculated to increase the production and facilitate the sale of agricultural products and to cheapen the cost of articles used by the farmers.

Rebellion of 1916.—The enrolment of the Ulster Volunteers to resist home rule angered the south of Ireland; the impunity accorded to an unconstitutional and illegal movement emboldened and stimulated the young Home Rulers. A body of "Irish Volunteers" was established in Oct. 1913 under the auspices of John MacNeill, a cultured Gaelic scholar and professor. It attracted to its ranks a number of constitutionalists and such residue of physical force men as were left in the country, and arms were smuggled in. Bad housing and labour conditions in 1913 led to much intimidation, sympathetic strikes and some violence, and produced the Citizen Army, composed of Dublin workers, men and boys, under the leadership of James Larkin and James Connolly.

When the war broke out, Redmond and his parliamentary followers declared unequivocally in favour of the allies, and for a time it seemed as if the whole country was with them. A meeting at the Mansion House, Dublin, on Sept. 25, 1914, at which the prime minister (Asquith), and Redmond, Dillon and other leaders spoke, was packed, and there was much enthusiasm. But the war did not go well; conscription soon had to be introduced in England; and it was put about that Ireland would also be put under the yoke; no Irishman would submit to compulsion to fight; if Germany won, no land purchase annuities would have to be paid; there was land enough for everybody; Sinn Fein pamphlets and newspapers multiplied prodigiously. Still, Ireland raised 134,000 recruits for the war, and the rebellion came as a great surprise.

About this time the Sinn Fein party began to get a little prominence. Founded by Arthur Griffith, a Dublin journalist, in 1900, it bore pretty much the same relation to the Home Rule party under John Redmond as the Young Irelanders bore to the Old Irelanders under O'Connell. Sinn Fein (the best equivalent of which is the French *nous-même*) was not content with the home rule which Redmond was willing to accept and which left the taxing power, for all practical purposes, at Westminster. Sinn Fein wanted a self-contained Ireland, with full taxing power and advocated the building up of a great manufacturing country by a system of tariffs. Culturally, it resented the "anglicization" of Ireland and favoured the revival of the Irish language.

The rebellion was planned by the Citizen Army, and the left wings of the Volunteers and Sinn Fein. But the German aid which had been arranged for did not arrive; the German vessel "Aud" containing the arms for the rebels was captured off the coast of Kerry; and Sir Roger Casement, who came from Germany in a submarine, was taken and later executed. The Volunteers tried to call the rebellion off, but the Citizen Army forced it on and it broke out on Easter Sunday of 1916. The actual fighting, which was chiefly street fighting in Dublin, lasted a week; there were only 2,000 rebels in all engaged. The British troops lost 377, including 106 killed; the rebel losses were trifling. Fifteen rebels, including James Connolly, were executed.

The Government at once set on foot negotiations for an Irish settlement, but these broke down, as also did a convention of Irishmen called under Government sanction which sat in deliberation for nearly a year. Ulster wanted its six counties intact; the Nationalists would not budge an inch on that question. It is probable, however, that the rebel movement would have died down, temporarily at least, had it not been for the introduction in 1918 of the Military Service bill of that year. The measure raised the age for compulsory service to 55 and it applied to Ireland. The country rose against the measure; funds were collected at every Catholic church in the country and a total of £200,000 was gathered. The act was never enforced, but Ireland swung definitely to the left. At the general election of 1918, at which the Sinn Fein party raised the Republican standard, the old Irish party was routed, and 73 Sinn Feiners were elected out of a total Irish representation of 106.

The "Anglo-Irish War."—The 73 met in Dublin, calling themselves the Dáil (national assembly), passed a declaration of independence and appointed ministers. But apparently it was no part of the original policy of the Dáil to resort to violence. A new departure was made in Irish politics by Daniel Breen who thought that the best method to clear the British out of the country was to kill off the Irish Constabulary, who were the eyes and ears of Dublin Castle, the seat of Irish Government. The "Anglo-Irish War," which began in Jan. 1919 and ended in May 1921 and which brought about a dominion status for 26 counties of Ireland, is surely one of the strangest episodes in history. Daniel Breen, who occupied the position of track walker on one of the Irish railways, began it, and in his book he tells the story with great frankness. Breen and seven comrades waylaid two Irish policemen in Tipperary and shot them dead (Jan. 1920). The same procedure or procedure somewhat similar was followed in other places. The idea caught on and Michael Collins, who was at one time a postal clerk in London, had crossed to Ireland in 1916, and was engaged in the rebellion of that year, took it up. Soon a process which its supporters call war and its opponents assassination became general.

The various stages of the "Anglo-Irish War" were: (1) the shooting, at rare intervals, of policemen as they moved about a city, town, village or countryside; (2) the like, at more frequent intervals; (3) attacks upon remote and outlying police barracks; abandonment of such barracks; alarm amongst the police and some defections; (4) the advent, in June 1920, of armed men from England to take the place of the police—some called Auxiliaries, to the number of 1,500, and others, from the colour of their clothing, Black-and-Tans, numbering 5,800; (5) a "war" as before, consisting of the shooting of policemen as before; the shooting of civilians engaged in the British service who were suspected of activity in putting down the revolutionary movement; ambushing with bomb or rifle or revolver fire of Auxiliaries, Black-and-Tans, police and sometimes of regular troops; the shooting of persons suspected of giving information to the British forces; the destruction, by arson or other means, of public or private property; the destruction or obstruction of roads and bridges; a general espionage among the lower classes of the community; a collection of moneys by those engaged in the "war" by threats of murder or destruction of property, and the general terrorism of the country.

It has been stated on very good authority that the actual number of gunmen engaged was only 2,000. At first, the great bulk of Irish public opinion was opposed to the guerrilla warfare. But soon its daring, its success and the ingenuity and resource shown in many of its episodes captured the support of the lower orders of the people. A ruthless system of terrorism intimidated responsible people, for no man could safely venture upon a public expression of a hostile opinion. The premises of the *Daily Independent*, which termed an attempt on the Viceroy's life "murder," were burned to the ground, and every newspaper in Ireland knew right well that a like measure would be dealt out to it in similar circumstances. The counter-terrorism and activities of the Black-and-Tans greatly helped the revolutionaries, for they created a hatred of British rule where it did not exist before and strengthened it where it did. But it was not till the "war" was coming to an end that the Dáil (March 1921) purported to ratify it.

The Irish Catholic bishops in secret sessions were of opinion that the "war" was not morally justified and some of them openly said so, but there was no public expression of opinion from the episcopal bench as a whole. The morality of the "war," however, was upheld by many if not most of the other Catholic clergy.

As the result of the activities of the Black-and-Tans and Auxiliaries the houses of those suspected of being revolutionaries were destroyed, besides many creameries. A great portion of the city of Cork was burned down by the regular military by way of revenge for some outrages committed upon them. Many murders of real or supposed revolutionaries were committed. There was a competition in crime.

The British Government winked at these performances. It even encouraged them. The *Weekly Summary*, an organ printed and published by the authorities in Dublin Castle, was a direct incitement to murder. "British rule became a byword and a scoff

in every country in Europe and across the Atlantic" (letter of Rev. D. C. MacGregor, Moderator of the Presbyterian Church of England to the *Times*, March 5, 1921). Public opinion in England was deeply stirred, and formed its expression in vehement denunciations of Black-and-Tan terrorism by many public men, foremost of whom was the archbishop of Canterbury. The events in the south of Ireland had their repercussion in the violent religious disturbances in the north. From July 1920 to June 1922 the city of Belfast was the scene of many shocking murders.

Soon after the beginning of the "war," the cabinet introduced and passed the Home Rule Act, 1920, which divided Ireland, for political purposes, into two areas, namely (1) six counties carved out of Ulster and (2) the other the remaining 26 counties. The statute, while transferring the administration of Ireland, north and south to Irish hands, left the great bulk of the taxing powers in the control of the British parliament. The passing of the measure rather aggravated the situation than otherwise, so far as the south was concerned. The six-counties parliament, however, was duly established.

The growing pressure of English public opinion was the principal factor that induced Lloyd George and his cabinet to enter into negotiations with E. De Valera, then the president of the Dáil. A time was arranged (July 1921) and the Anglo-Irish treaty, which was confirmed by the British parliament and by the Dáil, was entered into in Dec. 1921.

The treaty gave Ireland the political status of the dominion of Canada, with liberty, however, to the Ulster parliament to opt out of the measure. The new dominion was to be called the Irish Free State. Certain harbour and other facilities were reserved to Great Britain, and provision for other facilities in time of war or of strained relations with a foreign power. If Ulster opted out, a commission, consisting of one representative of the Irish Free State, one representative of Ulster, and a chairman to be appointed by Great Britain, was to be set up to readjust the boundaries between the six county area and the 26 county area. The treaty provided for the ascertainment by arbitration of the Irish Free State's liability for the national debt.

Ulster did opt out, but objected to the appointment of the boundary-fixing commission, upon the ground, which was wholly untenable, that Ulster was not a party to the treaty. The Free State Government strenuously pressed for the commission, and ultimately a supplementary statute was passed, under which a commission was set up consisting of a representative of Ulster, John MacNeill representing the Irish Free State and a South African judge as chairman. The commission arrived at a finding that was unanimous, and which was not favourable to the Free State. A premature publication of the finding led to a storm in Ireland.. For the sake of peace it was agreed that the commission and its findings should be scrapped, and that Great Britain should abandon any claim to an Irish contribution to the national debt.

The Irish Free State, accordingly, started on its way under favourable auspices. It was a rich agricultural community, yielding a national income, as the events proved, of £25,000,000 per year, on the same taxation basis as Great Britain. It had made enormous profits by the war. In 1921 there were nearly £200,000,000 on deposit in Irish banks, nearly £100,000,000 invested in Government securities and over £200,000,000 invested in England or abroad. A proportion of about two-thirds of this may safely be attributed to the Free State. It was an admirably equipped going concern, with excellent railway, telegraph and telephone systems, roads at least up to the European average, a full equipment of buildings, of schools and educational appliances, numerous public buildings, many of which were of great beauty. It was under no obligation to provide its own defence, or to have a single soldier or a single ship of war, or to pay Great Britain, which must always, in the nature of things, provide for its defence, a sixpence for doing so. It had not a farthing of national debt. (For the subsequent history of Ireland *see* IRISH FREE STATE and IRELAND, NORTHERN.)

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ARCHAEOLOGY

Human Inhabitants.—The human occupation of Ireland does not begin until a late date in the history of Europe. The island seems to have been uninhabited by man throughout the whole of the ice age: at least, no trace even of an interglacial colonization has as yet been found anywhere within its borders. The alleged discoveries in Co. Sligo do not modify this statement. While some of the numerous caves in the limestone regions may contain remains of Palaeolithic man, no such discoveries have hitherto been made.

The raised beach at Larne, Islandmagee, and other sites in Co. Antrim, have yielded the oldest relics of man as yet found in Ireland. These have affinities in two directions; they indicate that even at the beginning of human occupation in the country there was a racial admixture. On the one hand, there is a clear association suggested with northern Spain; on the other, there is evidence of influences from north-eastern Europe. The first association is indicated by certain roughly pointed choppers or picks, cognate with the tools of the Asturian type, first brought to notice by Obermaier (*El Hombre Fósil*, 1916, p. 334). The other is suggested by the so-called "Larne celt," a hand-pick which has all the appearance of being a degenerate form of the Campignian pick.

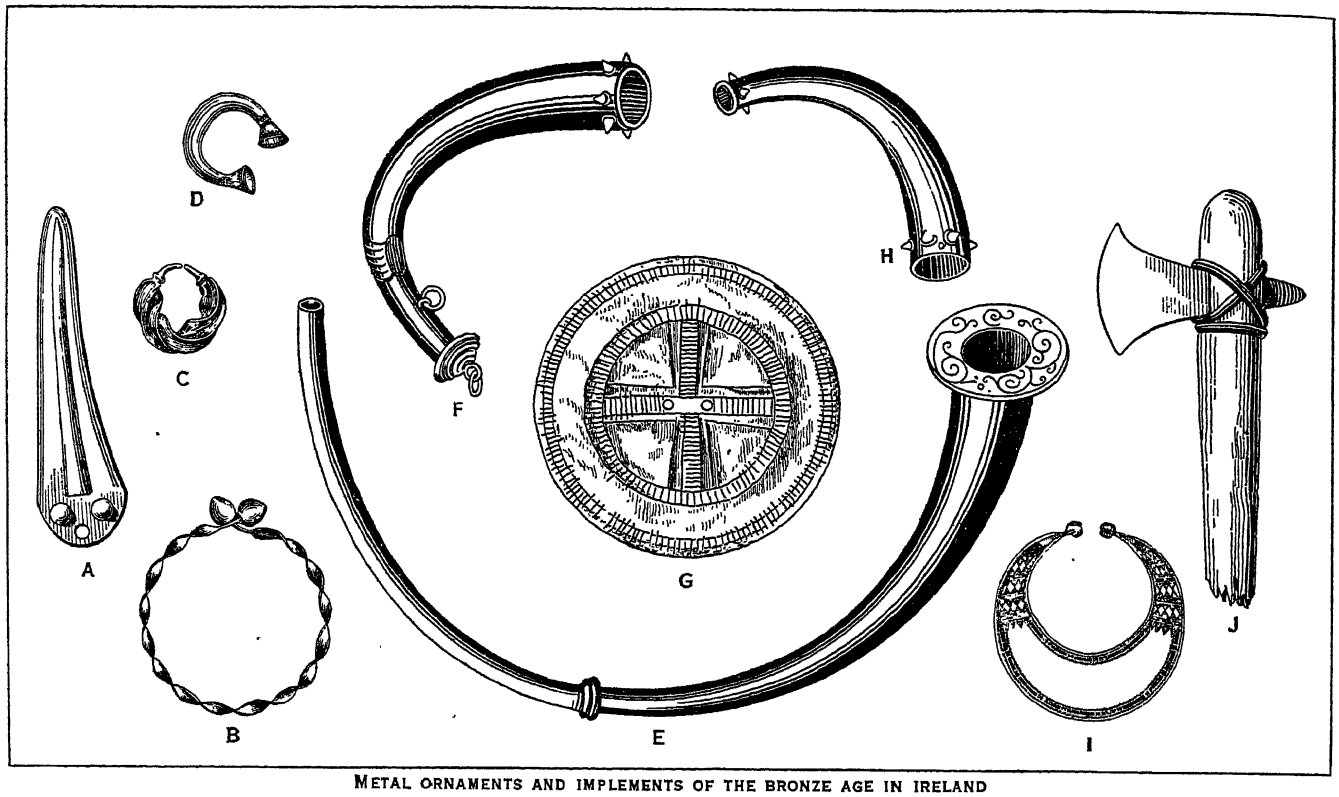
These two civilizations, the Asturian and the Campignian, were contemporary, each in its own region. The Asturian is a very primitive north Spanish and Pyrenean culture, the remains of which, in stratified deposits, overlie the Palaeolithic beds and underlie the Neolithic, and therefore belong to a time intermediate between the two main stone age cultures. The Campignian culture, which is distinguished by the presence of pottery (for the first time in Europe), of picks consisting of bars of flint so chipped as to have a blunt point at each end, and the *tranchet* or kitchen-midden axe (an implement with a bevelled edge, resembling the point of a gigantic turnscrew), extends over the greater part of northern Europe from Denmark (Maglemose and the shore-dwellers' shell-heaps) to France: in the latter country is the typical station of Le Campigny, which has given its name to this phase of civilization. The Campignian is intermediate between the Palaeolithic and the Neolithic cultures.

Thus there was a double immigration into Ireland at the beginning of its time of human occupation: an immigration from Spain, which must have crossed the Bay of Biscay—for the Asturian culture is not found in France—and one from some nearer place in northern Europe—but not from Great Britain, in which country the Campignian is all but completely absent.

As yet nothing but the implements have been found. No human remains have come to light associated with them. Nor are there any known inland sites yielding relics of these two occupations. They must, however, have endured for a considerable time, as the gravels where they are found are stratified to a considerable height, and artifacts are found practically through the entire deposit.

It is improbable that any human bones will ever come to light to tell us about the physical characters of these earliest immigrants. In the damp climate of Ireland the human bones that are found are so decomposed as to be almost useless for scientific purposes. No inland sites existed, because the interior of the country at the time was thickly covered with virgin forests, infested by dangerous wild beasts: and the shore offered a safe and comparatively easy source of sufficient food.

The ultimate fate of these first immigrants is unknown. They



METAL ORNAMENTS AND IMPLEMENTS OF THE BRONZE AGE IN IRELAND

(A) Copper halberd blade, the characteristic weapon of the early bronze age; (B) Gold torque, evidently a neck ring; (C) One of a pair of gold ear rings formed of four flat narrow fillets joined at their inner edges in torque pattern; (D) Gold open ring of the type probably used as currency; (E) Bugle-horn shaped trumpet made in two portions soldered together; (F) Cast trumpet, 34½ inches on concave side, probably used as a speaking trumpet; (G) Circular gold plate or "sun-disc," probably worn on breast; (H) Trumpet, 24 inches along curved edge; (I) Gold lunar or "moon disc" worn around the neck; (J) Copper hatchet, secured to a wooden handle by strings of hide or gut

may have endured to form the bulk, or at least the basis, of the later occupation of the Neolithic period, having learnt the Neolithic arts by way of trade: or else they may have been extinguished by a new immigration, introducing the Neolithic culture. Practically nothing is known but the bare fact of the existence of the Asturian-Campignian settlement.

THE STONE AGE

It becomes increasingly difficult to separate distinctly the Neolithic culture from the culture of the bronze age which followed it. Over the whole continent of Europe objects once classified as Neolithic persisted into the bronze age, if they were not actually introduced in this later period. For two reasons this difficulty is especially acute in Ireland. In the first place, the population was continuous throughout the two stages of culture. There is no racial break at the introduction of bronze, as there is in Great Britain. The latter country was invaded, at the beginning of the bronze age, by the (round-headed) folk commonly known as "The Beaker People": a body of invaders coming from the Rhineland. But beakers are all but unknown and brachycephalic skulls are rare in bronze age Ireland, where there was no change of population; and the bronze culture was introduced gradually, by way of trade.

Again, the stone age in Ireland was seemingly of very short duration. The metal culture must have reached that country considerably earlier than it reached Great Britain. All the archaeological evidence points to the conclusion that Ireland is an island of the Atlantic, Great Britain is an island of the North sea; and that though so close together, they do not therefore form one archipelago. Culture came into Ireland from the south-west, from Spain across the Bay of Biscay. The old connection between Ireland and Spain was maintained for many centuries. One of the most remarkable monuments of this connection is the inscribed slab at Clonfinloch, in the county of Offaly. This is a great flat stone, upon which is a sculpture indistinguishable in style from the Neolithic devices painted on the walls of certain Spanish caverns. This monument is undoubtedly the record of some sort of connection between the two countries; and we may call it the oldest historical record in northern Europe.

The remains naturally associated with the stone age in Ireland are implements of flint and of other stones, and certain classes of rude stone monuments. Such objects were certainly produced in the stone age: but they continued in use into the bronze age—indeed, flint tools continued in use in the country to an even later date, for in Ireland there is practically no native source of supply of tin, and no reason to believe that such a source ever existed. Tin was a necessary ingredient of bronze, and all the tin used in the country had to be imported from abroad. In consequence it must have been expensive, even if we accept the theory of the late Dr. Bremer, that the tin mines of Cornwall were at first an Irish possession, and were worked by Irish artificers down to the middle of the bronze age. This would account for the early pre-eminence of Ireland in the bronze age civilization, and for Ireland's precedence over Britain in the matter of the introduction of bronze (even although the want of tin in Ireland handicapped that country in the race); it also accounts for the frequent discovery of objects of Irish provenance in Cornwall, and, on the other hand, for the absence thence of definite traces of the Beaker people. On the other hand, the loss of the control of the Cornish mines is the most obvious explanation that can be made of a decline in the prestige of Ireland which we can trace, from the archaeological evidence afforded by the remains of about the middle of the bronze age.

Particulars of the various types of stone implements found in Ireland will be found in the works enumerated in the bibliography (*q.v.*). They correspond with the stone objects of the rest of northern Europe in general, though with certain local differences of detail. Their standard of excellence of workmanship is high on the whole; the knives and arrowheads, formed by chipping over the entire surface of the object, are often real works of art, showing great delicacy of touch on the part of their makers, and appreciation of beauty and symmetry of form. A peculiar type

of lance-head, of a lozenge shape with flat sides and chipped along the edges, is especially characteristic of Ireland, and affords one more link between this country and Spain, where similar weapons are also found.

Rude Stone Monuments.—Ireland is pre-eminently a country of rude stone monuments, some of them of great size. There is a considerable number of stone circles in the country, but on the whole the stones of which they are composed are comparatively small and few in number, though there are some notable examples here and there. On the other hand she possesses some of the most notable dolmens (table-stone monuments) in Europe. There are about 900 dolmens in the country—a large number for so small a region, especially since many must have been destroyed from time to time—but until a satisfactory archaeological survey has been carried out it will be impossible to say how nearly this number approximates to reality. Among the dolmens of Ireland is the great monument at Mt. Browne, near Carlow, whose immense cover-stone, weighing about 100 tons, is surpassed in size only by the cover-stone of one monument in Spain. In the matter of rude stone monuments, also, the affinities of Ireland with Spain are very close.

Gold.—One of the chief determining influences which gave to Ireland its important position during the bronze age was the gold in which at the time the alluvial gravels of certain parts of the present Co. Wicklow must have been very rich. There is no evidence that the parent vein of these deposits was ever discovered: there is no trace of early mining in the region; and indeed the parent vein has never been found, even in modern times. It is probably by now exhausted; gold in commercially remunerative quantities is no longer to be found in the district. But the large number of early gold ornaments found in Ireland prove that in the first stages of the bronze age there was a considerable store of the metal at the disposal of its inhabitants; and the wide dispersal of gold ornaments of Irish provenance over the continent of Europe shows that this metal formed an important material of trade.

The chief gold ornaments that have come down from the early stages of the bronze age are discs of thin gold plate, with a slight geometrical ornament engraved or embossed upon them. These are of Irish origin, wherever found. At a later stage in the bronze age, when Ireland had become a receiver rather than a giver in the matter of culture, the twisted *torque* was introduced—a collar consisting of a bar or ribbon of metal, twisted into a screw and curved into a loop; the ends being drawn out and bent abruptly, so as to hook into one another. Later still, as the bronze age was drawing to its close, a peculiar form of ornament of a problematical kind came into use. This is in the shape of an open ring with the ends terminating in discs, or in expanding solid or hollow conical knobs. Various conjectures have been made as to the use of these objects; one of the most probable is that they were media of currency.

THE BRONZE AGE

Of the bronze implements many types are similar to those found elsewhere in northern Europe, but some have distinctive character. The flat copper hatchet is probably indigenous to the country, from which it spread over the continent. The copper halberds are especially remarkable. They are a kind of dagger-axe, being in essence triangular dagger-blades mounted at right angles at the end of a long handle. Here again there is evident connection with Spain, where this form of weapon reappears. About the middle of the bronze age Ireland seems to have lost her initiative in civilization; the later types of hatchet-heads, etc., are imported into the country, rather than exported abroad. To the last, however, the Irish metallurgists of the bronze age retained their skill and their appreciation of beauty and symmetry; some of the late spear-heads, for example, are of admirable workmanship. For one class of objects Ireland was the source of supply for Europe till the end of the bronze age—the horn-shaped trumpets, made by the *cire perdue* process, which are found in many places on the Continent; there is one represented as lying by the side of the well known statue of the Dying Gaul.

The rude stone monuments show a power of manipulating enormously heavy masses of stone; and as this required the collaboration of a very large number of men, it presupposes no small degree of social organization. The great monuments that appear to have been erected in honour of deceased lords are impressive evidence of the respect in which they were held: such are the Giant's Ring near Belfast and, especially, the tumuli in the ancient royal cemetery on the river Boyne, about 5m. above the town of Drogheda. Of these tumuli, the most noteworthy is the famous mound of New Grange, which covers an acre of ground. It is about 40ft. in height, and encloses a large chamber the walls of which are lined with huge slabs of stone. A passage between 50 and 60ft. in length gives admission to this chamber. Many of the stones used in the construction of the passage and chamber, as well as certain stones of a surrounding kerb outside the mound, are covered with symbolic devices—spirals, lozenges, zigzags, etc., the meaning of which must be a matter of conjecture, as we possess no direct clue to their interpretation. A circle of pillar-stones, the tallest of which is about 8ft. in height, surrounds the mound. The neighbouring mound (called *Dowth*) possesses two independent chambers, the stones of which bear similar ornamentation. To the north of the same county of Meath, near the town of Oldcastle, the Lochcrew hills bear a series of carns containing similar but smaller chambers, likewise enriched with sculptured symbols; and there are others at Knockmany and Sess Kilgreen in Co. Tyrone, and in the Deerpark of Castle Archdall, Co. Fermanagh.

The few human bones found in Irish bronze age sites indicate that the population of the country during this period belonged to the Mediterranean race (*see* RACES OF MAN)—a relatively short, dolichocephalic (long-headed) and dark-complexioned people, to be seen to-day in their fullest purity in Spain. This population was apparently dominant all through the stone and bronze ages, for the few skulls of round-headed individuals that have been found are to be taken as those of casual wayfarers. Of the language of this people we are absolutely ignorant. Some of the river names, which cannot be explained with the aid of Celtic, may belong thereto: and a few inscriptions in the Ogham character, found in the Pictish regions of Scotland, may possibly preserve some words of this tongue, or of a cognate dialect. These inscriptions have defied all attempts to decipher them.

Scandinavian and other foreign objects of the late bronze age found in Ireland speak of an oversea trade with eastern and southern Europe; the centre of activity shifted eastward in the course of the bronze age. We may assume that the technical skill displayed by the bronze objects which have survived was likewise shown by the objects in wood and in textiles, which no longer exist. Here, as elsewhere, owing to the decay of organic materials, only a very incomplete picture of ancient civilization can be reconstructed. The bronze age was illiterate, so that no literary documents have survived, even indirectly; though there very likely is a considerable body of bronze age material embedded in the vast body of Irish literary and oral tradition.

THE IRON AGE

The Celtic (Iron Age) Immigration.—This ancient people remained in undisturbed possession of the country down to about 400–350 B.C. It is possible that there were occasional immigrations such as a gold-producing country would naturally attract; but if so these became absorbed in the aboriginal population, and cannot now be isolated. But at the date indicated a much more formidable immigration took place, doubtless only one phase of the movements of peoples in central Europe, of which the Gaulish sack of Rome in 390 B.C. and the attack on Delphi about 100 years later were outstanding incidents. The Celtic people seems to have had its origin in the regions between the head-waters of the Rhine and the Danube. There they developed their peculiar linguistic characteristics, which is the chief if not the only common mark of "Celticity" in the modern world. They seem early to have become acquainted with the iron-smith's craft, and with the aid of their iron weapons they subdued one by one the petty peoples of the area of Europe north of the Alps. Over these peoples they

spread a veneer of Celticity; they Celticized them in speech, in religion, and in organization: but could not make any very great modification in their racial affinities. This explains the racial diversity which underlies the superficial unity of the Celtic peoples, and which makes it difficult to determine to what people the term "Celtic" most fittingly belongs.

A community—or more probably, several communities—of this people effected an entrance into Ireland in or about the middle of the 4th century B.C. They were probably few in numbers; but they had the advantage of a superior military organization, and, especially, of iron weapons. In time they effected a complete revolution in the life of the country. Their Celtic speech completely ousted the aboriginal Pictish. Their Indo-European patriarchal organization took the place of the aboriginal matriarchate. New gods and new methods of government, new arts and new crafts, were introduced. The aborigines were reduced to vassalage, which, though mitigated with the establishment of Christianity, was never completely terminated until conqueror and conquered alike were subdued by the Norman. The newcomers were a tall fair people, of Nordic extraction, and contrasted physically with the aborigines. The contrast was maintained, as we cannot doubt, by restrictions on intermarriage. In the literature which a little later began to come into being, an aristocratic product, the distinction between fair and dark people is of paramount importance. Every person who is spoken of with respect, save for a number of individuals of exceptional character who "prove the rule" much more clearly than in most cases of the kind, is described as being tall and fair, with long flowing locks. Every person who for any reason is spoken of with disdain is described as being short, dark, and with close-cropped hair.

The culture which the newcomers brought into the country belongs to the later stage of the iron culture of Europe, which goes by the name of La Tène. The earlier phase of the iron culture, called by the name of Hallstatt, is not represented in Ireland save by a few stray objects which came in by way of trade or by mere accident, and do not indicate a permanent settlement. This enables us to assign a date to the Celtic invasion with tolerable exactness. The legends of the landing of the invaders, attracted by the country's store of gold, may at least be historical in that they represent the landing as taking place in the south-east corner of the island: the place where the gold-bearing gravels are to be found.

Iron Age Remains.—The actual remains of the pagan iron age in the country are, comparatively speaking, scanty. They include a number of types of bronze objects, some peculiar to Ireland, and several of very problematical use: some spearheads and other objects of iron: and, most remarkable of all, a few large stones, probably sepulchral gravemarks, bearing sculptured ornament of the geometric-floral type associated with the art of the La Tène period. In other respects the pagan iron age was of very great importance in the history of Ireland. At this time the literature began to come into being, though the documents which transmit it to our time are of much later date, and show clear evidence of editorial manipulation. The oldest written relics are the Ogham inscriptions, which preserve early forms of the Irish language not otherwise illustrated. Such of the inscriptions as have been deciphered contain nothing but names, with words denoting relationship linking them together. The Ogham alphabet is a cipher, based upon an abbreviated form of the Roman alphabet, and doubtless originally intended, not for writing at all, but for secret communication by means of the fingers. The letters are combinations of strokes, in number from one to five (representing the fingers) disposed in various positions around a central line. (*See* OGHAM.)

Probably the majority of the numerous ancient fortifications are also to be reckoned to this period. These are as a rule circular enclosures, surrounded by one, two or three ramparts of earth or of stone. Others, however, are much more complex in their plan. Very little is known of these enclosures, which are common everywhere. Probably some of them are as early as the bronze age; others, certainly, are quite late in date (say A.D. 700–1000) for inscribed stones are used as building material in their construction. Some are burial-enclosures; some, perhaps, sanctuaries; others cattle-pens; the majority, fortified steadings. Most likely many were erected as defences against wolves. They are often in positions strategically worthless, and show a singular carelessness with regard to facility of water-supply if they were expected to stand a siege.

CHRISTIAN REMAINS

We may safely date the beginning of Christianity as a power in Ireland to somewhere about A.D. 350–400. There probably were individual Christians even before this date, but they cannot have made much impression on the life of the community. But after about three centuries we begin to find definite traces of a specific Christian art. The earliest church buildings, and for a long time the most important ones, were built of wood, not of stone; and these have all disappeared through fire and decay. Stone building was in a rudimentary stage of development throughout the country; the extensive forests supplied the most obvious and the most easily worked building material. Probably also carved wooden plates did duty for sepulchral memorials: wooden tomb "stones" are still to be seen in some of the country graveyards. Early remains very likely lie hidden in some of the monastic sites; but these are effectually sealed from the excavator by modern interments. The Viking raids of the 9th and 10th centuries must be responsible for the disappearance of many of the earliest works of art.

The only remains of wooden constructions that we possess are the fragments of framed houses found in some of the lake-dwellings (commonly called in the country *crannogs*)—artificial islands made by piling earth and stones on the bottoms of the shallower lakes, and after securing them with a revetment of stones or wattlework, erecting a dwelling-house in the middle. These structures began in the La Tène period, were much in use (to judge by the remains found within them) about the 7th century, and were not wholly abandoned until about the end of the 16th century. The fragmentary structures which they bear are insufficient for us to gauge fairly the skill of the ancient builders in wood. Certain features of the earliest stone churches are evidently translations, so to speak, of constructional details proper to wood into stone, where they are merely otiose. The arch is not used for the larger openings in the earliest structures, though its use for small windows shows that its principle was understood from the first. The stones are set without mortar, or at most in mud. There is much variety in the character of the masonry, but this depends on the skill of the local masons and on the materials at their disposal, and is of no chronological significance. After the Irish missions to the Continent began, the stone building in the country began to improve notably. The Romanesque style was introduced and successfully practised: some very remarkable buildings were produced especially in the 12th century, such as King Cormac's chapel at Cashel, the Nunnery church at Clonmacnois, and the cathedral of Clonfert.

The round towers possess neither the historical nor the architectural importance which controversialists once attributed to them. They are simply the detached campaniles of the churches with which they are invariably associated: they were erected during the time of the Scandinavian raids, when watchtowers and keeps were as necessary as belfries to the churches which had treasures to guard.

The *scriptorium* was one of the busiest centres of industry in an ancient monastery. A sufficient number of manuscripts survive to prove the nature of the work there carried on. The oldest manuscript completely in the Irish language, the *Book of the Dun Cow* (so called from the animal from whose hide its vellum was said to have been manufactured) was written at Clonmacnois some time before A.D. 1106, but is founded on much earlier exemplars, now lost. These literary manuscripts however concern us less than the illuminated books, of which a considerable number was produced: those that survive date from the 8th century to the 11th. The documents thus enriched are psalters, service-books, and, especially, gospels; the enrichments consist not so much in miniatures as in an artistic treatment of the letters of the text itself; these are worked with great ingenuity into fantastic knots

and monograms, and decorated with applied ornament of great beauty. In the *Gospels of Kells* (probably of the middle of the 9th century) the art attains its high-water mark; some pages of this manuscript, especially the monogram of the name of Christ at the beginning of the Gospel of St. Matthew, rank among the finest illuminations in existence.

The art of these illuminations is one with the art of the metal-worker and the sculptor, differing only in the medium employed. It is a provincial phase of the great decorative art practised by Celtic and Teutonic peoples alike, though with differences of idiom, in the 6th to the 12th centuries. It consists of devices founded on such geometrical devices as spirals and interlacements, and on figures of animals or parts thereof, often conventionalized almost out of recognition. Patterns derived from the vegetable world are found in certain of the Teutonic regions, but are almost completely absent from the Celtic works of art.

Like the art of illumination, that of the metal-worker was almost wholly devoted to the service of the Church—save for ornamental pins and brooches, of which a number of very fine specimens have survived. Of these the best-known is the (falsely so called) *Tara brooch*, a work probably of about A.D. 800. It was found on the sea-shore at Bettystown, south of Drogheda, and is now preserved in the collection of the Royal Irish academy. On the reverse side is elaborate chasing, founded mainly on animal forms; on the face are sunk panels filled with ornament in extremely delicate filigree.

The more specifically ecclesiastical works in metal may be classed under the headings of bells, shrines, chalices and processional crosses. The bells used by the early Irish ecclesiastics were adaptations of cattle-bells, like those in Switzerland and elsewhere. They are rectangular, not round, in horizontal section. The earlier specimens, including the famous bell of St. Patrick, are of iron (sometimes brazed on the surface); the later are cast bronze. Bells are usually without ornament, save occasional decorative treatment of the handle; a few specimens are engraved with simple decoration. One is inscribed, and can be dated A.D. 908.

The shrines are of several different varieties, depending upon the nature of the object to be enshrined. Caskets for bones were made in the form of the ordinary church building of the time (understood to be the form in which the Temple of Solomon had been designed); or else in the shape of the part of the body from which the bone came. The best-known example of the latter type is the shrine of St. Laichtin's forearm, in the Royal Irish academy's collection, a work of the 12th century. Those meant for books were flat square boxes, of the size and shape of the volume which they were intended to contain. The books were not preserved in these shrines for perusal; they were holy relics, and were not meant to be taken out of their receptacle. Had they not been thus preserved, they would have perished: for the book which had belonged to a notable saint was accredited with miraculous powers; strips were cut from it to make amulets, water was poured over it to acquire healing virtues, and, according to Bede, books from Ireland were in especial request in England, for scrapings from their pages were a remedy against snake venom. Shrines for bells and crosiers, again, took the form of the object enclosed within them.

The solitary chalice which has survived from the days of Celtic Christianity far surpasses the best of these objects in artistry. It was found near Ardagh, Co. Limerick, and is now in the Royal Irish academy's collection. It is richly decorated with bands of chased and filigree panels, and its beauty is enhanced by the use of enamel, crystal, mica, glass and amber. It is a worthy companion to the *Gospels of Kells*, with which it is probably contemporary.

The one processional cross that has survived is the so-called Cross of Cong, made at Roscommon in or about 1125 to enshrine a fragment of the true cross. Its late date is reflected in the character of its ornament; the pure interlacements and other geometrical decoration of the Ardagh chalice give place to patterns founded on contorted animal figures. The cross-head, which alone remains, is about 2ft. high. It rises from the jaws of a monstrous animal head. The surface is covered with bronze plates, enriched with silver and enamel, and with applied panels of open work or what we may call false filigree representing animal figures in fantastic knots. In the centre of the face is a large crystal, behind which we may presume that the relic, or what is left of it, is still lying. On the sides are inscriptions in Latin and in Irish, explaining the purpose of the cross, and asking for prayers for all those concerned in its manufacture. The back had an inlaid saltire, presumably of gold, which some sacrilegious thief has picked out.

Numerous remains of sculptured art in stone exist in Ireland, beginning about the middle of the 8th century. They take the form of sepulchral slabs, carved crosses, or the sculptured decoration of church buildings. At Clonmacnois there is a valuable series of slabs, commemorating inmates of the monastery. These sometimes bear the names of persons known from other sources, and are therefore datable: it has been found possible to determine a sequence of styles from these, extending over four centuries. Of much greater importance are the standing crosses, erected in various important ecclesiastical centres. These are in some cases memorials of individuals, such as the fine cross erected at Clonmacnois by Abbot Colman in memory of his friend and patron, Flann, king of Ireland, who died in A.D. 914. Others seem to mark the limits of the monastic enclosure. Others are dedicatory, erected, perhaps, in fulfilment of a vow; such is the "Cross of Patrick and Columba" at Kells, Co. Meath. The earliest standing crosses are perfectly simple, being merely stones carved into a cross form. But about the beginning of the 10th century a much greater elaboration began. The so-called Celtic cross had by now been evolved—a Latin cross with a circular wheel surrounding the centre, probably an attempt to suggest a halo of glory. The surface of the shaft and head of the cross is usually divided into panels, each containing either ornamental devices or else figure subjects. The great majority of the latter which have been identified represent biblical scenes, chosen for their homiletic value—the Fall of Man, the Sacrifice of Isaac, and so forth. A few scenes which cannot be identified may possibly represent local events familiar at the time of the erection of the monument, but now forgotten.

The Scandinavians.—Two important foreign influences have profoundly affected the life of Ireland. The first was that of the Scandinavians, who began their piratical raids in the latter part of the 8th century. For over 200 years they continued their depredations, and did incalculable damage to the material welfare and to the *morale* of the country. But on the other hand they imported their own peculiar variety of the north European art, and from this and the native style there sprang a hybrid which produced works of great beauty: the cross of Cong is one of these. Nevertheless, despite the hold which the Scandinavians had upon the country, comparatively few objects of definitely Scandinavian type have been found there. Only one Scandinavian cemetery has been discovered, and the number of Runic inscriptions is far less than analogy with other Scandinavianized countries would lead us to expect.

The Anglo-Normans.—In 1172 came the Anglo-Norman invasion, which completely overturned the traditional life of the country. From that date onwards foreign methods and ideas impressed themselves with increasing intensity. The *immediate* result of the invasion was the total extinction of the traditional arts. Typical of the resultant chaos is that strange product, Irish Gothic architecture. There is nothing like it anywhere else. It is a curious jumble of styles and periods; and the mouldings which in English Gothic afford an infallible guide to chronology in ambiguous cases, are either totally absent, or else share in the general eccentricity. The Romanesque style had been voluntarily adopted, and had a healthy natural growth in the country: the Gothic style was violently forced on the country from without, and was never assimilated.

More prominent and characteristic remains of mediaeval Ireland are the numberless castles. At first wooden towers (*bretesche*) erected on earth mounds (*motte*), these developed along lines parallel to those followed by castles in England. They are thus

hardly monuments of Irish archaeology pure and simple, but of the archaeology of an extension of England. Naturally none of the temporary wooden towers survive, though the place-name *Brittas,* which is not infrequent, preserves a reminiscence of them, "Brittas" being a corruption of *bretesche;* and there are numerous *mottes* still in existence, such as the splendid example at Castletown Geoghegan, Co. Westmeath. The castles of Ireland are of all sizes and dates, from the great structure at Trim, founded in 1173, down to the humble "peel-towers"—small square structures of two or three storeys—some not earlier than the 17th century. The history of Ireland after the Norman invasion is a history of decay and degeneration, and it is vividly reflected in all the remains of antiquity that have come down out of those troubled centuries.

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(R. A. S. M.)

IRELAND, CHURCH OF. The beginnings of Christianity in Ireland are difficult to trace, but there is no doubt that the first Christian missionary whose labours were crowned with any considerable success was Patrick (*fl. c.* 450), who has always been reckoned the patron saint of the country. For six centuries the Church of which he was the founder occupied a remarkable position in Western Christendom. Ireland, in virtue at once of its geographical situation and of the spirit of its people, was less affected than other countries by the movements of European thought; and thus its development, social and religious, was largely independent of foreign influences, whether Roman or English. In full communion with the Latin Church, the Irish long preserved many peculiarities, such as their monastic system and the date at which Easter was kept, which distinguished them in discipline, though not conspicuously in doctrine, from the Christians of countries more immediately under papal control (*see* IRELAND: *Early History*). The incessant incursions of the Danes, who were the scourge of the land for a period of nearly three hundred years, prevented the Church from redeeming the promise of her infancy; and at the date of the English conquest of Ireland (1172) she had lost much of her ancient zeal and of her independence. By this time she had come more into line with the rest of Europe, and the Synod of Cashel put the seal to a new policy by its acknowledgment of the papal jurisdiction and by its decrees assimilating the Church, in ritual and usages, to that of England. There was no thought of a breach of continuity, but the distinctive features of Celtic Christianity gradually disappeared from this time onwards.

The Church of Ireland, as at present constituted, is the outcome of the extension to Ireland of the principles of the English Reformation. English influence was strong only in the region round Dublin (known as the Pale); and beyond this district the Irish were not disposed to view with favour any ecclesiastical reforms which had their origin in England. Thus from the days of Henry VIII. the Reformation movement in Ireland was hindered by national prejudice, and it never succeeded in gaining the allegiance of the Irish people as a whole. The policy which directed its progress was blundering and stupid, and reflects little credit on the English statesmen who were responsible for it. No attempt was made to commend the principles of the Reformation to the native Irish by conciliating national sentiment; and the policy which forbade the translation of the Prayer Book into the Irish language, and suggested that where English was not understood Latin might be used as an alternative, was doomed to failure from the beginning. And, in fact, the reformed church of Ireland is to this day the church of a small section only of the population.

REFORMATION AND AFTER

The Reformation period begins with the passing of the Irish Supremacy Act 1537. In Ireland the mass of the people were less deeply affected by the religious controversies of the times than in Great Britain. At Mary's accession five bishops either abandoned, or were deprived of, their sees; but the Anglo-Irish who remained faithful to the Reformation were not subjected to persecution such as would have been their fate on the other side of the Channel. Again, under Elizabeth, while two bishops were deprived for open resistance to the new order of things, and while stern measures were taken to suppress treasonable plotting against the constitution, the uniform policy of the government in ecclesiastical matters was one of toleration. James I. caused the Supremacy Act to be rigorously enforced, but on political rather than on religious grounds. The episcopal succession, then, was unbroken at the Reformation. The question of the continuity of the pre-Reformation Church with the Church of the Celtic period before the Anglo-Norman conquest of Ireland is more difficult. The present Church of Ireland claims to be the direct and legitimate successor of the Church of the 14th and 15th centuries, but it cannot be demonstrated that any existing organization is continuous with the Church of St. Patrick.

On the accession of Charles II. the Church was strengthened by the translation of John Bramhall (the most learned and zealous of the prelates) from Derry to the primatial see of Armagh, and the consecration of twelve other bishops, among whom was Jeremy Taylor. But though the Church had now been reformed for more than 100 years, she had made little progress; and the tyrannical provisions of the Penal Code introduced by the English government made her more unpopular than ever. The clergy, finding their ministrations unacceptable to the great mass of the population, were tempted to indolence and non-residence; and although bright exceptions could be named, there was much that called for reform. To William King (1650–1729) bishop of Derry, and subsequently archbishop of Dublin, it was mainly due that the work of the Church was reorganized, and the impulse which he gave it was felt all through the 18th century. In 1800 the Act of Union was passed by the Legislature; and thenceforward, until Disestablishment, there was but one "United Church of England and Ireland."

The dissatisfaction felt by the majority of Irishmen, because of

the continued existence of the Established Church in her privileged position, became increasingly plain as the years passed. Her position had been pledged to her by the Act of Union, and she was undoubtedly the historical representative of the ancient Church of the land; but such arguments proved unavailing in view of the visible fact that she had not gained the affections of the people. The census of 1861 showed that out of a total population of 5,798,967 only 693,357 belonged to the Established Church, 4,505,265 being Roman Catholics; and once this had been made clear, the passing of the Act of Disestablishment was only a question of time. Introduced by W. E. Gladstone, and passed in 1869, it became law on the 1st of January, 1871.

The Church was thus suddenly thrown on her own resources, and called on to reorganize her ecclesiastical system, as well as to make provision for the maintenance of her future clergy. A convention of the bishops, clergy and laity was summoned in 1870, and its first act was to declare the adherence of the Church of Ireland to the ancient standards, and her determination to uphold the doctrine and discipline of the Catholic and Apostolic Church, while reaffirming her witness, as Protestant and Reformed, against the traditions of Rome. Under the constitution then agreed on, the supreme governing body of the Church is the General Synod, consisting of the bishops and of 208 clerical and 416 lay representatives of the several dioceses, whose local affairs are managed by subordinate Diocesan Synods. The bishops are elected as vacancies arise, and, with certain restrictions, by the Diocesan Synods, the Primate, whose see is Armagh, being chosen by the bishops out of their own number. The patronage of benefices is vested in boards of nomination.

The finances are controlled by the Representative Church Body, to which a sum sufficient to provide life annuities for the existing clergy (2,043 in number) was handed over by the Church Temporalities Commissioners in 1870, together with £500,000 in compensation for private endowments. So skilfully was this fund administered, and so generous were the contributions of clergy and laity, at and since Disestablishment, that while on Dec. 31, 1926 only 17 annuitants were living, the total assets in the custody of the Representative Church Body amounted at that date to £10,240,750. Since 1869 the members of the Church have paid in to the Representative Body a total sum of £895,000. At the census of 1911 the number of members of the Church of Ireland was 547,490, or 13·1% of the entire population.

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IRELAND, NATIONAL UNIVERSITY OF. The National University of Ireland had its beginning in the Queen's university—incorporated in 1850. In 1880 the Queen's university was superseded by the Royal University of Ireland. It in turn was dissolved on Oct. 31, 1907, giving place to the National university. Of the three Queen's colleges, founded in 1845 at Belfast, Cork and Galway, which had formed the constituent colleges, of its two predecessors, Belfast became a separate university, Cork and Galway were taken over as constituent colleges, while a new college was projected in Dublin and Maynooth added as a recognized college.

The university has temporary accommodation at 48 and 49 Merion square, Dublin.

The Senate consists of 35 members, one of whom, it is laid down in the charter, must be a woman. Certain of the members are elected by Convocation, others are nominated and four are co-opted.

The university has three representatives in Dail Eireann and there were, on the register of 1925–26, 2,461 persons qualified to vote for the members of the Dail. The president of each university college becomes in rotation a vice-president of the National university. There are eight faculties, in arts, philosophy and sociology, Celtic, science, law, medicine, engineering and architecture and commerce. Music is included in art and Celtic study. There is no special professorate as such, but classes in all faculties are in operation at all the constituent colleges. The library of the university contains the Zimmer collection of Celtic books. There are also various scholarships and prizes of assistance to students. (*See* also UNIVERSITIES.)

See *The Year Book of the Universities of the Empire* (1929); *Minerva-Index Generalis.*

IRELAND, NORTHERN, a part of the United Kingdom of Great Britain and Northern Ireland, with a certain measure of local self-government. The capital city is Belfast on the river Lagan, which is an important centre of the shipbuilding, linen, tobacco, ropemaking, and distilling industries. A considerable trade in live-stock and agricultural produce is also carried on from this port. The following table shows the populations (census 1926) and areas of the counties and county boroughs composing Northern Ireland:—

County or County Borough.	Area in statute acres.	Persons.	Males.	Females.
Antrim	751,886	191,643	92,596	99,047
Armagh	327,902	110,070	53,609	56,461
Belfast Co. Borough	16,520	415,151	195,539	219,612
Down	609,239	209,228	101,202	108,026
Fermanagh	457,376	57,984	30,102	27,882
Londonderry (excluding Co. Borough)	520,750	94,534	47,119	47,415
Londonderry Co. Borough	2,579	45,159	20,785	24,374
Tyrone	806,919	132,792	67,136	65,656
Total	3,493,171	1,256,561	608,088	648,473

See also the articles on the separate counties and boroughs.

HISTORY

Under the Government of Ireland Act, 1920, the Lord Lieutenant summons, prorogues and dissolves parliament. He gives or withholds the Royal assent to bills passed by the Senate and House of Commons, subject to the following limitations:—

"(1) He shall comply with any instructions given by His Majesty in respect of any such bill or order; and

"(2) He shall, if so directed by His Majesty, reserve any such bill or order for the signification of His Majesty's pleasure, and a bill or order so reserved shall not have any force unless and until within one year from the day on which it was presented to the Lord Lieutenant for His Majesty's assent, the Lord Lieutenant makes known that it has received His Majesty's assent."

Northern Ireland is represented in the Parliament of the United Kingdom by 13 members. For the purposes of local self-government it has a parliament consisting of two houses (1) the Senate, composed of the lord mayor of Belfast, the mayor of Londonderry and 24 senators elected by the members of the House of Commons, and (2) the House of Commons, composed of 52 members who are elected by the same electors and in the same manner as the members returned by constituencies in Northern Ireland to the parliament of the United Kingdom, though until 1919 at general elections they were elected on the principle of proportional representation, each elector having one transferable vote. Money bills can only originate in the House of Commons and may not be amended by the Senate. If the Senate reject, or fail to pass, or pass with amendments to which the House of Commons will not agree, a public bill which is sent up to the Senate at least one month before the end of the session, and if the House of Commons in the next session again pass the bill, with or without any amendments which have been made or agreed to by the Senate, and the Senate reject or fail to pass it, or pass it with amendments to which the House of Commons will not agree, provision is made for the holding of a joint session. The parliament has power generally to make laws for the peace, order and good government of Northern Ireland for matters exclusively relating to the province. The Crown, armed forces, defence of the realm, relations with foreign States, etc., are excluded

from its power; nor can it make laws interfering with religious equality, taking property without compensation, etc., within its own area. All executive power in Northern Ireland continues vested in the King, but is exercised by the Lord Lieutenant or other chief executive officers for the time being appointed in his place. Certain taxes, such as customs and excise duties, are reserved to the imperial parliament; the postal service, post office savings bank, etc., were reserved temporarily, pending the formation of the proposed Irish union. The Act abolishes the Supreme Court of Judicature for Ireland, and establishes the Supreme Court of Judicature of Northern Ireland, consisting of two divisions, the High Court and the Court of Appeal.

Developments After 1920.—The Lord Lieutenant of Ireland (Viscount FitzAlan of Derwent) on May 4, 1921 summoned a parliament of Northern Ireland to meet in Belfast on June 7 following. The election of members of the House of Commons was held on May 24, the Unionists securing 40 seats to six Nationalist and six Sinn Fein. Elections for the Senate were held on June 12, and 24 Unionists were returned unopposed. The Ulster Unionist Council had on Feb. 4 unanimously elected Sir James Craig (Lord Craigavon) as leader of the party. The Nationalist and Sinn Fein members did not attend the opening of parliament. The Hon. Hugh O'Neill was elected as Speaker of the House of Commons and the Marquess of Dufferin and Ava as Speaker of the Senate. On June 22 parliament was formally opened by King George V. The first cabinet was constituted as follows: Prime Minister (Sir James Craig), Minister of Finance (Mr. H. M. Pollock), Minister of Home Affairs (Sir R. D. Bates), Minister of Labour (Mr. J. M. Andrews), Minister of Education (The Marquess of Londonderry), Minister of Agriculture and Commerce (Mr. E. M. Archdale). The Ministry of Commerce was subsequently (1925) separated from the Ministry of Agriculture under a minister with cabinet rank (Mr. J. M. Barbour).

Sir James Craig immediately made it clear that his policy was to preserve the existence of Northern Ireland as an integral part of the United Kingdom, and, while willing to contemplate common action with Southern Ireland under the Government of Ireland Act, to resist union with the rest of Ireland in any system which would involve separation from Great Britain and the abandonment of the representation of Northern Ireland in the Imperial Parliament. The first task of the Government was to restore internal order. Political and religious animosities, to which unemployment arising from the decline in trade and industry had added fuel, had been kindled to a dangerous heat. Outbreaks of civil disorder leading to murder and arson had taken place. The anti-British party in Southern Ireland had undoubtedly contributed to increase the difficulties of the Government, presumably in the hope of forcing an all-Ireland form of government by making government under the Act of 1920 impossible. However, the disruption of this political party, which followed upon the Irish agreement of the winter of 1921–22, accompanied by an outbreak of civil war in Southern Ireland, actually eased the situation in Northern Ireland, as it caused the withdrawal of certain elements of disorder which, organized and introduced from outside, were now called off to take part in the quarrels of their leaders.

INTERNAL STABILIZATION

After the setting up of the Provisional Government in Southern Ireland, the Royal Irish Constabulary was disbanded under the Constabulary (Ireland) Act, 1922, which received the Royal Assent on Aug. 4, 1922 and modified the provisions of the Government of Ireland Act by providing for the disbandment of the constabulary, in *lieu* of the transfer to the Government of Northern Ireland of the members of the forces serving in that area. Before this disbandment was completed the Parliament of Northern Ireland had established a new police force, the Royal Ulster Constabulary, and a considerable proportion of disbanded members of the Royal Irish Constabulary received appointments in the new force. A large body of auxiliary police was also organized and, thanks to vigorous measures both in and out of Parliament, order was restored in a comparatively short time.

The Irish Free State (Agreement) Act, 1922, affected Northern Ireland (although she was not a party to the agreement thereby given legislative sanction) in the following ways. It purported to give Dominion status to Ireland as a whole. It put a stay upon the exercise of the powers of the parliament and Government of the Irish Free State, as respects Northern Ireland, until the expiration of one month. It enabled Northern Ireland to vote herself out of the Free State by means of an Address presented to His Majesty by both houses of parliament of Northern Ireland, before the expiration of the month above referred to, and it attached to the presentation of such an Address the consequence that a commission was to be set up consisting of three members, one to be appointed by the Government of the Irish Free State, one to be appointed by the Government of Northern Ireland, and one (who was to be the chairman) to be appointed by the British Government, in order to "determine in accordance with the wishes of the inhabitants, so far as may be compatible with economic and geographic conditions, the boundaries between Northern Ireland and the rest of Ireland. It expressly preserved the Council of Ireland and the Irish Free State representation thereon, whilst depriving the Council of any powers in that State; and it offered to Northern Ireland, as an alternative to going out of the Free State, a continued existence under the Government of Ireland Act, subject to an over-riding jurisdiction of the parliament and government of the Irish Free State, in all matters in respect of which legislative power is withheld from the Parliament of Northern Ireland under that Act.

The majority of the points in which the constitution of Northern Ireland was affected by the setting up of the Irish Free State received attention from the Imperial legislature in the Irish Free State (Consequential Provisions) Act, 1922, which came into force on the same day as the Act providing for the Free State Constitution. This Act contained various provisions which were to take effect in the event of Northern Ireland voting herself out of the Irish Free State under Article 12 of the original agreement. This voting out was immediately accomplished, and thus authority was given for various constitutional changes. Subject to the provisions of the first schedule (Modification of the Government of Ireland Act, 1920, etc.) to the Act, the Government of Ireland Act was only to apply to Northern Ireland. This schedule provided for the appointment of a Governor of Northern Ireland, and for the application to him of the provisions of the Government of Ireland Act, 1920, with respect to the Lord Lieutenant. A Privy Council of Northern Ireland was established and a Great Seal of Northern Ireland authorised. On Dec. 9, 1922 the Duke of Abercorn was appointed Governor of Northern Ireland.

The most important legislative achievement of the Government of Northern Ireland has been the Education Act of 1923. Based largely on the recommendation of a committee of enquiry appointed in 1921 under the chairmanship of Sir R. Lynn, M.P., the Act established the principle of popular control under the county borough and county councils as local education authorities, the latter having power to appoint administrative sub-areas under "regional committees." The Intoxicating Liquor Act of the same session was an important piece of temperance legislation and achieved considerable reform in the sale of intoxicating liquors.

Boundary Question.—The chief obstacle to the development of better relations with the Irish Free State during the years 1923 and 1924 was the boundary question. The Government of Northern Ireland declined to appoint a Commissioner under Article 12 of the Irish Free State (Agreement) Act, 1922, and, as a consequence, the Irish Free State (Confirmation of Agreement) Act, 1924, was passed by the Imperial Government whereby, in the event of the continued refusal of the Government of Northern Ireland to appoint a boundary commissioner, the power of appointment residing in that Government was transferred to the British Government. The British Government and the Government of the Irish Free State had appointed as their respective Commissioners, Mr. Richard Feetham, a judge of the High Court of the Union of South Africa, and Prof. J. McNeill. Upon the passing of the above Act, the British Government appointed Mr. J. R. Fisher, barrister-at-law, as the Commissioner for Northern Ireland.

The boundary commission occupied upwards of a year in visiting, and hearing evidence in the various border districts in Ireland, and in considering the information so obtained. In Nov. 1925, on the eve of the promulgation of the report of the commission, the Free State commissioner withdrew. A conference was then held in London between the three governments represented on the commission, and a further agreement was concluded on Dec. 3, 1925. By the agreement, the Ireland (Confirmation of Agreement) Act, 1925, the three Governments "being united in amity" and "being resolved mutually to aid one another in a spirit of neighbourly comradeship" achieved the settlement which is set out in Article 1:—

The powers conferred by the proviso to Article 12 of the said Articles of Agreement on the commission therein mentioned are hereby revoked, and the extent of Northern Ireland for the purposes of the Government of Ireland Act, 1920, and of the said Articles of Agreement, shall be such as was fixed by sub-section (2) of section one of that Act.

The Act also provided for the transfer from April 1, 1926, of the Council of Ireland powers in relation to Northern Ireland to the Government of Northern Ireland. The constitution of Northern Ireland could now be described as being settled with finality.

The second parliament of Northern Ireland was elected in 1925, when Sir James Craig was again returned to power with a substantial majority over all other parties. All the Nationalist members of the Opposition had taken their seats before the close of the 1927–28 session. Only two members belonging to the Sinn Fein party still remained outside the House. The acceptance of the Parliament by the Nationalist party marks the abandonment of the original policy of opposition by abstention and the commencement of a new policy of opposition by recognized constitutional means. The establishment of a separate legislature has not led to a further differentiation of the law in Northern Ireland from that in other parts of the United Kingdom, but rather to the assimilation of the law in Northern Ireland to the law in Great Britain, and to the enlargement of the status of the subject in Northern Ireland to that of the subject in Great Britain. It is, perhaps, to this undertaking above all that the parliament of Northern Ireland, on a study of its statute-book, will be found to have addressed itself from its earliest inception. Particularly has social legislation in Northern Ireland kept pace with that at Westminster, adopting its various measures for unemployment insurance, and its comprehensive measure of 1925 for contributory old age pensions and pensions for widows and orphans of insured workers.

Moreover, it is to be noted that constitutional changes, either already made, such as the extension of the franchise to women on equal terms with men, or declared by the Government to be imminent, such as the abandonment of proportional representation and a reversion to single-member constituencies, bring electoral practice in Northern Ireland once more into line with that in Great Britain. (L.)

Defence.—From the military point of view, Northern Ireland forms one of the district commands of the British army. The commander is a Major-General, with his headquarters at Belfast. The troops under his command include 4 battalions of infantry, a signal company and the usual departmental troops. There are also recruit depots for battalions of the British army which are recruited in Northern Ireland, one at Omagh, for 2 battalions, and one at Armagh, for one battalion. There is also a British coast defence garrison at Lough Swilly, including a heavy battery of artillery, a fortress detachment of engineers, some signals, etc. There are no territorial or local troops in Northern Ireland. The strategic importance to the United Kingdom of all the harbours of Ireland is obvious to all students of the general problem of military defence. On this subject the late Admiral Mahan expressed his opinion that Ireland stands across "and controls" the approaches to the United Kingdom from the westward.

See also the British *Army List* (official). (G. G. A.)

FINANCIAL AND ECONOMIC HISTORY

Finance.—The financial provisions of the Government of Ireland Act, 1920, were necessarily of an intricate and comprehensive character, as not only did that Act completely overthrow the whole system of finance in force since the Act of Union of 1800, but went further and set up in Ireland two Exchequers, each under an entirely separate jurisdiction. Subsequent events have considerably modified the operation of the 1920 Act and it is therefore not necessary to deal in this article with Northern Ireland's position as regards the Irish Free State but simply to consider the relationship which exists under the Act between Northern Ireland and Great Britain, and the financial system which has been built up in Ulster since 1921.

The newly constituted State was not granted absolute financial autonomy. The Act of 1920 contemplated two distinct classes of revenue, and two classes of expenditure, (1) purely local revenue and expenditure and (2) taxation and expenditure which by reason of the wider issues involved, should not be delegated to a subsidiary authority. Under the first heading fall such duties as stamp duties, death duties and licence duties, together with expenditure on services such as old age pensions, police, education, etc., while included in the second category are the more important duties of income tax and customs and excise, and expenditure on the higher administration of justice, the Land Commission and certain other services.

Revenue.—Approximately 90% of the taxes are imposed and collected by the Imperial Government. In the year 1922–3 the revenue yielded by taxes under the control of the Imperial Government was £10,700,000, while the ordinary "transferred" tax revenue amounted to £923,000. This revenue, after deducting from it the cost of the various services reserved to the Imperial Govt., together with Ulster's contribution towards Imperial expenditure, is remitted to the Exchequer of Northern Ireland, and is used in the ordinary way to meet expenditure on local services. As a further source of revenue to meet the "additional expense incidental to the severance of the two Irish Governments," it was provided that produce of Land Purchase Annuities payable by those agricultural tenants who had bought out their holdings under the Land Purchase Acts (and who had effected their purchases by the payment of annuities extending over a period of 65 years) should be transferred to the Northern Government. After making provisions for a sinking fund with the object of ensuring a permanent revenue from this service, these land annuities produce a net revenue of £550,000 which should be added to the figures given above.

Fiscal Uniformity.—The control by the Imperial authority of the main sources of revenue requires almost complete fiscal uniformity between Ulster and Great Britain, and necessarily ensures that the industrial and general economic policy of the Province must, in practice, largely conform to that of the Imperial Government, not only in a local sense, but also in its commercial relations with foreign countries. Hence no tariff barriers can be erected between Northern Ireland and Great Britain, and the normal flow of merchandise between the two areas has continued without the inconveniences and hindrances resulting from the imposition of customs duties.

Contribution to Imperial Expenditure.—The Act of 1920 enacted that the Province should make a fixed statutory contribution to "Imperial" services, but this proving unworkable, it was eventually agreed to set up an arbitration committee which, after sitting for two years and having heard expert evidence on both sides, issued its final award in March 1925, settling the principles upon which Ulster's contribution is in future to be assessed. In brief, the contribution will be the balance of revenue over expenditure; for the purpose of making this calculation the taxes over which Ulster has control are to be presumed to raise a sum proportionate to the yield of similar taxes in Britain; while on the expenditure side the Province is allowed for development and social service a sum proportionate to the amounts required by Britain for similar purposes.

Reduction in Revenue.—The reductions in taxation made by the Chancellor of the Imperial Exchequer from time to time in the intervening years between 1922 and 1925 have had their reaction on the revenues of Northern Ireland resulting in an annual diminution in revenue of approximately £1,889,000. The severe

depression in trade has also been responsible for a further diminution in revenue; actual yield of taxes levied in Northern Ireland by the Imperial Government falling from £10,562,000 in 1922 to £8,217,000 in 1925. These reductions were naturally reflected in a corresponding decrease in the contribution which Northern Ireland was able to make towards the cost of Imperial services.

Public Debt.—Unhappily the establishment of the Government of Northern Ireland synchronised with the beginning of a period of profound commercial and industrial depression, with its natural reaction on employment. The principal industries of the Province—shipbuilding and the linen trade—suffered to an unwonted degree, thus compelling the newly-formed Government to finance the Unemployment Insurance Fund to an extent quite disproportionate to that of Great Britain, whose varied industries scattered over a wide area ensure a greater degree of solvency for its insurance scheme. At the end of the financial year—1924-5—the accumulated deficit of the unemployment fund was approximately £2,300,000. (The figures given throughout this article are the latest available: administrative difficulty having considerably delayed the publication of others.)

Capital Funds.—On its establishment the Government of Northern Ireland had received its apportioned share of the different capital funds previously set up in Ireland for administrative purposes, and including amongst others the Church Temporalities Fund, Teachers' Pension Fund, Development Fund, etc. It had in addition created certain other capital and sinking funds. To a very considerable extent the requirements of the Unemployment Insurance Fund and of Local Authorities and others to whom loans were made have been met by the temporary utilisation of this available capital. These sources were, however, insufficient to meet all the demands made on the Government, and a public debt was therefore created by the issue of Ulster Savings Certificates in April 1922, followed in Nov. 1925 by an Ulster Loan Stock issue of £2,000,000. The former, guaranteed by the British Government and providing a remunerative investment for savings, met with an immediate and sustained response throughout the Province. By March 31, 1925 a sum of £1,500,000 (after deducting repayments) had been invested in this way. The proceeds of the Ulster Loan Stock issue are available only for the purposes mentioned in the Government Loans and Exchequer Provisions Act (N.I.) 1925, which do not include the making of advances to the Unemployment Fund. Of the stock £1,000,000 was reserved for the investment of Government funds, the remaining moiety being taken up by public subscription.

The Budget.—Statistics regarding the public finances of Northern Ireland for the year ended March 31, 1925 showed a total revenue, including Post Office receipts, of approximately £11,336,000; the total expenditure for the same period amounted to £7,713,000, leaving a balance of revenue over expenditure of £3,623,000. Of this £3,472,000 was contributed to Great Britain, leaving a net surplus of £151,000.

Production and Industry.—Agriculture is one of the principal industries of the country and large quantities of butter, eggs and general agricultural produce are exported to Great Britain. Considerable quantities of flax are also grown and it is expected that the research work now being undertaken in this branch of agriculture will not only improve the quality of the flax but will also greatly stimulate general interest in this product.

During the post-War period the trade in live stock greatly increased. Up to 1926 Ulster had escaped the ravages of foot-and-mouth disease, and indeed was particularly free from outbreaks of animal diseases generally. During 1924 a total of 424,000 cattle, etc., were exported, chiefly to Great Britain.

The main industries of Northern Ireland are the manufacture of linen, shipbuilding, engineering, rope making and distilling. The linen industry normally employs directly or indirectly approximately 120,000 workers. Over 1,000,000 flax spindles are in use, representing one-third of the world's entire flax-spinning capacity; 40,000 looms are engaged in weaving. The major portion of the shipbuilding industry is located at Belfast, where a large number of the world's most famous vessels have been built, including the well-known "Titanic" and "Olympic." During 1923, 12 mercantile steam vessels with a total tonnage of 75,782 were launched in the North Irish yards.

Over 50 important firms are engaged in Belfast and the immediate vicinity in the manufacture of textile machinery of all kinds; heating, ventilating and drying plants and almost every variety of equipment for factories. There are some 12 modern distilleries operating in Ulster which together produced during the year ended March 31, 1924 a total of 2,534,426 proof gallons of spirits. A number of other industries are carried on. Belfast possesses the largest ropeworks in the world, which employ over 3,500 persons and can produce 350 tons per week of all classes of ropes and twines. Tobacco, soap, woollen goods, felt and aerated waters are also manufactured.

Trade.—Northern Ireland carries on a very considerable export trade. Statistics for 1923 show that the value of the exports for that year to Great Britain and foreign countries totalled £66,000,000, while the imports for the corresponding period amounted to £65,000,000.

Finance.—There are three banking companies having their head offices in Northern Ireland, viz.: the Belfast, Ulster and Northern banks. In addition there are several other banks operating in Ulster. The purely North Irish banks have all a close working agreement with one of the leading English Joint Stock Banks. The deposits in these three banks amounted in 1924 to over £48,000,000 while the advances of various descriptions totalled £31,000,000. In addition to these deposits the sums deposited in Trustee and Post Office Savings banks amounted to almost £9,000,000 in 1924. On Dec. 31, 1924, there were approximately 1,350 living companies registered in Northern Ireland with a nominal capital of £71,000,000 and a subscribed capital of £59,000,000.

An analysis of the registered capital produces the following results:—

Banking, etc.	£11,000,000
Brewing and distilling	2,250,000
Shipbuilding	13,500,000
Textile manufacturers	21,000,000
Engineering	10,000,000
Others	13,250,000
	£71,000,000

Communications.—The principal ports of Ulster are Belfast, Londonderry, Coleraine and Newry, while in addition there are Royal Harbours at Donaghadee and Ardglass. Of these Belfast is the most important. Belfast Harbour covers 2,287 acres and possesses a total lineal quayage of 26,512 feet. There are in addition, five graving docks, the largest of which is 850ft. long and 96ft. wide at the entrance. During 1923 the number of vessels arriving at ports in Northern Ireland totalled 12,383 with an aggregate tonnage of 4,872,225.

Northern Ireland is exceptionally well provided with roads and a very marked increase in the use of motor transport has been noticeable in the post-War period. There were altogether 12,892m. of roads in 1925 consisting of:—

	miles
Main trunk roads and the more important inter-town routes	1,023
Less important inter-town routes	1,111
All other roads	10,758
	12,892

There are seven private railway undertakings situated wholly in Northern Ireland and five others extending into the Irish Free State. The total mileage in Northern Ireland in 1925 was as follows: standard gauge 815m., narrow gauge 301 miles. The authorised capital of the railways wholly in Ulster is £1,888,757 and of those partly in Ulster and partly in the Free State £11,141,356. The total receipts in 1923 amounted to £1,090,526 in the case of Ulster railways and £2,395,285 in respect of the others.

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Free State Constitution Act, 1922 (Session 2) [13 Geo. 5, Ch. 1]; *Irish Free State (Consequential Provisions) Act, 1922* [13 Geo. 5, Ch. 2, Session 2]; *Constabulary (Ireland) Act, 1922* [12 and 13 Geo. 5, Ch. 55]; *Standing Orders of the Senate and of the House of Commons relative to Local Bills, 1923; Irish Free State (Confirmation of Agreement) Act, 1924* [14 and 15 Geo. 5, Ch. 41]; *Irish Free State (Agreement) Act, 1922; Report of the Judicial Committee of the Privy Council on Questions Connected with the Irish Boundary Commission* (Cmd. 2214 of 1924); *Irish Free State and Northern Ireland. Correspondence* (and further correspondence) *between His Majesty's Government and the Governments of the Irish Free State and Northern Ireland relating to Article 12 of the Articles of Agreement for a Treaty between Great Britain and Ireland* (Cmd. 2155 and 2166 of 1924); *Parliament of Northern Ireland, Standing Orders relating to Public Business. Adopted by the House of Commons, 1924; Ireland (Confirmation of Agreement) Act, 1925* [15 and 16 Geo. 5, Ch. 77]; *Ulster Year Book* (1926). (H. M. P.)

IRENAEUS (b. *c.* 130), bishop of Lyons at the end of the 2nd century, was one of the most distinguished theologians of the ante-Nicene Church. Very little is known of his early history. His childhood was spent in Asia Minor, probably at or near Smyrna; for he says (*Adv. haer.* iii. 3, 4, and Euseb. *Hist. Eccl.* v. 20) that as a child he heard the preaching of Polycarp, the aged bishop of Smyrna (d. 156). He can hardly have been born very long after 130, for later on he frequently mentions having met certain Christian presbyters who had actually seen John, the disciple of our Lord. At the time of the persecution of the Gallic Church under Marcus Aurelius (177) he was a presbyter of the church at Lyons. In 177 or 178 he went to Rome on a mission from this church, to make representations to Bishop Eleutherius in favour of a more lenient treatment of the Montanists. (*See* MONTANISM; Eus. v. 4. 2.)

On his return to Lyons Irenaeus was called upon to replace Bishop Pothinus, who had perished in the persecution (Eus. v. 5. 8). As bishop he carried on a great and fruitful work. Though the statement of Gregory of Tours (*Hist. Franc.* i. 29), that within a short time he succeeded in converting all Lyons to Christianity, is probably exaggerated, from him at any rate dates the wide spread of Christianity in Lyons and its neighbourhood. He sought to reconcile the numerous sects which menaced the existence of the church. In the dispute on the question of Easter, he endeavoured to effect a compromise, and in particular to exercise a moderating influence on Victor, the bishop of Rome, and his unyielding attitude towards the dissentient churches of Africa, thus justifying his name of "peace-maker" (Eirenaios) (Eus. *H.E.* v. 24. 2S). The date of his death is unknown. His martyrdom under Septimius Severus is related by Gregory of Tours, but by no earlier writer.

The chief work of Irenaeus, written about 180, is his "Refutation and Overthrow of Gnosis, falsely so called" (usually indicated by the name *Against the Heresies*). Of the Greek original of this work only fragments survive; it only exists in full in an old Latin translation. The treatise is divided into five books: of these the first two contain a description and criticism of the tenets of various heretical sects, especially the Valentinians; the other three set forth the true doctrines of Christianity. His work is the first systematic exposition of Catholic belief. The foundation upon which Irenaeus bases his system consists in the episcopate, the canon of the Old and New Testaments, and the rule of faith. With their assistance he sets forth and upholds, in opposition to the gnostic dualism, *i.e.*, the severing of the natural and the supernatural, the Catholic monism, *i.e.*, the unity of the life of faith as willed by God. The "grace of truth" (the *charisma*), which the apostles had called down upon their first disciples by prayer and laying-on of hands, and which was to be imparted anew by way of succession (*διαδοχή, successio*) to the bishops from generation to generation without a break, makes those who receive it living witnesses of the salvation offered to the faithful by written and spoken tradition. The Scriptures of the Old and New Testaments, rightly expounded by the church alone, give us an insight into God's plan of salvation for mankind, and explain to us the covenant which He made on various occasions (Moses and Christ; or Noah, Abraham, Moses and Christ). Finally, the "rule of faith" (*regula fidei*), received at baptism, contains in itself all the riches of Christian truth.

This exposition by Irenaeus of the divine economy and the incarnation was taken as a criterion by later theologians, especially in the Greek Church. (*Cf.* Athanasius, Gregory of Nyssa, Cyril of Alexandria, John of Damascus.) He himself was especially influenced by St. John and St. Paul. Before him the Fourth Gospel did not seem to exist for the Church; Irenaeus made it a living force. His conception of the Logos is not that of the philosophers and apologists; he looks upon the Logos not as the "reason" of God, but as the "voice" with which the Father speaks in the revelation to mankind, as did the writer of the Fourth Gospel. And the Pauline epistles are adopted almost bodily by Irenaeus, according to the ideas contained in them: his expositions often present the appearance of a patchwork of St. Paul's ideas. Certainly, it is only one side of Paul's thought that he displays to us. The great conceptions of justification and atonement are hardly ever touched by Irenaeus.

Till recent times whatever other writings and letters of Irenaeus are mentioned by Eusebius appeared to be lost, with the exception of a fragment here or there. Two Armenian scholars, Karapet Ter-Mĕkĕrttschian and Erwand Ter-Minassianz, published from an Armenian translation a German edition (Leipzig, 1907; minor edition 1908) of the work "in proof of the apostolic teaching" mentioned by Eusebius (*H.E.* v. 26). This work, which is in the form of a dialogue with one Marcianus, otherwise unknown to us, contains a statement of the fundamental truths of Christianity. It is the oldest catechism extant, and an excellent example of how Bishop Irenaeus was able not only to defend Christianity as a theologian and expound it theoretically, but also to preach it to laymen.

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IRENE, the name of several Byzantine empresses.

1. IRENE (752–803), the wife of Leo IV., East Roman emperor. Originally a poor but beautiful Athenian orphan, she speedily gained the love and confidence of her feeble husband, and at his death in 780 was left by him sole guardian of the empire and of their ten-year-old son Constantine VI. Seizing the supreme power in the name of the latter, Irene ruled the empire at her own discretion for ten years, displaying great firmness and sagacity in her government. Her most notable act was the restoration of the orthodox image-worship, a policy which she always had secretly favoured, though compelled to abjure it in her husband's lifetime. Having elected Tarasius, one of her partisans, to the patriarchate (784), she summoned two church councils. The first, held in 786 at Constantinople, was frustrated by the opposition of the soldiers. The second, convened at Nicaea in 787, revived the adoration of images and reunited the Eastern church with that of Rome.

As Constantine approached maturity he began to grow restive under her autocratic sway. An attempt to free himself by force was met and crushed by the empress, who demanded that the oath of fidelity should thenceforward be taken in her name alone. The discontent which this occasioned swelled in 790 into open resistance, and the soldiers, headed by the Armenian guard, formally proclaimed Constantine VI. as the sole ruler. A hollow semblance of friendship was maintained between Constantine and Irene, whose title of empress was confirmed in 792; but the rival factions remained, and Irene, by skilful intrigues with the bishops and courtiers, organized a powerful conspiracy on her own behalf. Constantine could only flee for aid to the provinces, but even there he was surrounded by participants in the plot. Seized by his

attendants on the Asiatic shore of the Bosporus, the emperor was carried back to the palace at Constantinople; and there, by the orders of his mother, his eyes were stabbed out.

Irene reigned in prosperity and splendour for five years. She is said to have endeavoured to negotiate a marriage between herself and Charlemagne; but according to Theophanes, who alone mentions it, the scheme was frustrated by Aëtius, one of her favourites. A projected alliance between Constantine and Charlemagne's daughter, Rothrude, was in turn broken off by Irene. In 802 the patricians, upon whom she had lavished every honour and favour, conspired against her, and placed on the throne Nicephorus, the minister of finance. The haughty and unscrupulous princess, "who never lost sight of political power in the height of her religious zeal," was exiled to Lesbos and forced to support herself by spinning. She died the following year. Her zeal in restoring images and monasteries has given her a place among the saints of the Greek church.

See E. Gibbon, *The Decline and Fall of the Roman Empire* (ed. J. Bury, London, 1896), vol. v.; G. Finlay, *History of Greece* (ed. 1877, Oxford), vol. ii.; F. C. Schlosser, *Geschichte der bilderstürmenden Kaiser des oströmischen Reiches* (Frankfort, 1812); J. D. Phoropoulos, Εἰρήνη ἡ αὐτοκράτειρα Ῥωμαίων (Leipzig, 1887); J. B. Bury, *The Later Roman Empire* (London, 1889), ii. 480–498; C. Diehl, *Figures byzantines* (Paris, 1906), pp. 77–109, and in *Cambridge Mediaeval History*, vol. iv., pp. 19–25. (M. C.)

2. IRENE [DUCAS] (*c.* 1066–*c.* 1120), the wife of Alexius I. The best-known fact of her life is the unsuccessful intrigue by which she endeavoured to divert the succession from her son John to Nicephorus Bryennius, the husband of her daughter Anna. Having failed to persuade Alexius, or, upon his death, to carry out a *coup d'état* with the help of the palace guards, she retired to a nunnery and ended her life in obscurity.

3. IRENE (d. 1161), the first wife of Manuel Comnenus. She was the daughter of the count of Sulzbach, and sister-in-law of the Roman emperor Conrad III., who arranged her betrothal. The marriage was celebrated at Constantinople in 1146. The new empress, who had exchanged her earlier name of Bertha for one more familiar to the Greeks, became a devoted wife, and by the simplicity of her manner contrasted favourably with most Byzantine queens of the age.

H. v. Kap-Herr, *Die abendländische Politik des Kaisers Manuel* (Strasbourg, 1881).

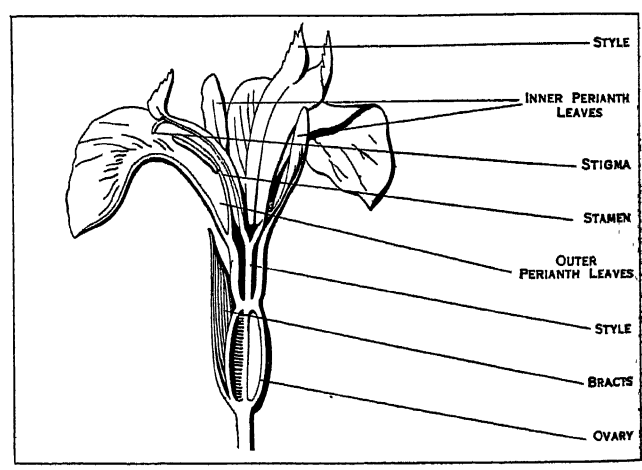
IRETON, HENRY (1611–1651), English parliamentary general, eldest son of German Ireton of Attenborough, Nottinghamshire, was baptized on Nov. 3, 1611, became a gentleman commoner of Trinity College, Oxford, in 1626, graduated and entered the Middle Temple in 1629. On the outbreak of the Civil War he joined the parliamentary army, fought at Edgehill (1642) and at Gainsborough (1643), was made by Cromwell deputy-governor of the Isle of Ely, and next year served under Manchester, afterwards supporting Cromwell in his accusations of incompetency against the general. On the night before the battle of Naseby, in June 1645, he surprised the Royalist army and captured many prisoners, and next day was made commissary-general and appointed to the command of the left wing, Cromwell himself commanding the right. The wing under Ireton was broken by the charge of Rupert, and Ireton was wounded and taken prisoner, but after Cromwell's rout of the enemy he escaped. He took an active part in the campaign which resulted in the overthrow of the royal cause. On Oct. 30, 1645 Ireton entered parliament as member for Appleby, and while occupied with the siege of Oxford he was, on June 15, 1646, married to Bridget, Cromwell's daughter. He was opposed to the destructive schemes of the extreme party, disliked especially the abstract and unpractical theories of the Republicans and the Levellers, and desired, while modifying their mutual powers, to retain the constitution of King, Lords and Commons. He urged these views in the negotiations of the army with the parliament, and in the conferences with the king, being chiefly entrusted with the drawing up of the army proposals. He endeavoured to prevent the breach between the army and the parliament, but when the division became inevitable took the army side. He aroused great suspicion by supporting the negotiations with the king. But becoming at length convinced of the hopelessness of dealing with Charles, after the king's flight to the Isle of Wight he urged the parliament to establish an administration without him. Ireton served under Fairfax in the second civil war in the campaigns in Kent and Essex, and was responsible for the executions of Lucas and Lisle at Colchester. After the rejection by the king of the last offers of the army, he showed special zeal in bringing about his trial, was one of the chief promoters of "Pride's Purge," attended the court regularly, and signed the death-warrant. Ireton accompanied Cromwell in his Irish campaign, and was appointed major-general; on the recall of his chief to take the command in Scotland, he remained as lord-deputy to complete Cromwell's work of reduction and replantation. He was rapidly bringing his task to a close, when he died on Nov. 26, 1651 of fever after the capture of Limerick. His loss "struck a great sadness into Cromwell," for while he possessed high abilities as a soldier, and great political insight, he resembled in stern unflinchingness of purpose the protector himself. Ireton left one son and three daughters.

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IRIARTE (or YRIARTE), **TOMÁS DE** (1750–1791), Spanish poet, was born in the island of Teneriffe. His *Fábulas literarias* (1781), composed in a great variety of metres, show considerable ingenuity in their humorous attacks on literary men and methods; but their merits have been greatly exaggerated. During his later years, partly in consequence of the *Fábulas*, Iriarte was absorbed in personal controversies with Forner and others.

See E. Cotarelo y Mori, *Iriarte y su época* (1897).

IRIDACEAE (the iris family), in botany, a family of flowering plants belonging to the order Liliiflorae of the class Monocotyledons, containing about 800 species in 60 genera, and widely distributed in temperate and tropical regions. The members of this family are generally perennial herbs growing from a corm as *Crocus* and *Gladiolus*, or a rhizome as *Iris*; more rarely, as the Spanish iris, from a bulb. A few South African representatives have a shrubby habit. The flowers are hermaphrodite and regular as in *Iris* and *Crocus*, or with a symmetry in the median plane as in *Gladiolus*. The arrangement of the flower parts resembles that in the nearly allied order Amaryllidaceae (*Narcissus*, *Snowdrop*), but differs in the absence of the inner whorl of stamens.



FROM GROOM, "ELEMENTARY BOTANY" (G. BELL)

IRIS (IRIS PSEUDACORUS). LONGITUDINAL SECTION THROUGH FLOWER

The most important genera are *Crocus* (*q.v.*), with about 60 species, *Iris* (*q.v.*), with about 200 and *Gladiolus* (*q.v.*), with 150. *Ixia*, *Freesia* (*q.v.*) and *Tritonia* (including *Montbretia*), all natives of South Africa, are well known in cultivation. *Sisyrinchium*, blue-eyed grass, is a new-world genus of 75 species, extending from arctic America to Patagonia and the Falkland Isles. One species, *S. angustifolium*, an arctic and temperate North American species, is also native in Galway and Kerry in



PAINTED FOR THE ENCYCLOPÆDIA BRITANNICA BY ISABEL COOPER

TWELVE CULTIVATED VARIETIES OF IRIS

The iris family (*Iridaceae*) comprises about 1,000 species and has representatives throughout the temperate and tropical regions. Besides the familiar irişes the family includes many other plants cultivated for ornaments, as gladioli, freesias and crocuses

TALL BEARDED IRISES: 1. Iris (*Plicata* type). 2. Iris (*Kochi*). 3. Hybrid Trojan iris (*I. trojana* x). 4. Iris (*Flavescens*). 6. Iris (*Neglecta* type). 8. Trojan iris (*I. trojana*). 9. Céleste iris. 11. Yemen iris (*I. albicans*)

BULBOUS IRISES: 5. Purple Spanish iris (*I. Xiphium*). 7. Dutch iris (*I. Xiphium hybridum*). 10. White Spanish iris (*I. Xiphium* var.). 12. Dutch iris (*I. Xiphium hybridum*)

Ireland. Other British representatives of the family are: *Iris Pseudacorus* (yellow iris), common by river-banks and ditches, *I. foetidissima* (stinking iris), *Gladiolus illyricus*, a rare plant found in the New Forest and the Isle of Wight, and *Romulea Columnae*, a small plant with narrow recurved leaves a few inches long and a short scape bearing one or more small regular funnel-shaped flowers, which occurs at Dawlish in Devonshire. In the eastern United States there are 10 species of *Iris* and 13 species of *Sisyrinchium*, but in the Rocky Mountain region these genera are represented by only 2 or 3 species.



IRIS

IRIDIUM, a metal found in small amounts in ordinary platinum ore, but generally obtained from the native alloy osmiridium. (Symbol Ir, atomic number 77, atomic weight 193·1.) The best method of obtaining it is that of Deville and Debray (*see* RUTHENIUM and OSMIUM), the process having been further simplified by G. Matthey (*Proc. Roy. Soc.*, 1879). The metal was first definitely identified by Smithson Tennant in 1804 (although other chemists, such as Descotels, Faucroy and Vauquelin, had previously indicated its separate existence) and was by him named iridium in consequence of the varying colour of its compounds. The metal is usually separated in the form of sparingly soluble ammonium iridium chloride, $(NH_4)_2IrCl_6$; this salt on ignition gives a residue of pure spongy iridium from which the massive form of the metal may be obtained by fusion. Iridium is a white metal possessing a lustre similar to that of steel; it is very hard and somewhat brittle when pure, but loses the latter property when alloyed with small quantities of other metals. It has the greatest density of any known substance (sp. gr.—22·4), and melts at about 2,260° C., volatilizing at a somewhat higher temperature. In the massive state the metal is practically insoluble in all acids, but in the spongy or finely divided condition it is attacked by aqua regia producing the higher chloride $IrCl_4$.

Iridium is known to form two oxides, Ir_2O_3 and IrO_2, which both act as bases forming salts with acids. The former is produced by igniting the finely divided metal in oxygen at a temperature below 800° C.; at a higher temperature decomposition into its elements results. The higher oxide is formed by gentle ignition of the corresponding hydroxide, $Ir(OH)_4$. The salts of iridium are not of great importance. Two chlorides, $IrCl_3$ and $IrCl_4$, are known, and with chlorides of the alkali metals these readily form double salts of the types M_3IrCl_6 and M_2IrCl_6, most of which are easily soluble in water. Corresponding bromine compounds of iridium are also known, and at least three sulphides have been identified. Iridium forms many compounds with ammonia (*see* AMMINES) which in their properties are generally similar to those of the corresponding rhodium and platinum derivatives. The metal iridium is of considerable importance in industry, the chief use being in the form of platinum alloys. Platinum itself is a soft metal and as such is not suitable for general use. If, however, a small percentage of iridium is alloyed with it, the metal becomes very much harder, and hence ordinary platinum dishes, crucibles and weights always consist of a platinum iridium alloy, unless for special reasons pure platinum is necessary. The standard metre (étalon) is made of an alloy containing 90 parts of platinum and 10 parts of iridium (*see* PLATINUM). Iridium is also used to a small extent for producing a splendid black colour on china or porcelain. In magnetos, iridio-platinum is a necessity for contacts, screws, etc., as it resists the temperature of the electric spark much better than pure platinum. As a material for anodes in electrolytic reduction, platinum is the most suitable metal, but when the electrolyte contains chlorides pure platinum undergoes corrosion and iridio-platinum alone is satisfactory. Iridium is always determined quantitatively by ignition of any of its salts and conversion into the metal. (F. E. M.)

IRIGA, a municipality (with 13 *barrios* or districts) of the province of Camarines Sur, Philippine islands, on the Bikol river, about 20 m. S.E. of Naga, the provincial capital, and near the south-west base of Mt. Iriga, a volcanic peak reaching a height of about 4,000 ft. above sea-level. It is on the railway running south from Manila through Naga. Pop. (1918), 24,145, of whom 11,955 were males and 18 whites. The soil in its vicinity is rich, producing rice, corn, sugar, pepper, cacao, cotton, abacá, tobacco and copra. Various valuable hardwoods are found in the nearby regions. In 1918, it had 11 manufacturing establishments with output valued at 100,000 pesos; three rice mills with output valued at 162,600 pesos; and 718 household industry establishments with output valued at 128,800 pesos. Eleven of the 12 schools were public. The language spoken is Bikol.

IRIS, in Greek mythology, daughter of Thaumas and the ocean nymph Electra (according to Hesiod), the personification of the rainbow and messenger of the gods; as a messenger of the gods, she is mentioned frequently in the *Iliad*, but never in the *Odyssey*, where Hermes takes her place. She is in Homer the messenger of both Zeus and Hera, but later the especial servant of Hera. By command of Zeus she carries in a ewer water from the Styx, with which she puts to sleep all gods who perjure themselves. Her attributes are the *caduceus* (herald's staff) and a vase.

IRIS. In botany, the iris plant belongs to the family Iridaceae of the class Monocotyledons; it is characterized by a petaloid six-parted perianth, an inferior ovary and only three stamens (the outer series), being thus distinguished from the Amaryllidaceae family, which has six stamens. They are handsome showy-flowered plants, the Greek name having been applied on account of the hues of the flowers. The genus contains about 200 species widely distributed throughout the north temperate zone. Two of the species are British. *I. Pseudacorus*, the yellow flag or iris, is common in Britain on river-banks, and in marshes and ditches. It is called the "water-flag" or "bastard floure de-luce" by Gerard; its flowers appear in June and July, and are of a bright golden-yellow colour. The other British species, *I. foetidissima*, the fetid iris, gladdon or roast-beef plant, the *Xyris* or stinking gladdon of Gerard, is a native of England south of Durham, and also of Ireland, southern Europe and North Africa.

In North America there are about 20 native species, found chiefly in the eastern United States; among the best known are the blue flag (*I. versicolor*) which grows in wet places from Newfoundland to Manitoba and southward to Florida and Arkansas, and the western blue flag (*I. missouriensis*), native to wet soils from North Dakota and New Mexico westward to California and British Columbia.

Iris florentina, with white or pale-blue flowers, is a native of the south of Europe, and is the source of the violet-scented orris root used in perfumery. *Iris germanica* of central Europe, "the most common purple Fleur de Luce" of Ray, is the large common blue iris of gardens, the bearded iris or fleur de luce and probably the Illyrian iris of the ancients. The garden plants known as the Spanish iris and the English iris are both of Spanish origin, and have very showy flowers. Along with some other species, as *I. reticulata* and *I. persica*, both of which are fragrant, they are great favourites with florists. All these just mentioned differ from those formerly named in the nature of the underground stem, which forms a bulb and not a strict creeping rhizome as in *I. Pseudacorus, germanica, florentina*, etc.

The iris flower is of special interest as an example of the relation between the shape of the flower and the position of the pollen-receiving and stigmatic surfaces on the one hand and the visits of insects on the other. The large outer petals form a landing-stage for a flying insect which in probing the perianth-tube for honey will first come in contact with the stigmatic surface which is borne on the outer face of a shelf-like transverse projection on the under side of the petaloid style arm. The anther, which opens towards

the outside, is sheltered beneath the over-arching style arm below the stigma, so that the insect comes in contact with its pollen-covered surface only after passing the stigma, while in backing out of the flower it will come in contact only with the non-receptive lower face of the stigma. Thus an insect bearing pollen from one flower will in entering a second deposit the pollen on the stigma, while in backing out of a flower the pollen which it bears will not be rubbed off on the stigma of the same flower.

IRISH, the Celtic language of Ireland (*q.v.*), also called Erse. Old Irish (700–1100) contains a wealth of inflectional forms in declension and conjugation. Many of the forms, however, disappeared early. An interesting rule of vocalic harmony (slender to slender and broad to broad) is recorded. In Irish final syllables in general disappear except long vowels followed by *s* or *r* and *u/o* preceded by *i*. There were difficulties due to the insufficiency of symbols, and it is possible that popular speech moved rapidly ahead of the written language in phonetic developments. In Middle Irish the declensions and conjugations were much simplified. The neuter gender disappeared. In several respects the verbal system is developed as compared with the old Irish forms, details of which are given in standard grammars. Dialectical variations must have existed from early times, and while Leinster Irish has disappeared, there are still peculiarities distinguishing the Irish of Munster, Connaught and Ulster, the south being more conservative than the north. In the early period a number of loan words appear from Latin connected with the church or with articles of civilization. There are some of Norse origin. In the Middle Irish periods many French words were accepted. English has now provided a large number of words but the revival of Irish under the new political conditions should lead to further developments.

See J. Vendryes, *Grammaire du vieil-irlandais* (1908); R. Thurneysen, *Handbuch des Alt-Irischen* (1909), also *Revue Celtique* and *Zeitschrift für keltische Philologie.*

IRISH FREE STATE (Saorstat Eireann). The Irish Free State, with the status of a British dominion, came officially into being on Jan. 15, 1922, when the Irish Peace Agreement, signed in London on Dec. 6, 1921, by the British and Irish delegations, already ratified by the British Parliament on Dec. 16, was adopted by a meeting of elected members of the parliament of Southern Ireland convened by Arthur Griffith. In 1923 the State was admitted a member of the League of Nations. The new State is composed of 26 of the counties and four of the county boroughs of Ireland. Its area is 17,019,155 statute ac., and its estimated population in 1926 was 2,972,802.

HISTORY

The treaty which led to the creation of the Irish Free State was concluded by the British Government with representatives of an Irish Government, which Great Britain had never recognized. From Jan. 1919, onwards, a large majority of the members of parliament elected for Irish constituencies had styled themselves Dáil Eireann—the Assembly of Ireland—had declared the Irish Republic in existence and had chosen a president and ministers. In May 1921, when elections were held under the Government of Ireland Act, 1920, Republican candidates were returned unopposed for all constituencies outside of Northern Ireland (except that of Dublin university) and for several constituencies in Northern Ireland. This, the second Dáil, met for the first time after the truce at the Dublin Mansion House on Aug. 16, 1921. All its members took the oath to the republic. Negotiations with Great Britain, at first conducted by E. de Valera, were resumed by a delegation headed by Arthur Griffith and Michael Collins. When the terms of the treaty were published on Dec. 6, 1921, de Valera announced his opposition. In the Dáil's debate, prolonged until Jan. 8, 1922, it was generally admitted that the country at large was for acceptance, but the treaty was accepted by the Dáil with a majority of only 64 to 57; and when de Valera resigned the presidency, Griffith was elected by only two votes.

The Provisional Government.—Under Article 17 of the treaty a provisional government was appointed at a meeting in which all members elected for constituencies in Southern Ireland were summoned. Opponents of the treaty absented themselves. Eight men were named members of the Provisional Government, Collins being chairman. Griffith remained outside it. So did General Mulcahy, who became minister for defence. In theory the army was still the army of the republic, and the Provisional Government had no force at its disposal. The old constabulary was at once disbanded. Collins and his colleagues decided at once to form a new "Civic Guard," but it necessarily took time to organize, and its creators had decided in principle that it should be unarmed. British troops were rapidly evacuating the country. There was the Irish army, now largely in uniform; but it soon became clear that the army was a source of danger.

With the exception of Collins, only one man in the Provisional Government, Prof. Eóin MacNeill, was widely known in Ireland. Of the others, William Cosgrave, minister for local government, had been a prominent member of the Dublin Corporation from 1913 on, and in 1917 was returned as a Sinn Féin member of parliament. Duggan had been one of the signatories to the treaty. The others, K. O'Higgins, J. Magrath, F. Lynch and P. J. Hogan, were still young men with their careers yet to come.

Collins, a man of immense resource and energy, sought to strengthen his position by the reunion of Ireland. Under the treaty, if Northern Ireland consented, all powers retained in that province by the Parliament at Westminster would pass to the Parliament of the Free State. Interviews with Sir James Craig (Lord Craigavon), the Ulster prime minister, were arranged. Settlement was desirable for North as well as South, since in Belfast there raged a murderous strife between Catholic and Protestant; but no accommodation proved possible. Both Griffith and Collins desired a general declaration from the country by an election. But the Republicans, knowing as well as they what the result would be, resisted this, and de Valera called instead, on Feb. 21, a convention of delegates of the whole Sinn Féin organization. At this meeting, Collins consented to delay the election for at least three months and not to hold it till the draft of a constitution, based on the treaty, had been published.

Meanwhile, various acts of open disorder were committed in the name of the republic, which Collins, in hope of avoiding conflict, declined to punish. De Valera proclaimed at meetings that there was only one legitimate government in Ireland—that of the republic. The extremist Republican Party definitely desired renewal of war with England, and their armed bands still moved uncontrolled, levying toll from banks and commandeering motor-cars.

It appeared from his public utterances that President Griffith desired drastic action; but Michael Collins, the head of the Provisional Government, whose personal hold was stronger still, compromised, and on May 20 announced that he had reached agreement with de Valera. An election was to be held, but Free Staters and Republicans were to put forward a joint panel of candidates, so arranged as to reproduce the distribution of views in the existing Dáil. After the election a coalition ministry was to be formed, giving de Valera four seats in nine. The result of the election was not to be considered as a vote on the treaty. Appeal was made jointly that no other candidates be selected. But organized Labour insisted on putting forward candidates, and other interests took courage to follow their example. Michael Collins, at Cork, publicly advised the people to vote as they chose. There resulted some appearance of a free election in some constituencies, where the polling took place on June 16. Thirty-four candidates not on the agreed panel were elected—all supporting the treaty. The Republican defeat was evident.

CIVIL WAR

Several aggressive actions by the mutinous section of the army then followed, and on June 22 Sir Henry Wilson was murdered in London by two Irishmen who had served in the British army. The British Government made it clear that the Free State must act. A definite cause of action was afforded when the mutineers captured, in Dublin, the assistant chief of staff of the Free State army and held him as a hostage. On June 28 the Four Courts headquarters were summoned to surrender, and on refusal

siege was laid. After eight days' of localized fighting the struggle in Dublin was over. Rory O'Connor, who led the section in the army that demanded the right to be consulted on the terms of any settlement, was captured after he had blown up the Four Courts with all their records. De Valera, who had joined the insurgents, escaped.

Some districts of the country south and west were held by Republicans. The Government's army had neither a trained staff nor a system of supply. Five members of the Government took rank as generals, and Collins himself, flinging his whole energy into the struggle which he had so long sought to avoid, became commander-in-chief. But on Aug. 12 Arthur Griffith died suddenly. Ten days later, on the 22nd, Collins was killed in an ambush in the Co. Cork. Thus the task of establishing the Free State fell not to any man but to a group, the right wing of Sinn Féin.

Framing the Constitution.—It was necessary under the treaty that the third Dáil should as a provisional parliament frame a constitution which should also be adopted by the British Parliament before Dec. 6, 1922. On Sept. 9 it was possible to summon this body to meet in Leinster House, the premises of the Royal Dublin Society. In the adjacent College of Science the Government had established their offices. The block of buildings was placed under guard. None but carefully scrutinized representatives of the Press assisted at the nominally public debates. Under these conditions the Irish parliament and Irish government operated for nearly a year. Ministers lived as in a fortress.

At the Dáil's first meeting Cosgrave was elected president of the Irish Free State and he assumed the ministry of finance. Eleven ministers, proposed by him, were elected by the Dáil. The Dáil sat persistently to fulfil its task. The clauses of the constitution, which defined the relations between the Irish Free State and the British Crown and imperial defence, had been settled in discussion between Arthur Griffith and the British Government. Ministers had the task of persuading the Dáil to accept this limitation; they had also to put forward their own proposals for all that was left free.

The Restoration of Public Order.—By the end of Sept. 1923 at latest, there were no formed forces of the irregulars in the field, and all towns were held for the Government. Demand began to be heard for courts to which men could bring their cases. But the essential was to restore order. Property of all kinds was assailed. Whole bands of men in the name of the Republic were commandeering what they required. Much private robbery followed. More serious than all, the permanent land-hunger awoke.

Courts were long in being framed. The Civic Guard was being organized; but gunmen flouted, beat and in certain cases killed, members of this unarmed force. O'Higgins, minister for justice, however, stood resolutely to his principle: Ireland must be taught to regard the police, not as the agents of an outside power, but as its own servants, needing and deserving public assistance. The issue has justified his view; but for immediate purposes this body was useless. The Government on its side was driven, like the British, to enrol a large force of soldiers, which finally exceeded 50,000. This force, hastily levied, with officers as untrained as the men, did not always give satisfaction by its conduct.

Neither was Ireland, at the close of a movement extending over more than 40 years, easily able to support government in the face of terrorism; and terror was applied. The ministry was slow to counter this menace. Trial by jury was futile in such a state of things. The gaols were crammed with prisoners, untried and unpunished. Power to try and to punish most drastically by court-martial was given by an act of the Dáil; yet till November fear of the irregulars was stronger than fear of the Government throughout the country. At last a proclamation was posted announcing that four men had been tried, convicted and executed—in each case for having a revolver without licence. In the following week seven men were sentenced, on the same charge, to long terms of penal servitude. Thus the right of Government to deal at its will with persons in arms against the State had been asserted. But the irregular campaign of wreckage went on. More executions followed, among them that of Erskine Childers, who had been the most powerful influence over de Valera. There was no improvement perceptible by Dec. 6, when the Irish Constitution was formally ratified by both parliaments.

FORMAL INAUGURATION

Ratification completed, Northern Ireland notified the British Government by address of both houses of Parliament, that exercising its right under Article 12 of the treaty, it refused to come under the Free State, and desired to retain its position created by the act. The Free State being now formally constituted as a "Dominion," sensation was created by the appointment (Dec. 1922) of T. M. Healy, K.C. as its first governor general. On Dec. 8, when the Dáil assembled to choose a senate, as provided by the Constitution, President Cosgrave announced that one member of the Dáil had been shot dead and another wounded on the way to the meeting. Next morning four of the leading irregulars who were in prison were shot without trial by way of reprisal. Among them was Rory O'Connor. All these had been arrested long before the proclamation of martial law. General Mulcahy's justification was not given till some months later, when he pointed out that no other member of the Dáil had been attacked. In fact, the counter-terror succeeded. The country might now be terrorized into silence by the irregulars, but it gave them no such willing support as it had given to the Irish Republican army. Information came, surreptitiously but steadily, to the Free State troops. Further, in Dublin, where courts were now in session, juries did their duty fearlessly.

In nominating one half of the members of the Senate, President Cosgrave made good the promise given by President Griffith to leading Irish Unionists that they should be generously treated; his nominations comprised several leading landlords and other prominent Protestants. The Senate when constituted chose as its chairman Lord Glenavy, who as Sir James Campbell had been Sir Edward Carson's chief lieutenant.

The gravest danger was that foreseen by Michael Collins when he pointed out that criminal folly might destroy "our belief in ourselves as a nation." There was an orgy of destruction, which almost paralysed communication by road and rail; houses were burnt or bombed by dozens, and the Government, once started on their path of severities, pursued it ruthlessly. By the end of January executions had risen to 50, and the prisoners to 10,000. No government could be popular under such conditions. Yet signs of weakening began to show. By May 1923, de Valera called upon his followers to abandon hostilities and dump their arms in concealment. The sound of firing was no longer heard in the streets, and public meetings were once more held. When August brought the annual horse show, ministers were seen moving freely in the crowd. The resumption of normal civic life may be dated from this time.

In April the Free State, still maintaining and collecting the British system of taxes, found it necessary to set up a customs system at the ports and along the Ulster border. The first object was merely ascertainment of revenue, but the machinery for a protective tariff existed. In June the minister for agriculture introduced a measure for the completion of land purchase, and this was carried through hastily. The third Dáil, which had passed the constitution, still existed, but a general election on the new register with adult suffrage was fixed for the last days of August. The Government's action had exposed it to much odium. Some 10,000 prisoners were detained in gaol, mostly untried, and over 70 men had been executed. Yet President Cosgrave, Mr. O'Higgins and General Mulcahy were returned by huge majorities at the head of the group in which they stood. But de Valera also headed the poll in County Clare and the Republicans returned no less than 44 members out of 128. Government had in its own following less than half the Dáil. But the various groups of Independents were notably increased. All these supported the treaty and the constitution.

The New Government.—Ireland's accession to her new status was practically signified on Sept. 10, 1923, when her representatives took their place with acclamation in the Council of the

League of Nations. A month later Cosgrave attended the Dominion Conference in London, where he was warmly welcomed. At home the executive council was for the first time constituted, consisting of seven. Four other ministers were chosen as "extern," having individual, not collective, responsibility. Ernest Blythe, who now became minister for finance, had at once to face a serious situation. It had become clear that the State would not be destroyed by violence—there was fear lest it should be bankrupt. Civil war had produced damages, then reckoned at £50,000,000, though, when compensation came to be paid, the bill reduced itself to about ten. But the army was costing over £14,000,000 a year, and taxation stood at the peak point to which Great Britain had raised it. In December the Government came to the country for a loan of £10,000,000 at 5%—the issue figure being 95, repayable at par in 20 years. It was oversubscribed in ten days, the subscribers numbering over 22,000. This demonstration of confidence greatly cheered the country, and rounded off the satisfaction felt in comparing the settled order of Christmas 1923, with the ruinous anarchy in which the year opened.

Yet the year 1924 was a very unhappy period. Organized resistance to the State was withdrawn, but de Valera's followers refused to surrender or hand in their arms. There was much crime, especially robbery with violence. The army, so rapidly raised, was reduced, for motives of economy, with equal rapidity, and men were suddenly thrown out of employment. A bad harvest in 1923 had left acute financial depression, and work was scarce.

Legislation.—Added to this was the unpopularity of the Government's measures. Blythe reduced old age pensions from ten shillings to nine shillings. Taxation was severely levied; tenants in default with their land purchase annuities were forced to pay up; citizens who had withheld their income tax during the last years of the British administration, with Sinn Fein's approval, were now called upon for their arrears. More widely felt was the innovation of a customs barrier, causing delay in the delivery of goods; and, in addition, Blythe decided to embark experimentally on a measure of protection, its main feature being a duty of 15% on imported boots.

In framing the new judicial system, the number of judges and their salaries were reduced, the office of lord chancellor disappeared; a supreme court was constituted, and a high court, both sitting in Dublin. High court judges no longer went on circuit; a new order of circuit judges was instituted. As regards the magistracy, unpaid justices of the peace were abolished, and stipendiary district justices were appointed to cover the whole country.

Judges of the previous régime were free to retire on rather more than four-fifths of their salary, and most of them did so. In making the new appointments the Government showed a fine disregard of political record, and totally ignored religious differences. By 1925, five out of the nine high court judges were Protestants, and several had been strong Unionists. The effect of this was to confirm the allegiance already promised by the minority in the Free State; and leading members of it, notably divines of the Church of Ireland and of the Presbyterian Church, offered testimony to the impartiality of the Government.

People were forced to see that no alternative to it existed, and ministers showed little disposition to win support by conciliating public feeling. O'Higgins forced on a drastic bill to restrict the facilities for buying and selling drink; Burke, the new minister for local government, by simple administrative act suppressed the corporations of Dublin and Cork and put civic affairs into the hands of commissioners; and presently, when the commissioners produced improved administration and reduced the inordinate rates, this experiment was approved. Outside the towns, the ministry abolished district councils, thus throwing more work on the county councils. A tendency to centralization and even to bureaucratic administration showed itself in all directions.

Such a policy made enemies everywhere, and the weather was no friend to Cosgrave. A second bad season in 1924 hit the farmers hard, and Blythe was still levying taxes that were now actually higher than the British scale; for the reduction of income tax from 5s. to 4s.6d. in 1924 was not followed in the Free State. The new postmaster greatly cut down the public facilities, and kept the stamp at twopence. If there had been any alternative ministry the Government would have fallen, but there was none: and the bellicose protestations of Republicans kept them in power. Another thing assisted them: when a turn in English politics replaced a Labour Ministry by a strong Tory Government, English ministers kept faith absolutely with Ireland.

BOUNDARY TROUBLES

The Boundary Commission.—No step had been taken until 1924 to give effect to the provision in Article 12 of the treaty under which, if Northern Ireland decided to remain outside the Free State a commission of three was to be appointed to "determine in accordance with the wishes of the inhabitants, so far as may be compatible with economic and geographical considerations, the boundaries between Northern Ireland and the rest of Ireland." But with the cessation of civil war Cosgrave's Government was pressed to demand its application. Immediately threats came from Ulster of resistance by force to the cession of a single inch of territory. Ramsay MacDonald attempted to settle the matter by private negotiations, but this failed. The Free State named Prof. MacNeill as their representative on the commission, but Northern Ireland refused to recognize the commission in any way. MacDonald appointed Justice Feetham, a South African judge, as chairman, but Northern Ireland contended that its own refusal to appoint a representative would make the constitution of the commission void. The difficulty was referred by the Labour Government to the judicial committee of the Privy Council, which found that without a new act of Parliament enabling the Imperial Government to appoint a commissioner to represent Northern Ireland nothing could be done.

Parliament was summoned on Sept. 30 instead of on Oct. 28, as had been originally intended, in order to pass through its stages the Irish Free State (Confirmation of Agreement) bill, which had been introduced by the Government at the end of the session. The defeat of the Labour Government on another issue was not allowed to prejudice the Irish settlement, and just before the dissolution the bill received the royal assent. A well known publicist, from Ulster, was appointed; and the commissioners, after long preliminaries in London, proceeded to investigate opinion on the border itself during several months in 1925 without the least disturbance. In the meanwhile, from many quarters, but notably from Cosgrave and his ministers, came utterances to the effect that there was no intention of coercing Ulster. She must choose her own time for uniting, if she chose, with the rest of Ireland. This indicated a departure from the expectations held out by Michael Collins after the treaty was signed, for he had led Ireland to hope that the commission's award would transfer so much territory to the Free State that Northern Ireland would not be able to maintain its separate status.

At the opening of 1925 Blythe's budget of April marked the beginning of normal finance. It soon became apparent that the ministry was not proposing a mere negative policy of economy, and early in 1925 they committed themselves to a project for utilizing the Shannon (*see* SHANNON) for a considerable electric power scheme. Nor did this stand alone. By promise of a subsidy amounting to a total of over £1,000,000 a Belgian firm was induced to start the sugar beet industry on a large scale, Carlow being chosen as the site for the central factory. Simultaneously came a whole group of proposals for the development of Irish industry and Irish agriculture, which had been interminably discussed in and out of Parliament during the British régime. They stood committed to a policy of industrial development, having as the pivot of the whole an enterprise so colossal that its possibility had never even been seriously considered under the old order. In the meantime tranquillity returned to the country so completely that it seemed dull. Tourists refilled their old haunts in summer; the Dublin Horse Show enlarged its scope.

The Ulster Boundary Crisis.—In the late autumn a new crisis threatened the Government's prestige and even existence. The report of the boundary commission was awaited without emotion, though a London newspaper published a forecast of its decision differing widely from any anticipations that had been formed

in the Free State. There was a fierce outcry, and President Cosgrave reiterated the Free State's contention that the commission was only entitled to transfer to their natural destination those parts of the six counties whose inhabitants desired to be in the general body of Ireland. These declarations were followed by the announcement that the Free State representative had withdrawn from the commission. Prof. MacNeill followed this up by resigning his post on the executive council.

Both the Government and Prof. MacNeill were attacked with great violence in the Dáil and outside it. The Republican leader came into new prominence. Cosgrave refused to commit himself publicly to any line of action, and went to London, where negotiations proceeded. Sir James Craig was summoned from Ulster; and on Dec. 3, a new agreement was concluded, to which not only Great Britain and the Free State were parties, but Northern Ireland also. It was agreed that the award of the commission should not be published and that the existing boundary should stand. This gave to Ulster all that Ulster claimed, but it gave to Ireland the repose of finality. Further, the treaty was altered by the cancellation of Article 5, under which Ireland assumed liability for the public debt of the United Kingdom as existing in 1921 "in such proportion as may be fair and equitable, having regard to any just claims on the part of Ireland by way of set off on counter claims." This at once liberated the Irish exchequer from an undefined, hanging liability injurious to its borrowing power. Ireland, however, undertook to repay to Great Britain compensation already paid for war damages in the period 1919–21, and to add 10% to the compensation awarded to claimants for damages suffered in the civil war from 1922 on. The total cost to Ireland was estimated at under £5,000,000.

Legislation embodying the terms of this agreement was carried without difficulty in Great Britain, and the Northern Parliament expressed its satisfaction. But in the Dáil President Cosgrave was angrily opposed by the Labour Party and by some of his own followers, and after much talk the bill was carried by 71 to 20. Business men as a whole regarded the issue as fortunate for Ireland, which now definitely became a country with a total national debt of under £20,000,000 and less than a year's gross revenue. Other sections found their chief satisfaction, as did President Cosgrave, in the changed relation of the governments concerned. An immediate consequence was the disbandment of the Ulster special police in two of its three branches.

The Imperial Conference.—Freed from these long-standing anxieties, the fourth Dáil made steady progress with the work of reorganization, and extended the foundations of further economic development. In the spring of 1926 questions of external affairs and imperial relations occupied considerable attention. The Free State's membership of the League of Nations had brought definite responsibilities for the prevention of future wars; and the approach of the Imperial Conference turned the attention of the Government towards a fuller insistence upon the international rights of the Free State. A conflict over appeals from the Irish courts to the Privy Council, the position of the governor general, the question of passports for Irish citizens in foreign countries, and other questions affecting the international status of the Free State, were vigorously canvassed before the Imperial Conference met in the autumn. When the conference assembled, Kevin O'Higgins, who had already assumed a more prominent part in the representation of the Free State at the League of Nations, quickly became one of its most important figures. His insistence upon a fuller definition of the rights inherent in dominion status found strong support among some of the other dominions, and had a profound influence upon the decisions which the conference reached.

GOVERNMENTAL PROGRESS

Reconstruction.—By the spring of 1927 the Dáil could look back upon four years of solidly constructive work as the general elections approached. McGilligan, in introducing the Electricity Supply bill, reported very satisfactory progress with the Shannon scheme. Hogan was able to report an immense improvement in the prospects of Irish trade owing to the Government's enforcement of an official grading of exported butter and eggs; and he introduced a bold measure for giving long term credits to farmers to supplement the facilities offered by the banks. Blythe's budget for 1927 announced that the Government now felt it safe to reduce the estimate of normal army expenditure by £500,000; and with the assistance of certain economies he was thus able to lower the income tax to below the English level, at 3s. in the pound.

Within four years nearly 200 acts had been passed by the fourth Dáil, and the foundations of the new State had been laid, while all the compensation claims arising before the Anglo-Irish truce had been dealt with, and only 400 out of some 20,000 subsequent claims still remained. Members of all parties gave expression to their sense of a new comradeship acquired during the work of the Dáil and congratulated each other on the rapid growth of a parliamentary tradition which had produced new feelings of mutual respect and confidence.

At the elections held in June the strong desire for a change of government after the first trying years of the new State was clearly manifest. The smaller parties which criticized the Government on various grounds gained in strength, and Cosgrave came back at the head of a party of 46 instead of 57, unable to command a majority in the Dáil. No other party, however, found itself able to form a government, and Cosgrave consented to resume office on the clear understanding that he would pursue his own programme until the other parties agreed to defeat his ministry.

Murder of Kevin O'Higgins.—Then, to the consternation of the whole country, on July 10, Kevin O'Higgins, the vice-president of the executive council, was assassinated outside his house near Dublin. The Republicans immediately disclaimed responsibility for, or sympathy with, his murder, but Cosgrave expressed the popular indignation and horror by denouncing it as a deliberate attack upon the State. The Government, unable to trace the authorship of the crime, sought drastic powers by the new Public Safety Act, which proclaimed all revolutionary societies as being treasonable and gave powers to arrest or deport suspected persons, in addition to introducing the death penalty for any treasonable offence.

Holding the Republicans responsible for having encouraged acts of murder, the Government also introduced a bill designed to force the Republican deputies to enter the Dáil, by prescribing an oath of willingness to enter the Dáil and also the oath of allegiance to the Constitution, for every candidate at future parliamentary elections. De Valera exhausted every effort to defeat the passage of the bill, and finally, in despair, consented to lead his party into the Dáil at once. They agreed at last to take the oath of allegiance, while proclaiming in advance that they all regarded it as an "empty formula" which would not bind their actions in any way. An agreement was quickly reached with the Labour Party and with Capt. Redmond's National League to outvote the Government on a motion of no confidence, on the understanding that Johnson was to assume office with the support of the Republicans. When the motion was debated on Aug. 16, it was anticipated that Cosgrave would be in a minority of one, but the disappearance of Alderman Jinks at the last moment enabled the Speaker to save the Ministry by his casting vote.

In such circumstances a second general election was obviously inevitable. Cosgrave awaited the results of two by-elections in Dublin, which both gave him large majorities, and then suddenly announced a dissolution before any party could prepare for an election or replenish its funds. The election resulted in a drastic reduction of the smaller parties, Cosgrave winning many seats from the Farmers' Party and the National League, and de Valera many more from the Labour Party. The sixth Dáil assembled on Oct. 11, with Cosgrave's party of 61 still in a minority of the Dáil, and with the Republicans' strength increased to 57.

The Sixth Dáil.—But with the support of the Farmers' Party and the Independents, against a combination of Republicans, Labour Party and National League, Cosgrave could count on a safe majority of six votes, and he did not hesitate to accept office. On the first division in the Dáil the Labour Party voted with the Government, and a little later de Valera's effort to repeal the Public Safety Act was defeated by a majority of six. The first

serious business of the Government was to float a new loan of £7,000,000, at the same price of issue as before. The general belief that de Valera's accession to office would shake public credit had been the chief deterrent to a change of Government; which in spite of all that Cosgrave's ministry had accomplished, had long been desired, in view of the widespread unpopularity that the Government had inevitably incurred by its vigorous enforcement of the law and its policy of drastic retrenchment. For the first time the Dáil now included all its elected deputies, and contained an alternative government in the Republicans, who had not only agreed to take part directly at last in the development of the Free State, but had pledged themselves to act on constitutional lines.

1928.—For some months work in the Dáil was impeded by acrimonious debates, and in the new year de Valera, having obtained the necessary number of signatures, demanded that a referendum on the abolition of the oath of allegiance should be taken. Cosgrave retaliated by introducing a bill to abolish the provisions for referendum and for initiative of legislation contained in the constitution. The Republicans, seeing that defeat was inevitable, adopted systematically obstructive tactics. By the autumn of 1928, however, a growing sense of co-operation in the work of the Dáil was perceptible. The Republicans took part in several joint committees of all parties; and although they stubbornly resisted Cosgrave's decision to adopt the majority recommendations for a different form of election to fill the triennial vacancies in the Senate, they took advantage of the resulting opportunities, and secured the return of their full quota of candidates in the election in October. The Government had in January exercised its right, which had been conceded at the Imperial Conference of 1926, to choose the successor to Mr. T. M. Healy as governor general. Mr. James McNeill, who had been High Commissioner in London, was appointed. In November the creation of two new Irish embassies, in Paris and Berlin, was announced, and Professor Smiddy was transferred from Washington to replace Mr. McNeill in London. Professor Smiddy was succeeded by Mr. Michael MacWhite, who took office on March 24, 1929.

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(S. G.; D. G.)

THE CONSTITUTION

The present political status of the Irish Free State is that of a co-equal member of the community of nations forming the British Commonwealth. It has a written constitution which rests on the provisions of an act passed by Dáil Eireann sitting as a constituent assembly in the autumn of 1922.

It is provided in this act that the Constitution shall be construed with reference to the treaty between Great Britain and Ireland, and that if any provision of the constitution or of any amendment thereof or of any law made thereunder is in any respect repugnant to any of the provisions of the treaty, it shall, to the extent of such repugnancy, be void and inoperative. It is also provided that to the extent to which they are not inconsistent with the constitution all laws in force in the Free State at the time of passing of the constitution are to continue to have full force and effect until repealed or amended by the Oireachtas.

In conformity with practice in the British Commonwealth the executive authority is vested in the king. The governor general represents and fulfils the functions of the Crown. He is appointed "in like manner as the governor general of Canada and in accordance with the practice observed in the making of such appointments." His powers are strictly limited as in the case of the Sovereign in Great Britain, all executive acts being done on the advice of the executive council. The latter consists of not more than 12 nor less than five ministers, and is directly responsible to Dáil Eireann, retiring from office when it has lost the support of a majority of deputies.

Dáil Eireann may not at any time be dissolved except on the advice of the executive council, and Article 53 provides that the Oireachtas shall not be dissolved on the advice of an executive council which has ceased to retain the support of a majority in Dáil Eireann. The maximum life of a parliament is six years. The president of the executive council, who is appointed on the nomination of Dáil Eireann, nominates the executive council. Other ministers, not members of the executive council, may be appointed on the nomination of committee of Dáil Eireann, and these ministers are directly and individually responsible to the Dáil for the administration of their departments. Members of the executive must be members of Dáil Eireann, but this provision does not apply to other ministers. The legislature, known as the Oireachtas, consists of the king and two houses, Dáil Eireann (the Chamber of Deputies) and Seanad Eireann (the Senate). In the Oireachtas is vested "the sole and executive power of making laws for the peace, order and good government of the Irish Free State."

The Senate.—Seanad Eireann is composed of 60 members, the term of office of each member being 12 years. One-fourth of the members are elected every three years by proportional representation, the whole of the Free State forming one electoral area. At every election a panel of candidates is formed, consisting of three times as many persons as there are senators to be elected. Two-thirds of the panel is nominated by the Dáil and one-third by the Seanad. Any former senators may be added to the panel if they so desire. Candidates, who must have reached the age of 35 years, are chosen on the ground that they "have done honour to the nation by reason of useful public service or that, because of special qualifications or attainments, they represent important aspects of the nation's life." Casual vacancies in the Seanad are filled by co-option, who retire at the next election.

The Chamber of Deputies.—Dáil Eireann (the Chamber of Deputies) is composed of members directly elected on the system of proportional representation by constituencies determined by law. The number of members was fixed at 153. This number may, however, be varied from time to time, but shall not be fixed at less than one member for each 30,000, or more than one member for each 20,000 of the population of the state. In addition the two universities each elect three members.

All citizens of both sexes who have reached the age of 21 and who comply with the electoral laws, may vote for members of Dáil Eireann, and all citizens who have reached the age of 30 years and who comply with the electoral laws may vote for members of Seanad Eireann. Voting is by secret ballot, and no voter may exercise more than one vote at any election.

Members of both houses receive an allowance for expenses which is fixed at £360 per annum. Every member of the Oireachtas must take the following oath before taking his seat:—

> I ..... do solemnly swear true faith and allegiance to the constitution of the Irish Free State as by law established, and that I will be faithful to H. M. King George V., his heirs and successors by law, in virtue of the common citizenship of Ireland with Great Britain and her adherence to and membership of the group of Nations forming the British Commonwealth of Nations.

Powers of the Senate.—Seanad Eireann has no authority to amend a money bill, but may make recommendations to Dáil Eireann regarding such bill within 21 days after a bill certified to be a money bill has been passed by Dáil Eireann. The definition of a money bill given in Article 35 of the Constitution is adopted from the United Kingdom "Parliament" Act of 1911. There is a proviso that the decision of the chairman of Dáil Eireann as to whether the bill is or is not a money bill may be appealed against before a committee consisting of three members of each house presided over by a judge of the Supreme Court. The Seanad may reject or amend all other bills, and may initiate legislation, but a bill passed by the Dáil which has not been passed by the Seanad 270 days after it was first sent to the Seanad, is deemed to have been passed by both houses in the form in which it was last passed by Dáil Eireann. Any bill passed or deemed to have been passed by both houses may be suspended for a period of 90 days on the written demand of two-fifths of the members of Dáil Eireann, or of a majority of the members of Seanad Eireann presented to the president of the executive council not later than

seven days from the day on which such bill shall have been so passed or deemed to have been so passed. During the period of suspension the bill shall be submitted to a referendum if so demanded by one-twentieth of the voters on the register or by three-fifths of the members of the Seanad. These provisions do not apply to money bills or to bills declared by both houses to be necessary for the immediate preservation of the public peace, health or safety.

Defence.—The Oireachtas has the exclusive right of raising and maintaining armed forces in the Free State, but under the provision of the treaty the army shall not exceed in size such proportion of the army in Great Britain as that which the population of Ireland bears to the population of Great Britain.

Nationality, etc.—Every person domiciled in the Free State at the time of the coming into operation of the Constitution, who was born in Ireland or either of whose parents was born in Ireland, or who has been ordinarily resident in the area of the jurisdiction of the Free State for not less than seven years is entitled to citizenship in the Free State. Freedom of conscience and the free profession and practice of religion are, subject to public order and morality, guaranteed to every citizen. No law may be made to endow any religion or to give any preference or to impose any disability on account of religious belief. No discrimination may be made as respects State aid between schools under the management of different religious denominations.

Court of Appeal.—The Supreme Court of the Free State is a court of final appeal and its decision cannot be reviewed by any other court, tribunal or authority whatsoever, provided that nothing in the constitution shall impair the right of any person to petition His Majesty for special leave to appeal to His Majesty in council or the right of His Majesty to grant such leave.

Amendments.—Article 50 gives power to the Oireachtas to make by ordinary legislation any amendment of the Constitution within the terms of the treaty during the first eight years; and a number of amendments have already been passed. A Government Bill was introduced in October 1928 to extend the time limit which prevents any further amendments after 1930 without confirmation by a referendum.

The first amendment resulted from the agreement in London in 1925 to cancel Articles 5 and 12 of the treaty. In Dec. 1926 the Government introduced and carried without a division four minor amendments. The proposal to return the speaker unopposed to sit in the next Dáil without representing any constituency, whether he was re-elected as speaker or not, was amended in the Senate, which obtained the Government's consent to its compromise proposal that the speaker should be automatically re-elected for the same constituency as before, but that the constituency should elect one member less. The second amendment has abolished the public holiday prescribed for the polling day of each general election. The third extends the maximum term of office of Dáil Eireann from four years to six. The fourth has increased the membership of the executive council from seven to twelve.

Several amendments were carried in 1927 in connection with the attitude of the Republican party. They were compelled to enter the Dáil by the imposition of the oath of allegiance, and of a declaration of willingness to sit in the Dáil, for all candidates in elections. To prevent the holding of a referendum on the oath of allegiance and to nullify the petition for initiative of legislation to the same effect, the provisions for referendum and for initiative were soon afterwards removed from the Constitution. Various amendments affecting the Senate were carried in 1928 before the triennial elections to fill one-third of its seats. Instead of election by the whole country as one constituency, vacancies are now filled by the Dáil and Senate voting together; candidates being chosen from a panel to which each House elects as many candidates as there are vacancies. The age limit for senators has been lowered from 35 to 30 years, Powers of the Senate to delay legislation have been increased to 18 months, after which there can be a further delay of two months if the Dáil carries the same legislation again. The term of office of senators has been reduced from 12 to 9 years.

See J. G. Swift McNeill, *Studies in the Constitution of the Irish Free State* (1925).

ECONOMIC AND FINANCIAL HISTORY

The area of the Free State is 17,024,642 statute acres, of which 15,619,044 are under agricultural holdings. The area ploughed, the area under hay and the area under grass are respectively 1,551,447, 2,287,849, and 8,416,439 acres. The valuation of the urban districts is £2,779,846 and of rural districts £8,715,022, the total valuation being £11,494,868.

Population.—The last census of Ireland was taken in 1926. The population of the Free State was 2,972,802, or 5·3% less than in 1911.

In 1926 the number of marriages registered was 13,570, being 4·57 per 1,000 of the population; the number of births was 61,176, being 20·6 per 1,000 of the population; and the number of deaths was 41,740, being 14·05 per 1,000 of the population. While the reduction in the mortality from tuberculosis has been steady and continuous for many years, the death rate from cancer is increasing. Of the total deaths at all ages 16·2% were deaths of children under five years of age, and the number of deaths of infants under one year was equivalent to a rate of 7·4 of the birth rate. Infantile mortality is decreasing.

Practically no emigration took place from Ireland during the World War. It is estimated that the number of emigrants to "places out of Europe and not within the Mediterranean sea" was 15,000 in 1922, 20,570 in 1923, 19,077 in 1924, 30,302 in 1925, and 30,359 in 1926. Of the emigrants in 1926, 26,367 were bound for the United States, 1,994 for British North America, 1,268 for Australia, 236 for New Zealand, 166 for British South Africa, 109 for India and 219 for other countries. The population of the Free State is overwhelmingly rural. There are only two towns with more than 50,000 inhabitants, namely, Dublin and Cork, and two others with more than 20,000, namely, Limerick and Waterford.

In 1911 the population of the 26 counties now forming the Free State contained 2,812,509 Roman Catholics, 249,535 members of the Church of Ireland, 45,058 Presbyterians and 3,805 Jews. The great majority of the population were English-speaking, but 16,869 spoke Irish only, and 536,848 were bilingual. Of persons aged nine years and upwards, 260,694 could neither read nor write, and 74,001 could read but could not write. The number of houses in the 26 counties in 1911 was 642,541, or one house for 4·88 inhabitants.

Agriculture.—The total acreage under crops on June 1, 1927, was 3,694,285. The following are figures of acreage under crops and numbers of live-stock in the Free State in 1926–27:—

	1926.	1927.
Crops		
Wheat	29,386	34,446
Oats	647,407	644,610
Barley	141,009	120,796
Rye	6,645	6,055
Flax	6,802	5,998
Potatoes	374,771	364,639
Turnips	194,600	183,213
Mangolds	80,839	79,804
Sugar-beet	9,483	17,698
Cabbage	34,428	30,871
Hay	2,287,849	2,183,086
Live-stock		
Cattle	3,947,249	4,048,430
Sheep	3,003,080	3,120,637
Pigs	884,216	1,177,637
Goats	189,439	185,810
Horses	424,304	428,614
Asses	199,172	196,925
Poultry	21,366,801	21,575,798

There are 442,606 agricultural holdings, of which 86,033 are less than one acre, 223,991 above one and not exceeding 30ac., 130,807 above 30 and not exceeding 500ac. and 1,775 above 500 acres. Official figures show that the percentage of land ploughed varies inversely with the size of the holding; that for equal areas of crops and pastures, the number of live-stock (especially milch cows, pigs and poultry, and excepting sheep) rapidly increases as the size of the holding diminishes; and that the larger the per-

centage of land tilled, the larger the number of animals supported.

The cultivation of cereal crops plays a comparatively unimportant part in the agricultural economy of the Free State, and the bulk of the attention of the farmer is devoted to the raising of stock. As between the production of beef and of dairy produce, conditions vary in different parts of the country. In certain areas dairy breeds, in others beef breeds, are predominant. The type of cultivation favoured by the soil, climate and prevailing holding is extensive. The percentage of the total area ploughed is 12·7% as compared with 56·7 in Denmark, and the net value of agricultural exports per 1,000ac. is £1,227 as compared with £4,939 in Denmark.

In accordance with detailed recommendations made by the commission which reported in 1924, an act was passed (No. 35 of 1924) providing for the testing, grading and packing of exported eggs, for the prohibition of the export of dirty or bad eggs, and for the registration of all premises where grading, packing or preserving is carried on. Another act (No. 58 of 1924) made elaborate provision for the regulation of the butter trade. Butter can now be exported only by registered creameries, factories or exporters, and must be packed and marked in a specified manner. The most minute regulation of creameries and factories is insisted on, and provision is made for the establishment at a later date of a national mark or brand for creamery butter. A federation of co-operative creameries has been established with the aim of introducing a system of "orderly marketing" of butter, and the majority of the privately owned creameries have been purchased by the State and transferred to co-operative societies. The dairy industry has thus been rationalized. The licensing of bulls was made compulsory by another statute (No. 3 of 1925). This measure, together with the Government's scheme for providing premium bulls and boars and for subsidizing the purchase of pedigree rams, has resulted in levelling up the standard of the live-stock in the country.

The Government has set up an agricultural credit corporation designed to provide long-term loans for farmers and to co-ordinate the activities of the local co-operative credit societies. Other measures taken to develop agriculture are the increase of the grant in aid of agricultural rates, the provision of higher agricultural education in the National University and the undertaking of extensive arterial drainage.

Land Purchase.—The total amount of the purchase money for which advances have been made under the Land Purchase Acts of 1870–1909 in respect of lands in the Free State is £99,800,000, the total area comprised in the sales being 11,290,000 acres. The land commission also advanced £3,796,000, to rural district councils for the erection of labourers' cottages under the Labourers' Acts.

The Land Act of 1923 aimed at attaining the dual object of completing land purchase and relieving congestion. This act provided for the creation of land bonds, bearing interest at the rate of 4½%, in which all payments to landlords and encumbrancers were to be made. These bonds were later guaranteed, as to principal and interest, by the British Government. Advances made to purchasers were to be repaid by an annuity at the rate of 4¾% of the amount advanced, and the price to be paid was roughly equal to about 15 years' purchase of the value of the holding, of which the Government contributed 10% in relief of the tenant. Very wide powers were given to the land commission to acquire untenanted land for the creation of holdings in relief of congestion, and to consolidate and exchange holdings with the same object.

The area of untenanted land already acquired by the land commission and the late congested districts board and utilized for the relief of congestion amounts to 860,000 acres. Advances were authorized to be made to tenants of uneconomic holdings, tenants exchanging their holdings, persons who had been evicted and labourers who had lost their employment through the progress of land purchase. The money required by the land commission for making roads, fences, drains, etc., and for the erection of buildings on newly created holdings is provided out of public funds, and so much as the land commission decides can be repaid by the purchasers is made repayable by them along with their purchase annuities. All arrears of rent due before the first gale day of 1920 were remitted; but rent due after that date (subject to 25% reduction) was made recoverable.

It is estimated that advances amounting to £30,000,000 will be required to complete land purchase under the 1923 Act. As regards tenanted land, holdings situated on 6,000 estates have to be dealt with, while as regards untenanted land, the land commission has inspected or is making enquiries in respect of 1,000,000 ac., with a view to their acquisition for the purpose of distribution; and of this area the land commission has acquired or entered into agreements for the acquisition of over 250,000 acres. Of the untenanted land acquired 130,000ac. have been already divided among allottees.

Fisheries.—The work formerly done by the department of agriculture and the congested districts board in connection with fisheries and with rural industries has now been transferred to a separate ministry, whose policy is to develop the deep-sea fisheries and to organize the home demand for fish, which is at present very small. The Government is helping the fisheries by making loans for boats and gear, erecting and maintaining curing stations, and subsidizing fishery schools. A brand for mackerel has been instituted. One urgent requirement is being delayed for financial reasons, namely, a second patrol boat to keep the coast free from the numerous foreign trespassers who at present infest it. In 1927 the land commission was transferred to the ministry of fisheries.

INDUSTRY AND TRADE

Manufactures.—Ireland was, even before partition, an overwhelmingly agricultural country, but the predominance of agriculture became greater than ever after the exclusion of the six counties. The agricultural commission reckoned that three-quarters of the real wealth produced in the Free State is farm produce. Too great dependence upon any one industry is always undesirable, and the Government has taken steps to redress the unequal balance between the agricultural and manufacturing industries.

The treaty left the Free State at liberty to frame its tariff policy as it chose. There was a widespread popular belief that Irish industry could best be revived by the adoption of a high protective tariff, and the Government appointed a small committee of economists to enquire into the probable effects of protective duties. The report of this committee was strongly free trade in tone. It pointed out the numerous factors, besides external competition, that operated to retard the growth of industry in Ireland. The necessity for a dominantly agricultural country of the lowest possible prices of raw material and consumable commodities was pointed out. Nevertheless the Government proceeded to institute a number of experiments in protection.

On the setting up of the customs barrier in April 1923 the manufacture of tobacco automatically secured protection. The Finance Act of 1924 imposed a duty of 3⅜d. per lb. on sugar confectionery, of 6d. per lb. on cocoa preparations, of 10% *ad valorem* on candles, 15% *ad valorem* on boots and shoes, 33⅓% on glass bottles (not white glass) and 10% *ad valorem* on soap. The McKenna duties were altered so as to provide encouragement for the building of commercial motor bodies, and the imperial preference on manufactured tobacco was abolished. The Finance Act of 1925 went a good deal farther in the same direction, but the minister for finance declared that the new duties were purely experimental in nature. This act imposed a duty of 15% *ad valorem* on clothing, wearing apparel, blankets and blanketing, and 33⅓% on bedsteads and wooden furniture; the duty on bottles was extended, and an additional duty of 10% was put on toilet soaps. In 1926 a duty of 2s. 6d. per cwt. was imposed on imported oatmeal, and in 1927 duties of 33⅓% on rosary beads and of 3d. per lb. on margarine. All applications for protection are now heard by a tariff commission composed of three civil servants representing respectively the ministries of finance, agriculture and industry and commerce. This commission has rejected the application for a duty on imported flour.

At the same time some important revenue duties were abolished or reduced. It would appear, however, from the cost of living index numbers that the result of the new tariff (in conjunction with other causes, such as a bad system of retail distribution) has been to prevent the cost of living in the Free State from being reduced at the same rate as in Great Britain. This is shown by the following table:—

Cost of Living Index Numbers
(Basis: July 1914 = 100)

Year.	Free State.				Great Britain and Northern Ireland.			
	Jan.	April.	July.	Oct.	Jan.	April.	July.	Oct.
1922	..	191	185	189	192	182	184	178
1923	190	181	180	186	178	174	169	175
1924	188	178	183	193	177	173	170	176
1925	195	188	188	188	180	175	173	176
1926	188	180	182	189	175	168	170	174
1927	182	171	171	175	175	165	166	167

In addition to giving the protective assistance outlined above, the Government has endeavoured to encourage industry by means of subsidies, the development of cheap sources of power, and the provision of credit facilities. The growth of sugar-beet and the manufacture of beet-sugar were encouraged by the grant of a subsidy payable for ten years to persons manufacturing in the Free State sugar from home-grown sugar-beet. A large Belgian-Czechoslovakian group, encouraged by the subsidy, opened a sugar-beet factory in Carlow. The result of the first year's working was successful beyond all expectations.

An important attempt is also being made to provide the Irish manufacturer with cheap power. The Government sought the advice of Messrs. Siemens-Schuckert, who drew up a scheme for utilizing the great water power of the Shannon. Another method by which the Government attempted to encourage industry was by helping enterprises to obtain capital on easy terms under the Trade Loans Guarantee Act (No. 41 of 1924). The maximum amount that might be advanced under Government guarantee under the act was fixed at £750,000. The minister was further authorized to grant or to guarantee loans proposed to be raised by any public authority or any association of producers or consumers "calculated to promote a reduction in the retail prices in Saorstat Eireann of essential commodities." The maximum grant under this action was limited to £50,000, and the maximum grant and guarantee together to £250,000. By an amending act (No. 19 of 1925) the period in which this assistance might be rendered was extended; and the Finance Act of 1925 provided for the advance of £300,000 to the National Land Bank for the purpose of trade loan guarantees.

An Industrial Trust Company designed to provide long-term credits for manufacturers has been established, part of the capital being subscribed by the State.

Banking.—All the banks having their head offices in the Free State have numerous branches in Northern Ireland, and two of the Belfast banks have numerous southern branches. Shortly after the treaty, the Belfast bank, which is affiliated with the Midland bank, sold its branches situated in the Free State to the Royal Bank of Ireland. More recently the Bank of Ireland absorbed the National Land Bank. The Government's banking business is transacted by the Bank of Ireland. The deposits of the six Free State banks amounted in 1927 to £127,798,000 as against £133,035,000 in 1926, and the amount of the Dublin clearings in 1927 was £253,817,000, an increase of £3,798,000 on 1926. The Currency Act (No. 32 of 1927), which was based on the recommendations of the banking commission, provides for the establishment of a separate currency to be managed by a currency commission independent of Government control. The legal tender note will be backed pound for pound by gold, British notes or British Government securities, and will be convertible into sterling on demand. There will also be a bank-note issue limited in amount to £6,000,000 which will not be legal tender. The Free State currency will thus be "anchored to sterling." The first national loan, both as regards principal and interest, is repayable in sterling, as are also the bonds created under the Land Purchase Act.

Trade.—The following are the imports and exports of the Irish Free State, the figures indicating hundreds of thousand £'s.—

Year.	1924.	1925.	1926.	1927.
Imports	68,590	62,950	61,286	60,826
Exports	51,585	44,382	41,956	44,852
Balance	17,305	18,568	19,330	15,974

The invisible items are approximately estimated as follows: exports, including dividends on foreign investments, remittances from the United States, British war pensions, etc., £17,000,000; imports, including land purchase annuities payable to the British Government, pensions to ex-police and civil servants resident abroad, etc., £8,000,000.

Communications.—In 1914 there were in Ireland 28 railway companies operating 3,454 miles of line. The Irish railways were placed under the control of the British Government in 1917 and were released in Aug. 1921, a few months before the treaty. During the control period, the net receipts for 1913 were guaranteed, and on the cessation of control the Government paid the railways £3,000,000 in full settlement of all claims. Meanwhile, wages had been raised by about 200%, while freight and passenger rates had been raised only by 120% and 100% respectively. The resulting difficulties led to the Railways Act of 1924, modelled on the British Act of 1921, for amalgamating all the lines situated wholly in the Free State. On Jan. 1, 1925, came into being the new Great Southern railway, comprising all the companies in the Free State, but excluding the Great Northern railway (Ireland), which is partially situated in Northern Ireland. The traffic receipts of the Great Southern railway in 1927 were £4,247,244, an increase of £61,210 on 1926.

The conditions which prevail in the Free State render the competition of the road vehicle very formidable; the average journey is short, and many places in the country are several miles from a railway station. The number of motor vehicles licensed in 1926 was 44,962 and in 1927, 45,774.

TAXATION AND FINANCE

In the following table can be found the revenue and expenditure of the Irish Free State for each year from 1922 to 1928:—

Year.	Receipts.	Expenditure.
	£000s.	£000s.
1922–23	27,863	29,595
1923–24	31,414	38,687
1924–25	26,948	27,937
1925–26	25,439	26,693
1926–27	25,060	27,392
1927–28	29,123	26,080

The deficits shown in the above table were mainly accounted for by the extraordinary non-recurrent expenditure arising out of the military expenses and compensation incurred in respect of the civil war of 1922–23. In addition a large amount of expenditure of a capital nature on the Shannon scheme and other productive projects has been met out of current expenditure.

Public Debt.—In Nov. 1923 the Irish Free State floated its first loan. The nominal amount raised by this loan was £10,000,000. The interest offered was 5% and the issue prices 95, the flat yield being thus about 5¼%. The loan is redeemable at par between 1935 and 1945. The loan was a great success, being oversubscribed in the Free State; no part of it was underwritten or taken by the banks. Provision was shortly afterwards made for the satisfaction of persons who had contributed to the official Sinn Fein loans floated during the Anglo-Irish fighting. Irish subscribers were to receive savings certificates, and subscribers elsewhere were to have their holdings redeemed. In 1927 the second national loan was floated. The amount raised was £7,089,175 (nominal), the price of issue 97 and the rate of interest 5%. £3,082,250 of this issue was raised in the United States as a

dollar loan and holders of the Irish issue have the right to transfer into the American issue at a fixed rate of exchange. The price of the national loans in Feb. 1928 was 100 and of compensation stock 97½. The agreement made between the British and Free State Governments in Dec. 1925, provided that the outstanding liabilities of the Free State under the treaty in respect of the British National Debt should be settled by an annual payment of £250,000 for a period of 60 years. A further and final agreement made in March 1926 provided for the liquidation of all outstanding liabilities between the two Governments. The public debt amounts to about £20,000,000.

Taxation.—The system of taxation in operation at the time of the treaty was taken over, and, owing to the difficult financial situation created by the civil war, no reductions were attempted for a couple of years. In the years 1923–24 and 1924–25 the income tax was maintained at the rate of 5s., and the corporation profits tax was retained. In both these respects the Free State taxes were higher than the British. The budget of 1924 reduced the super tax on very high incomes, and reduced the tea duty from 8d. to 5d. per pound. In 1925 the income tax was reduced to the British rate of 4s., and the exemption limit to corporation profits tax was raised. The duty on sugar was considerably reduced and imperial preference in that commodity discontinued, and the duties on tea, coffee, cocoa and chicory were abolished. In 1927 the income tax was reduced to 3s. The relief which the taxpayer might have derived from these concessions was to some extent counterbalanced by the burden of the new protective duties.

In addition to the sums raised by national taxes, the following sums were raised by local taxation: year ending March 1922, £6,762,672; March 1923, £4,153,060; March 1924, £5,327,341; March 1925, £5,310,550; March 1926, £5,296,977. The total (national and local) taxation amounts (1928) to about £10 per head of the population.

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See also E. J. Riordan, *Modern Irish Trade and Industry* (1920); W. L. Micks, *History of the Congested Districts Board* (1925); Conroy, *A History of Railways in Ireland* (1928). (G. O'B.)

DEFENCE

Historical.—Immediately after the ratification of the Anglo-Irish Treaty in January 1922, British troops began to withdraw from Free State territory, and soon afterwards the Irish regiments included in that territory, with a magnificent fighting record, were withdrawn from the British Army. In the terms of the treaty it was agreed that responsibility for defence by sea both of Great Britain and of Ireland should be undertaken by Imperial forces, and that the Irish defence forces should not exceed, in their military establishments, the proportion to the British army which the population of Ireland bears to the population of Great Britain. The question of Irish participation in coastal defence was postponed for five years. The civil war which followed the withdrawal of British troops and the mutiny of March 1924 brought about some changes in the administration of the Free State army, of which full details are given below.

Recruitment and Service.—Recruitment is based upon voluntary enlistment, from the age of 18 onwards, for periods up to 12 years' service, of which periods of 1 month up to 3 years in the infantry, and up to 5 years in other arms, are spent with the colours. The Minister of Defence has the power to vary the terms of service; and re-engagements up to 21 years, with the right to discharge on three months' notice, are permitted. All soldiers, on completion of their term of service with the colours, if shorter than the term for which they originally enlisted, are transferred to the reserve. Reservists can be called up for training for 30 days in any one year. They can be called up for permanent service in the event of imminent national danger, but not for more than 12 months over the unexpired portion of their time in the reserve. Until the expiry of 5 years after the establishment of the Military College, the following will be eligible for appointment to commissions in the Irish Free State army. (a) Citizens of the Irish Free State, (b) officers and men serving in the army, (c) such other persons as the minister may approve. After the 5 years, preference in appointment to commissions will as far as possible be given to Military College graduates. £5,000 was allowed in the Budget for 1927–28 for military training of officers abroad.

Strength, Organization and Higher Command.—The Budget effectives in 1927–28 numbered 12,753, including 833 officers up to the rank of Lieutenant General. The organization is in 27 battalions of infantry, grouped in 9 brigade areas; 4 armoured car companies; two battalions of artillery; various engineer units (5 companies, one of them a training company, and a depot); army medical services; military police (5 companies and 4 detention barracks); a signal corps of 5 companies; and army transport companies.

The ministry of defence is charged with administration, discipline and control of the military defence forces. Under the minister, there is a council of defence presided over by himself as "commander-in-chief." There are three military members, the Chief of Staff, Adjutant General and Quartermaster General and a civil member, member of *Dail Eireann,* as finance member and parliamentary secretary to the minister. Under the ministry of defence, the Irish Free State is divided into four military districts, each forming a separate command. These are No. 1, Western Command; No. 2, Southern Command; No. 3, Eastern Command; No. 4, Curragh Training Camp.

Each military district contains a certain number of brigade areas, of which at present (1928) there are nine, each with its own headquarters. The Curragh training camp contains schools of instruction for officers and for non-commissioned officers, and a reception and training depot.

Besides the afore-mentioned Irish Military College, and schools of instruction at the Curragh, there is an army school of music. There are special training companies at the Curragh for engineers, medical services, signals and army transport.

Excepting in certain coast defences still occupied, in accordance with the terms of the treaty with Great Britain, by small garrisons of British troops, there are no modern permanent fortifications in the Irish Free State.

The *Garda Siochana,* or unarmed Civic Guard was in 1925 amalgamated with the Dublin Metropolitan Police. The combined force so formed has a maximum establishment strength of 6,454, including 192 officers.

The Army Air Corps includes a headquarters and one squadron.

See also *League of Nations Armaments Year-book* (Geneva, 1928). (G. G. A.)

IRISH LITERATURE. The English occupation of Ireland raised its first literary monument in the *Kildare Poems* of the early 14th century whose interest is now mainly philological. Up to the middle years of the 16th century the use of English was limited to a few towns and to the confines of the Pale. It was not until the close of the next century that the conflicting policies of the two countries produced a special colonial spirit, whose spokesman was Molyneux, and a literature of corresponding character, Irish to the English, English to the Irish. This Janus-faced attitude of Anglo-Irish literature lasted almost into our own period, injuring its artistic integrity by its partisan spirit. In the 17th century the author of the *Hiber-*

niad proudly counts Swift, Denham, Parnell, Farquhar, Steele, Southerne, Roscommon, Boyle, Ussher and Berkeley amongst the Irish authors of his day. Only of the two greatest of these, Swift and Berkeley, may it be fairly said that their life in Ireland left a deep impress on their work. Ireland taught Swift his fierce hatred of injustice and that deep compassion for material suffering which Lecky observes. The same spectacle of Irish conditions added to Goldsmith's incomparable charm a sense of social values which lifts him above the urbane and artificial poets, and it gave to Burke the passion for justice which glows in his political philosophy. A strong Irish accent marked the thought as it marked the speech of both men. These men were born into the violent contrasts of the Irish 18th century where the most artificial inequalities of status and political control maintained a brilliant and corrupt society in the capital, firing the eloquence of Grattan and Curran and pointing Sheridan's wit.

Thomas Moore.—Into this strife, too, was born Thomas Moore (1779–1852) whose *Irish Melodies* had in their day a European vogue and were acclaimed by the greatest of his contemporaries. His practice of writing to music necessarily betrayed him into a diffuse and cloying sweetness, and writing before the Wordsworthian reaction his language and imagery are often out-moded. But he remains a master of swift, light and musical verse as well as of witty political satire. His control of varied metres restored to the English lyric the freedom of 17th century verse. In this he was an innovator as well as in his introduction of certain Irish modes to English metre. With him for the first time there entered into Anglo-Irish poetry some faint breath of the Gaelic spirit which is the vital force of its later development. The cadences and imagery of Gaelic poetry give whatever is of value to the folk-verse of Callanan (1795–1829) and Walsh (1805–50), and the scholarly George Darley (1795–1846) dipped his pen in the same glittering honeydew. Its influence is supreme in the visionary James Clarence Mangan (1805–49), whose genius let and hampered, as has been said, by inborn physical and spiritual sensitiveness, reached in his best work the highest lyrical levels. Lionel Johnson, a kindred soul, ranks Mangan's "Dark Rosaleen" with the great lyrics of the world where the chivalry of a nation's faith is struck of a sudden into the immortality of music. His "Nameless One" has the troubled and vehement sincerity of Villon and Byron. At this time O'Curry, O'Donovan and Petrie were laying the foundations of Gaelic scholarship but with slight influence, Mangan excepted, upon the poets of their day.

The writers of *The Nation* newspaper, Duffy, D'Arcy McGee and the rest who followed the fruitful plough-share of Thomas Davis (1814–45) were pre-occupied with the Repeal and '48 movements and the work of politics. Literature was to them a tool and not an end in itself. Similarly, the new scholarship touched but did not greatly affect the impersonal and meditative Aubrey de Vere (1814–1902), Denis Florence M'Carthy, the translator of Calderon, or John Auster the translator of Faust. But as the fruits of their studies ripened, Sir Samuel Ferguson (1810–86) found Irish themes to fit "the epic largeness of his conception" and he revealed to the younger poets the harvest about their feet.

Gaelic Influence.—The modern school traces its ancestry back in this way through Ferguson and Mangan to the Gaelic poets. The way to their ancient founts was pointed by the scholars already mentioned and by their successors, Whitley Stokes, Standish Hayes O'Grady, Kuno Meyer, Dr. Sigerson, Dr. Douglas Hyde and the editors of the Gaelic poets of the 17th and 18th centuries. Particular importance attaches to the publication of Hyde's *Love Songs of Connacht* and his edition of Raftery which notably influenced the new school in the direction of folk-simplicity, and to the works of Standish O'Grady, second of that name, who influenced it in the contrary direction by the glamour with which he invested the older heroic literature. The emergence of this group about 1900 was the literary evidence of a resurgent national spirit as race-conscious in literature as the Gaelic League in education, or Sinn Fein in politics. It had its origin in this race-consciousness stimulated by the study of the old heroic literature and of the folk poetry which still existed in Irish. It might have been a phenomenon of merely political or antiquarian interest if its chiefs were not primarily artists.

W. B. Yeats worked to a standard of well-nigh perfect artistry and the writings of George Russell (A.E.) were deepened and generalized with a profound consciousness of the divine origin and destiny of man. Yeats's interest in magic and A. E.'s pantheism remove their work still further from the kingdoms of this world. Yeats has always been a highly self-conscious artist. His early work broods in sorrowful ecstasy over visionary beauty; his later work is more austere in form, deliberately fashioned into abstract simplicity, very personal and often petulant. About these two writers and the Abbey theatre, the Gaelic League and Sinn Fein, were grouped in diverse relations the poets, novelists and dramatists of the so-called Irish literary revival. Ethna Carbery impersonated its spring-tide, Alice Milligan its clean-cut masculine purpose; there were nature poets like Katharine Tynan and Francis Ledwidge; poets of the people like Padraic Colum, Joseph Campbell, Moira O'Neill; town poets like Seumas O'Sullivan who introduced a new and mordant note into his fastidious art; the newcomers, Austin Clarke, whose imagination is fitly exercised in epic subjects, F. R. Higgins, who seeks to develop the subtle Gaelic mode in clarity, and Oliver Gogarty, a writer of witty and lapidary verse. Reaction from cloudy abstraction and a transition to prose marked the passing of youth and the coming of age of the movement. The appearance of James Stephens may be taken as the turning point, who passes indifferently from verse to prose, from slum idylls to the riotous invention of the *Crock of Gold* and *The Demigods*, and exhibits at each turn the same leaping fancy and the same wise and witty humanity.

Fiction.—The politics which became prose literature under Swift's pen remained literature in the hands of Wolfe Tone (*Autobiography*), Mitchel (*Jail Journal*) and Padraic Pearse, but the novel had a later start. Maria Edgeworth (1767–1849), the earliest of Anglo-Irish novelists, still remains a central figure amongst them. Equalling any of her successors in the vivacity of her dialogue and in the fidelity of her character studies she brought to bear on Irish life a criticism more serious and candid than any of the group after her. Samuel Lover (1797–1868) redeems with a touch of poetry his inclination to buffoonery. Charles Lever (1806–72) excels in the rollicking novel of adventure. He rarely touches serious issues but fills his pages with the "half-sirs" and "squireens" who swarmed in Ireland up to the date of the Incumbered Estates Act. He fashioned out of this class a pseudo-national figure of the hard-drinking, devil-may-care Irishman, and succeeded in impressing it on his foreign readers as the national type. The once popular Lady Morgan enjoyed a social and political vogue, and the singular figure of Maturin, whose influence Balzac admitted, will always hold the attention of literary historians. Of more importance is the group which includes the Banim brothers (John, 1798–1842; Michael, 1796–1824), and the charming idyllist of peasant life, Charles Kickham (1826–82). With their knowledge of the people, but not without a sentimental and idealizing tendency, they penetrated the surface upon which Lever's school was content to play. With better models and technical equipment this period might have produced an Irish Turgeniev. Between the frivolous and the idealists stands the considerable figure of Carleton (1794–1869), a twisted genius of unusual intensity, the opposite of Maria Edgeworth in all points, his blind power, grotesque humours and native, uncertain art contrasting with the security of her judgment and technique. Emily Lawless and Jane Barlow continue the study of the Irish peasant with the seriousness of their age, and contemporary with them the two writers who, under the names of Somerville and Ross, reproduce the laughing surface of Irish life in the true rhythm of Anglo-Irish speech—all three with a poet's sensitiveness to the changing beauty of the Irish landscape. The modern novelists, George Moore at their head, range themselves less consciously along the lines drawn by the religious and agrarian struggle of the 19th century. They are more pre-occupied with their art than with politics. The realism of the early Moore and of *The Real Charlotte* fortifies but does not displace the creative imagination of

which James Stephens is the exemplar. Daniel Corkery's short stories and his single novel, *The Threshold of Quiet*, are studies of intense though quiet reality with which may be mentioned Colum's *Castle Conquer*. The premature death of Seumas O'Kelly was a great loss to Irish literature. His *Weaver's Grave* is the best modern Irish short story. Post-war conditions explain the brutal and immature talent of O'Flaherty whose short stories deserve recognition. There remains the unique personality of James Joyce, who passes the bounds of Anglo-Irish, if not indeed of English, literature.

The Literary Theatre.—The history of the Irish theatre begins in the mid-17th century and the stage was firmly established in the 18th when Garrick and Mrs. Siddons were welcomed in the rivalry of genius with the native Spranger Barry and Peg Woffington. Congreve was contemporary in Dublin with Farquhar who made his first appearance as an actor in the famous Crow street theatre, and on them followed Goldsmith and Sheridan—the twin glories of the 18th century stage. Macklin, O'Keeffe, Gerald Griffin and Dion Boucicault carry on the succession into the 19th century when the supremacy of Dublin, and Ireland, in this field is resumed first with the brilliant and unhappy Oscar Wilde and in our day with Bernard Shaw and the Abbey dramatists. The movement which resulted in the foundation in 1904 of the Abbey theatre began in the meeting of the writers Russell and Yeats with the actors W. G. and Frank Fay. It was a fortunate junction of poets with actors who sought in simplicity for truth. The first plays were heroic and poetical. With the accession of Synge (1871–1909) the movement received its most powerful impulse. He founded no school; his tragic imagination was not hereditable and his gift of richly imaged speech could not safely be imitated. Lady Gregory contributed comic verse, inexhaustible invention and an instinct for cumulatively absurd dramatic situation. These, with Padraic Colum, were the foundation dramatists. Colum, with his social sense and grave beauty of speech, was the first begetter of the peasant drama; his best play *Thomas Muskerry* was produced in the year of Synge's death and it is to his idiom rather than to Synge's that later dramatists returned. The new writers include T. C. Murray, Lennox Robinson, St. John Ervine and Lord Dunsany. Murray uniformly shows a strong sense of dramatic situation, the technique of an accomplished artist and a faculty for significant and beautiful speech. Lennox Robinson is master of easy, graceful dramatic conversation while the highly personal talent of Lord Dunsany exhibits itself in unusual invention and verbal felicities. Sean O'Casey's first play was staged in 1923. His advent is significant of the vitality of the movement and its change. The heroic play in verse or prose has given place to the drama of realism, and the townsman is challenging the peasant's monopoly of the stage. O'Casey has a consummate power of creating and energizing character, a speech that holds rich local savour without losing its natural rhythm, pity and humour that transcend the squalor of the slums. In these gifts and in his passion for truth, the fruit of enthusiasm and disillusion, lies his promise. (C. P. Cu.)

GAELIC

In the absence of a native coinage it is extremely difficult to say when the use of letters was introduced into Ireland. It is probable that the Latin alphabet first came in with Christianity. With the exception of the one bilingual Ogam inscription as yet discovered in Ireland (that at Killeen Cormac) all the inscriptions in Roman letters are certainly later than 500. With regard to the Ogam inscriptions we cannot make any confident assertions. Owing to the lack of criteria for dating certain Irish sound-changes accurately it is impossible to assign chronological limits for the earlier stones, which cannot be later than the 5th century, but there is nothing to show whether they are Christian or not. The Ogam system is certainly based on the Latin and not the Greek alphabet, and was probably invented by some person from the south of Ireland who received his knowledge of the Roman letters from traders from the mouth of the Loire.

Early Irish Mss.—The great bulk of Irish literature is contained in mss. belonging to the Middle Irish period (1100–1550), but it will be convenient for us to deal first with those documents which are termed Old Irish. Most of the Old Irish documents have been printed by Stokes and Strachan in the *Thesaurus Palaeohibernicus*, and where no reference is given the reader is referred to that monumental work. The extraordinary outburst of intellectual activity in Ireland from the 6th to the 9th centuries and the compositions of Irishmen in the Latin language, belong to the history of mediaeval European literature and fall outside the scope of this article. For the *Confessions of St. Patrick* and his "Letter to the Subjects of Coroticus" *see* Patrick. The only Irish document ascribed to the saint is the strange so-called "Hymn," the *fáeth fiada*, more properly *fóid fiada*, "the cry of the deer." This hymn, which contains a number of strange grammatical forms, is undoubtedly referred to in the Book of Armagh, and may very well go back to the 5th century. The date of the Irish hymns in the *Liber Hymnorum* ranges, according to Stokes and Strachan, from the 7th to the 11th centuries. Ultán's hymn on St. Brigit beginning *"Brigit bé bithmaith,"* which is by far the most artistic of the collection, was perhaps composed in the 7th century. Definite metrical laws had evidently been elaborated when this poem was written. The beat is iambic, but the natural accent of the words is rigidly observed. The long line consists of two units of five syllables each. The rhymes are dissyllabic and perfect. Alliteration is always observed in the latter half of each line and assonances are found knitting up the half-lines. The well-known hymn on St. Patrick traditionally ascribed to Fiacc, bishop of Sletty, and the piece beginning *Sén Dé*, traditionally ascribed to Colmán, are assigned on linguistic grounds to the beginning of the 9th century. The Patrician documents by Muirchu Maccu Machthéni, who professed to write at the command of Bishop Aed of Sletty (d. 698), and by Tirechán, who is said to have received his information from Bishop Ultán (d. 656), are contained in the Book of Armagh, a ms. compiled by Ferdomnach in 807.

The earliest pieces of connected prose in Irish are three:—(1) the Cambray Homily, contained in an 8th-century codex at Cambray: the language dates from the second half of the 7th or the beginning of the 8th century; (2) the additions to the notes of Tirechán on the life of St. Patrick in the Book of Armagh; these seem to go back to the early 8th century; (3) the tract on the Mass in the Stowe Missal, which is in all probability nearly as old as the Cambray Homily. Of especial interest are the spells and poems found in the Stowe Missal and two Continental mss. A St. Gall codex has preserved four Irish incantations of the 8th and 9th centuries. The 9th-century codex preserved at the monastery of St. Paul in Carinthia contains several interesting short poems in Irish.

For our knowledge of the older language, however, we have to rely mainly on the numerous glosses scattered about in a large number of mss., which it is impossible to enumerate here. It will be sufficient to mention the three most important codices containing Old Irish glosses. These are as follows:—(1) The Codex Paulinus at Würzburg. The date of this highly important ms. is much disputed; part of the Irish glosses seem to date from about 700, whilst the rest may be placed a little before 800. (2) The Codex Ambrosianus, formerly at Bobbio, now at Milan; these glosses were copied in the first half of the 9th century. (3) Glosses on Priscian contained in four mss. The other chief texts or authors provided with Irish glosses are Augustine, Bede, the Canons, the Computus, Eutychius, Juvencus, Philargyrius, Prudentius and Servius. The Milan and the St. Gall codices just mentioned both contain several short poems in Irish.

Two ponderous religious poems have now to be noticed. To Oengus the Culdee is attributed the lengthy *Félire* or Calendar of Church Festivals, consisting of 365 quatrains in *rinnard* metre, one for each day in the year. The language of this dry compilation, which is heavily glossed and annotated, points to 800 as the date of composition, and Oengus, who is stated to have lived about that time, may well have been the author.

It may perhaps be as well to enumerate here the later Irish martyrologies. (1) The *Martyrology of Tallaght*, founded on an 8th-century calendar, but containing additions down to 900 (ed.

D. H. Kelly, 1857). (2) The metrical *Martyrology of O'Gorman, c.* 1166–74, edited by Stokes for the Bradshaw Society (1895). (3) The *Martyrology of Donegal,* an important compilation in prose made by Michael O'Clery in 1630, edited by J. H. Todd (1864). A composition which is wrongly assigned to Oengus the Culdee is the *Saltair na Rann* or Psalter in Quatrains, published without a translation by Stokes (1883). The work proper consists of 150 poems, but 12 poems have been added, and in all it contains 2,098 quatrains. This psalter received additions as late as 998. We should perhaps also mention here the famous *Amra* or Eulogy of St. Columba, commonly attributed to Dallán Forgaill, a contemporary of the saint, but Stokes takes the view that it was written in the 9th century, and is intentionally obscure.

During the 9th and 10th centuries Ireland was harassed by the Vikings, and a host of scholars seem to have fled to the Continent, carrying with them their precious books, many of which are preserved in Italy, Switzerland, Germany and elsewhere. Hence very few early Irish mss. are preserved in Ireland itself. When the fury of the storm was past, Irish scholars showed increased interest in the old literary documents, and copied all that they could lay hands on into miscellaneous codices. The earliest of these collections, such as the *Cin of Druim Snechta,* the *Yellow Book of Slane,* the *Book of Dubdaleithe,* the *Psalter of Cashel,* exist no longer, though their names have come down and certain of them were known in the 17th century. However, copies of a goodly portion of the contents of these old books are preserved to us in one form or another, but mainly in a series of huge miscellaneous codices ranging in date from the 12th to the 16th century. The oldest is *Lebor na h-uidre,* which we shall abbreviate as LU., preserved in the Royal Irish Academy and published in facsimile (1870) by the Academy, which is also publishing the entire text of this codex in Roman letters marking the different handwritings. This ms. was compiled in part in the monastery of Clonmacnoise by Moelmuire MacCelechair, who was slain in 1106. LU. is almost entirely devoted to romance, the stories which it contains belonging mainly to the Ulster cycle. The next ms. in point of age is the Book of Leinster (abbreviated LL.) now in Trinity college, Dublin, which was transcribed by Finn, son of Gorman, bishop of Kildare (d. 1160), and also contains a large number of romances in addition to other important matter bearing more particularly on the affairs of Leinster. The Yellow Book of Lecan (YBL.), also in Trinity college, Dublin, was written at different times by the MacFirbis family, and it also contains a vast amount of romance. The most extensive collection of all is the Book of Ballymote (BB.), now belonging to the Royal Irish Academy, which was compiled about the beginning of the 15th century by various scribes. In 1522 it was purchased by the O'Donnells for 140 milch cows. The contents of the *Leabhar Breac* (LB.), or Speckled Book, now in the Royal Irish Academy, are chiefly ecclesiastical and religious. All these five codices have been published in facsimile by the Royal Irish Academy with a description of their contents. Two important Mid. Ir. mss. in the Bodleian (Rawlinson B 512 and Laud 610) are also published in facsimile by Henry Frowde.

Other mss. which require special mention are (1) The Great Book of Lecan, compiled in the year 1417 by Gilla Isa Mór MacFirbis, in the Royal Irish Academy, for whose checquered history *see* the Marquis MacSweeny's article R.I.A. (1928). (2) The Book of Lismore, the property of the duke of Devonshire at Lismore castle, whose contents are described in the introduction to Stokes's *Lives of Saints from the Book of Lismore* (1890). (3) The Book of Fermoy in the Royal Irish Academy. The contents are described in the introduction to O'Beirne Crowe's edition of the *Táin Bó Fraich* (1870). (4) The Book of Hy Maine now in the Royal Irish Academy. The scribe who wrote it died in 1372. O'Curry, O'Longan and O'Beirne Crowe drew up a ms. catalogue of the Irish mss. in the Royal Irish Academy, completed by Purton in over 30 ms. volumes. The Academy has since published in 1927–28 three fasciculi of a new catalogue by O'Rahilly, Miss Mulchrone and Miss Byrne. O'Donovan performed the same service for the Trinity college, Dublin, collection. A briefer account of the Irish mss. in TCD. will be found in Abbott's and Gwynn's Catalogue of the mss. in that library. O'Curry also drew up a list of the Irish mss. in the British Museum, and S. H. O'Grady printed part i. of a descriptive catalogue of this collection (1901). Robin Flower completed this catalogue in 1926. The mss. in the Franciscan monastery in Dublin are described by J. T. Gilbert in the *Fourth Report of the Royal Commission on Historical MSS.* W. F. Skene catalogued the collection of mss. in the Advocates' Library, Edinburgh, a printed catalogue of which has been issued by D. Mackinnon (1909; *see also Trans. Gaelic Soc. of Inverness,* xvi. 285–309).

O'Curry states that if the five oldest vellum mss. were printed the result would be 9,400 quarto pages. Other mss. ranging in date from 1300 to 1600 would fill 9,000 pages of the same size. D'Arbois de Jubainville, published in 1883 a tentative catalogue of Irish epic literature. He mentions 953 Irish mss. containing epic matter preserved in Irish and English libraries. To these have to be added another 56 in Continental libraries.

The language in which the huge miscellaneous codices enumerated above are written is called by the general name of Middle Irish, which is a very wide term. Irish scribes often copied their original somewhat mechanically, without being tempted to change the language to that of their own time. Thus in many parts of LU. we find a thin Middle Irish veneer on what is largely Old Irish of the 8th or 9th century, and it may even happen that a 14th or 15th century ms. such as YBL. contains much older forms than a corresponding passage in LL.

The "Fili."—It remains for us to say a few words about the *fili,* the professional literary man in Ireland. The *fili* (from the stem *vel-,* "to see," Welsh, Breton, *gwelet,* "to see") appears to have been originally a diviner and magician, and corresponds to the *vates,* οὐάτεις, of the ancient Gauls mentioned by classical writers. Part of the tremendous influence exercised by the *fili* was due to the belief in his powers of satire. The *filid* were held in such esteem that the annalists give the obituaries of the head-ollams as if they were so many princes. With the introduction of Christianity they seem to have gradually superseded the druid. We are here only concerned with the *fili* in his capacity of story-teller and poet. (1) The highest degree of *fili* is the *ollam* (ollave), who knows 350 stories; (2) the *áuruth,* 175 stories; (3) the *clíi,* 80 stories; (4) the *cana,* 60 stories; (5) the *doss,* 50 stories; (6) the *macfuirmid,* 40 stories; (7) the *fochlocon,* 30 stories; (8) the *drisac,* 20 stories; (9) the *taman,* 10 stories; (10) the *oblaire,* 7 stories. In LL. we are told that the stories (*scél*) are divided into primary and secondary, and that the latter are only obligatory on the first four of the grades enumerated. The higher grades were allowed a number of attendants, whom the kings had to support along with the poet himself. The 6th century monarch, Aed MacAinmirech, weary of the pretensions of the poets, attempted to banish them, which led to the famous assembly of Druim Ceta, where Columba intervened and reduced their number.

We have already stated that the stories which formed the stock-in-trade of the poets were divided into primary and secondary stories. Of the latter there were 100, but little is known of them. The oldest catalogue (contained in LL.) gives the titles of 187 of the primary tales arranged under the following heads—destructions, cow-spoils, courtships, battles, caves, navigations, violent deaths, expeditions, elopements and conflagrations; together with the following, which also reckon as prime-stories—irruptions, visions, loves, hostings and migrations. Of these stories 68 have been preserved in a more or less complete form. The tales enumerated in these catalogues in their substance doubtless go back to the 8th or even to the 7th century. It ought to be observed that the church never showed itself hostile to the *filid,* as it did to the druids. Dubthach, chief *fili* of Ireland in the time of St. Patrick, is represented as the saint's constant companion.

Like the official *filid,* the bards, an inferior class of poets, were divided into grades. There were both patrician and plebeian bards, each subdivided into eight degrees, having their own peculiar metres. In course of time the office of *fili* became extinct,

owing to a variety of causes, and from the 13th to the 16th century we find the hitherto despised family bard stepping into the place of the most influential literary man in Ireland. His importance was fully realized by the English Government, which did its best to suppress the order.

Mediaeval Romances.—The mediaeval romances form by far the most attractive part of Irish literature. Two main groups of stories have to be distinguished. The one is the Ulster cycle, with Conchobar and Cúchulinn as central figures. The other is the Southern or Leinster-Munster cycle, revolving round Finn and Ossian.

The Ulster cycle may be regarded as Ireland's most important contribution to the world's literature. The chief and at the same time the lengthiest romance in which the heroes of this group figure is the great epic, the *Táin Bó Cualnge* or the Cattle-raid of Cooley (Co. Louth). Here we find ourselves in a world of barbaric splendour, and we are constantly reminded of the *Iliad*, though the Irish epic from a purely literary point of view cannot bear comparison with the work of Homer. The main actors in the drama are Conchobar, king of Ulster, the great warrior Cúchulinn (*q.v.*), Ailill and Medb, king and queen of Connaught, and Fergus, Conchobar's predecessor as king of Ulster, now in exile in Connaught. These persons may or may not have actually lived, but the Irish annalists and synchronists agree in placing them about the beginning of the Christian era. And there cannot be any doubt as to the antiquity of the state of civilization disclosed in this great saga. It has been repeatedly pointed out that the Irish heroes are equipped and conduct themselves in the same manner as the Gauls described by the Greek traveller Posidonius, and Prof. W. Ridgeway has shown that several articles of dress and armour correspond exactly to the La Tène types of the Continent. To mention a few primitive traits among many—the Irish champions of the *Táin* still fight in chariots, war-dogs are employed, whilst the heads of the slain are carried off in triumph and slung round the necks of the horses. It may also be mentioned that Emain Macha, Conchobar's residence, is reported by the annalists to have been destroyed in A.D. 323, and that portions of Meath, which is stated to have been made into a separate province in the 2nd century A.D., are in the *Táin* regarded as forming part of Ulster. Noteworthy is the exalted position occupied by the druid in the Ulster sagas, showing how little the romances were influenced by Christianity. No Roman soldier ever set foot in Ireland, and this early epic literature is of supreme value as a monument of primitive Celtic civilization. The YBL. version of this epic preserves a number of forms as old as the O.Ir. glosses (*i.e.*, 8th century or earlier), and a curious story contained in LL. seems to point to the fact that the *Táin* was first committed to writing in the 7th century.

At this point it will be well to say a few words about the form of the *Táin*. The old Irish epic is invariably in prose with poems of varying length interspersed. The narrative and descriptive portions are in prose and are frequently followed by a brief epitome in verse. Dialogues, eulogies and laments also appear in metrical form. The oldest poems, termed rhetoric, which are best represented in LU., seem to be declamatory passages in rhythmical prose, not unlike the poetical passages in the Old Testament, and the original *Táin* may have consisted of such rhetorics bound together with short connecting pieces of prose. At a later date poems were inserted in the metres of the *filid*. The genesis of the *Táin* may thus be briefly summarized as follows. The story was first committed to writing in the 7th or 8th century, after which it was worked up by the *filid*. Extended versions existing in the 10th or 11th century form the basis of the copies we now possess.

Though the sagas of the Ulster cycle are eminently Irish and pagan in character and origin, it cannot be denied that traces of foreign influence are to be observed. A number of Latin and Norse loan-words occur in them, and there can be little doubt that the monkish scribes consciously thrust the supernatural element into the background.

From what we have already said it will be plain that the Irish epic is in a fluid state. The *Táin* is of interest in the history of literature as representing the preliminary stage through which the great verse epics of other nations have had to pass, but its value as a work of art is limited by its form. As already stated, the atmosphere is frankly pagan and barbaric, with none of that courtly element which we find in the Arthurian epics. The two features which strike one most forcibly in the mediaeval Irish romances are dramatic force and humour. The unexpected and weird is always happening, the effect of which is considerably heightened by the grim nature of the actors. In particular the dialogues are remarkably brilliant and clever, and it is a matter for surprise that this gifted race never developed a drama of its own. This is doubtless partly due to the political conditions of the island. And, moreover, we are constantly struck by the lack of sustained effort which prevented the *filid* from producing great epics in verse. Dramatic material is abundantly present in the old epics, but it has never been utilized. Perhaps the most serious defect of most Irish literary products is the lack of any sense of proportion, which naturally goes hand in hand with the love of the grotesque.

The Ulster Cycle.—The *Táin Bó Cualnge* formed a kind of nucleus round which a number of other tales clustered. A number of these are called *remscéla* or introductory stories to the *Táin*. Such are the "Revealing of the Táin," the "Debility of the Ultonians," "The Cattle-Driving of Regamon, Dartaid and Flidais," *Táin bó Regamna*, "The Cattle-Driving of Fraech," "The Dispute of the Swine-herds," telling the previous history of the Bulls, "The Capture of the Fairy Mound," "The Dream of Oengus," the "Adventures of Nera," the "Wooing of Ferb." Other stories form a kind of continuation of the *Táin*. Such are the "Battle of Rosnaree," the "Great Rout of the Plain of Murthemne" and "Cúchulinn's Death." We are also told of the vengeance taken on the slayers by Conall Cernach. Other stories deal with the "Conception of Conchobar," the "Conception of Cúchulinn," "The Glories of Conchobar's Reign," with an account of how he acquired the Throne from Fergus, "The Wooing of Emer and the Hero's Education in Scotland under Scathach," "The Siege of Howth," "Bricriu's Feast and the Exile of the Sons of Doel Dermait," "The Battle of the Boyne" (*Eriu*, vol. ii.), "The Deaths of Ailill, Medb and Conall Cernach," "Destruction of Bruden Dá Choca," "The Tragical Death of Conlaech at the hands of Cúchulinn his father," "The Deaths of Goll and Garbh," "The Sickbed of Cúchulinn," "The Intoxication of the Ultonians," "The Death of Conchobar," "The Phantom Chariot of Cúchulinn," in which the hero is brought up from the grave.

Four other stories in connection with the Ulster cycle remain to be mentioned. The first is *Scél mucci Maic Datho* ("The Story of MacDatho's Pig"). In this savage but picturesque Irish story we find the Ulstermen vaunting their achievements against the Connaughtmen. Nowhere, perhaps, is the dramatic element better brought out. Apart from the *Táin* the greatest and at the same time the longest saga in which Cúchulinn figures is *Fled Bricrend* (Bricriu's Feast). Bricriu is the mischief-maker among the Ulstermen, and he in turn incites the three chief heroes, Cúchulinn, Conall Cernach and Loigaire Buadach, to claim the champion's portion in a feast which he prepared. In order to decide the dispute, visits are paid to Medb at Rath Cruachan and to Curói in Kerry, and the story ends with the "beheading incident," which occurs in the romance of "Sir Gawayne and the Green Knight."

But the story of the Ulster cycle which is better known than any other, is the story of the "Tragical Death of the Sons of Usnech, or the Life and Death of Deirdre," one of the "Three Sorrows of Story-telling." This is almost the only tale of the group which has survived in the minds of the common people down to the present day. It is foretold of Deirdre, a girl-child of great beauty, that she will be the cause of great misfortunes, but Conchobar, having lost his wife, determines to have her brought up in solitude and marry her himself. The oldest version of the story is found in LL., and the characters are as rugged and unsophisticated as those of the *Táin*. But in the later versions the savage features are toned down.

Few of the old romances deal directly with what we may call Irish mythology. The "Battle of Moytura" tells of the tre-

mendous struggle between the Tuatha Dé Danann and their enemies, the Fomorian pirates. Connected with the events of this saga is the story of the "Tragic Deaths of the Sons of Tuirenn," which, though mentioned in Cormac's glossary, is not found in any ms. older than the 18th century. This is the second of the "Three Sorrows of Story-Telling." An old story dealing with Tuatha Dé Danann personages, but having a certain bearing on the Cúchulinn cycle, is the "Courtship of Etáin," who, though of supernatural (*síd*) birth, is wedded to a mortal king. Her former husband wins back Etáin from her mortal husband in a game of chess and carries her off to his fairy mound. For sake of completeness we may add the titles of two other well-known stories here. The one is the "Story of Baile the Sweet-Spoken." The other is the "Fate of the Children of Lir," the third of the "Three Sorrows of Story-telling," which is only known in a modern dress.

A large number of sagas, which claim to be founded on historical events, present a great similarity to the tales of the Ulster cycle. The "Destruction of Dind-Rig and Exile of Labraid Loingsech" relates how the kingdom of Leinster was snatched by one brother from another in the 6th century B.C. The story of the visit of the pigmies to the court of Fergus MacLeite, king of Ulster in the 2nd century B.C., contained in a 15th-century ms., is commonly stated to have given Swift the idea of his *Gulliver's Travels to Lilliput*. *Caithréim Chonghail Claringnigh,* which only occurs in a modernized 17th-century version, deals with a revolution in the province of Ulster, supposed to have taken place before the Christian era. The most important Old Irish saga after the *Táin* is beyond doubt the *Destruction of Dá Derga's Hostel,* contained in LU. It deals with events in the reign of the High-King Conaire Mór, who is said by the annalists to have been slain in 43 B.C. after a reign of 70 years.

We can do no more than enumerate the titles of other historical tales: The "Destruction of the Hostel of MacDareo," describing the insurrection of the Aithech-Tuatha (1st century A.D.), "The Expulsion of the Déisi" and the "Battle of Mag Lemna" (2nd century A.D.), "Battle of Mag Mucrime" (A.D. 195 or A.D. 218), "Siege of Drom Damgaire" (3rd century), "Adventures of the Sons of Eochaid Muigmedóin, father of Niall Nóigiallach" (4th century), "Death of Crimthann" (reigned 366–378), "Death of Dathi" (d. 428), "Death of Murchertach, son of Erc," and "Death of Diarmait, son of Cerball" (6th century) "Wooing of Becfola, who became the wife of Diarmait, son of Aed Slane" (reigned 657–664), "Battle of Mag Rath" (637), "Battle of Carn Conaill" (*c.* 648), "Death of Maelfothartaig MacRonain" (7th century), who was a kind of Irish Hippolytus, "Battle of Allen" (722).

The visits of mortals to the Irish Elysium form the subject of three romances, and the whole question has been exhaustively dealt with by Kuno Meyer and Alfred Nutt in the *Voyage of Bran* (1895–97). Condla Caem, son of Conn Cétchathach, was one day seated by his father on the hill of Usnech, when he saw a lady in strange attire approaching invisible to all but himself. She describes herself as coming from the "land of the living," a place of eternal delight, and invites the prince to return with her. This is the *Imram* or Adventure of Condla Caem, the oldest text of which is found in LU. A similar story is entitled *Imram Brain maic Febail,* contained in YBL. and Rawlinson B 512 (the end also occurs in LU.). A later story preserved in BB., YBL. and the Book of Fermoy, tells of the visit of Cormac, grandson of Conn Cétchathach, to Tír Tairngiri. The romances we have just mentioned are almost entirely pagan in character, but a kindred class of story shows us how the old ideas were transformed under the influence of Christianity. A typical instance is *Imram curaig Maelduin,* contained in YBL. and in part in LU. *Imram ua Corra* (Book of Fermoy) and *Imram Snedgusa ocus Mac Riagla* (YBL.) resemble this, but in these cases, the voyage is undertaken as an expiation for crime. In the 11th century an unknown monkish writer compiled the *Navigatio S. Brendani,* drawing the material for his episodes from *Imram curaig Maelduin.*

Fenian or Ossianic Cycle.—Unfortunately the origin of the stories and poems connected with Finn and his warriors is obscure, and scholars are by no means agreed over the question (*see* FINN MAC CUMHAIL). In the earlier, the Ultonian, cycle the figures and the age in which they live are sharply drawn, and we can have no hesitation in assuming that the *Táin* represents in the main the state of Ireland at the beginning of the Christian era. Finn and his companions are more nebulous personages, and, although it is difficult to discover the actual starting-point of the legend, yet from the 12th century onwards we are able to trace the development of the saga with some degree of certainty. Of the 134 pages contained in LU. only half-a-dozen deal with Finn as against 58 with Cúchulinn. Again in Urard MacCoisi's list of tales, which seems to go back to the 10th century, only two appear to deal with subjects taken from the Ossianic cycle. The vehicle of the older epic is prose, but this later cycle is clothed in ballad form. Of these ballads about a dozen, apart from poems in the *Dindsenchus* are preserved in LU., LL. and YBL., and none of these poems is probably much older than the 11th century. At the same time we do find a few prose tales, *e.g.*, *"Fotha catha Cnucha"* in LU., describing the death of Cumall, Finn's father, and in LL. and Rawlinson B 502, part of which Zimmer assigns to the 7th century, we have the first story in which Finn actually occurs. But it is remarkable that in no case do tales belonging to the Finn cycle contain any of the old "rhetorics" which occur in the oldest of the Ulster romances. By the 12th century the stories of the Fiann and their destruction at the battle of Gabra must have been fully developed, and from this time onward they appear gradually to have supplanted the Cúchulinn cycle in popular favour.

We have already stated that the form assumed by the stories connected with Finn in the earliest mss. is that of the ballad, and this continued down to the 18th century. But here again the Irish poets showed themselves incapable of rising from the ballad to the true epic in verse. The oldest composition of any length which deals with the Ossianic legends is the *Acallam na Senórach* or Colloquy of the Old Men, which is mainly preserved in three 15th-century mss., the Book of Lismore, Laud 610 and Rawlinson 487. In this text we have the framework common to so much of the later Ossianic literature. Ossian and Cáilte are represented as surviving the battle of Gabra and as living on until the time of Patrick. The inflated style to which the Irishman is so prone is seen at its worst in the 16th century *Battle of Ventry,* and we are treated to a nauseous heaping up of epithet upon epithet, *e.g.*, we sometimes find as many as 27 adjectives accompanying a substantive running in alliterating sets of three.

Of greater literary interest are the later ballads connected with Finn and Ossian. Nutt has pointed out that there is a striking difference in spirit between the *Acallam na Senórach* and the 15th–16th century poems. In the latter Ossian is represented as a "pagan, defiant and reckless, full of contempt and scorn for the howling clerics and their churlish low-bred deity," whilst Patrick is a sour and stupid fanatic, harping with wearisome monotony on the damnation of Finn and all his comrades. The earliest collection of these later Ossianic poems is that made in Scotland by James Macgregor, dean of Lismore, early in the 16th century. Two other published collections are the first half of *Duanaire Finn* and the *Transactions of the Ossianic Society* (1854–61). We further possess a number of prose romances, which in their present form date from the 16th to the 18th century; *e.g.*, *The Pursuit of Diarmaid and Gráinne, Finn and Gráinne, Death of Finn, The Clown in the Drab Coat, Pursuit of the Gilla Decair, The Enchanted Fort of the Quicken-tree, The Enchanted Cave of Ceis Corann, The Feast in the House of Conan.*

At the present moment it is impossible to give a complete survey of the other branches of mediaeval Irish literature. The attention of scholars has been largely devoted to the publication of the sagas to the neglect of other portions of the wide field. An excellent survey of the subject is given by K. Meyer, *Die Kultur der Gegenwart,* i. xi. 1, pp. 78–95 (Berlin-Leipzig, 1909).

As early as the Old Irish period nameless Irish poets were singing the praises of nature in a strain which sounds to our ears peculiarly modern, but it is, generally speaking, quite an accident

if any of the delightful little lyrics entered in the margins or on blank spaces in the mss. have remained. There are exquisite nature poems ascribed to Finn, which have been collected into a pamphlet with English renderings by Kuno Meyer (under the title of "Four Old Irish Songs of Summer and Winter," 1903), and he has edited a native poem referred to the 10th century in the form of a colloquy between Guaire of Aidne and his brother Marban. Another text full of passionate emotion and tender regret ascribed to the 9th century tells of the parting of a young poet and poetess, who after plighting their troth are separated for ever (*Liadain and Curithir*, ed. with trans. by K. Meyer, 1902). In the *Old Woman of Beare* (publ. K. Meyer, in *Otia Merseiana*) an old courtesan laments her departed youth, comparing her life to the ebbing of the tide (10th century).

Professional Literature.—We must now step aside from pure literature and turn our attention to the various productions of the professional learned classes of Ireland during the middle ages. The range of subjects coming under this heading is a very wide one, comprising history, genealogies, hagiology, topography, grammar, lexicography and metre, law and medicine. Irish tradition preserves the names of a number of antiquarian poets of prehistoric or early mediaeval times, such as Amergin, one of the Milesian band of invaders; Moran Roigne, Adna and his successor Ferceirtne, Torna (*c.* 400), Dallán Forgaill, Senchán Torpéist, and Cennfaelad (d. 678), but the poems attributed to these writers are of much later date. To Maelmura (d. 887) is attributed a poem on the Milesian migrations. Flanagan, son of Cellach, wrote a long composition on the deaths of the kings of Ireland, and Flann MacLonáin (d. 918), called by the Four Masters the Virgil of Ireland, wrote poems, of which about 1,000 lines survive. Cormacan, son of Maelbridge (d. 946), composed a vigorous poem on the circuit of Ireland. A poet whose poems are most valuable from an antiquarian point of view is Cinaed Ua h-Artacáin (d. 975). Contemporary with him is Eochaid O'Flainn (d. *c.* 1003). A little later comes MacLiac (d. 1016), who celebrated in verse the glories of the reign of Brian Boroime. Contemporary with MacLiac is Urard MacCoisi (d. 1023). To Cúán ua Lothcháin (d. 1024), chief poet in the reign of Maelsheachlainn II., are ascribed poems on the antiquities of Tara. A writer who enjoyed a tremendous reputation in mediaeval Ireland was Flann Mainstrech (d. 1056), who in spite of his being a layman was head of the monastery school at Monasterboice. Flann's successor, Gilla Coemgin (d. 1072), gives us a chronological poem dealing with the annals of the world down to A.D. 1014. He also is the author of the Irish version of Nennius which contains substantial additions dealing with early Ireland. Minor writers of the same nature, some of whose works have come down to us, are Colmán O'Sesnáin (d. 1050), Néide ua Maelchonaire (d. 1136), Gilla na noem ua Duinn (d. 1160), Gilla Moduda O'Cassidy (1143). In the 13th century these historical poems become very rare. In the next century we again find antiquarian poets of whom the best-known is John O'Dugan (d. 1372), whose work was completed by his younger contemporary Gilla na naem O'Huidhrin. From the beginning of the 13th century the official poets began to give way to the hereditary bards and families of scribes. Among the chief bardic families we may mention the O'Dalys, the MacWards, the O'Higinns, the MacBrodys and the MacDaires, and in Scotland the MacVarrichs descendants of O'Daly (*c.* 1214–40). Gilla Brigde MacConmidhe was a contemporary of the last-mentioned bard. Donnchad Mór O'Dálaig is said to be the greatest religious poet that Ireland has produced. Angus O'Daly, who lived in the second half of the 16th century, was believed to have been employed by the English to satirize the chief Gaelic families in Ireland. Two members of the O'Higinn family deserve mention, Tadg mór O'Higinn (d. 1315) and Tadg Óg O'Higinn (d. 1448). A *duanaire* was inserted into YBL, which contains a large number of poems by him.

Closely connected with the compositions of the official poets are the works of native topography. The *Dindsenchus* is a compilation of etymologies of place names. But its chief value consists in the amount of legendary matter it contains, adduced in support of the etymologies given. A kindred compilation is the *Cóir Anmann* (Fitness of Names), which does for personal names what the *Dindsenchus* does for geographical names.

History.—No people on the face of the globe have ever been more keenly interested in the past of their native country than the Irish. We may now describe briefly the historical works in prose which have come down to us. They may be divided into two classes, (1) works containing a connected narrative, (2) annals. Closely allied to these are the sagas dealing with the high-kings. The earliest of these histories is the wars of the Gael and Gall (*Cogad Gaedel re Gallaib*), which gives an account of the Viking invasions of Ireland, the career of Brian Boroime and the overthrow of the Norsemen at the battle of Clontarf, obviously written by an eye-witness of the battle, or from materials supplied by a person actually present. *Caithreim Cellacháin Caisil* treats of the conflicts between the Vikings and the Irish, and the *Leabhar Oiris* gives an account of Irish history from 979 to 1027. Another ancient work also partly preserved in LL. is the Book of Invasions (*Leabhar Gabhála*). This deals with the five prehistoric invasions of Ireland (*see* IRELAND: *Early History*) and the legendary history of the Milesians. Part 1 of O'Clery's recension was edited by Macalister and MacNeill (Dublin, n.d.). The *Boroma* or History of the Leinster Tribute contained in LL. belongs rather to romance. Another history is the *Triumphs of Turlough O'Brian*, written about the year 1459 by John MacCraith, a Munster historian. This inflated composition is an important source of information on Munster history from the landing of the Normans to the middle of the 14th century. A life of Hugh Roe O'Donnell, by Lughaidh O'Clery, and also a contemporary history of the *Flight of the Earls*, by Tadhg O'Cianan, have been published. *See* also *Leabhar chlainne Suibhne* (Walsh, 1920) and *mcGuidir Fhearmanach* (Dinneen, 1917). But the most celebrated Irish historian is certainly Geoffrey Keating (*c.* 1570–1646), who is at the same time the greatest master of Irish prose. He travelled up and down Ireland examining all the ancient records, and compiled a history of Ireland down to the Norman Conquest. Its value for the scholar lies in the fact that the author had access to many important sources of information now lost, and has preserved accounts of events independent of and differing from those contained in the Four Masters. In addition to the history and a number of poems, Keating is also the author of two theological works in Irish which are models of Irish prose.

From the writers of historical narrative we turn to the annalists, the most important sources of information with regard to Irish history. We may here mention the *Synchronisms* of Flann Mainistrech. Apart from this work the earliest collection of annals which has come down to us is the compilation by Tigernach O'Braein (d. 1088), abbot of Clonmacnoise. Tigernach, whose work is partly in Latin, partly in Irish, states that all Irish history previous to 305 B.C. is uncertain. The *Annals of Innisfallen* were perhaps compiled about 1215. The invaluable *Annals of Ulster* were compiled on Belle Isle on Upper Lough Erne by Cathal Maguire (d. 1498), and afterwards continued by two different writers down to 1604. The *Annals of Loch Cé* (near Boyle in Roscommon) were copied in 1588 and deal with Irish events from 1014 to 1636. The *Annals of Connaught* run from 1224 to 1562. The *Chronicon Scotorum* deals with Irish affairs down to 1135. The *Annals of Boyle* extend down to 1253. The *Annals of Clonmacnoise*, which come down to 1408, only exist in an English translation made by Connell MacGeoghegan in 1627. The most important of all these collections is the *Annals of the Four Masters* (so christened by Colgan), compiled in the Franciscan monastery of Donegal by Michael, Conary and Cucogry O'Clery and Ferfesa O'Mulconry. Michael O'Clery (1575–1643), the greatest of the four, was a lay brother in the order of St. Francis, and devoted his whole life to the history of Ireland. He collected all the historical mss. he could find, and was encouraged in his undertaking by Fergal O'Gara, prince of Coolavin, who paid all expenses. The great work, which was begun in 1632 and finished in 1636, comes down to 1616. Nearly all the materials from which O'Clery drew his statements are now lost. Very important, are the lists of genealogies which occupy a great deal of

space in the older mss. But by far the most important collection of all is that made by the last great shanachie Duald MacFirbis, compiled between 1650 and 1666 in the college of St. Nicholas at Galway.

Religious Literature.—When we turn from secular to religious themes we find that Ireland is also possessed of a very extensive Christian literature, which is extremely valuable for the comparative study of mediaeval literature. One of the most important documents is the Tripartite Life of St. Patrick. The *Leabhar Breac* contains a quantity of religious tracts, most of which have been published. R. Atkinson issued a number of them under the title of *Passions and Homilies from Leabhar Breac* (1887). They do not however deal with the lives of any Irish saints. Stokes has published nine lives of Irish saints from the Book of Lismore. These lives also occur in the *Leabhar Breac.* Other lives of saints have been published by O'Grady in *Silva Gadelica.* Plummer published 17 lives in Irish and a volume of Latin lives. The longest life of St. Columba was compiled in 1536 at the command and with the help of Manus O'Donnell (O. Kelleher and Schöpperle, Chicago, 1918).

But the most interesting Irish religious text is the *Vision of Adamnan* (preserved in LU.), which Stokes assigns to the 11th century. The soul of Adamnan is represented as leaving his body for a space to visit heaven and hell under the conduct of an angel. The whole treatment of the theme challenges comparison with Dante's great poem, but the Irish composition contains many ideas peculiar to the land of its origin. Later specimens of this kind of literature tend to develop into grotesque buffoonery. We may mention the *Vision of Fursae,* the *Vision of Tundale* (Tnugdal), published by V. Friedel and K. Meyer (Paris, 1907), Laisrén's *Vision of Hell* and the *Vision of Merlino.* Kuno Meyer edited a tract on the Psalter in his *Hibernica Minora* from a 15th century Oxford ms., but he holds that the text goes back to 750. For the religious literature in general the reader may refer to O'Curry, *Lectures on the MS. Materials of Ancient Irish History* (pp. 339–434), and G. Dottin, "Notes bibliographiques sur l'ancienne littérature chrétienne de l'Irlande," in *Revue d'histoire et littérature religieuses,* v. 162–167. *See* also *Revue celtique,* xi. 391–404; *ib.* xv. 79–91.

An extraordinary production is *Aisling Meic Conglinne,* the Vision of Mac Conglinne, found in LB. and ascribed to the 12th century (ed. K. Meyer, 1892). The composition seems to be intended as a satire on the monks, and in particular as a travesty of mediaeval hagiology. Another famous satire, entitled "The Proceedings of the Great Bardic Institution," holds up the professional bards and their extortionate methods to ridicule (see *Transactions of the Ossianic Society,* vol. v.).

Collections of pithy sayings in the form of proverbs and maxims must have been made at a very early period. Not the least remarkable are the so-called Triads, 9th century (publ. K. Meyer, 1906), which illustrate every statement with three examples. There are also two documents attributed to 1st-century personages, "The Testament of Morann MacMóin to his son Feradach," which is quoted as early as the 8th century, and "The Instructions of Cúchulinn to his foster-son Lugaid." K. Meyer has published *Tecosca Cormaic* or the Precepts of Cormac MacAirt to his son Cairpre (1909), and R. M. Smith the *Senbriathra Zithaic* (1928).

Classical Stories.—With that enthusiasm for the classics which is characteristic of the Irish, it is not strange that we should find mediaeval versions of some of the better-known authors of antiquity. It is interesting to note that only those works are translated that could be utilized by the professional story-teller. So much so, that in the 10th century catalogue of sagas enumerated by Urard MacCoisi we find mention of *Togail Troi* and *Scéla Alexandir maic Pilip.* An Irish abstract of the *Odyssey,* following an unknown source, and part of the story of Theseus have been published by K. Meyer. *Imthechta Aeniusa,* taken from the *Aeneid,* is contained in BB. and published by Calder (1903). A number of mss. contain the *Cath Catharda,* a version of books vi. and vii. (?) of Lucan's *Pharsalia,* which has been published by W. Stokes. There is further at least one ms. containing a version of Statius's *Thebaid* and of Heliodorus's *Aethiopica.* Somewhat later we have Irish versions, amongst others of the *Gesta Romanorum,* the *Historia Brittonum,* the Wars of Charlemagne (Hyde, 1917), the History of the Lombards, Sir John Maundeville's Travels (trans. by Fingin O'Mahony in 1475), the Book of Ser Marco Polo (abridged). Guy Earl of Warwick, Bevis of Southampton, the Quest of the Holy Grail, Octavian, the chronicle of Turpin, Balaam and Josaphat, and the story of Fierabras. For translation literature *see* M. Nettlau, *Revue celtique,* x. pp. 184, 460–461.

By the beginning of the Middle Irish period a good part of the cumbrous Old Irish verb-system had become obsolete, and texts which were at all faithfully copied had to be plentifully supplied with glosses. But even before this Cormac mac Cuillenáin, the bishop-king of Cashel (d. 903), had compiled a glossary of archaic words containing much invaluable information. Later collections of archaic words are O'Mulconry's Glossary (13th century), the Lecan Glossary (15th century), which draws principally from the glosses in the *Liber Hymnorum,* O'Davoren's Glossary (16th century), drawn principally from the Brehon Laws, a 16th century list of Latin and Irish names of plants employed in medicine, and O'Clery's Glossary (published at Louvain, 1643). BB. contains a curious tract on Ogamic writing. An Irish treatise on grammar, called *Uraicept na n-éces,* the Poet's Primer, traditionally ascribed to Cennfaelad and others, is contained in BB. and YBL. (Calder, 1917). The St. Gall glosses on Priscian contain Irish terms for all the nomenclature of the Latin grammarians, and show how extensive was the use made of Irish even in this department of learning.

Thurneysen has edited from BB., Laud 610 and TCD. ms. three treatises on metric which give an account of the countless metres practised by the *filid.* We have seen that there is some reason for believing that the primitive form of Irish verse was a kind of rhythmical alliterative prose as contained in the oldest versions of the sagas. The *filid* early became acquainted with the metres of the Latin church hymns, whence rhyme was introduced into Ireland. (This is the view of Thurneysen and Windisch. Others like Zeuss have maintained that rhyme was an invention of the Irish.) In any case the *filid* evolved an intricate system of rhymes for which it is difficult to find a parallel. The result of the complicated technique evolved in Ireland was an inclination to sacrifice sense to musical harmony. *See* K. Meyer, *A Primer of Irish Metrics* (1909).

Law and Medicine.—We can conclude this survey of mediaeval Irish literature by mentioning briefly two departments of learning to which much attention was paid in Ireland. These are law and medicine. The so-called Brehon Laws (*q.v.*) are represented as having been codified and committed to writing in the time of St. Patrick. The Brehon Laws were no doubt originally transmitted from teacher to pupil in the form of verse, and traces of this are to be found in the texts which have been preserved. But the Laws as we have them do not go back to the 5th century. Kuno Meyer has pointed out that in the commentary to one text, *Críth Gablach,* there are linguistic forms which must go back to the 8th century, and Arbois de Jubainville, who apart from Sir Henry Maine is the only scholar who has dealt with the subject, has attempted to prove from internal evidence that part of the oldest tract, the one on *Athgabáil* or Seizure, cannot, in its present form, be later than the close of the 6th century. Kuno Meyer has published the *Cáin Adamnáin* or Adamnan's Law from an Oxford ms. Adamnan succeeded in getting a law passed which forbade women to go into battle. An interesting text in prose and verse called *Leabhar na gCeart* or Book of Rights was edited with an English translation by O'Donovan (1847).

The medical profession in Ireland was hereditary in a number of families, such as the O'Lees (from Irish *liaig,* "a leech"), the O'Hickeys (Irish *icide,* "the healer"), the O'Shiels, the O'Cassidys, and many others. These families each had their own special leech-books, some of which are still preserved. The medical literature which has come down to us is contained in mss. ranging from the 13th to the 18th centuries. The Irish mss. are translations from the Latin with the invariable commentary, and they further contain additions derived from experience. YBL. contains

four of these tracts, and amongst others we may mention the Book of the O'Hickeys, a translation of the *Lilium Medicinae* of Bernard Gordon (written 1303), the Book of the O'Lees (written in 1443), the Book of the O'Shiels, transcribed in 1657, and the Book of MacAnlega, transcribed in 1512. Of these texts two have been published from mss. in Edinburgh and one from a ms. in R.I.A. Some few mss. deal with the subject of astronomy, one of which was published by Miss Power (1916).

LATER IRISH LITERATURE

With the steady advance of English culture on the heels of the English power after 1600 it was only natural that the school of bardic poets should decline. Amongst the prominent poets of this later period may be mentioned Tadhg Dall O'Higinn (d. shortly before 1617), published by Miss Knott (1922 and 1926), and Eochaidh O'Hussey, who between them have left behind nearly 7,000 lines in the classical metres, Bonaventura O'Hussey and Ferfesa O'Cainti. The intricate classical measures gradually broke down. Dr. Douglas Hyde gives it as his opinion that the exceedingly numerous metres known in Middle Irish had become restricted to a couple of dozen, and these nearly all heptasyllabic. However, during the 17th century we find a new school arising with new principles and new methods. These consisted in (1) the adoption of vowel rhyme in place of consonantal rhyme, (2) the adoption of a certain number of accents in each line in place of a certain number of syllables. (For English imitations *see* Hyde, *A Literary History of Ireland*, pp. 548 ff.)

The consequences of the changed political conditions were of the greatest importance. The bards, having lost their patrons in the general upheaval, threw behind them the old classical metres and turned to the general public. It is only during the last 25 years that the works of any of the poets of the 17th and 18th centuries have been published. Pierce Ferriter was the last chieftain who held out against Cromwell's army, and he was hanged in 1653. His poems have been edited by P. S. Dinneen (1903). The bard of the Williamite wars was David O'Bruadar (d. 1697–98), published by MacErlean (3 vols., 1910–17). From this period date three powerful satires on the state of affairs in Munster, and in particular on the Cromwellian settlers. Their titles are the Parliament of Clan Thomas, the Adventures of Clan Thomas, and the Adventures of Tadhg Dubh (by Egan O'Rahilly). A description of the parliament of Clan Thomas is given by Stern in the *Zeitschr. f. celt. Phil.* v. pp. 541 ff.

A little later we come across a band of Jacobite poets, whose pet theme was the *Aisling* or Vision, and we find several noteworthy war-songs. We can do no more than mention the names of John O'Neaghtan (d. *c.* 1720; edition of his poems by A. O'Farrelly, 1908), Egan O'Rahilly, who flourished between 1700 and 1726 (published by Irish Texts Society), Tadhg O'Naghten, Hugh MacCurtin, author of a grammar and part editor of O'Begley's *Dictionary*, John Clárach MacDonnell (1691–1754), John O'Tuomy (d. 1775), Andrew Magrath, Tadhg Gaolach O'Sullivan (d. *c.* 1795), author of a well-known and often published volume of religious poems, and Owen Roe O'Sullivan (d. 1784), the cleverest of the Jacobite poets (his verses and *bons mots* are still well known in Munster). These poets hailed mostly from the south, and it is chiefly the works of the Munster poets that have been preserved. Ulster and Connaught also produced a number of writers. The best known are *Seumas Mac Cuarta* (O'Muireadhaigh, Dundalk, 1925), *Art MacCooey* (O'Muirgheasa, Dundalk, 1913) and the Connaught poet Raftery (1784–1835), whose compositions have been rescued by Hyde (*Abhráin an Reachtúire*, 1903). Torlough O'Carolan (1670–1738), "the last of the bards," was really a musician. Having become blind he was educated as a harper and won great fame. Michael Comyn (b. *c.* 1688) is well known as the author of a version based upon older matter of "Ossian in the Land of Youth." This appears to be the only bit of deliberate creation in the later Ossianic literature. Brian MacGiolla Meidhre or Merriman (d. 1808) is the author of perhaps the cleverest sustained poem in the Irish language. His work, which is entitled the *Midnight Court*, was written in 1781 and contains about 1,000 lines with four rhymes in each line. Donough MacConmara (Macnamara) (d. *c.* 1814) is best known as the author of a famous lyric "The Fair Hills of Holy Ireland," but he also wrote a mock epic describing his voyage to America and how the ship was chased by a French cruiser.

The translation of the New Testament made by William O'Donnell and published in 1603 was first undertaken in the reign of Queen Elizabeth, who sent over to Dublin the first fount of Irish type. It is perhaps of interest to note that the earliest specimen of printing in Irish is a poem on Doomsday (1571).

The scholars of the various Irish colleges on the Continent were particularly active in the production of books of devotion, many of them translated from Latin. We can mention only a few of the more important. *Sgathán an chrábhaidh* (*The Mirror of the Pious*), published in 1626 by Florence Conry; *Sgathán sacramente na h-Aithrighe* (Mirror of the Sacrament of Penance), by Hugh MacCathmhaoil, published at Louvain, 1618; *The Book of Christian Doctrine*, by Theobald Stapleton (Brussels, 1639); *Párrthas an Anma, or The Paradise of the Soul*, by Anthony Gernon (Louvain, 1645); a book on *Miracles*, by Richard MacGilla Cody (1667); *Lochrán na gcreidmheach, or Lucerna Fidelium*, by Francis O'Mulloy (Louvain, 1676); O'Donlevy's *Catechism* (Paris, 1742). O'Gallagher, bishop of Raphoe, published a collection of sermons which went through 20 editions and are still known at the present day. It is only within recent years that attention has been paid to the collection of folk-songs and tales in Irish. The first collection of the sort was Hyde's *Leabhar Sgeuluigheacta* (1889). We may mention among others Patrick O'Leary's *Sgeuluidheacht Chuige Mumhan* (1895); Hyde's *Beside the Fire* (1890) and *An Sgeuluidhe Gaedhealach*, 35 tales in Irish and French, reprinted from the *Annales de Bretagne* (1901); Daniel O'Fogharta's *Siamsa an Gheimhridh* (1892); J. Lloyd's *Sgéalaidhe Oirghiall* (1905), his *Measgán Múscreahe*, his *Cruach Conaill* and *Tonn Tóime*, Michael Timony's *Sgealta Gearra* (1906), and Larminie's *West Irish Folk-Tales* (1893). The most important collections of folk-songs are *Love-Songs of Connaught* (1893) and *Religious Songs of Connaught* (2 vols., 1906), both published by Hyde. An extensive collection of proverbs is the one entitled *Seanfhocla Uladh* by Henry Morris (1907). *See* also a large collection by O. Siochfhradha (1927), Hydes' *An Scathrunn*, O'Rahilly's *Miscellany of Irish Proverbs* (1922) and O'Donoghue's *Munster Proverbs* (1902). It should be mentioned that the Saor-Stát is encouraging and paying for new contributions to Irish literature. About a score of books, chiefly stories and novels have been published in 1927 and 1928. Plays are being produced in Irish.

BIBLIOGRAPHY.—In the absence of a comprehensive history, the best manual is Eleanor Hull, *Text Book of Irish Literature* (2 parts, 1904–08; vol. 2 contains a bibliographical appendix). D. Hyde's larger *History of Irish Literature* (1899) is valuable for the more modern period. A full bibliography of all published material is contained in G. Dottin's article "La littérature gaélique de l'Irlande" (*Revue de synthèse historique*, vol. iii., p. 1 ff.). Dottin's article has been translated into English and supplemented by Joseph Dunn under the title of *The Gaelic Literature of Ireland* (Washington, 1906, privately printed). The following are important works:—W. Stokes and J. Strachan, *Thesaurus Palaeohibernicus* (2 vols., 1901–03); J. H. Bernard and R. Atkinson, *Liber Hymnorum* (1895); E. O'Curry, *Lectures on the ms. Materials of Ancient Irish History* (1873) and *Lectures on the Manners and Customs of the Ancient Irish* (3 vols., 1873); P. W. Joyce, *A Social History of Ancient Ireland* (2 vols., 1903); E. O'Reilly, *Irish Writers* (1820); S. H. O'Grady, *Catalogue of Irish mss. in the British Museum* (1901; Robin Flower completed this catalogue in 1926); H. d'Arbois de Jubainville, *Introduction à l'étude de la littérature celtique* (1883), *Essai d'un catalogue de la littérature épique de l'Irlande* (1883), *L'Epopée celtique en Irlande* (1892), *La Civilisation des Celtes et celle de l'épopée homérique* (1899); E. Windisch, *Táin Bó Cualnge*, ed. with an introd. and German trans. (Leipzig, 1905); L. Winifred Faraday, *The Cattle-Raid of Cualnge* (1904); the Irish text according to LU. and YBL. has been published as a supplement to *Eriu*; Eleanor Hull, *The Cuchulinn-saga* (1899); W. Ridgeway, "The Date of the First Shaping of the Cuchulinn Cycle," *Proceedings of the British Academy*, vol. ii. (1907); A. Nutt, *Cuchulin, the Irish Achilles* (1899); H. Zimmer, "Keltische Beiträge" in *Zeitschrift f. deutsches Altertum*, vols. 32, 33 and 35, and "Über den compilatorischen Charakter der irischen Sagentexte im sogenannten Lebor na hUidre," Kuhn's *Zeitschr.* xxviii. pp. 417–689. We cannot here enumerate the numerous heroic texts which have been edited. For texts published before 1883 *see* d'Arbois's

Catalogue, and the same writer gives a complete list in *Revue Celtique*, vol. xxiv. pp. 237 ff. The series of *Irische Texte*, vols. i.–iv. (Leipzig, 1880–1901), by E. Windisch (vols. ii.–iv. in conjunction with W. Stokes), contains a number of important texts. The Irish Texts Society has published 24 volumes of texts with translations. Others, more particularly these belonging to the Ossianic cycle, are to be found in S. H. O'Grady's *Silva Gadelica* (2 vols., 1902). *See* also R. Thurneysen, *Sagen aus dem alten Irland* (1901); P. W. Joyce, *Old Celtic Romances* (1901).

For the Ossianic cycle *see* H. Zimmer, "Keltische Beiträge III." in vol. 35 of the *Zeitschr. f. deutsches Alliertum*, also *Göttinger Gelehrte Anzeigen*, 1887, pp. 153–199; A. Nutt, *Ossian and the Ossianic Literature* (1899); L. C. Stern, "Die ossianischen Heldenlieder," in *Zeitschr. f. vergleichende Litteraturgeschichte* for 1895, trans. by J. L. Robertson in *Transactions of the Inverness Gaelic Society*, vol. xxii.; J. MacNeill, *Duanaire Finn* (1908); *Book of the Dean of Lismore*, ed. by T. Maclauchlan (1862), and in vol. i. of A. Cameron's *Reliquiae Celticae* (1892); *Transactions of the Ossianic Society* (6 vols., 1854–61); Miss Brooke, *Reliques of Ancient Irish Poetry* (1789).

Keating's *History* was translated by John O'Mahony (1866). The first part was edited with Eng. trans. by W. Halliday (1811) and the whole work in 3 vols. for the Irish Texts Society by D. Comyn and P. Dinneen (1901–08). For the work of the older bards *see* O'Rahilly's *Dauta gradha* (Dublin 1916 and Cork 1926) and his *Measgra Dauta* (1927); Father McKenna's *Dán Dé* (Dublin, n.d.); Bergin's contributions to *Studies;* McKenna's *Poems of Aongus O'Dálaigh*. Editions of the poems of Ferriter, Geoffrey O'Donoghue, O'Rahilly, John O'Tuomy, Andrew Magrath, John Claragh MacDonnell, Tadhg Gaolach and Owen Roe O'Sullivan by Dinneen, Gaelic League, Dublin, and Irish Texts Society, London, 1900–03; Loyd's *Duanaine na Midhe* (Dublin, 1914); O. Muirgheasa's *Cead de Cheoltaibh Vladh* (Dublin, 1915), etc. (E. C. Q.; D. Hy.)

IRISH MOSS or **CARRAGEEN** (Irish *carraigeen*, "moss of the rock"), a seaweed (*Chondrus crispus*) which grows abundantly along the rocky parts of the Atlantic coast of Europe and North America. In its fresh condition the plant is soft and cartilaginous, varying in colour from a greenish-yellow to a dark purple or purplish-brown; but when washed and sun-dried for preservation it has a yellowish translucent horn-like aspect and consistency. The principal constituent of Irish moss is a mucilaginous body, of which it contains about 55%; and with that it has nearly 10% of nitrogenous material and about 15% of mineral matter rich in iodine and sulphur. When softened in water it has a sea-like odour, and from the abundance of its mucilage it will form a jelly on boiling with from 20 to 30 times its weight of water. The jelly thus formed of Irish moss is used as food. It may also be used as a thickener in calico-printing and for fining beer.

IRKUTSK, a town in the Siberian Area of the R.S.F.S.R. in lat. 52° 36′ N., long. 104° 10′ E., altitude 1,490 ft. It is situated on the right bank of the Angara river, a tributary of the Yenisei river, 45 m. below its outflow from Lake Baikal; its suburb Glazkovskoe lies on the left bank, and a pontoon bridge spans the river, which is 630 yd. wide. The railway and station are on the left bank. The Irkut river, from which the town of Irkutsk takes its name, enters the Angara river on its left bank, but is not navigable and the small Ushakovka river flows through the town and enters the Angara on the right bank. The town grew out of the winter quarters established by Ivan Pokhabov in 1652 for the collection of the fur tax from the Buriats. Its advantageous position for trade with China, the Amur region, the Lena goldfields and the fur regions of Siberia have made it an important city; its population in 1926 was 98,979. A post road runs north to the Lena and Yakutsk and south-east to Listvenichnoe on Lake Baikal, and other roads link it with the east. The Angara is navigable for steamers to Lake Baikal, though the current is against them. The river is frozen from January to April. The average January temperature is −5·4° F, July 65·1° F; the average rainfall per annum is 14·5 in. The town is well built with wide streets and has a drainage system and an electric power station. In 1879 fire destroyed many of the public buildings, including the library and museum of the Russian Geographical Society which has here the headquarters of its Siberian section, with valuable books, maps and exhibits. The town has long been a cultural centre for the district. It contains schools, a training college for teachers and a recently established Workers' Scientific Institute. St. Innocent's monastery, five miles outside the town influenced much of Eastern Siberia. Its industries include brewing, timber-milling, flour-milling, leather works, the making of fur and sheepskin coats and various small articles especially for the posting routes. It was a storm centre from 1918 to 1921 and much damage was then done to the town and railway. The State gold treasure, which had been removed from Leningrad under the charge of employees of the tsarist régime, was handed over by them to the Bolshevists in Irkutsk in 1920; and here Admiral Kolchak was executed in the same year. The town was in tsarist times the centre of the Irkutsk government, an area occupying 287,061 sq.m., but is now only the centre of one of the twenty counties of the Siberian Area (*q.v.*).

IRMIN or **IRMINUS,** in Teutonic mythology, a deified eponymic hero of the Herminones. The chief seat of his worship was Irminsul, or Ermensul, in Westphalia. Wooden pillars raised to his honour were regarded as sacred by the Saxons.

IRNERIUS, Italian jurist, sometimes referred to as "lucerna iuris." He taught the "free arts" at Bologna, his native city, during the earlier decades of the 12th century. Of his personal history little is known, except that he died, perhaps during the reign of the emperor Lothair II., but certainly before 1140. He was the first of the Glossators (*see* Gloss), and according to ancient opinion (which, however, has been much controverted) was the author of the epitome of the *Novellae* of Justinian, called the *Authentica*, arranged according to the titles of the *Code*. (*See* Roman Law.)

IRON, a metallic chemical element. Although iron (symbol Fe, atomic number 26, atomic weight 55·84, isotopes 56 and 54) occurs only sparingly in the free state, the abundance of ores from which it may be readily obtained led to its application in the arts at a very remote period. It is generally agreed, however, that the iron age, the period of civilization during which this metal played an all-important part, succeeded the ages of copper and bronze, notwithstanding the fact that the extraction of these metals required greater metallurgical skill. The Assyrians and Egyptians made considerable use of the metal; and in Gen. iv. 22 mention is made of Tubal-cain as the instructor of workers in iron and copper. The earlier sources of the ores appear to have been in India; but it was also obtained by the Greeks from the south coast of the Black sea, and by the Romans from Spain and Elba.

The chief occurrences of metallic iron are as minute spiculae disseminated through basaltic rocks, as at Giant's Causeway and in the Auvergne, and, more particularly, in meteorites (*q.v.*). In combination it occurs, usually in small quantity, in most natural waters, in plants and as a necessary constituent of blood. The economic sources are treated under Iron and Steel below; in the same place will be found accounts of the manufacture, properties and uses of the metal, the present article being confined to its chemistry. The principal iron ores are the oxides and carbonates, and these readily yield the metal by smelting with carbon. The metal so obtained invariably contains a certain amount of carbon, free or combined, and the proportion and condition regulate the properties of the metal, giving origin to the three important varieties: cast iron, steel, wrought iron. The perfectly pure metal may be prepared by heating the oxide or oxalate in a current of hydrogen; when obtained at a low temperature it is a black powder which oxidizes in air with incandescence; *i.e.*, it is "pyrophoric." It may be obtained electrolytically from solutions of ferrous salts.

Properties.—Iron has a silvery lustre and takes a high polish. Its specific gravity is 7·84; and the average specific heat over the range 15°–100° C is 0·10983; this value increases with temperature to 850°, and then begins to diminish. It is the most tenacious of all the ductile metals at ordinary temperatures with the exception of cobalt and nickel; it becomes brittle, however, at the temperature of liquid air. It softens at a red heat, and may be readily welded at a white heat; above this point it becomes brittle. Pure iron melts at *c.* 1525° C and may be distilled in the electric furnace. It is attracted by a magnet and may be magnetized, but the magnetization is quickly lost. The variation of physical properties which attends iron on heating has led to the view that the metal exists in allotropic forms. This has been proved

recently by X-ray analysis. (*See* IRON AND STEEL.)

When pure iron is cooled from its melting point, its temperature falls evenly to 1400° and then remains almost stationary for a time; the cooling again becomes regular when 890° is reached, where a similar lag occurs or even a rise of temperature (which may be so pronounced as to cause a flow or recalescence); with still further cooling, yet a third lag is found at 760°. Similar irregularities occur at nearly the same (but slightly higher) temperatures when iron is slowly heated. Moreover, at these temperatures other physical properties of the metal (such as the coefficient of expansion, electrical resistance, and especially the characteristic magnetic property) undergo sudden changes, which lead to the assumption that there are four allotropic modifications of iron with transition points thus:

$$\alpha \overset{769^\circ}{\rightleftharpoons} \beta \overset{906^\circ}{\rightleftharpoons} \gamma \overset{1404^\circ}{\rightleftharpoons} \delta$$

The crystal structure of α, β and δ is the same, viz., body-centred cubic (*see* CRYSTALLOGRAPHY), but that of γ-iron is a face-centre cube, and this difference is held by some metallurgists to show that β-iron is not a distinct modification, but only a solid solution of α and γ-iron.

It should be pointed out that "pure" iron is almost a curiosity, for the metal, as commonly used, nearly always contains a certain small proportion of carbon which much modifies its properties.

Iron is very reactive chemically. Exposed to atmospheric influences it is more or less rapidly corroded, giving the familiar rust (*q.v.*). For the production of rust, the presence of water and oxygen does not seem to be sufficient, and an "impurity" seems to be essential; this is provided usually in the iron itself or by the presence of carbon dioxide. The decomposition of steam by passing it through a red-hot gun-barrel, resulting in the liberation of hydrogen and the production of magnetic iron oxide, Fe_3O_4, is a familiar laboratory method for preparing hydrogen (*q.v.*). When strongly heated, iron inflames in oxygen and in sulphur vapour; it also combines directly with the halogens. It dissolves in most dilute acids with liberation of hydrogen, the reaction between sulphuric acid and iron-turnings being used for the commercial manufacture of this gas. It dissolves in dilute cold nitric acid with the formation of ferrous and ammonium nitrates, no gases being liberated; when heated, or with stronger acid, ferric nitrate is formed with evolution of nitrogen oxides.

After having been immersed in strong nitric acid, iron neither dissolves in acids nor precipitates metals from solutions. This "passivity" may be brought about by immersion in other solutions, especially by those containing such oxidizing anions as NO'_3, ClO'_3, less strongly by the anions SO''_4, CN', CNS', $C_2H_3O'_2$, OH', while Cl', Br' practically inhibit passivity; H. is the only cation which has any effect, and this tends to exclude passivity. It is also occasioned by anodic polarization of iron in sulphuric acid. Several hypotheses have been promoted to explain this behaviour, and, although the question is not definitely settled, the more probable view is that it is caused by the formation of a film of an oxide (*see* U. R. Evans, *Journ. Chem. Soc.*, 1927, p. 1020). Other metals also exhibit the phenomenon of passivity under similar conditions.

COMPOUNDS OF IRON

Oxides and Hydroxides.—Iron forms three oxides: ferrous oxide, FeO; ferric oxide, Fe_2O_3; and ferroso-ferric oxide, Fe_3O_4. The first two give rise to well-defined series of salts, the ferrous salts, wherein the metal is bivalent, and the ferric salts wherein the metal is trivalent; the former readily pass into the latter on oxidation, and the latter into the former on reduction.

Ferrous oxide is obtained as a black pyrophoric powder when ferric oxide is reduced in hydrogen at 300°. Sabatier and Senderens obtained it by acting with nitrous oxide on metallic iron at 200°, and Tissandier by heating the metal to 900° in carbon dioxide; Donau, on the other hand, obtained a magnetic and crystalline ferroso-ferric oxide at 1200°. It may also be prepared as a black velvety powder which readily takes up oxygen from the air by adding ferrous oxalate to boiling caustic potash. Ferrous hydrate, $Fe(OH)_2$, when prepared from a pure ferrous salt and caustic soda or potash free from air, is a white powder which may be preserved in an atmosphere of hydrogen. Usually, however, it forms a greenish mass, owing to partial oxidation. It oxidizes on exposure with considerable evolution of heat; it rapidly absorbs carbon dioxide, and readily dissolves in acids to form ferrous salts, which are usually white when anhydrous, but greenish when hydrated.

Ferric oxide or iron sesquioxide, Fe_2O_3, constitutes the valuable ores red haematite and specular iron; the minerals brown haematite or limonite, and göthite and also iron rust are hydrated forms. It is obtained as a steel-grey crystalline powder by igniting any ferric salt containing a volatile acid or by passing ferric chloride vapour over heated lime. When finely ground it forms a brownish red powder which dissolves slowly in acids, the most effective solvent being a boiling mixture of eight parts of sulphuric acid and three of water. Ferric oxide is employed as a pigment, as jeweller's rouge and for polishing metals. Several ill-defined hydrates are known, corresponding to various minerals in composition, and "colloidal" solutions have also been prepared. (*See* COLLOIDS.) Thomas Graham obtained a soluble hydrate by dissolving the freshly prepared hydrate in ferric chloride and dialysing the solution, the soluble hydrate being left in the dialyser. All the chlorine, however, does not appear to be removed by this process, the residue having the composition $8Fe(OH)_3{\cdot}FeCl_3$; but it may be by electrolysing in a porous cell. On standing, the solution usually gelatinizes, a process accelerated by the addition of an electrolyte. It is employed in medicine under the name *Liquor ferri dialysati,* or "dialysed iron."

Red ferric hydroxide dissolves in acids to form a well-defined series of salts, the ferric salts, also obtained by oxidizing ferrous salts; they are usually colourless when anhydrous, but yellow or brown when hydrated. It has also feebly acidic properties, forming *ferrites* with strong bases.

Magnetite, Fe_3O_4, is regarded as ferrous ferrite, $FeO{\cdot}Fe_2O_3$. Most "mill scale," *i.e.*, the oxidized surface formed on red hot iron and steel, is Fe_3O_4. This important ore of iron is most celebrated for its magnetic properties, but the mineral is not always magnetic, although invariably attracted by a magnet. It may be obtained artificially by passing steam over red-hot iron. It dissolves in acids to form a mixture of a ferrous and ferric salt, and if an alkali is added to the solution a black precipitate is obtained which dries to a dark brown mass of the composition $Fe(OH)_2{\cdot}Fe_2O_3$; this substance is attracted by a magnet, and thus may be separated from the admixed ferric oxide. Calcium, magnesium and zinc ferrites, $RO{\cdot}Fe_2O_3$(R=Ca, Mg, Zn), are obtained by intensely heating mixtures of the oxides; magnesium ferrite occurs in nature as the mineral magnoferrite, and zinc ferrite as franklinite, both forming black octahedra.

Ferric Acid, H_2FeO_4.—By fusing iron with saltpetre and extracting the melt with water, or by adding a solution of ferric nitrate in nitric acid to strong potash, an amethyst or purple-red solution is obtained which contains potassium ferrate. The same solution results when chlorine is passed into strong potash solution containing ferric hydrate in suspension. Haber and Pick prepared potassium ferrate by electrolysing concentrated potash solution at 70 degrees Centigrade, between two cast iron electrodes, the current being reversed every few minutes. When concentrated, the solution is nearly black, and on heating it yields a yellow solution of potassium ferrite, oxygen being evolved. Barium ferrate, $BaFeO_4{\cdot}H_2O$, obtained as a dark red powder by adding barium chloride to a solution of potassium ferrate, is fairly stable. It dissolves in acetic acid to form a red solution, is not decomposed by cold sulphuric acid, but with hydrochloric or nitric acid it yields barium and ferric salts, with evolution of chlorine or oxygen.

Halogen Compounds.—Ferrous fluoride, FeF_2, is obtained as colourless prisms (with $8H_2O$) by dissolving iron in hydrofluoric acid, or as anhydrous colourless rhombic prisms by heating iron or ferric chloride in dry hydrofluoric acid gas. Ferric fluoride, FeF_3, is obtained as colourless crystals (with $4\frac{1}{2}H_2O$) by evaporating a solution of the hydroxide in hydrofluoric acid. When heated in air it yields ferric oxide. Ferrous chloride, $FeCl_2$, is obtained as shining scales by passing hydrochloric acid gas over red-hot iron, or by reducing ferric chloride in a current of hy-

drogen. It is very deliquescent, and freely dissolves in water and alcohol. Heated in air it yields a mixture of ferric oxide and chloride, and in steam magnetic oxide, hydrochloric acid, and hydrogen. It absorbs ammonia gas, forming the compound $FeCl_2 \cdot 6NH_3$, which on heating loses ammonia, and, finally, yields ammonium chloride, nitrogen and iron nitride. It fuses at a red-heat, and volatilizes at a yellow-heat; its vapour density at 1300°–1400° corresponds to the formula $FeCl_2$. By evaporating in vacuo the solution obtained by dissolving iron in hydrochloric acid, there result bluish monoclinic crystals of $FeCl_2 \cdot 4H_2O$, which deliquesce, turn greenish on exposure to air, and effloresce in a desiccator. By adding ammonium chloride to the solution, evaporating in vacuo and then volatilizing the ammonium chloride, anhydrous ferrous chloride is obtained. The solution, in common with those of most ferrous salts, absorbs nitric oxide with the formation of a brownish solution.

Ferric chloride, $FeCl_3$, may be obtained anhydrous by the action of dry chlorine on the metal at a moderate red-heat, or by passing hydrochloric acid gas over heated ferric oxide. It forms iron-black plates or tablets which appear red by transmitted and a metallic green by reflected light. It is very deliquescent, and readily dissolves in water, forming a brown or yellow solution, from which several hydrates may be separated. The solution is best prepared by dissolving the hydroxide in hydrochloric acid and removing the excess of acid by evaporation, or by passing chlorine into the solution obtained by dissolving the metal in hydrochloric acid and removing the excess of chlorine by a current of carbon dioxide. It also dissolves in alcohol and ether; boiling-point determinations of the molecular weight in these solutions point to the formula $FeCl_3$. Vapour density determinations at 448° indicate a partial dissociation of the double molecule Fe_2Cl_6; on stronger heating it splits into ferrous chloride and chlorine. It forms red crystalline double salts with the chlorides of the metals of the alkalis and of the magnesium group. An aqueous solution of ferric chloride is used in pharmacy under the name *Liquor ferri perchloridi*.

Ferrous bromide, $FeBr_2$, is obtained as yellowish crystals by the union of bromine and iron at a dull red-heat, or as bluish-green rhombic tables of the composition $FeBr_2 \cdot 6H_2O$ by crystallizing a solution of iron in hydrobromic acid. Ferric bromide, $FeBr_3$, is obtained as dark red crystals by heating iron in an excess of bromine vapour. It closely resembles the chloride in being deliquescent, dissolving ferric hydrate and in yielding basic salts. Ferrous iodide, FeI_2, is obtained as a grey crystalline mass by the direct union of its components. Ferric iodide does not appear to exist.

Sulphur Compounds.—Ferrous sulphide, FeS, results from the direct union of its elements, best by stirring molten sulphur with a white-hot iron rod, when the sulphide drops to the bottom of the crucible. It then forms a yellowish crystalline mass, which readily dissolves in acids with the liberation of sulphuretted hydrogen. Heated in air it at first partially oxidizes to ferrous sulphate, and at higher temperatures it yields sulphur dioxide and ferric oxide. It is unaltered by ignition in hydrogen. A black amorphous form results when ferrous salts are precipitated by ammonium sulphide.

Ferric-sulphide, Fe_2S_3, is obtained by gently heating a mixture of its constituent elements, or by the action of sulphuretted hydrogen on ferric oxide at temperatures below 100°. It is also prepared by precipitating a ferric salt with ammonium sulphide; unless the alkali be in excess a mixture of ferrous sulphide and sulphur is obtained. Magnetic pyrites or pyrrhotite has a composition varying between $5FeS \cdot Fe_2S_3$ and $6FeS \cdot Fe_2S_3$. It has a somewhat brassy colour, and occurs massive or as hexagonal plates; it is attracted by a magnet and is sometimes itself magnetic. The mineral is abundant in Canada, where the presence of about 5% of nickel makes it a valuable ore of this metal. Iron disulphide, FeS_2, constitutes the minerals pyrite, which is important as a source of sulphuric acid, and marcasite (*q.v.*); copper pyrites is (Cu, Fe)S_2. Pyrite may be prepared artificially by gently heating ferrous sulphide with sulphur, or as brassy octahedra and cubes by slowly heating an intimate mixture of ferric oxide, sulphur and sal-ammoniac. It is insoluble in dilute acids, but dissolves in nitric acid with separation of sulphur.

Ferrous sulphate, green vitriol or copperas, $FeSO_4 \cdot 7H_2O$, was known to, and used by, the alchemists: it is mentioned in the writings of Agricola, and its preparation from iron and sulphuric acid occurs in the *Tractatus chymico-philosophicus* ascribed to Basil Valentine. It occurs in nature as the mineral melanterite, either crystalline or fibrous, but usually massive; it appears to have been formed by the oxidation of pyrite or marcasite. It is manufactured by piling pyrites in heaps and exposing to atmospheric oxidation, the ferrous sulphate thus formed being dissolved in water, and the solution run into tanks, where any sulphuric acid which may be formed is decomposed by adding scrap iron. By evaporation the green vitriol is obtained as large crystals. Ferrous sulphate forms large green crystals belonging to the monoclinic system; rhombic crystals, isomorphous with zinc sulphate, are obtained by inoculating a solution with a crystal of zinc sulphate, and triclinic crystals of the formula $FeSO_4 \cdot 5H_2O$ by inoculating with copper sulphate. By evaporating a solution containing free sulphuric acid in a vacuum, the hepta-hydrated salt first separates, then the penta-, and then a tetra-hydrate, $FeSO_4 \cdot 4H_2O$, isomorphous with manganese sulphate. By gently heating in a vacuum to 140°, the hepta-hydrate loses 6 molecules of water, and yields a white powder, which on heating in the absence of air gives the anhydrous salt. The monohydrate also results as a white precipitate when concentrated sulphuric acid is added to a saturated solution of ferrous sulphate. Alcohol also throws down the salt from aqueous solution, the composition of the precipitate varying with the amount of salt and precipitant employed. The solution absorbs nitric oxide to form a dark brown solution, which loses the gas on heating or by placing in a vacuum. Ferrous sulphate forms double salts with the alkaline sulphates. The most important is ferrous ammonium sulphate, $FeSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$, obtained by dissolving equivalent amounts of the two salts in water and crystallizing. It is very stable and is much used in volumetric analysis. It is often called Mohr's salt.

Ferric sulphate, $Fe_2(SO_4)_3$, is obtained by adding nitric acid to a hot solution of ferrous sulphate containing sulphuric acid, colourless crystals being deposited on evaporating the solution. The anhydrous salt is obtained by heating these, or by adding strong sulphuric acid to a solution. It is sparingly soluble in water, and on heating it yields ferric oxide and sulphur dioxide. Many basic ferric sulphates are known, some of which occur as minerals. The iron alums are obtained by crystallizing solutions of equivalent quantities of ferric and an alkaline sulphate. Ferric potassium sulphate, common iron alum, $K_2SO_4 \cdot Fe_2(SO_4)_3 \cdot 24H_2O$, forms bright violet octahedra.

Nitrides, Nitrates, etc.—Several nitrides are known. Guntz obtained ferrous nitride, Fe_3N_2, and ferric nitride FeN, as black powders by heating lithium nitride with ferrous potassium chloride and ferric potassium chloride respectively. Fowler obtained a nitride Fe_2N by acting upon anhydrous ferrous chloride or bromide, finely divided reduced iron, or iron amalgam with ammonia at 420°; and also, in a compact form, by the action of ammonia on red-hot iron wire. It oxidizes on heating in air, and ignites in chlorine; on solution in mineral acids it yields ferrous and ammonium salts, hydrogen being liberated. A nitride appears to be formed when nitrogen is passed over heated iron, since the metal is rendered brittle. Ferrous nitrate, $Fe(NO_3)_2 \cdot 6H_2O$, is a very unstable salt, and is obtained by mixing solutions of ferrous sulphate and barium nitrate, filtering and crystallizing in a vacuum over sulphuric acid. Ferric nitrate, $Fe(NO_3)_3$, is obtained by dissolving iron in nitric acid (the cold dilute acid leads to the formation of ferrous and ammonium nitrates) and crystallizing, when cubes of $Fe(NO_3)_3 \cdot 6H_2O$ or monoclinic crystals of $Fe(NO_3)_3 \cdot 9H_2O$ are obtained. It is used as a mordant.

Ferrous solutions absorb nitric oxide, forming dark green to black solutions. The coloration is due to the production of unstable compounds of the ferrous salt and nitric oxide, probably of the type $2FeSO_4 \cdot NO$; the reaction, however, is reversible, the composition varying with temperature, concentration and nature of the salt. The reaction is utilized in the "brown ring" test for

nitrates. Reddish brown amorphous powders of the formulae $2FeCl_3{\cdot}NO$ and $4FeCl_3{\cdot}NO$ are obtained by passing the gas over anhydrous ferric chloride. By passing the gas into an ethereal solution of the salt, nitrosyl chloride is produced, and on evaporating over sulphuric acid, black needles of $FeCl_3{\cdot}NO{\cdot}2H_2O$ are obtained, which at 60° form the yellow $FeCl_3{\cdot}NO$. Complicated compounds discovered by Roussin (*Ann. Chim. Phys.*, 1858, 52, p. 285) are obtained by the interaction of ferrous sulphate and alkaline nitrates and sulphides. Two classes may be distinguished:—(1) the ferrodinitroso salts; *e.g.*, $K[Fe(NO)_2S]$, potassium ferrodinitrososulphide, and (2) the ferroheptanitroso salts; *e.g.*, $K[Fe_4(NO)_7S_3]$, potassium ferroheptanitrososulphide. These salts yield the corresponding acids with sulphuric acid. For further information the above paper by Roussin, and also one by Pavel (*Ber.*, 1882, 15, p. 2600), should be consulted.

Phosphides, Phosphates.—H. Le Chatelier and S. Wologdine obtained Fe_3P, Fe_2P, FeP, Fe_2P_3, but failed to prepare five other phosphides previously described. Fe_3P occurs as crystals in the product of fusing iron with phosphorus; it dissolves in strong hydrochloric acid. Fe_2P forms crystalline needles insoluble in acids except aqua regia; it is obtained by fusing copper phosphide with iron. FeP is obtained by passing phosphorus vapour over Fe_2P at a red-heat. Fe_2P_3 is prepared by the action of phosphorus iodide vapour on reduced iron. Ferrous phosphate occurs in nature as the mineral vivianite $Fe_3(PO_4)_2{\cdot}8H_2O$. It may be obtained artificially as a white precipitate, which rapidly turns blue or green on exposure, by mixing solutions of ferrous sulphate and sodium phosphate. It is employed in medicine. Normal ferric phosphate, $FePO_4{\cdot}2H_2O$, occurs as the mineral strengite, and is obtained as a yellowish-white precipitate by mixing solutions of ferric chloride and sodium phosphate. It is insoluble in dilute acetic acid, but dissolves in mineral acids. The acid salts $Fe(H_2PO_4)_3$ and $2FeH_3(PO_4)_2{\cdot}5H_2O$ have been described. Basic salts have been prepared, and several occur in the mineral kingdom; dufrenite is $Fe_3(OH)_3PO_4$.

Arsenides, Arsenites, etc.—Several iron arsenides occur as minerals; mispickel or arsenical pyrites, Fe_2AsS_2, is an important commercial source of arsenic. A basic ferric arsenite, $4Fe_2O_3{\cdot}As_2O_3{\cdot}5H_2O$, is obtained as a flocculent brown precipitate by adding an arsenite to ferric acetate, or by shaking freshly prepared ferric hydrate with a solution of arsenious oxide. The last reaction is the basis of the application of ferric hydrate as an antidote in arsenical poisoning. Normal ferric arsenate, $FeAsO_4{\cdot}2H_2O$, constitutes the mineral scorodite. On the constitution of pharmacosiderite and acid arsenates, *see* N. H. Hartshorne, *Journ. Chem. Soc.*, 1927, p. 1759.

Carbides, Carbonates.—The carbide of iron Fe_3C plays an important part in determining the properties of the different modifications of the commercial metal, which are discussed under IRON AND STEEL.

Ferrous carbonate, $FeCO_3$, or spathic iron ore, may be obtained as microscopic rhombohedra by adding sodium bicarbonate to ferrous sulphate and heating to 150° for 36 hours. Ferrous sulphate and sodium carbonate in the cold give a flocculent precipitate, at first white but rapidly turning green owing to oxidation. A soluble carbonate and a ferric salt give a precipitate which loses carbon dioxide on drying. Of great interest are the carbonyl compounds. Ferropentacarbonyl, $Fe(CO)_5$, obtained by L. Mond, Quincke and Langer, by treating iron from ferrous oxalate with carbon monoxide, and heating at 150°, is a pale yellow liquid which freezes at about −20°, and boils at 102·5°. Air and moisture decompose it. The halogens give ferrous and ferric halides and carbon monoxide; hydrochloric and hydrobromic acids have no action, but hydriodic decomposes it. On exposure to sunlight, either alone or dissolved in ether or ligroin, it gives lustrous orange plates of diferrononacarbonyl, $Fe_2(CO)_9$. If this substance be heated in ethereal solution to 50°, it deposits lustrous dark green tablets of ferrotetracarbonyl, $Fe(CO)_4$, very stable at ordinary temperatures, but decomposing at 140°–150° into iron and carbon monoxide. For the cyanides *see* PRUSSIC ACID.

Ferrous salts give a greenish precipitate with an alkali, whilst ferric give a characteristic red one. Ferrous salts also give a bluish white precipitate with ferrocyanide, which on exposure turns to a dark blue; ferric salts are characterized by the intense blood-red coloration with a thiocyanate. Iron is estimated either by reduction to the ferrous condition and titration by potassium permanganate or dichromate, or by titration in the ferric condition by means of titanous chloride. (*See* also CHEMISTRY: *Analytical.*)

A. Werner prepared salts of ferrous tri-dipyridyl, $[Fe(C_{10}H_8N_2)_3]X_2$, which were resolved into dextro- and laevo-rotatory forms (*see* STEREOCHEMISTRY), and W. Thomas similarly resolved potassium ferrioxalate, $K_3[Fe(C_2O_4)_3]$.

MEDICAL USES

All the official salts and preparations of iron are made directly or indirectly from the metal. The pharmacopoeial forms of iron are as follow:—

Ferri sulphas exsiccatus, which has two subpreparations: (*a*) *Pilula ferri*, "Blaud's pill," (*b*) *Pilula aloes et ferri.*

Ferri phosphas, a slate-blue powder of ferrous and ferric phosphates with some oxide. Its preparations are: (*a*) *Syrupus ferri phosphatis;* (*b*) *Syrupus ferri phosphatis cum quinina et strychnina*, "Easton's syrup," in which each fluid drachm represents 1gr. of ferrous phosphate, $\frac{1}{8}$gr. of quinine sulphate, and $\frac{1}{32}$gr. of strychnine.

Syrupus ferri iodidi (strength 5·5gr. of ferrous iodide in one fl.dr.).

Liquor ferri perchloridi fortis, strong solution of ferric chloride (strength, 22·5% of iron); its preparations only are prescribed, viz.: *Liquor ferri perchloridi* and *Tinctura ferri perchloridi.*

The scale preparations of iron, so called because they are dried to form scales, are three in number, the base of all being ferric hydrate:

(*a*) *Ferrum tartaratum*, dark red scales, soluble in water.

(*b*) *Ferri et quininae citratis*, greenish yellow scales soluble in water.

(*c*) *Ferri et ammonii citratis*, red scales soluble in water, from which is prepared *Vinum ferri citratis* (ferri et ammonii citratis 1gr., orange wine 1 fl.dr.).

Substances containing tannic or gallic acid turn black when compounded with a ferric salt, so it cannot be used in combination with vegetable astringents except with the infusion of quassia or calumba. Iron may, however, be prescribed in combination with digitalis by the addition of dilute phosphoric acid. Alkalis and their carbonates, lime water, carbonate of calcium, magnesia and its carbonate give green precipitates with ferrous and brown with ferric salts.

There are numerous organic preparations of iron. Ferratin is a reddish brown substance which claims to be identical with the iron substance found in pig's liver. Carniferrin is a tasteless powder containing iron in combination with the phosphocarnic acid of muscle preparations, and contains 35% of iron. Ferratogen is prepared from ferric nuclein. Triferrin is a paranucleinate of iron, and contains 22% of iron and 2½% of organically combined phosphorus, prepared from the casein of cow's milk. Haemoglobin is extracted from the blood of an ox and may be administered in bolus form. Dieterich's solution of peptonated iron contains about 2gr. of iron per oz. Vachetta used the albuminate of iron with striking success in grave cases of anaemia. Succinate of iron has been prepared by Hausmann. Haematogen, introduced by Hommel, claims to contain the albuminous constituents of the blood serum and all the blood salts as well as pure haemoglobin. Sicco, the name given to dry haematogen, is a tasteless powder. Haemalbumen, introduced by Dahmen, is soluble in warm water.

Therapeutics.—Iron is a food and a medicine. Externally its salts are not absorbed by the unbroken skin, but when applied to the broken skin, sores, ulcers and mucous surfaces, the ferric salts are powerful astringents, because they coagulate the albuminous fluids in the tissues themselves. The salts of iron quickly cause coagulation of the blood, and the clot plugs the bleeding vessels. They thus act locally as haemostatics.

Internally, a large proportion of ordinary diet contains iron.

When given medicinally preparations of iron have an astringent taste, and the teeth and tongue are blackened owing to the formation of sulphide of iron. It is therefore advisable to take liquid iron preparations through a glass tube or a quill.

In the stomach all salts of iron are converted into ferric chloride. If given in excess, or if the hydrochloric acid in the gastric juice be deficient, iron acts directly as an astringent upon the mucous membrane of the stomach wall. Acid preparations are more likely to do this, and the acid set free after the formation of the chloride may act as an irritant. Iron, therefore, must not be given to subjects in whom the gastric functions are disturbed, and it should always be given after meals. Preparations which are not acid, or are only slightly acid, such as reduced iron, dialysed iron, the carbonate and scale preparations, do not disturb the digestion. In the intestine the ferric chloride becomes changed into an oxide of iron; the sub-chloride is converted into a ferrous carbonate, which is soluble. Lower in the bowel these are converted into ferrous sulphide and tannate, and are eliminated with the faeces, turning them black. Iron in the intestine is astringent or constipating and is therefore useful occasionally to check diarrhoea and dysentery. Salts of iron being constipating, they are best used in combination with a purgative. The pill of iron and aloes (B.P.) is designed for this purpose. Iron is certainly absorbed from the intestinal canal. As the iron in the food supplies all the iron in the body of a healthy person, there is no doubt that it is absorbed in the organic form. Whether inorganic salts are directly absorbed has been a matter of much discussion; it has, however, been directly proved by the experiments of Kunkel (*Archiv für die gesamte Physiologie des Menschen und der Tiere*, lxi.) and Gaule. The amount of iron in the human blood is only 38gr.; therefore, when an excess of iron is absorbed, part is excreted immediately by the bowel and kidneys, and part is stored in the liver and spleen.

Iron is prescribed when the amount of haemoglobin in the blood is lowered or the red corpuscles are diminished. In certain forms of anaemia its administration rapidly improves the blood in both respects, though the exact method in which it acts is a matter of dispute. In cases with toxaemia from absorption of intestinal products, not only laxatives in combination with iron but intestinal antiseptics are necessary. That form of neuralgia which is associated with anaemia usually yields to iron.

IRON AGE: *see* ARCHAEOLOGY.

IRON AND STEEL. Iron is the most useful metal of material civilization; it means plant, tools, machinery. It is principally used when alloyed with other elements, notably carbon; a moderate amount produces steel, an excess produces cast iron. Many special steels for particular uses have been devised in recent years; these steels contain a proportion of other metals, such as manganese or chromium (resulting in manganese steel, or chromium steel in these two cases, for instance). About 84 million gross tons of pig iron and 98 million gross tons of steel were made in 1927.

Outline of Manufacturing Process.—The source of commercial iron and steel is the oxide ores of iron, occurring in great abundance in all continents. This is charged into the top of a shaft-like blast furnace together with coke and some limestone. Hot air is blown into this furnace near the bottom, burning the coke and furnishing the gases and heat necessary to reduce the iron oxide to molten iron metal; trickling down over the white hot coke it absorbs an excess of carbon; drained from the bottom is the impure high-carbon alloy pig iron, which is merely remelted and cast into moulds to form the familiar iron castings of commerce. Limestone is charged into the furnace to convert earthy minerals mixed with the iron ore (gangue) and the coke ash into a fusible slag; this is also drained periodically from the furnace hearth. The blast furnace therefore operates continuously; solids are charged at the top, liquid iron and slag are drawn from the bottom.

To change pig iron into steel two methods are used extensively, the Bessemer converter and the Siemens-Martin open-hearth furnace. The converter is a brick-lined vessel, with perforations in the bottom through which air is blown. Into this vessel some molten pig iron is charged, and the air blowing through the metal burns out the carbon and some of the other impurities; at these high temperatures there is a pronounced selective action so that relatively little of the iron is burned. Combustion of these impurities furnishes the necessary heat to maintain operations. At the end of the blow, a matter of ten to 15 min., the purified metal is dumped into a ladle, and an alloy of manganese and iron known as spiegel is added to degasify the melt, whereupon the finished steel is poured into ingot moulds. Refining pig iron in an open-hearth furnace is a much more deliberate process, requiring eight to ten hours. The furnace is a flat shallow basin with a low roof. At either end are ports through which gas and hot air enter; the flame sweeps through, out the ports at the other end, and thence into chambers filled with checker brick to absorb some of the waste heat. At intervals the flow of gases is reversed by suitable valves thus returning the recovered heat to the furnace hearth. Scrap and pig iron are placed in the furnace through side doors, and melted down. Iron ore and limestone are also added, and a series of chemical reactions take place between the iron oxide and the impurities in the metal; the latter either vanish as gases or accumulate in a scum of thin slag. When the reactions are complete the bath is tapped into a ladle from which the slag overflows, and the finished steel is then cast into ingots. Ingots are squat prisms of steel and are given marketable shape in the rolling mills. By successively passing between rolls with steadily diminishing apertures, bulky ingots are converted into long rods, bars, plates, rails or various structural shapes. Rather thicker bars are known as billets and are used in forge shops for hammering out more intricate pieces of non-uniform cross section. Specially shaped rolls and auxiliary machinery also convert bars into sheet-steel, plate into pipe, and rods into wire products.

EARLY HISTORY

Antiquity of Iron.—Few implements of iron or steel survive for many years before they rust away, consequently there is little direct evidence to prove the point; nevertheless the antiquity of iron smelting is great. It doubtless has been discovered and rediscovered many times; explorers reaching primitive peoples in many parts of the world find the native blacksmith using methods very similar to those known to other tribes at far distant times and places. An iron blade, probably 5,000 years old, has been found in one of the Egyptian pyramids. Even without this discovery one could plausibly maintain that the ancient Egyptians *must* have had skilled steel workers in order to have built the great pyramids and other monumental architecture, to say nothing of the statuary and hieroglyphics cut into the hardest rocks. Steel working and hardening, an advanced stage in the art which doubtless required centuries to reach, was common 3,000 years ago in Greece, and is mentioned in Homer. It is more probable that iron was first found in the ashes of a big fire built near some red paint-rock than that the first tools were made from meteorites. When paint-rock and fire came to be associated with iron as cause and effect, the next step was to produce it intentionally in fires built against a bank exposed to prevailing winds, or in pits or rude rock furnaces where the fires were fanned by bellows, one of the earliest mechanical devices.

These are the primitive methods which survive to-day in the Catalan forge (*q.v.*): a mixture of charcoal and iron ore, selected for its purity, is heated intensely for several hours, with fuel additions made from time to time, and a vigorous blast of air fanning the fire. The iron ore becomes an incandescent sponge of metal; the clay or other minerals mixed with the iron oxide together with the charcoal ash sinter into a slag, permeating the sponge and protecting the freshly reduced iron from further chemical action. After a given time, the furnace is broken into, the glowing ball of iron pulled out, and immediately, while still white hot, hammered vigorously to expel as much of the slag as possible, and to weld the hot particles of metal into a coherent mass.

Steel from Indirect Processes.—With various changes in the furnace details, and in methods of producing the air blast, these methods produced all the iron available from the beginning up to the 14th century. It was truly a *wrought* iron, the best product containing no more than 0·1% of total impurities alloyed with the

metal, but shot through with microscopic slag particles, aggregating 3% or more of the total weight. Steel was made sometimes as an accidental product in the old forges; by design the wrought iron bars would be packed with charcoal in clay boxes or jars, and heated for days, whereupon the iron absorbed enough carbon to become steel and thus acquired the superior hardness and strength necessary for keener tools.

As the demand for iron grew, the furnaces became bigger and a stronger blast of air was required to drive the products of combustion from the bottom up through the mixed charge. It resulted that the iron ore was reduced to spongy metal in the upper part of the furnace, and it then proceeded to absorb more carbon as the charge settled down, thereby converting itself to pig iron, a much more readily fusible alloy. The bigger, taller furnaces introduced in the early 14th century therefore produced liquid pig iron, a complex alloy of iron, carbon and other elements. Subsequent developments have been along three main lines; (*a*) increasing the size of the furnace and developing mechanical auxiliaries to produce pig iron more economically and in greater amounts, (*b*) invention of various processes for changing this impure pig iron into the more useful wrought iron, (*c*) production of steel either by way of wrought iron, or from pig iron direct. Sir Henry Bessemer's process, announced in 1856, for making steel from pig iron in a pneumatic converter, began the steel epoch. Cheap and ample supplies of steels in a wealth of sizes, shapes and surface finishes, grades of hardness, or types of alloy, are now available to meet the special demands of metal workers, machinery builders, or tool users.

Modern metallurgical developments have consequently been away from the simple and direct production of wrought iron to the complex indirect manufacture of steel. The change from the small, intermittent operations controlled by a highly skilled artisan to the large continuous furnaces, machine driven, has been associated with enormous expansion in total output and as great a saving in labour, and a notable conservation of raw materials.

Steel from Direct Processes.—Some metallurgists, however, believe that the excessively high temperatures attained in the modern blast furnace cause the pig iron to alloy with undesirable compounds, notably of nitrogen, which cannot be eliminated later, and which cause the present day metal to be markedly inferior to that produced by the old direct processes operating at a low temperature. Hence many methods of making iron and steel direct from the ore have been proposed since 1910, and extended experimentation on a semi-commercial scale has produced some marketable metal by these processes. Most of them rely upon the fact that iron ore is reduced by gas in the upper cooler part of the blast furnace. That is, the reaction

$$Fe_2O_3 + 3CO \rightarrow 2\,Fe + 3CO_2$$

is substantially completed at 800° C, low red heat, too low to break up other minerals in the ore. Consequently hot iron ore is passed through a revolving kiln containing producer gas, and the iron sponge formed therein is either passed direct to an electric melting furnace, or quenched rapidly to prevent re-oxidation, separated from unreduced ore and gangue, and the metallic portion briquetted or melted. Whether these so-called direct steel-making processes are destined to supplant the present indirect system of smelting ore to an impure product, and refining the latter, cannot be predicted. In view of the great investment in the present plants for making steel which is reasonably satisfactory to the user, any innovation would have to show a considerable saving in costs, or have material collateral advantages, before it could be widely adopted. Such savings and advantages have not yet been demonstrated.

IRON ORE

Iron is smelted from several oxidized minerals occuring in abundance in the earth's crust. In order of commercial importance these minerals are hematite (Fe_2O_3), magnetite (Fe_3O_4), limonite (hydrated iron oxide) and the carbonate siderite ($FeCO_3$). Great deposits of these minerals in relatively pure state, close enough to the surface to be mined easily, occur in all regions. They are so common that an iron and steel industry will be developed whenever and wherever a population of machinery-using humanity accumulates. Iron deposits located in sparsely settled countries are potential ores of the future; for present uses an ore must be so situated and of such a nature that it can be mined, smelted by methods now known, and transported to market at a profit. Proximity to cheap fuel will enhance the value of ore—in Great Britain inland furnaces smelt local ores containing as low as 27% iron. The enormous ore deposits near Lake Superior in North America are a thousand miles from coking coal and an iron-consuming population, but intensive production and cheap water transport on the Great Lakes enables them to dominate the American market. On the other hand Brazil has huge untouched reserves of iron too far inland to export and with no home demand. The Continent depends upon the minette ores of Lorraine —ores which until the beginning of this century were valueless for steel making because no way was known to eliminate a high percentage of harmful phosphorus.

American Deposits.—The most productive iron ore region in the world is in very old (pre-Cambrian) strata surrounding Lake Superior, on the border between United States and Canada. Several long narrow areas called ranges contain the workable ores, which are hematites. Data on these ranges follow (production in long tons of 2,240 lb.):

Name	Location	Opened	Production in 1927	Total production including 1927	Greatest yearly production
"Old Ranges"					
				Million	
Marquette	Michigan	1854	4,171,000	160	5,396,000
Menominee	Michigan	1872	5,193,000	158	6,569,000
Gogebic	Michigan & Wisconsin	1884	6,390,000	167	8,763,000
Vermillion	Minnesota	1884	1,553,000	53	1,947,000
"New Ranges"					
Mesabi	Minnesota	1892	33,043,000	780	42,527,000
Cuyuna	Minnesota	1911	1,882,000	25	2,479,000

The deposits in the Mesabi range are flat, thick and close to the surface, and are therefore mined in open cuts by steam shovels. Underground mining is the rule in the others, the veins being fairly steep and worked to 3,000 ft. depth. The wealth of these ranges is such that ores of various analyses and textures are available. One-fourth the output is Bessemer ore, suitable for acid steel, containing on the average 55% iron and 0·04 phosphorus. The Cuyuna ore contains notable amounts of manganese. Basic or non-Bessemer ores from the ranges are higher in phosphorus and averaged 51·5% iron in 1926, with silica forming the principal impurity.

In view of the tremendous annual production of the Mesabi range, it may be questioned how long it will be before the region is worked out. The average iron content of all lake ores dropped from 55½% in 1902 to 51¾% in 1910, and has been maintained since then only by mining increasing amounts of high grade ore, and washing or screening one-third of the remainder. Minnesota, which is mining at the rate of about 40 million tons a year, is estimated by the State geologist to have demonstrated reserves of 1,250 million tons of recoverable ore. Unless these reserves are increased by new discoveries the Mesabi range will therefore be worked out by 1960. But any prediction about the age of a mining district must prophesy also the state of the future art of ore concentration—lean rock to-day may be workable ore to-morrow. In fact, this region contains an unlimited tonnage of magnetite-bearing strata just outside the classification of ore, as defined by conditions in 1927.

While seven-eighths of American ore comes from the Lake ranges, the balance of about eight million tons is taken from many ore occurrences in the Clinton formation in the Appalachian mountains, an uplift which parallels the Atlantic coast from north

to south. In the northern region the ores are predominantly magnetites; at the southern end in the State of Alabama, deposits of a low-grade red hematite with an easily fusible gangue are found near extensive coal measures. All these deposits are mined by underground methods; among them are mines which have produced continuously since the earliest iron smelting in America.

Lorraine Deposits.—Ore beds second in importance only to those in the Lake Superior region occur in strata of Mesozoic age near the Franco-German border, extending northward into Luxemburg and Belgium. They are of recent commercial development. While only 830,000 tons were produced in 1897, they are now the chief ores for the French, Belgian, German and Luxemburg blast furnaces which together in 1927 produced 36% of the world's pig iron. Mining is done in three principal basins, Longwy near the Belgian border, Briey, and Nancy at the south. Previous to the World War much of this area was German territory, and practically all of the rest was promptly overrun and occupied by the invading army. Possession of this all but essential region was thereafter one of the aims of the contending Powers. Great damage was done during the occupation and the retreat, and not until 1926 did the area approach the productivity of 1913. While the output of the region exclusive of Belgium and Luxemburg was about 40 million tons in 1913, equally divided between France and Germany, the French department of Meurthe-et-Moselle was able to hoist only 5 million tons in 1920. Recovery of the reunited provinces has been so rapid, however, that the output of ore reached 37 million tons in 1926. The ore beds occur in flat strata 60 to 120 ft. thick, from 300 to 750 ft. below the surface. The iron is contained in tiny nodules of hematite, cemented with a calcareous or a siliceous gangue. It is only necessary to combine these two to procure a self-fluxing, easy smelting mixture, very desirable commercially even though its iron content is quite low. Representative analyses, after driving off 8 to 12% moisture, are as follows:

	Siliceous ore	Calcareous ore
	%	%
Iron	35 to 37	38 to 42
Silica	12 to 18	4 to 8
Alumina	3 to 7	3 to 7
Lime	3 to 7	9 to 13

Phosphorus is strikingly uniform, being 1·7 to 1·9% of the iron contained, and the Lorraine pig iron must therefore be used in basic steel making.

Ores in Great Britain.—Since the rich blackband, clay iron stone and brown hematites of the Carboniferous strata have been almost exhausted, 80% of the iron ore mined in Great Britain is now taken from leaner strata, averaging only 27½%, which are a continuation of the Lorraine beds. Workable deposits extend in a broad strip from the coast of Yorkshire south-west to that of Dorset and are estimated to contain 3,400 million tons of workable ores. The beds are nearly horizontal, and consequently have broad outcrops in gently rolling ground, thus permitting them to be mined by quarrying operations. As a rule the individual deposits are small, and do not warrant the powerful excavating machinery installed in the great Mesabi pits. A maximum working face is 30 ft. Such "marlstones" (or simply "stone") contain the iron in tiny ooliths like the Lorraine ore, but near the surface the iron has been oxidized and hydrated to limonite, and at depth is a carbonate. Gangue materials are either calcareous or siliceous. These deposits have been longest mined at Cleveland, and here a limited area has produced 5½ million tons a year since 1875. All mining is underground in carbonate ores sometimes as deep as 600 ft.; 9 to 12 ft. beds are reckoned excellent. A governmental survey made in 1918 found only 200 million tons of recoverable ore here in reserve. An average analysis follows:

Oxide (FeO)	28%*
Silica (SiO_2)	12%
Alumina (Al_2O_3)	10%
Lime (CaO)	5%
Sulphur	0·26%
Phosphorus	0·47%
Water	6·8%

*(24·6 to 33·3%)

Cleveland ores therefore are suitable for basic steel making, wrought iron manufacture or general iron foundry work. Except for the several post-war years of acute industrial depression, Great Britain's ore demands have been about stationary since the turn of the century. Each year Cleveland hoists 5½ million tons, other regions dig 9 million tons and 6 million tons are imported, principally low phosphorous ore from Spain and Sweden.

Future Stores of Iron.—Whether there is any likelihood of exhausting the available iron ore is a question which has occupied some minds. From the above remarks, it may appear that certain regions, such as the Mesabi range and the Cleveland beds, may be exhausted in the near future. However there is little to fear but that other deposits, only slightly less favoured, will supply the gap. Conservative estimates by economic geologists indicate that there are now about 30 billion tons of ore in reserve, which at the present annual consumption of 100 to 125 million tons, should last 200 years. Of this huge tonnage, two-thirds is located in the Western hemisphere; Brazil and United States possess most of this, but Newfoundland and Cuba both have notable deposits; France has half the balance, and the rest is scattered about in readily accessible locations. All such computations assume a certain state of metallurgical art in order to define ore. But metallurgical art is constantly advancing. Since so large a proportion of the earth is iron, it is safe to say that in the future, as in the past since before history began, the mind of man will always find means to win from mother earth this most useful metal, in supply ample for his current needs.

PREPARATION OF ORE FOR SMELTING

Transport.—In England and on the Continent much of the iron ore is smelted in furnaces erected nearby—even at the mine mouth. Freight is a minor matter. That which is transported from overseas is handled for the most part in ordinary cargo vessels. In America, however, the long haul down the Lakes from the ranges to the furnaces has caused the development of very specialized handling equipment. At the mines, hopper-bottom railroad cars of 50 to 60 tons capacity are loaded by steam shovels in the pit, or from storage bins at the mine, and hauled to the nearest port. Here long lines of ore bins are built out into the water; whole trainloads of ore are dumped in a few minutes by pneumatic devices. When these bins are full an ore boat docks alongside, opens her hatches, and a load of 10,000 tons of ore is spouted into her in less than a half hour. Ore boats that are used for service on the relatively calm Great Lakes are of special construction and are essentially long, self-propelling barges with a movable deck. Arrived at its destination, the hatches are again opened, and enormous grab-buckets reach through into the hold, scooping out the ore and dropping it inshore, either in railroad cars, or on a stock pile. If the furnace plant is inland, trainloads of ore are hauled to the site, and dumped in bins or placed in stock piles. Hopper-bottomed cars are used almost exclusively for this purpose, although for stockpiling it is generally found better to install a car-dumper, which turns the car upside down, and then to move the ore to the pile by a grab-bucket and overhead bridge. One cannot comprehend the magnitude and power of this unloading machinery, unless it has been seen in operation. Large stock piles, which are almost unknown elsewhere, are the general rule in America, where water transportation is entirely suspended by ice during the winter months. Limestone and coke are also stocked in sufficient quantity to provide against irregular deliveries from a distance.

Dressing.—Up to the beginning of the 20th century iron ore was seldom treated in any way prior to its utilization. High grade materials, however, are becoming increasingly scarce, and the future will see a rapid extension of ore dressing methods.

Screening is the simplest method. Some 17 million tons of Lake ore were improved by this method in 1927. In England as well the miner frequently digs marlstone without removing the

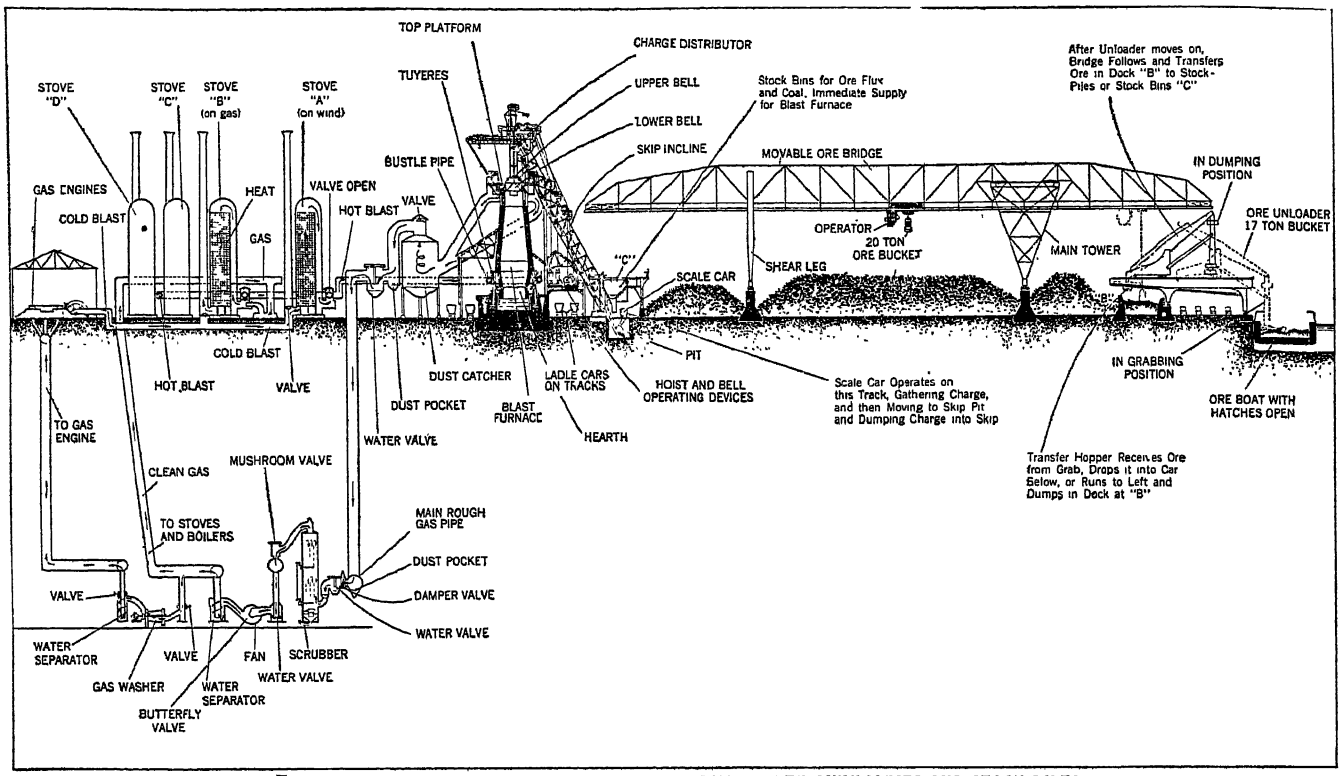


FIG. 1.—DIAGRAMMATIC ELEVATION OF BLAST FURNACE WITH AUXILIARIES AND STOCK PILES

loamy overburden; the quarried material is then crushed, and the fine particles screened out and discarded. In this way the average iron content of the ore is increased, and the suitability for smelting improved, for too many fines in the charge slow down blast furnace operations.

Washing is also common in America. This is an application of the water concentration methods so highly developed in ore dressing (*q.v.*) used at copper, lead and zinc mines. Some five million tons of Mesabi ore were treated in log washers in 1927. The washer is an inclined trough; from end to end is a stout shaft or log, with plow blades so set on its circumference that when the shaft revolves the plows clear the trough bottom and move any solid material gradually along. The fine screenings enter at one end, and travel against a copious current of water, which washes out the finer, clay bearing particles, lean in iron.

Calcining is common in England, particularly on the Cleveland carbonate ores. A Gjers kiln is ordinarily used, a short cylindrical steel shell set vertically, and lined with fire brick. A mixture of ore, with about 5% slack coal, is charged through the top as the burned ore is withdrawn at the base. Such a kiln will drive moisture and carbon dioxide from about 1,000 tons of ore in a week; Cleveland ores lose 27 to 30% in weight, but the resulting ore has had its iron percentage increased thereby to about 31%; still a very lean ore, viewed by American standards. Lorraine ores contain much moisture, but cannot be calcined, because this preliminary heating causes them to fall to powder.

Sintering is a method of converting fine ores or flue dusts into a porous clinker which can easily be smelted. American and Swedish magnetite ores, low in grade, are frequently concentrated by fine grinding, and drawing the iron bearing minerals out of waste rock with strong magnets. This fine magnetite is then moistened and mixed with fine coal and a little flux or with blast furnace flue dust, and spread over a travelling grate, the coal ignited and burned in a strong down-draft. The resulting clinker smelts so much more easily than the dense magnetic ores that the latter, even of high grade, are frequently sintered at the American plants.

BLAST FURNACES

Having followed thus far the mining, transport and preparation of ore, attention should next be given to the process of smelting it into metal. In the present state of the art, this is done in a blast furnace, and the metallic product is a high carbon alloy of iron called pig iron and containing more or less silicon and manganese. Since an article is devoted to the construction and operation of the blast furnace (*q.v.*) these matters will be summarized only briefly here; more attention however will be given to that entire assemblage of auxiliary equipment (*see* fig. 1) which together goes to form the blast furnace department of a modern steel making plant. A blast furnace is a structure often topping the general ground level by 100 ft. It is round in cross section, bound with steel plates, and lined with a thick wall of special fire brick. Piercing the very top of the shell are two side openings leading into brick lined pipes—downcomers—for venting the furnace gases. The top is closed by a double bell, which in effect is an air-lock for introducing charges of ore, coke and limestone, while permitting no gas to escape. Charging is continued at such a rate that the furnace shaft is always full. About 8 ft. above the furnace base is a series of 10 or 12 water-cooled nozzles called tuyères, equally spaced around the circumference, through which hot air is blown into the interior. The coke in the mixed charge burns in this air, producing a region of intense heat sufficient to melt the metallic iron descending to that level from above, and superheat it so much that when it trickles to the hearth it collects at the bottom of the shaft in a pool which remains molten for hours. Five or six times a day this iron is drawn off or cast by opening a tap-hole at the very bottom.

Reduction of Iron Ore.—Much study has been given to the chemical reactions which reduce the ore to iron. At the tuyères the heat is so intense that coke burns only to carbon monoxide, thus:

$$2C + O_2 = 2CO$$

It is this gas which reduces the ore, and at a fairly low temperature, *i.e.*, near the top, by a series of reactions which may be simplified as

$$Fe_2O_3 + 3CO = 2Fe + 3CO_2$$

The secret of rapid furnace driving to produce big tonnages is to use such ore, or prepared sinter, that the gases may permeate it readily and completely. Pure iron is relatively infusible—melting point 1,530° C; when alloyed with 4·3% carbon its melting point

is about 1,150° C. The freshly reduced iron in the blast furnace picks up this necessary carbon to convert it into the more fusible pig iron, either by physical contact with the hot carbon, or by the gas reaction

$$3Fe+2CO=Fe_3C+CO_2,$$

a reaction which is the basis of the case-hardening phenomena. By no means all the CO is oxidized to CO_2 by the furnace reactions. A typical analysis of the gases from the furnace top is

Carbon monoxide (CO)	24·5% by volume
Carbon dioxide (CO_2)	12·0
Hydrogen (H_2)	1·25 (from moisture in the air blast)
Methane (CH_4)	0·25
Nitrogen (N_2)	62·0

rich enough in the combustible gases CO, H_2 and CH_4 to be valuable as a fuel. Leakage must be carefully avoided, for the monoxide content makes it highly lethal.

Slag Formation.—Impurities in the ore and the coke ash must also be disposed of. They consist of earthy substances like clay. If they contain a preponderance of a single oxide like silica (SiO_2) they cannot even be melted unless sufficient limestone is present to flux them—that is to say, convert them into an easily fusible glass or lava-like substance called slag (*q.v.*) or cinder. The formation temperature of slag depends upon the relative proportion of basic oxides (lime CaO, or magnesia MgO) and acid oxides (silica SiO_2, or alumina Al_2O_3) which are present in the furnace charge. The operator therefore chooses his ores and fluxes with the aim of producing a slag which works well at some temperature, which he does not measure, but which he knows will produce the kind of pig iron which is demanded by his customers. Like the iron, slag melts in the hot region above the tuyères and trickles down, forming a pool floating on the iron. It is tapped or flushed through a cinder notch located between the tuyère line and the furnace bottom; usually just before the iron is tapped.

Ore Handling Equipment.—A furnace making 600 tons of pig iron a day will consume 1,160 tons of ore, 580 tons of coke, 290 tons of limestone, and 2,370 tons of air blast. It produces in addition to the iron, 330 tons of slag, 70 tons of dust and 3,400 tons of gas. It requires 17,000 tons of water to keep the furnace parts cool and to wash the dust from the gas. Therefore equipment must be provided to handle expeditiously no less than 26,000 tons of material each 24 hours. Such auxiliaries are so large and so numerous that the furnace itself is frequently inconspicuous, despite its huge bulk (fig. 1). In America, much space is ordinarily given to stock piles. Ore that comes from such storage, or direct from the mine, is dumped into bins alongside the furnace. Other compartments hold coke and flux. On a track underneath operates a scale car, which stops under appropriate gates and the attendant draws off a specified amount. When the proper quantities have been assembled, the car proceeds to the skip pit, and drops its load into a car which in turn is hoisted up the inclined bridge and dumped into a hopper at the very top of the furnace.

Furnaces a century ago were usually built on sloping ground, and the ore and charcoal wheeled off the hill top and dumped into the furnace. Later, when the value of the gases was discovered, a single bell was used to close the furnace top, and as the tonnage requirements increased, ore, coke and flux were shovelled from stock piles into carts, which were then pushed to the furnace, hoisted on platform elevators, and dumped by hand. Material handling by machinery is essential for furnaces making more than a hundred tons of iron a day.

Disposal of Iron and Slag.—In view of the congested surroundings, the pig iron and slag tapped from a big furnace are led by clay-lined troughs or runners to the edge of the foundation where they flow into ladle-cars standing below, and are hauled away while still liquid. If the furnace is serving a steel-making plant, the iron may be taken direct to a steel-making furnace. More usually it is poured into a mixer that is in effect a storage reservoir, sometimes of 1,500 tons' capacity. A mixer is usually shaped like a huge barrel, made of strong steel plate and lined with fire brick; it may be rolled on its foundation by suitable trunnions so the opening may at one time receive metal from a ladle-car above, or later discharge it into another for transfer to the steel furnace. The bad effect on steel-making processes of sudden variations in composition of the pig iron, so-called off casts, is minimized by dilution in a pool of reserve metal. Furthermore, some of the harmful sulphur may be eliminated from high manganese pig iron in the mixer, if the temperature is properly controlled. Iron which cannot be converted promptly must be cast into pigs. Much of this work is done by machinery. A pig casting machine is an endless chain to which is attached a series of moulds. A ladle-car of iron pours slowly as this conveyor moves underneath. After the iron is chilled, the conveyor passes through a long water tank for more rapid cooling. When the chain moves over the tail pulley the moulds turn upside down and the now solid pig iron drops into a railroad car. Some furnaces specializing on foundry iron, and of rather limited tonnages, run their iron direct from the tap hole into pig moulds formed in the sandy floor of the furnace house (*see* PIG IRON). Slag may be hauled to a nearby bank, dumped and wasted. In some localities, the slag may be marketed for railway ballast, filling material, or concrete aggregate. It would then be run molten into a water sump, the stream being broken up by a strong jet of water. Granulated in this manner, it can be reclaimed by grab-bucket and crane and shipped. Since the slag is essentially a calcium aluminium silicate, large tonnages are utilized as raw material in the manufacture of Portland cement.

Utility of Blast Furnace Gas.—As noted above, gases from the furnace top are good fuels, but they bear too much dust to be used without cleaning. Even when burned under boilers it is found that dust will fuse to the water tubes, reducing the efficiency of heat transfer and increasing the cost of maintenance to a prohibitive figure. For use in internal combustion engines, the cleaning must be even more complete. Much of the coarser ore and coke particles swept out of the furnace with the gas remains in the dust catchers, one or two cylindrical tanks placed in series just alongside the furnace proper. Essentially they are enlargements of the downcomer pipes; the velocity of the gas and its carrying power are reduced in passing through them. A change in direction of travel also aids in catching solids, which as they accumulate are drawn off from the hopper-like bottom. Usually the reclaimed dust is mixed with fine ore, sintered, and resmelted. Formerly it was usual to send hot gas from the dust catchers direct to the stoves, but lately more and more furnace managers have been convinced that this rough gas contains entirely too much dust for this purpose, and the efficiency of the heat transfer suffers therefrom. Consequently further cleaning, either by scrubbing towers, by electrostatic precipitation, or by filtering through bags is now commonly undertaken. Electrostatic precipitation has the advantage that it handles gas without cooling it and may recover valuable amounts of potash for fertilizer. In this process the slightly humidified gas is passed through vertical pipes; in the centre of each is a wire charged at high voltage. In the electrical field so formed solid particles drift toward the grounded pipe walls, adhering there until dislodged by hammering.

Fig. 1 shows a scrubber, of which two would be required, each about 80 ft. high by 12 ft. diameter. By means of spray nozzles and screens the ascending gas is intimately mixed in these towers with fine particles of water. The dust content, which on entering is about 3·5 grains per cu. ft. is washed out except for about 0·2 grain. A powerful fan is necessary to draw the gas through the scrubber and to give it the necessary delivery pressure; water jets are introduced through the shell at several places so the fan acts as a further cleaner, delivering gas to stoves or boilers with about 0·05 grain of dust per cu. ft. Frequently all the gas is burned in this way, utilizing the steam so generated to drive blowing engines or electric generators. When it is desired to use the heat more efficiently, internal combustion prime movers may be installed (*see* GAS ENGINES) whereupon an even cleaner gas is required. Dust may be reduced to less than 0·01 grain per cu. ft. by a rotary washer, which is a combination turbo-blower and cleaner. The large amount of water used for these cleaning purposes may be again used after passing it through a cooling tower and settling basin.

BLAST FURNACE PLANT

Blowing Engines.—Fig. 1 indicates the essential steps whereby the energy contained in the furnace gases is utilized to generate hot blast and auxiliary power for pumping, hoisting and lighting. Cleaned gas is used to drive gas engines direct connected with compressor cylinders. Compressed air goes to the furnace by way of a stove, therein acquiring a temperature of some 550° C, and on through a brick lined hot blast main to a bustle pipe circling the furnace. From the bustle pipe gooseneck connections deliver blast to the furnace through the tuyère openings. The required amount of air is fixed by the size of the furnace and the pressure, which varies from 12 to 20 lb. per sq. in. with operating conditions, and must be delivered without fail. About 50,000 cu. ft. of air per min. is necessary for a furnace making 600 tons of pig iron per day (*see* BLOWING ENGINES).

Dry Blast.—One auxiliary (not shown in fig. 1) more commonly installed in Great Britain, although proposed by the American James Gayley, reduces the humidity of the blast. Gayley showed that water vapour entering the tuyères, amounting in summer to about 250 gals. per hour, is dissociated into its elements by the white hot coke, this action absorbing heat not usefully regained within the furnace. Variations in moisture content are especially undesirable, for these produce variations in the temperature at the focus, and consequently change the chemical composition of the pig iron. To produce a low and uniform humidity in the air blast, the compressors may suck air through an adequate refrigeration system. (*See* AIR CONDITIONING.) Silica gel has been proposed as a more proper medium to dry the air blast.

Stoves.—Four stoves are usually installed to heat the blast. These are steel cylinders up to 100 ft. high and 22 ft. diameter. Each has a vertical combustion chamber, either at side or centre; the burned gases then return to the bottom through a multitude of narrow flues made of fire brick (*see* COWPER STOVE). In the passage they give much of their heat to the brick work, and flow off through a chimney. In operation (fig. 1), stoves B, C, and D may at any hour be filled with burning gas, thus acquiring heat; the cold blast passes through one of them, stove A; when this one cools off, valves are changed in a certain order, to prevent accumulation of explosive gas-air mixtures; stove A will then be on gas, *i.e.*, heating; stove B will be on wind, *i.e.*, giving up its heat to the air passing through it enroute from engines to furnace. Usually valves are changed every hour. In a four-stove installation, therefore, each stove is heating for three hours, and cooling for one. Many designs have been proposed for the method of building the stove interior. A two-pass stove is simplest, and most favoured in America, where the trend is to use cleaner gas, injected with a regulated amount of air for combustion, through carefully designed burners. Cleaner gas permits much smaller chequer-work, higher heat capacity, longer life before the openings are plugged with fused dust, frequently enabling satisfactory furnace operation with only three stoves. A three-pass stove, where the gas is introduced at the bottom, goes up, down, up again and out a short stack built on top the stove, is favoured by some designers. (*See* HOT BLAST.)

Valves for handling these furnace gases are of special construction. On the cleaning system a water valve is favoured. As shown in the diagram of the blast furnace department, it is nothing much but a large pot with a diaphragm extending from top toward the bottom. To close this valve it is only necessary to fill the pot with water until the bottom of the diaphragm is submerged several inches; draining the pot opens the valve. Valves for handling hot blast are more difficult to construct and to maintain in good condition. Also, since the valve seat is exposed to the corrosive action of hot gases, it requires occasional replacement. This can be done by loosening all the turnbuckle clamps, wedging the flue sections apart, and sliding the old seat out sideways. The valve disc is also a hollow copper casting with spherical bottom; cooling water enters the hollow stem as shown. To open the valve it is only necessary to lift the disc up until it strikes the bricked dome. All blast furnace stoves have four valves. Two are shown on stove A (fig. 1); stove A is on wind, the chimney valve and the gas burner opening being closed. Stove B is on gas; the chimney valve is open, the gas burner in place, and the valves into the cold and hot blast mains are closed.

Blast Furnace Operation.—From the foregoing description it may be surmised that the blast furnace superintendent's task is primarily to harmonize operations of various large mechanical elements. But the furnace itself is his greatest care, even though the principal reactions within it are in virtual equilibrium. Slight variations from normal are self-adjusting—that is to say, if for some reason a surplus of heat is generated, the action within the furnace changes in the direction which will absorb that extra quantity of heat. Nevertheless the skilled operator is quick to observe clues which indicate deviations from the normal, and he immediately makes such adjustments in the operating conditions as experience tells him will avoid any serious irregularity. A hundred years ago his problem was simpler. His furnace plant consisted only of stack and blower; his ore was pure and rich, carefully selected by hand; his fuel was charcoal, ideal in character; the driving rate was slow; under such circumstances his pig iron was relatively free from impurities. Even to-day some of this charcoal pig iron is made in small furnaces with either cold blast or hot blast, and is favoured by foundrymen for castings which require a dense, tough and strong body, or by manufacturers of high grade tool steels. Rich ores and forests were very soon exhausted, however, and the progress of metallurgy has been associated with the ability to recognize the specific effects of each disturbing element and to devise ways and means to utilize the impure ores and coke fuel remaining. For many of the minerals entering the furnace top with the iron ore are broken up and the elements therefrom alloy with the pig iron, often to its detriment.

Control of Sulphur.—Sulphur, largely from iron pyrite contained in coke ash, is the worst offender; if left in the iron causes it to be very tender at red heat (red short). High sulphur castings often crack in the moulds after cooling, and high sulphur steels may break when being worked in rolls or forging. Since no sulphur is removed in the converter or open-hearth steel making processes, it is essential that this undesirable element be eliminated from the blast furnace. This is done by charging enough limestone so the slag shall be distinctly basic, and thus have a higher solubility for sulphur compounds. Such a slag requires a hotter furnace for its operation and this surplus heat also helps drive the sulphur into the gas or slag. Once in the iron, its harmful effects may be mitigated in castings if two or three times as much manganese is present; an innocuous manganese sulphide results. In steel, zirconium has been found to have the same effect. Sulphur may be eliminated in electric furnace steel by refining at a high temperature under a slag very high in lime and containing some calcium carbide. Pig iron for grey iron castings must therefore have less than 0·10% sulphur; structural steel must contain less than 0·06%; many alloy steels are specified to contain less than 0·04% sulphur.

Effect of Silicon on Pig Iron.—A blast furnace working very hot tends to reduce silicon and manganese from any minerals containing them present in the charge. Manganese is now considered beneficial in all subsequent processes. But silicon must be sharply limited to pass some specifications. Silicon in pig iron causes much of the carbon present to separate and collect into tiny flakes of graphite, permeating the entire metallic structure; this graphite is responsible for the characteristic grey fracture of castings for machinery; its presence also makes for easy machineability. If not present, the carbon would exist in the alloy as a compound of iron, a carbide, Fe_3C, called cementite, and form a much harder, stronger alloy. Consequently in such things as car wheels or in white iron castings, which are later to be converted into malleable iron (*q.v.*) by annealing, the silicon must be strictly limited. Silicon in pig for Bessemer steel must also be under close control, as we shall presently see. Therefore for those irons where both sulphur and silicon are limited, the ore and fuel must be specially selected for a low content of sulphur.

Grey and White Iron.—Carbon is another element in pig iron which will vary somewhat. It may be from 3·0 to 4·25%, depending upon furnace conditions. Generally if either silicon or phosphorus runs unduly high, the carbon will be low. Manganiferous

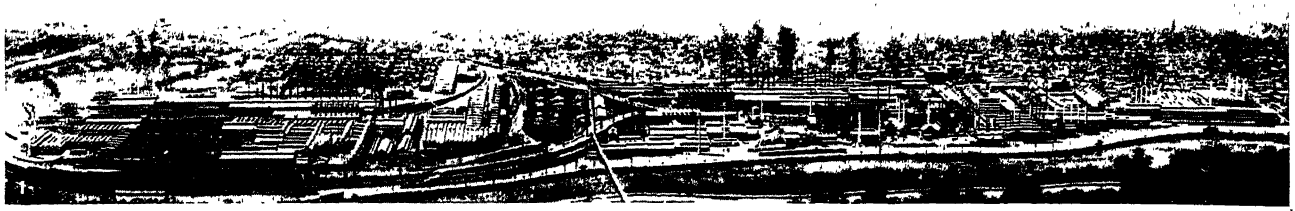


BY COURTESY OF THE BETHLEHEM STEEL COMPANY

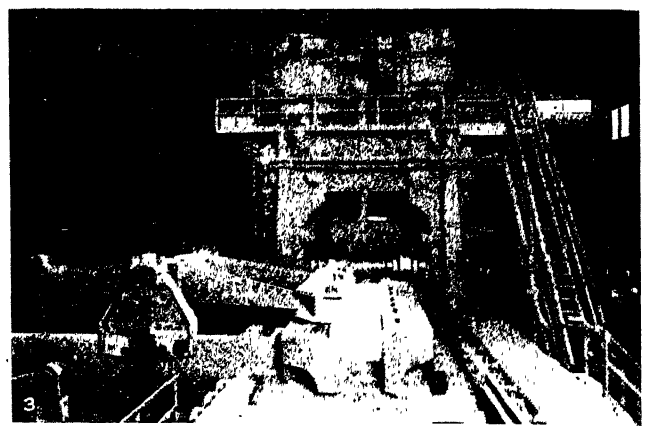
BESSEMER CONVERTER IN FULL BLOW

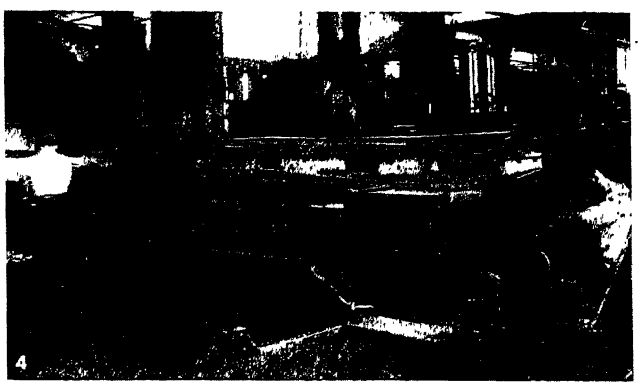
The converter or furnace, into which molten pig-iron is poured, is lined with brick having perforations in the bottom; through these a powerful blast of air enters and passes through the molten metal, thereby oxidizing the impurities, which if liquid, go into the slag, or if gaseous, out of the mouth of the converter. After 10 or 15 minutes "blowing" the metal is poured into ingots. This quick and inexpensive method of manufacturing steel, invented by Henry Bessemer in 1856, has greatly influenced modern industry

IRON AND STEEL

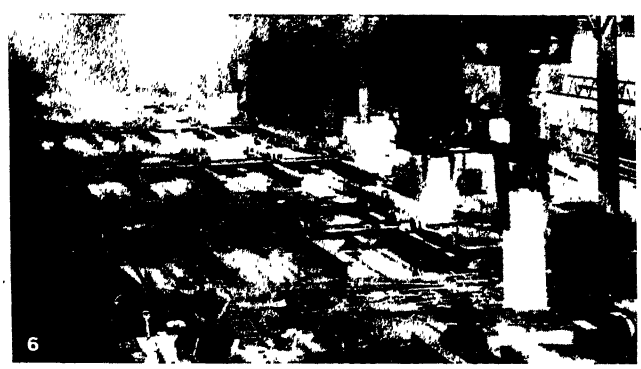


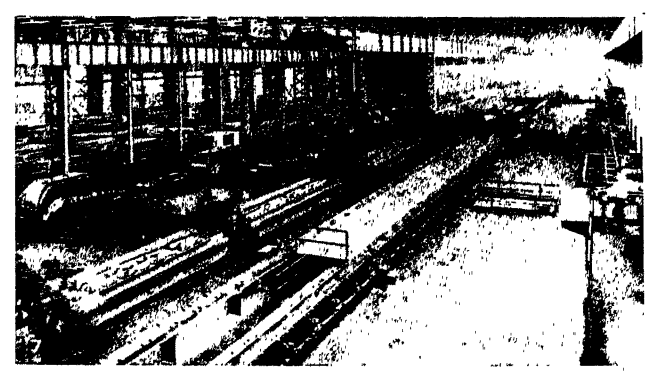












BY COURTESY OF (1, 4, 5) THE BETHLEHEM STEEL COMPANY, (2) THE U.S. STEEL CORPORATION, (3) THE CARNEGIE STEEL COMPANY, (6) THE WHEELING STEEL CORPORATION, (7) THE FORD MOTOR COMPANY

PROCESSES IN THE MANUFACTURE OF STEEL PRODUCTS

1. General view of large steel plant in eastern Pennsylvania, showing open hearth and blast furnaces, and rolling and finishing mills
2. Pouring molten steel into electric furnace. Bucket travels on overhead crane from smelting furnace. This process prepares steels of special quality
3. Blooming mill with 54 in. rolls in structural steel mill. Roller tables (foreground) carry hot bloom between manipulators. Top roll (background) depressed after each rolling by power driven screw press
4. Skelp, or steel plate, being fed into furnace for manufacture of butt welded steel pipe. Furnace door, left; feeding table, centre
5. Pipe emerging from furnace after passing through the welding bell, which draws the hot plate into welded pipe. Beveled edge at weld
6. View of soaking pit at steel plant, showing hot ingots being drawn from pit by overhead travelling cranes leading to rolling mills
7. Continuous merchant mill of automobile steel plant. Hot billets from furnace passing through first three roughing rollers (centre). Finishing train and runout tables (right) convey the billets to saw and cooling beds in distance. Entire train of mills is driven by covered gearing (left) and main motors in glass enclosed room (top)

irons, on the other hand, are usually high in carbon. The colour of a freshly broken piece of pig iron is due to the way the carbon is held, rather than its total quantity; in white iron, nearly all the carbon is combined with iron in the carbide cementite; in grey iron, seven-eighths of it is in the form of graphite; intermediate proportions are called mottled irons.

Phosphoric Ores and Iron.—Phosphorus, until about the turn of the century, was the most undesirable element entering the blast furnace. Whereas much sulphur can be slagged off, between 90 and 100% of the phosphorus entering with the ore and the fuel ash comes out with the iron. Phosphorus makes both iron castings and steel brittle. For some types of thin castings requiring fluid iron *e.g.*, stove plates, from about 1·0 to 1·5 % of phosphorus may be permitted, but in steel it is kept as low as sulphur, namely from 0·02 to 0·07%; the lower the analysis the better the steel. Consequently the phosphoric iron ores of Lorraine were of small value—in fact of no value for steel-making until the Thomas-Gilchrist basic process was suggested (1878). Subsequent developments have converted the phosphorus in the ore to a pronounced economic asset. In view of all these facts, the furnace operator selects and mixes the ores and fuels which are available to him, and then adjusts his flux and controls his hearth temperature, by varying the amount of coke charged and the temperature of the blast, so the desired kind of iron will issue from the tap hole (*see* CAST IRON). Further notes on the varieties required for the various conversion processes will be given later.

WROUGHT IRON

Wrought iron, as compared to the total tonnage of steel, is an unimportant commodity. It amounts to less than 3% of the total production of steel. But it is important for its unique combination of physical properties, enabling it to survive since the time 75 years ago when it was the principal metal of engineering construction.

Puddling Process.—If about 600 lb. of pig iron and considerable iron ore are placed on the hearth of a small reverberatory furnace and melted, various reactions occur between the iron oxide from the ore and the impurities in the droplets of pig iron. The first reactions to occur may be simplified as follows:

$$2\,FeO + Si = SiO_2 + 2Fe$$
$$FeO + Mn = MnO + Fe$$

The iron thus reduced from the ore enters the pool of metal, and the silicon and manganese oxides join with the surplus ore to form a highly basic slag. This slag has the ability to absorb any phosphorus oxides which result from reactions between the phosphorus alloyed in the metal and the surplus iron oxide in the slag. The workmen stir the slag and iron together, an operation which is known as puddling; after the silicon and manganese have been substantially eliminated from the metal the carbon content begins to go down. The reaction may be written as follows:

$$Fe_3C + FeO = 4Fe + CO$$

Carbon monoxide gas bubbling upward causes the bath to boil. Removal of all these alloying elements leaves practically pure iron, of a much higher melting point. Toward the end of the process, therefore, the bath is converted into a metallic sponge of white hot, pasty iron, filled with liquid slag. This is cut into 200 lb. balls by the furnaceman, surplus slag squeezed from the dripping mass, and the resulting balls rolled into flat muck-bars. The metal is hot enough to weld together satisfactorily, and the process is accompanied by a great spray of slag sparks, squeezed out by the rolls. Muck-bars are cut to short lengths, arranged and wired together in piles, heated to a welding heat and re-rolled into marketable shapes.

Nature of Ferrite.—From a knowledge of the manufacturing process it may be understood that commercial wrought iron is essentially pure iron containing a greater or lesser number of slag particles.

The chemical changes which occur in the process of refining are thus indicated:

	Forge pig iron	Metallic portion of wrought iron
	%	%
Carbon	3·5 to 4·25	0·02
Manganese	0·25 to 1·0	0·005
Phosphorus	0·5 to 1·0	0·07
Sulphur	0·03 to 0·10	0·02
Silicon	1·0 to 2·0	0·03
Iron	95 to 92	99·855

About 3% of the wrought iron by weight is slag.

A view of a polished section through a microscope shows the structure of wrought iron (Plate III., fig. 9). The mirror-like metal appears white in the photograph; the stony lustre of the slag particles appears grey. The slag itself is not a simple glass, it is a high iron silicate containing more or less manganese and phosphorus and frequently develops well crystallized minerals. Slight etching of the polished surface under examination develops characteristic markings; the metallic portion seems to consist of a number of closely fitted or interlocking grains. If one of these grains were picked out, it would have an irregular surface; nevertheless it is undoubtedly true that its inner structure is that of a true crystal—that is to say, the ultimate atoms are arranged in regular rows and ranks, in geometric order. Such tiny crystals of substantially pure iron are called ferrite.

Properties of Wrought Iron.—Wrought iron has superior properties for forge welding, because at high heats the slag particles melt and spread into a film protecting the metal from atmospheric oxygen. The purity of the iron is responsible for great toughness, resistance to shock and bending. It also resists atmospheric and aqueous corrosion, either by virtue of purity of the metal or by virtue of the slag inclusions, or for some other reason. These special properties cause it to be in demand for pipe, chain cable, boiler stays, sheet iron and blacksmith's bar iron. For some of these purposes a variety known as charcoal iron (*q.v.*) is preferred. Wrought iron is moderately strong in tension, developing from 45,000 to 55,000 lb. per sq.in. ultimate strength. Furthermore it is a soft metal—Brinell hardness measuring 75 to 80. Likewise the production of big masses of it is tedious, and puddling requires a large amount of exhausting labour from skilled workmen. These facts all combined to hamper competition with the harder and stronger steel—the Bessemer's process showing how to make the latter in great quantity, rapidly and almost automatically. In 1883 70% of all the pig iron made in England was made into puddled bar; in 1897 only 5%.

Aston's Process.—Mechanical puddling furnaces have been proposed and used to some extent, but the manufacture of metal in small batches is not in keeping with modern mass production. A more promising development consists of the process established in 1927 in America through James Aston. Knowing the essential characteristics of the ferrite and slag constituting wrought iron, he produces pure iron in a Bessemer converter, following the regular steel-making practice, and pours this iron into a pool of synthetic slag, which has been melted in a large cupola. Strong evolution of gas in the metal causes it to granulate itself into very fine particles; the resulting spongy mass of iron and slag is withdrawn, squeezed and rolled in the conventional manner.

BESSEMER STEEL

Early Steel-making Processes.—Prior to 1870 the principal metallic materials of construction were cast iron and wrought iron. The former could be made quite hard, but then was brittle; the latter resisted shock excellently, but was comparatively soft. There was a great and growing demand for metal which was both strong, wear resisting and tough; but there was no method of producing cheaply enough to make, for example, railroad rails. Consequently, the discovery of the Bessemer process for making cheap steel was a godsend—an eager market was waiting; and in turn the satisfied market created other demands. Steel had been known for centuries. While accurate statistics are lacking one may reasonably guess that 250,000 tons a year of blister steel and crucible steel were being made in Europe in 1865. Blister steel

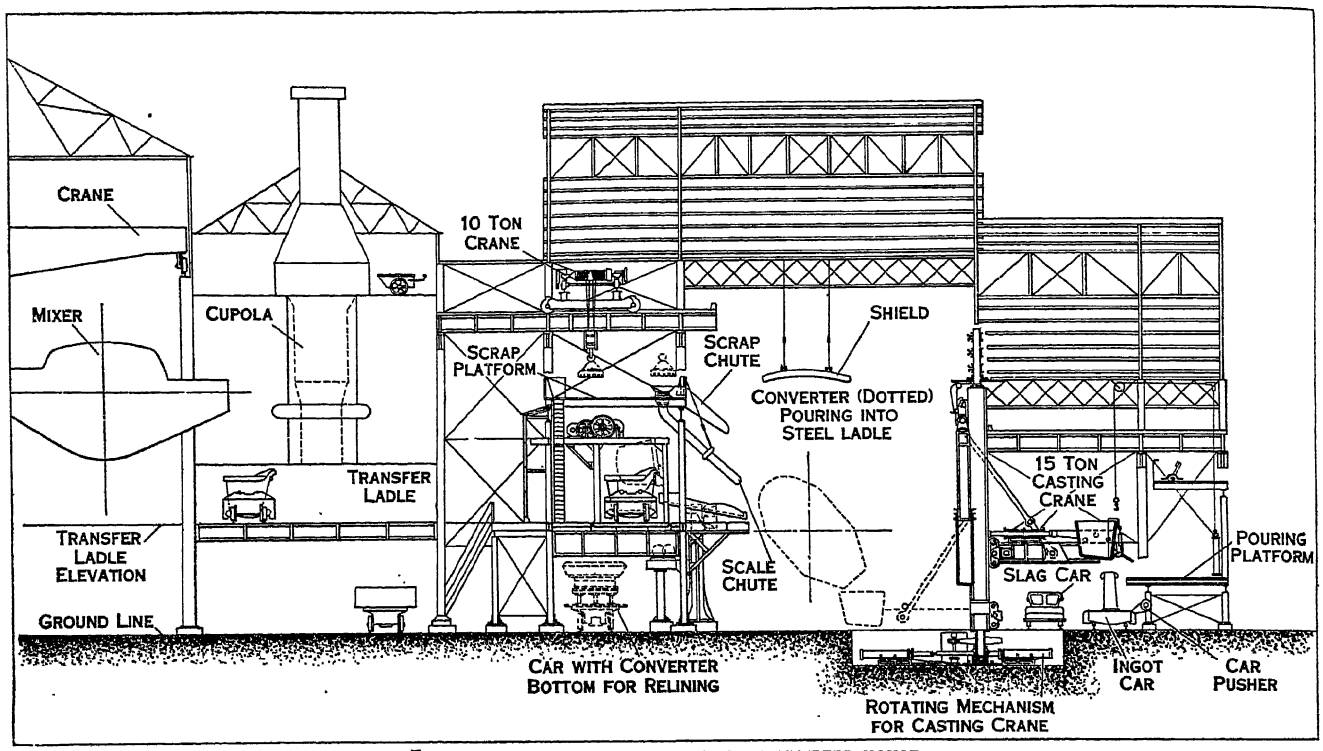


FIG. 2.—GENERAL CROSS SECTION OF CONVERTER HOUSE

was, and still is, made by packing wrought iron bars in a long stone box full of charcoal, and heating the container for several days at a full red (*see* BLISTER STEEL; CEMENTATION). Carbon gradually is absorbed by the iron under these conditions, and it becomes steel. In order to improve the quality by equalizing the carbon content in this steel, and also eliminating the slag contained in the original wrought iron, blister steel is cut in short lengths and melted in a clay crucible (*see* CRUCIBLE CAST STEEL). For the manufacture of fine tools and cutlery such processes survive even yet, principally in the Sheffield region where the industry thrived a half-century ago. But obviously this very indirect method of getting steel, bit by bit, was totally incapable of supplying the needs of the coming mechanical age.

Bessemer's Invention.—As has been pointed out the alloyed impurities in pig iron can be eliminated by oxidizing them. In all the old refining processes, iron oxide in the form of ore, mill scale, or iron silicate slag (basic cinder) is the means whereby the necessary oxygen is carried into the pig iron under purification. While experimenting on some methods for improving metal for cannon in 1856, it occurred to the English inventor Henry Bessemer that this oxygen for refining could be taken directly from the air if a blast were blown on or through the melted pig iron. On trial it not only purified the iron, but instead of blowing cold and freezing, the metal became hot enough to remain molten even when all the carbon was gone and hitherto infusible pure iron remained. The whole reaction required only a few minutes; at the end an ingot of mild steel could be cast, ready for the forge or rolling mill.

It took years of experimentation before the new process became a commercial success. The conservatism of engineers and constructors retarded the adoption of cheap steel and the useful mechanical auxiliaries, largely perfected by the American, Alexander L. Holley, which enables a modern plant with two converters to send forth a continuous procession of ingots, without halt, day and night (*see* BESSEMER, SIR HENRY; BESSEMER STEEL).

Converter House.—(*See* fig. 2.) Molten pig iron comes from the blast furnaces in ladle cars, and an overhead crane lifts the ladles and pours the contents into the mixer. By joining a reservoir of several hundred tons of metal wide variations in chemical composition in a single cast are lost by dilution. A reservoir of uniform and promptly available raw material is thus established. Uniformity and continuity are foundations of rapid production of Bessemer steel; neither of these results when converting metal direct from the blast furnace or remelted pig iron from the cupola —although the latter sources may be used in emergency. At the proper time a ladle of iron, 10 to 25 tons depending upon the size of the converter, is poured from the mixer; it tilts by rolling on a circular track under positive control of a screw mechanism or hydraulic ram. A small locomotive pushes this full ladle car to the converter house, and by means of a launder the contents are run into the hot converter, with mouth tilted over to receive the charge. The blast is turned on, the converter tilted up to vertical position, and the blow is on (*see* Plate I).

Conversion Process.—The converter itself (*q.v.*) is a cylindrical steel pot perhaps 10 ft. diameter by 20 ft. high mounted on elevated trunnions and geared into a rack and pinion so it can be turned completely over. It is lined a foot thick with a refractory mixture. The bottom bricks are perforated by many small openings, tuyères, through which air is sprayed into the metal at high enough pressure to keep it from trickling down into the wind box attached to the bottom of the converter shell, yet not so high as to throw too many splashings out the open mouth. Oxygen in the air blast burns the pig iron it first strikes. This product of reaction may be represented by FeO, and it is swiftly distributed throughout the churning mass. At the temperature of operation silicon and manganese atoms have a greater affinity for oxygen than iron has, so these two reactions occur:

$$Si + 2FeO = 2Fe + SiO_2$$
$$Mn + FeO = Fe + MnO$$

These oxides are insoluble in metal and accumulate into droplets of slag—a mixture of iron oxide, manganese oxide and silica. When the metals silicon, manganese and iron combine with oxygen, or burn, much heat is released—enough to heat the incoming air and escaping nitrogen, to provide for radiation losses, and to increase the temperature of the remaining metal and slag so it is always quite liquid. During this early stage of the blow the red hot nitrogen coming from the mouth glows faintly. Gradually the carbon begins to burn, thus:

$$FeO+Fe_3C=4Fe+CO.$$

A roaring boil then takes place in the vessel; the carbon monoxide burns in a big, yellow, luminous flame at the converter mouth, and countless flying sparks of metal and slag add to the spectacle.

In only a few minutes the carbon is gone; the flame flickers, and suddenly contracts. This is the signal for turning the vessel over on its side, and stopping the blast. Inside the hot converter is now a seething mass of fluid iron, practically free of silicon, manganese and carbon, covered with a thin layer of slag. The metal, however, contains much gas in solution and if cast immediately would solidify in a spongy mass. Consequently some cupola-melted spiegel—a pure pig iron containing 20% manganese—is run into the converter. A violent reaction ensues, wherein the steel is freed of oxygen by combination with the excess of manganese and carbon in the spiegel. The converter then tilts further over, discharging its contents into a waiting ladle. The blow has taken perhaps 12 min.; no greater time is necessary to add the spiegel, pour out the steel, turn the converter upside down to discharge any loose slag chunks, and back up to receive another ladle of liquid pig iron. A second converter alongside will be blowing while the first is dumping. In fact the whole equipment of the converter department is co-ordinated for a complete cycle every 12 to 15 min., and is built of the most rugged proportions, so delays from breakdowns will seldom occur.

Converter Lining.—The violent reactions at high temperatures cause considerable scour on the lining of the vessel; especially the tuyère brick at the bottom must be replaced after 20 to 25 blows. Holley is responsible for the plan of sectionalizing the converter shell; when a new bottom is required a car carrying a stout jack is placed under the upright converter, a series of bolts unloosed, and the jack lowered away, carrying with it the entire bottom part of the shell. This car is immediately replaced by another carrying a newly made bottom, already warm, ready for lifting and bolting into place. It is therefore unnecessary to leave a shell in the stand while it cools and the lining is repaired, dried and reheated—a matter of several days—but these sectional lining operations are done in a separate department and replacement of bottom or mouth portion requires less than 30 min. In American practice the lining material is a highly siliceous rock, ground with a little fire clay, moistened and tamped in place with pneumatic rammers. Such a lining is known as an acid lining, and steel made therein is called acid Bessemer steel.

Pig Iron Used.—Since the reactions described above leave untouched any sulphur or phosphorus, it is necessary that the pig iron entering the converter be quite low in these two elements. Furthermore silicon is limited by the rate of driving. It is the chief heat-producing element; if silicon in the pig is high the converter shell and its contents get superheated during continuous blowings and must be cooled either by dropping a quantity of cold scrap into the shell, by blowing steam in with the blast (which dissociates and absorbs heat), or by delays for radiation. On the other hand if the converter with a new bottom is a little cold, it is tilted partly over so some blast does not penetrate the iron, but burns the CO to CO_2 thus liberating more heat within the vessel. Maximum production may be had by blowing a pig iron with higher silicon and lower carbon; reducing the blowing time by charging mill scale or ore at the beginning of the blow; and charging scrap to absorb the excess heat generated. But in general the pig iron used for acid Bessemer practice, and the product therefrom will be about as follows:

	Carbon	Silicon	Sulphur	Phosphorus	Manganese
Pig iron . .	3½ to 4	1 to 1¼	0·05	0·09	½ to 1¾
Full blown .	0·03	0·01	0·05	0·10	0·03
With spiegel .	0·40	0·10	0·06	0·10	0·90

Growth of Uses.—Obviously such material as represented by the last analysis is immeasurably superior to wrought iron for railroad rails. The carbon content is responsible for hardness, wear resistance and strength which wrought iron could never acquire. Furthermore, the *amount* of carbon, and the corresponding degree of improvement in properties, is under control, for it is only necessary to place some charcoal in the steel ladle to make a higher carbon steel, or to use a spiegel or a ferro-manganese containing higher manganese and lower carbon when a milder or softer steel is desired. It is not surprising, then, that when the process was finally established on a producing basis in Bessemer's own plant in Sheffield, the product was rapidly absorbed for rails and tires. In 1868 there were 110,000 tons produced; in 1883 Bessemer steel reached its peak of production in Great Britain of 1,700,000 tons. Puddling had meanwhile declined; 70% of British pig iron went into wrought iron in 1883; only 5% in 1887. A similar story may be told of America. In 1867 460,000 tons of iron rails were made and sold for $83 per ton; that same year 2,550 tons of Bessemer steel rails were produced and some purchasers paid $170 a ton for them. By 1884, however, the last iron rails were made, steel had replaced them to an annual production of 1,500,000 tons a year, and the selling price was $32 per ton.

THOMAS-GILCHRIST DISCOVERY

Control of Phosphorus.—This so-called acid process demands low-phosphorus ores and pig, and such material in Europe is relatively scarce and costly. Early efforts to remove phosphorus in the converter failed. Arguing from an analogy in the puddling furnace, where a slag rich in iron oxide will carry off phosphorus oxides, it was thought that if the converter blast was carried on after the carbon was gone, much iron oxide would go to the slag, and it would then be in a condition to absorb the phosphorus. When this was tried, however, the iron wasted away, ate into and ruined the lining, but unfortunately had no effect on the phosphorus. Not until 1876 did the Englishmen, Sidney G. Thomas and Percy G. Gilchrist discover that if the converter were lined with a basic material like burned limestone, dolomite or magnesite, and if burned lime were charged with the pig iron, then a basic slag would form and be maintained in such condition that it would absorb and hold phosphorus oxides produced during the blow. These are the essential features of the basic Bessemer process now so widely used on the Continent for the production of so-called Thomas steel.

Basic Bessemer Process.—A modern basic plant is arranged much like its counterpart using the acid process. Converter shells are lined with different materials. Dolomite is freshly calcined in a cupola, ground with hot dehydrated tar, and the sticky mass tamped between the shell and a centre form. The perforated bottoms are lined two ft. thick, but even so they must be replaced daily.

In its modern development a heat of Thomas steel is made thus: Into a 10-ton converter 1½ tons of freshly burned lime are charged and then 10 tons of pig iron. The blast is turned on, the converter tipped up, and the blow proceeds exactly like an acid heat already described, but it continues after the carbon flame drops. In this last stage of the blow the following reaction occurs:

$$5FeO+2P=5Fe+P_2O_5$$

and the phosphorus joins with excess lime in the slag to form a calcium phosphate. There is no flame to indicate occurrences in the converter during this period. The duration of the after blow is judged from a knowledge of the phosphorus contained in the original pig iron. When the process is thought to be complete, the converter is tipped to its side, the blast turned off, and a spoonful of metal cast into an iron mould. This test ingot is chilled, hammered into a bar, and nicked, bent and broken. If the metal is brittle and coarsely crystalline, the air blast is resumed for a few seconds, and another test taken, and repeated until the metal is tough and fine grained. This finishes the blow. Next the slag must be skimmed off as closely as possible, because phosphorus has a trick of returning to the metal on slight pretext; then the spiegel or other recarburizer and degasifier is added, and the steel poured into the ladle. About the only additional equipment in the converter house needed beyond that found in

an acid Bessemer plant is some handy means of caring for the large volume of slag produced. This slag, by the way, is ground and sold as fertilizer, it contains up to 20% of soluble phosphoric acid.

Thomas Steel.—In this Thomas-Gilchrist process, the pig iron must have relatively low silicon to limit the amount of slag formed. Phosphorus is the principal heat producing element, and it may be as high as 3%. It is doubly essential that a mixer be used to store pig iron, in order that phosphorus may never show wide fluctuations in analysis, heat to heat. Percentages in average analyses are as follows:

	Carbon	Silicon	Sulphur	Phosphorus	Manganese
Basic pig	3½ to 4	0·5 to 1	0·05	2 to 2½	1 to 1½
Thomas steel	0·10 to 0·60	0·20	0·05	0·03 to 0·10	0·30 to 0·50

The process was introduced in Germany in 1879, and at the present time is used to refine the bulk of the pig iron produced from the Lorraine deposits. Approximately 15,700,000 tons of Thomas steel were made in France, Germany, Luxemburg and Belgium in 1926. It provides satisfactory material for all classes of tonnage steels used on the Continent, such as bars, boiler plate, pipe, structural steel and rails. But despite the fact that the Thomas-Gilchrist process was proposed to solve the problem of high phosphorus British ores, Thomas steel is not popular among English engineers, and hardly any of it is now made in England. This is probably due to the fact that the home ores do not smelt into a low-silicon high-phosphorus pig iron necessary for the economical operation of a basic converter, and further that the basic open-hearth furnace has meanwhile been developed to refine such phosphoric pig irons as are made.

OPEN-HEARTH PROCESS

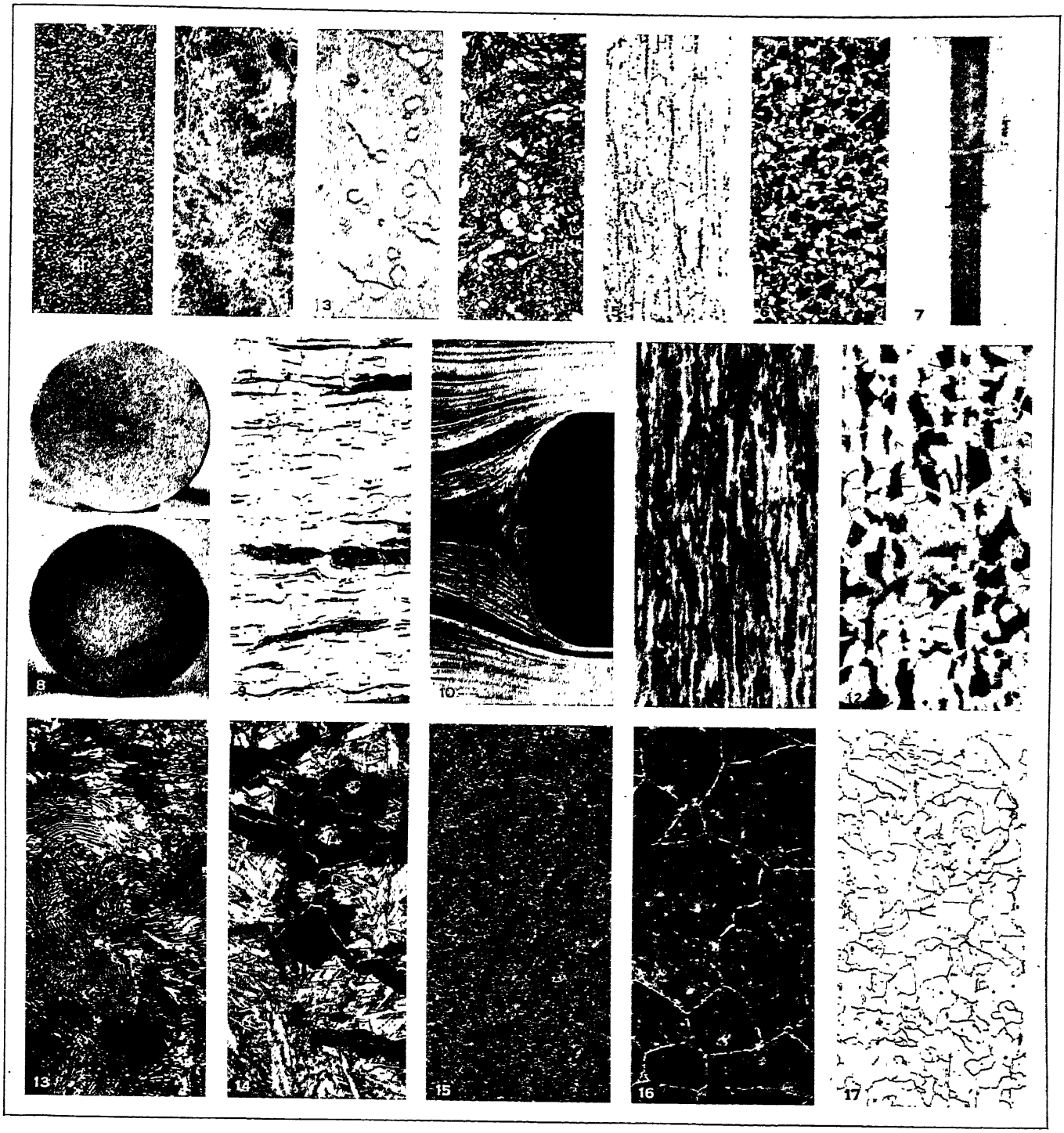
As soon as the Bessemer process attained a production stage it was found that the mild steels intermediate in carbon content, strength and ductility between carbon-free wrought iron on the one hand and high carbon crucible steel on the other, were most useful materials for machinery and engineering structures. These mild steels were really new materials, never before procurable in quantity, and inventors attempted to make them in ways which would not infringe the Bessemer patents. An insuperable difficulty was the inability of any furnace, even when burning high volatile coal under forced draft, to melt them. As in the puddling process, when the refining reached a certain stage, the metal became a pasty sponge. This obstacle was met by Sir William Siemens, who resurrected a forgotten proposal to regenerate some of the waste heat (*see* REGENERATIVE FURNACE). He passed the smoke through brick chequer-work; after the passages had thus been highly heated, air for combustion of the coal was drawn through the chamber. This pre-heated air had the effect of increasing the flame temperature materially. Using a furnace with such a device Emile and Pierre Martin made steel at Sireuil, France in 1864, by melting a good grade of pig iron, then adding some selected wrought iron scrap which alloyed with the pig iron, continuing these additions until the carbon content was reduced to the desired percentage mainly by dilution (the Martin pig and scrap process). William Siemens (*q.v.*) and his brother Friedrich found it necessary to erect an experimental furnace plant in Birmingham to develop the application of their ideas in the steel industry. By 1868 the principal features of the modern open-hearth process were there developed; namely, gaseous fuel, regenerative chequer-work for pre-heating both air and gas, a thin furnace roof of silica brick and the method of refining pig iron by ore or iron oxide (the Siemens pig and ore process). These entire furnaces, hearth, sidewalls and roof were made of highly siliceous refractories; the only slags which would not corrode these contain an excess of silica—so-called acid slags. Not until Thomas had shown how to remove phosphorus by a basic, high lime, slag in the basic lined converter did it occur to anyone to make an open-hearth furnace with hearth and side walls of sintered dolomite—lime and magnesia oxide—and to refine the steel under a high lime slag. J. H. Darby built the first of these basic open-hearth furnaces at Brymbo, Wales in 1884. The most available ores in both England and America smelt into pig iron well suited for such basic open-hearth refining; furthermore the product is distinctly superior in quality to Bessemer steel. Consequently at the present time the latter is used in America for the production of low-carbon steels like ordinary steel sheet, pipe, wire, bars and hoops. Basic open-hearth steel, however, makes boiler and ship plate, structural steel, rails and all the higher carbon machine steels, such as shafting and forging billets. Production by processes is shown in the following table—it will be observed that the basic open hearth is competing with the basic converter even on the Continent.

	United Kingdom 1925	United States 1926	France 1926	Germany 1926
Acid converter	447,200	6,934,568	60,699	..
Basic converter	28,300	..	5,812,264	5,452,223
Acid open hearth	1,968,600	1,038,664	..	116,126
Basic open hearth	4,744,000	39,653,315	2,458,296	6,484,467
Electric	64,100	651,723	83,554	104,564
Crucible and others	133,200	15,493	15,189	

Furnace Auxiliaries.—The essential furnace is often dwarfed by the auxiliaries found necessary for rapid and economical production. (*See* fig. 3; also REGENERATIVE FURNACE.)

In the first place adequate fuel must be provided; consequently alongside is another building containing gas producers (*q.v.*) of the continuous type. A series of such producers in operation discharge gas into one main pipe from which it is drawn to the furnaces as needed. The producer house must have therefore adequate coal handling machinery; a plant with 10 60-ton furnaces would use 400 tons of coal a day, with means for hauling or sluicing the ashes away, and boilers for raising steam to blow into the producers. Gas producers are usually found as standby equipment, even where other fuels are used, such as blast furnace gas, by product coke oven gas, natural gas, tar, oil and powdered coal. Next a stock of adequate raw material is necessary. If open-hearth and blast furnaces are within the same fence, melted pig iron (hot metal) will be used. That requires a mixer for intermediate storage. Otherwise an ample stock of iron in pigs is required. Furthermore a big tonnage of steel scrap of various kinds is used—the proportions of pig iron and scrap charged into steel making furnaces now depends solely upon the relative availability and cost of these two materials. Scrap must be segregated as to nature and approximate analysis; big shears and drop balls (skull crackers) are necessary for cutting and breaking unwieldy pieces; travelling cranes and lifting magnets are installed for economical handling of this material. Bins and stockpiles must be provided for the various special metals used for alloying or degasifying the hot steel, for the limestone, fluorspar and other fluxes, for the silica, chrome, magnesite and other fire brick to repair the furnace, for the dolomite or silica rock used for making the bottoms. In basic open-hearth plants an auxiliary building is necessary for grinding, calcining and storing the dolomite continually needed for repairing the furnace bottom and side walls (banks). Spiegeleisen, if used for a deoxidizer, must be melted in a cupola or electric furnace.

Means must be provided for introducing the fuel into the furnace, and reversing the flow of flame at frequent intervals. This requires proper valves in the flues, with an appropriate series of interlocking operating devices. Latter-day trends in furnace design call for much shorter and more direct flues than shown in the cross sectional view, and the use of water cooled gate valves offering no obstruction to gas flow when open. Waste heat boilers are also quite frequently placed between regenerators and chimney, together with fans to pull the hot gases through them. A most interesting device is installed to charge solid material through the doors into the furnace itself. By this means long delays between heats to refill the furnace are avoided, together



METALLOGRAPHY: ETCHING AND MICROSCOPIC EXAMINATION OF STEEL

1. Sorbite, showing structural fineness (50 diam.). Lightly etched
2. High carbon steel; carbon content 1.15% (500 diam.). Etched
3. Quenched high-speed steel; austenite, containing small grains of carbide which separates from the metal on cooling (500 diam.). Etched
4. High-speed steel, properly drawn at 600° C to give best cutting properties; martensite changing to troostite; white grains are excess carbide. Change occurs near 700° C to pearlite and cementite (500 diam.)
5. Steel sheet with grains flattened by moderate cold rolling (500 diam.). Etched
6. Annealed medium hard steel containing 0.60% carbon (100 diam.). Etched
7. Sulphur print from section along centre of steel bar, showing high sulphur core. Sulphur in bar reacts with silver compound on paper
8. Photograph of cross section of deeply etched steel bars showing uniform structure in bar above, segregated centre of crystals in bar below
9. Wrought iron, section parallel to rolling direction (500 diam.). Etched
10. Banding or flow lines due to high phosphorus regions in base of shrapnel shell forging (½ size). Etched with ammonium persulphate
11. Section of high carbon steel wire, drawn to limit (350 diam.). Unetched
12. Structural steel containing 0.25% carbon, showing banding of constituents (75 diam.). Form of crystallization indicates strength. Etched
13. Annealed pearlite containing 0.90% of carbon (250 diam.). Etched
14. Troostite (dark areas) in martensite (light crystals) (200 diam.). Etched
15. Nickel steel forging (3%) before heat treatment (7 diam.). Etched
16. Nickel steel ingot (3%) showing coarse grain structure as compared with fig. 15 (7 diam.). Etched
17. Ingot iron; pure ferrite with small non-metallic inclusions (100 diam.). Note comparative purity of untreated iron. Lightly etched

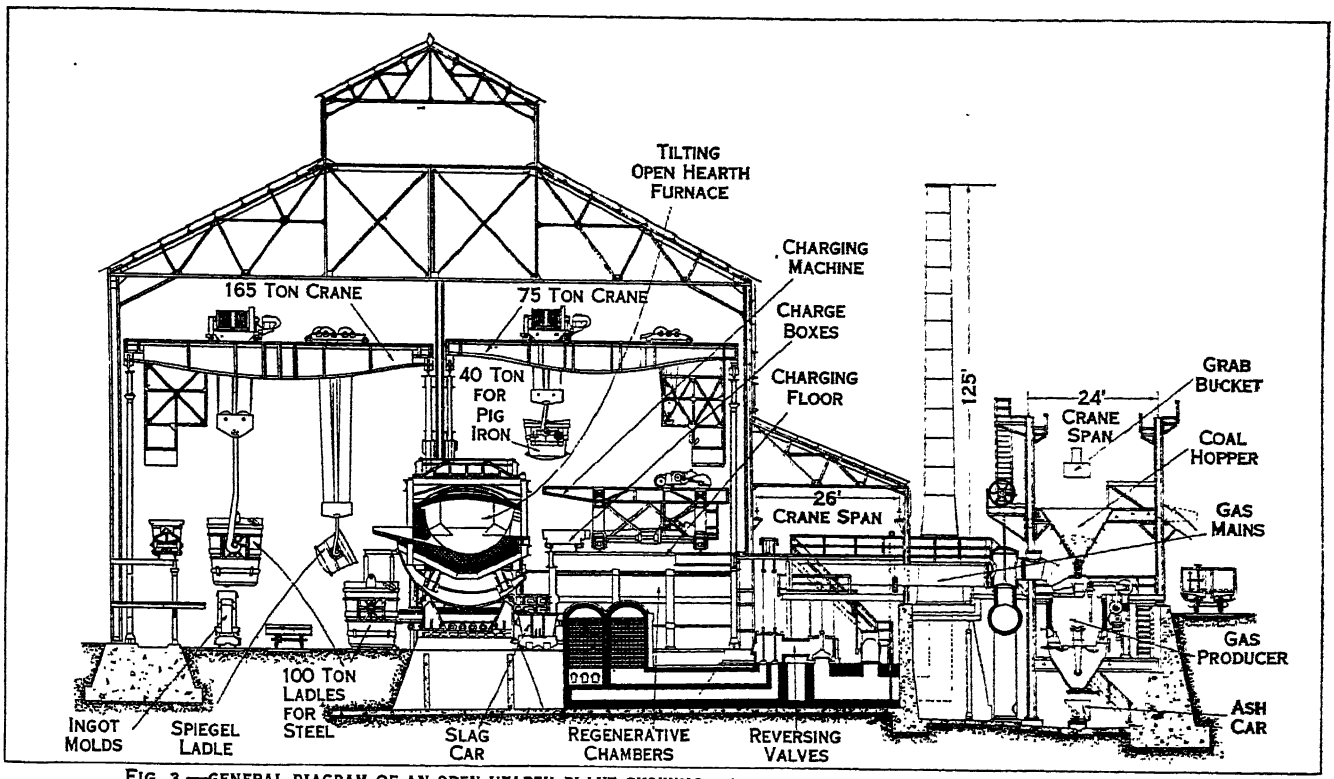


FIG. 3.—GENERAL DIAGRAM OF AN OPEN-HEARTH PLANT SHOWING GAS PRODUCERS AND CRANES FOR HANDLING METAL

with much exhausting labour. All solid materials are now loaded into charging boxes, cast steel trays about 24 in. wide and deep and about 4 ft. long, thus holding at least a ton of the bulkiest steel scrap. A complete charge for a furnace is assembled into 40 or 50 such boxes, placed on a train of small flat cars, and moved to a track running close to the furnace doors. On a wide gauge track alongside, the charging machine operates. Its ram engages an end socket on the box and is locked in. The ram then lifts the loaded box off the car, moves it forward through the open door into the furnace, slews it to either side and tips it upside down, discharging its contents in the correct place. These motions are then repeated in the reverse order. When the empty box is on the car, the charging machine moves sidewise, taking with it the entire train of loaded cars until the next full box is spotted directly in front of the proper door. This is then picked up, thrust into the furnace, and dumped. In this manner a 60-ton furnace can be loaded in less than an hour. Equipment must also be installed to pour the finished steel into ingot moulds, but this is an operation which, both in the principles involved, and in practice, is similar to casting a Bessemer heat, and will be described later.

Open-hearth Steel from Cold Metal.—The basic open-hearth process (1928) makes by far the most steel. Many steel-making furnaces are distant from blast furnaces, so they operate entirely on cold stock, and as noted, any proportion of pig and scrap may be charged, as economics require. This process as commonly practiced in a 50-ton furnace and its elementary chemistry are here briefly explained. After a furnace has been tapped and the bottom and banks repaired charging is begun. Plate scrap, if available, is spread out to protect the bottom, followed by from 2½ to 10 tons of limestone, depending upon the impurities to be removed from the pig and scrap. The furnace is then filled as full as possible, with scrap, pig iron and some iron ore; the doors are then closed, the flame given an excess of air and melting begins; as the mass melts and settles, the balance of the cold metal is added. Melting pig iron will trickle down over the white hot steel, still solid. Silicon and manganese in the pig iron droplets oxidize by the excess oxygen in the furnace atmosphere, and join with the iron oxide forming on the white hot steel and some of the lime on the bottom or furnace wall forming a slag. In four to five hours the molten metal is virtually free from silicon, and much manganese has also gone into the slag. Vigorous stirring is necessary as chemical reactions only occur at the surfaces where metal and slag are in mutual contact. This is effected principally by gases rising from the limestone, and some two hours after the metal is fluid it continues to break up, thus

$$CaCO_3 = CaO + CO_2$$

The gas coming to the surface in big bubbles causes a characteristic boil. The lime also floats up, joining the slag as a base, not only releasing some of the iron oxide contained therein for refining reactions, such as

$$2P + 5FeO = P_2O_5 + 5Fe$$

but also maintaining the basic slag necessary to dissolve and hold this phosphorus oxide. When the lime is all up further boiling in the bath is due to the chemical reaction between iron oxide and carbon, which has been going on continually but its mechanical effect somewhat overshadowed by the lime boil

$$FeO + Fe_3C = 4Fe + CO$$

The iron oxide is dissolved by the metal from the slag. Bubbles of carbon monoxide gas evolved continue to keep the metal and slag in motion. The active refining reagent in the open-hearth furnace is the same as in the Bessemer and the earlier refining processes, namely iron oxide, but its origin is different. In the open-hearth process iron oxide is formed by oxidation of the steel during melting, picked up from the rusty scrap, and is added as desired to the slag in the form of ore. During the late refining period, the furnaceman frequently takes a spoonful of metal from the bath, pours test ingots and breaks them, judging from the fracture the content in phosphorus and carbon. It is necessary to regulate the proceedings so that phosphorus in the metal shall be down to the desired minimum some time before the carbon is down. This relative elimination can be controlled by adjusting the temperature, reversing the flow of gases more frequently increases the heat, changing the slag by adding either lime or ore, increasing its fluidity by adding fluorspar (CaF) or increasing the carbon by adding some low-phosphorus pig iron. In about three hours the carbon boil should subside, the bath should be low in phosphorus,

and the slag essentially a high lime silicate—to hold the phosphorus; the furnace is then driven hard to increase the metal's temperature sufficiently for casting. The slag and the metal have been slowly losing iron oxide and carbon respectively by mutual interaction, and the metal gives up considerable gas held in solution. When the word is given, the furnace crew thrusts a long heavy bar through an opening in the centre door, across the furnace into the bath; several battering-ram thrusts break through the plugged tap hole, and white-hot metal rushes down the spout into a ladle set beneath. This ladle is just large enough to hold the steel; slag which follows after overflows into a pit or slag ladle alongside.

As in the Bessemer process, it is necessary to add manganese to this metal in order that it may not evolve gas when solidifying and form a spongy ingot. This is done by placing some 80% manganese alloy into the ladle before tapping; any deficiency in carbon is made up by broken coke or charcoal. These are absorbed by the superheated steel coming from the furnace, and distribute themselves throughout the entire mass before the steel is cast. The pig iron used should be free from sand and low in silicon, in order to limit the total volume of slag; its phosphorus content is considerably lower than in the basic Bessemer, else some will remain after the carbon boil. Manganese of 1 to 2% helps burn out some sulphur during melting, and quiets the steel during the finishing stage.

VARIATIONS IN PROCESS

Use of Molten Pig.—Various methods have been proposed to speed these actions, which take in all about 12 hours. By ideas suggested to Ambrose Monell at Pittsburgh in 1900, 75% or more of melted pig iron is used and a heat completed in nine hours. The process is as follows:

Into a 50-ton furnace are charged 5 tons of limestone, twice as much iron oxide and 10 tons of scrap. After about two hours the ore is a pasty mass, a little of the lighter steel has melted, and forty tons of melted pig iron are rapidly poured into the furnace. Chemical reactions between iron oxide slag, silicon, manganese, phosphorus and carbon in the pig iron start immediately, and go forward simultaneously but at different rates. A slag containing silica and manganese oxide forms without delay; iron ore and calcined lime work up from the bottom and enter the slag. As more and more of the iron and lime comes up, the slag becomes more basic, *i.e.*, the proportion of CaO and FeO to SiO_2 increases, until it can absorb and hold the phosphoric oxide being formed by the familiar reaction with iron oxide. Slag also becomes more viscous with increasing lime; the carbon escaping in gas bubbles causes it to froth, swell to great bulk and overflow through an opening above and alongside the tap hole, thus carrying out of the furnace most of the phosphorus, manganese and iron ore. In about two hours the frothing dies down, because the carbon content has been reduced, both by continued oxidation and by dilution with the now melted scrap. The increased heat, however, causes the limestone still on the bottom to break up into CaO and CO_2, the gas bubbles cause a vigorous lime boil, the lime replaces iron oxide in the slag, allowing it to re-enter metal for the slower reduction of the residual carbon. Final adjustment of slag, temperature and composition during refining, finishing, and tapping stages is no different than when using cold pig.

Continuous Steel Making.—Benjamin Talbot first built furnaces for continuous production of steel at Pencoyd, Pa., in 1899. They are of large capacity—200 to 300 tons of metal—and are mounted like a mixer on trunnions; they can be tilted forward and slag skimmed or metal poured through a spout, normally far above the liquid bath. In operation, a full charge of metal is refined in the usual way, when ready to pour, the slag is drawn off first, and then about one-third of the steel is poured into waiting ladles. A new and highly active slag is then made up by charging limestone with an excess of iron oxide. When heated sufficiently, melted pig iron is poured in to refill the furnace. Refining is very rapid, and casts of completed steel can be made at 6- to 8-hour intervals. By virture of the ability to remove slag easily when its utility has gone, a tilting furnace is very useful for refining steels to various compositions, from a charge of molten pig iron without scrap.

Duplex Processes.—Other means of speeding the rather deliberate open-hearth reactions are used extensively, perhaps the most important being a combination of acid Bessemer and basic open hearth. This enables the steel-makers to start with a high sulphur ore, smelting it to a high silicon, low sulphur pig iron, blowing the silicon and carbon out in a converter, and transferring the molten steel to a large tilting furnace where the phosphorus, oxide and gases are eliminated. In American practice 250-ton tilting furnaces are used; 50 tons of molten steel are reserved in the hearth, a highly basic combination of ore and lime is charged, melted, and about 150 tons of blown metal poured in. When the temperature and slag are correctly adjusted, a ladle of basic pig iron from a mixer is charged. A strong carbon boil ensues immediately, and the slag foams up and overflows, carrying much of the phosphorus and some sulphur. When the first reaction quiets down, a second ladle of pig iron causes it to resume, and drives out the rest of the phosphorus. The slag is then skimmed off, enough pig iron is added to bring the carbon to the desired percentage, and the metal finished and superheated for pouring. From such a furnace, 200 tons of steel can be taken every 3 or 4 hours. Other variations in this practice have enabled the furnaceman to finish heats in even shorter time.

Duplex processes of the sort described but using two open-hearth furnaces originated in Germany and are used for irons somewhat too low in phosphorus for the basic converter. In the first furnace, run at a rather low temperature, the phosphorus and silicon are eliminated into a lime slag rich enough for use as a fertilizer. The furnace is tapped, the slag separated, and the metal introduced into another and hotter furnace, wherein awaits a proper slag for rapid carbon elimination. This is called the Bertrand-Thiel process; the Hoesch modification recharges the partly purified metal back into the furnace from which it has just been drained. Super-refining molten basic steel in an electric furnace is another variety of duplexing which has been practised in America; by eliminating sulphur and oxidizing particles, most excellent steel is made.

Acid Steel.—Furnaces made with siliceous bottoms and banks, the descendants of the original open-hearth furnaces, still exist in considerable number. They make steel under slags which are essentially mixtures of iron, manganese and silicon oxides, having well over 50% of the latter, and are so quite acid in nature. Such acid steel has an enviable reputation for quality, but since the furnace reactions remove neither sulphur nor phosphorus, the raw materials and fuel must be selected with much more care; low silicon and high manganese are also desirable.

Pig and scrap, as available, are charged cold into the furnace, which has a higher roof to withstand the higher refining temperature; during melting, nine-tenths of the manganese and silicon are oxidized, and join with the rust and burned iron to form a slag. Carbon is eliminated slowly by reaction with the iron oxide in the slag; a little ore is added some two hours after the charge is well melted to keep this reaction going until the residual carbon in the metal equals that required in the steel being made. Temperature is driven higher and higher. Toward the end of this refining period—which may require seven hours—some manganese and silicon re-enters the metal, reduced from the slag by obscure chemical reactions. They are very effective in removing oxygen and other dissolved gases. At the end the metal is slowly losing carbon but gaining manganese and silicon. However, manganese is still too low for most steel specifications, so an appropriate amount of ferro-manganese is added some 20 min. before tapping. A complete cycle of operations may require up to 16 hours when making steels for ordnance. The superiority of acid open-hearth steel is due to the better grade of raw material used, the small amount of slag formed (perhaps 7% of the metal), the more deliberate working of the heat enabling the furnaceman to bring his metal to the right analysis without making large additions of alloys, and the ability to eliminate gases and non-metallic impurities from a super-heated fluid metal while it is still in the furnace.

ELECTRIC STEEL

Electric furnaces (*q.v.*) are usually round in plan, with low side walls, flat domed roofs and invert bottoms, built inside a stout bowl of steel plates, which in turn is attached to some tilting device. Side walls are pierced by one or more doors and a pouring spout. The side wall and bottom linings may be either acid—silica brick and fused siliceous material—or basic magnesite. (The acid furnace is confined generally to small installations in foundries, and is merely a melting and super-heating device, since the unique carbide slags to be described later cannot be formed inside a siliceous lining.) Roofs are of silica brick, and are pierced for carbon or graphite electrodes, one for each phase of current, of proper size to carry the electricity without undue resistance. Furnace capacities range from ¼ ton for small foundries, to 50 tons for super-refining liquid steel. Size is limited by the size of electrodes available; of the latter, a carbon 40 in. in diameter is the maximum; a 7-ton furnace would be about 12 ft. in outer diameter, with 13 in. side walls, and hearth 5½ ft. inside height. In operation, the electrodes are automatically adjusted so the lower ends are constantly a correct distance above the slag. Electric currents of large amperage arc cross this gap, flow through the slag to the metal and there neutralize equal currents of opposite phase led in through the other electrodes. Heat is generated principally by the resistance offered by the air gap and the slag layer to the flow of this current. The electrodes are consumed gradually, combining with oxygen of the air within the furnace, producing a carbon monoxide atmosphere, desirable for steel refining.

Advantages of Electric Heat.—No virtue is given to electric steel by the electricity. It is merely a convenient source of heat, under close control. The advantages of electric furnaces for steel making are: (*a*) the ability to generate a high temperature and thus cause certain desirable reactions to occur; (*b*) the virtual absence of products of combustion and their undesirable compounds of carbon, hydrogen, sulphur and oxygen; (*c*) the ability to remove a slag and make up new ones, thus controlling refining reactions; (*d*) the metal is hotter than the refractory, a prime advantage in cost over crucible melting; (*e*) less slagging of alloying elements, thus making for economy and control of chemical composition within narrow limits. Such advantages are illustrated in the process of super-refining molten metal from the open-hearth furnace; in such operations the basic electric furnace is a unit of a duplex or even a triplex process—the pig iron may be desiliconized in an acid converter, de-phosphorized in a basic open hearth, and de-oxidized and de-sulphurized in a basic electric furnace.

Super-refining Molten Steel.—Open-hearth steel is taken from the furnace when the carbon has dropped to the required figure, and a little ferro-silicon or aluminium added to the ladle to prevent further decarbonization during the transfer. In such condition the phosphorus and silicon are both very low—0·010% or less—while the sulphur depends upon the purity of the metal at the beginning, none being lost in the process so far, in fact the metal picks up a little from the furnace gases. If a nickel steel is to be made, the correct amount of shot nickel is added when this liquid metal is poured into the electric furnace. After the current has played long enough to remelt any crust of metal which may have chilled, a highly basic white slag is made up and melted, consisting mostly of burned lime with only enough silica sand and fluorspar to give it the proper fluidity. In quantity this would amount to about 3% of the metal. An excess of ground carbon is then shovelled in, the furnace closed, left under current for from 1½ to 5 hours, depending upon the quality of steel required, and the doors opened only for sampling or adjusting the slag. Under these conditions of a reducing atmosphere, a high lime slag, and intense heat, calcium carbide is formed by reaction between the lime and crushed carbon

$$CaO + 3C = CaC_2 + CO$$

Slag samples quenched in water give off much acetylene (*q.v.*) easily distinguished by its characteristic odour. Such a carbide slag not only reduces oxygen in the steel but is capable of abstracting the sulphur. The reaction for the latter may be something like this:

$$3MnS + 2CaO + CaC_2 = 3Mn + 3CaS + 2CO$$

By this means ordinary open-hearth charges which usually melt to 0·05% sulphur are reduced to one-half that amount in a four-hour cycle, while selected charges melting to 0·015% sulphur can be driven to less than 0·010% in a heat taking 8 hours. It will be observed from this reaction that some manganese is necessary. This will be residual in the open-hearth metal, for it has been found that if say 2% manganese is in the original pig iron, the resulting steel, containing 0·30 to 0·50 manganese will be of much better quality, sounder and cleaner, than from a low-manganese charge.

When the soapy slag stops its slight foaming, it is a sign that desulphurizing and deoxidizing is about completed, and the various alloys necessary to make the required analysis are added at intervals in order of their oxidizing power, namely, ferro-silicon first, then ferro-manganese, ferro-chromium, and finally ferro-vanadium. Carbon is picked up from the carbide slag and from these alloys. After all these alloys are melted and diffused the current is shut off and the metal lies quiet for 30 min. or more, to allow entrapped particles of slag to arise and the superheated metal to cool and liberate dissolved carbon monoxide gas. Slag is then most carefully skimmed, and the steel poured into a ladle which may contain a little carbon, ferro-silicon and ferro-zirconium. After 30 min. further cooling the metal is teemed into warm, scrupulously clean moulds with hot tops. A sectioned ingot will show no cavities as large as a pin head.

Quality of Deoxidized Steel.—Quality of such deoxidized and desulphurized steels rests in a number of characteristics, some not capable of evaluation, such as better response to heat treatment, less non-metallic inclusions, as shown under the microscope and after deep pickling in strong acid. A better gauge is the transverse properties. If a well made heat of basic open hearth steel is forged into a big gun, tension test pieces cut out of this forging will show high ductility if the piece is cut in a directon parallel to the axis of the gun. On the other hand if these test pieces are cut tangentially to the bore, the ultimate strength is satisfactory but the ductility is not much more than half the longitudinal piece. Unfortunately this transverse weakness is in the very direction which must bear the heaviest stress when the gun is fired. An accepted explanation of this phenomenon is that the work of forging ranges the non-metallic impurities into layers parallel to the faces of compression, and interrupts the metallic continuity. Obviously, the cleaner the steel the less would be the transverse weakness. For that reason important forgings, such as hollow tubes to resist internal pressure, are commonly made of acid open-hearth steel. Super-refined basic electric steel is even better, as shown by the following typical tests from big gun forgings of nickel steel:

	Longitudinal	Tangential
Ultimate strength, lb. per sq. in.	110,000	110,000
Elastic limit, lb. per sq. in.	58,000	58,000
Elongation in 2 in., %	56	42
Contraction in area, %	24	21

Melting Cold Scrap.—By far the larger number of electric furnaces are of small capacity for melting cold scrap. While it is possible to refine impure pig iron in either the acid or basic electric furnace, it has been generally found more economical to start with clean, relatively heavy, high manganese scrap and melt without additions of iron ore. In a basic furnace considerable lime would be charged into the empty furnace; melting is done under the heaviest power input practicable. The slag formed on the steel is always black from the rust and oxide formed during melting. This slag is removed as soon as the charge is melted, and some ground carbon electrode butts are shovelled into the furnace and flapped under the metal. As the carbon dissolves, it first tends to deoxidize the steel

$$FeO + C = Fe + CO$$

and the carbon monoxide gas comes up in bubbles. Some surplus carbon helps bring the carbon to the required analysis. Then a

white or carbide slag is made up, and the refining and alloying is done with current of lower voltage and as described in detail above. Whereas a large furnace for deoxidizing clean liquid open-hearth steel can turn out a heat of steel in 2½ hours with a current consumption of 150 kva. per ton, a heat from cold metal in a small furnace requires 6 to 8 hours and consumes about 650 kva. of electricity per ton of steel. A typical cycle would be:

	Hours
Repairs and charging	1
Melting	2
Skim and make up white slag	½
Deoxidation	2
Soaking	1
Kill, cool and pour	½
Total	7

If the carbon is a little low, washed metal (a pure pig iron) is added after the deoxidation period. It is also customary to add a little ferro-silicon about 30 min. before pouring.

Statistics show that electric steel has practically supplanted crucible steel in America, but has not been so successful in Great Britain. Italy being rich in water power, but very poor in fuel, has about 200 electric furnaces with annual capacity of one million tons, but nearly all of them produce tonnage steels. Much controversy exists as to the relative quality produced by the two processes. It is probably true that there is little difference when selected raw material is charged, an expert furnaceman is employed, and equally careful pouring, forging and annealing practice is adhered to—in other words, when equal care is given to the respective heats. But steel from either process can be disappointing when conditions get out of control. The crucible is more convenient for smaller casts of plain high-carbon steels; the electric is more convenient for heavy ingots of lower carbon, higher alloy steels.

INGOTS

Gases in Liquid Metal.—Early attempts to make steel in England by Bessemer's process were failures because the metal when poured into ingot moulds boiled over and the remaining portion when solid would be full of blow-holes, like a Swiss cheese. Robert Mushet noted that the only apparent difference between sound ingots and the spongy ones was that the former were made of high-manganese pig iron and a little manganese remained in the steel; consequently he proposed adding some of the metal after the blow. Thus originated the practice already described of adding spiegel or ferro-manganese to heats of steel made by any of the Bessemer or open-hearth modifications. Superheated liquid steel absorbs gases from the atmosphere or oxygen from the slag. This gas is only slowly evolved as the steel cools off, but it boils out vigorously just at the freezing point. In the crucible and acid open-hearth process much of this oxygen is eliminated by holding the melted metal quietly in the furnace until reactions between the siliceous linings and the metal allow the latter to absorb some silicon which in turn is very effective in removing dissolved or combined oxygen existing in the steel, and causing it to solidify quietly without effervescing, which imparts superior physical properties. This time-consuming reaction is avoided when producing cheaper steels in great tonnages by adding the degasifyers to the steel in the ladle, or even as it is poured into the ingot. Melted spiegel-eisen is used for medium carbon Bessemer steels. Since spiegel ordinarily contains 20% manganese and 5% carbon, it will be observed that sufficient manganese to quiet the steel will also introduce considerable carbon. Should this be too much for the desired grade of steel, ferro-manganese is used instead. Since a relatively small amount of this is required small pieces are placed in the ladle, and melted by the inrushing steel; if the metal on casting still seems too effervescent, a few aluminium shot are thrown into each ingot. The principal effect of each of these metals is to rob harmful iron oxide existing in the steel of its oxygen, thereby transferring it to MnO, SiO_2 or Al_2O_3 as the case may be. These oxides are highly insoluble in metal, and tend to accumulate into slag particles and float; but there is little opportunity for such elimination when the reactions occur in the ladle or ingot mould.

Teeming Practice.—It is usual practice to transfer steel from converter or open-hearth to ladle somewhat too hot to pour; also to use a ladle of correct size so most of the slag overflows. Ladles, therefore, contain from 5 to 200 tons of steel, depending on the furnace served (*see* fig. 4). They are strong steel pots, lined with fire brick, and equipped with trunnions and shackles for crane transport. The hot metal is kept in the ladle sometimes as much as half an hour, to enable all trapped slag particles to float. Then the ladle is carried to the ingot moulds, and the metal teemed through a hole in the bottom. When one mould is filled, the metal stream is interrupted by lowering the stopper until the ladle may be moved to an empty mould. Splashing against the sides of the moulds must be carefully avoided, for such splashings are the most general cause of surface defects on the finished articles. In Bessemer plants hydraulic jib cranes are usually employed for handling steel ladles, a practice standardized before the advent of electric travelling cranes. During pouring of the entire heat the ladle is stationary; ingot moulds are moved successively up to the nozzle by a car-pusher, a hydraulic ram which engages the side of an ingot car, and pushes it forward the required distance. This means that the solidifying metal is jostled around more or less, a practice which causes some unsound ingots. The steel castings are ordinarily teemed in the same way; furnaces in steel foundries are usually very small as compared with furnaces serving rolling mills. 97% of all the steel made is cast into ingots.

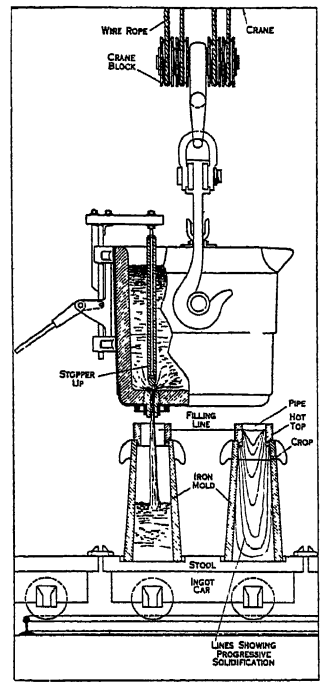


FIG. 4.—DIAGRAM SHOWING LADLE AND METHOD OF POURING INGOTS; AND LINES SHOWING PROGRESSIVE SOLIDIFICATION OF INGOTS

Cavities in Ingots.—Well-killed steel contracts in volume when it changes from liquid to solid; consequently a mould poured level full will have a top cavity, or pipe, when solid. Good practice so proportions the chilling effect of the mould, the temperature of the steel and the rate of pouring that the ingot solidifies from the bottom up. A hot-top—a preheated firebrick collar—set on top of the mould, as shown, is a most useful device for keeping the top portion of the metal fluid until the last, and in condition to feed and fill the shrinkage cavity below (*see* fig. 4). A certain segregation or concentration of alloying elements also occurs toward the pipe; consequently all the defective top must be cropped as indicated and remelted as scrap. Segregation and piping is also minimized by casting ingots big-end-up and by slow pouring of rather cool metal. The latter is well accomplished by having several ingot-moulds on one stool, teeming into the central one, and allowing metal to rise in the others through connecting passages in the common base. Enough gas is left in most low carbon tonnage steels so a slight effervescence occurs in the mould, just enough to counteract the piping tendency. When properly made and cast, such ingots will have a flat top, a smooth solid surface, but a number of deepseated small blow holes. During subsequent rolling these are squeezed shut and the metal welds together more or less effectively.

Stripping and Soaking.—Size of ingots depends upon the use to which the metal is to be put. Ingots of alloy steel and high grade tool steel sometimes weigh no more than 100 lb. Forging ingots are from two to five times the thickness of the biggest part of the resulting forging; those for rails, plates and structural shapes are adjusted to the size and capacity of rolling mill, and

the cross section of the desired product; for rolling mills they are generally square in cross section, with rounded corners, and about three times as high as thick. A common size is 2x2x6 ft. weighing about 6 tons. Forging ingots are frequently fluted hexagons or octagons in cross section. The moulds are heavy-walled iron castings, made of low-phosphorus low-sulphur pig iron, such as is suitable for the acid Bessemer process, sprayed with lime wash or other coating. When the metal in the ingot walls has well solidified, the train of moulds is moved to a stripper, an overhead crane with a vertical plunger which can be forced down by suitable gearing on top of the ingot, holding it down against the stool. A pair of stirrups then loop over the ears on either side of the mould, and lift; if the inner surface of the mould is in good condition and smooth, no difficulty is had in thus removing the mould, and it is then placed on an empty car alongside. At this time the surface of the ingot is at a full red heat, yet the interior may still be semi-fluid. To equalize this heat the ingot is placed in a soaking pit, a square fire brick chamber large enough to contain two to six ingots standing on end; an arched cover rolls aside for entrance. Auxiliary heat is supplied as necessary by a gas-air flame, operating through regenerative chequer-work, ports and auxiliary control as described for open-hearth furnaces. Pit capacity for at least 100 ingots is required to maintain a steady supply of properly heated metal to a modern rolling mill.

ROLLING MILLS

Hot Working.—A spongy lump of wrought iron, hot from the furnace, requires forging in order to squeeze out much of the trapped slag, and to consolidate the metal. Even the best ingot of steel is improved by hot work, such as forging or pressing; its fracture is changed from a coarse crystalline cleavage like sugar to a mossy or fibrous appearance associated with greatly increased toughness; it also becomes more amenable to heat treatment. Formerly all this was done on the blacksmith's anvil. Massive gun tubes and armour-plates are forged slowly in hydraulic presses; heavy engine parts, axles and cranks are beaten out by steam-hammers; repetition tools, levers and machine parts are forged under drop-hammers. In every instance the aim is to convert a steel casting (ingot) into a special shape and with improved physical properties.

Modern machines and structures—even foods and personal conveniences—require large quantities of steel parts of uniform cross section, such as plates, bars, beams, rails, pipes, sheets, etc. These are made in rolling-mills where the work is performed by passing the red hot metal through one pair of heavy rollers after another, so grooved and spaced that each succeeding pass is smaller and more nearly the required final shape. While the products of a rolling-mill vary widely in weight and shape, a common characteristic is that each piece is of uniform cross section from end to end, and is of a length limited only by the size of the original ingot, or by the size of the runout floor (*see* ROLLING-MILL).

The word *mill* may mean the entire steel making plant, just one department, or one stand of rolls in the department. Complete departments have various names, such as rail mills, structural mills, plate mills, merchant bar mills, depending upon the product they most efficiently produce. Each such mill contains a number of roll-stands of decreasing size and power, from the blooming or cogging mills which do the heaviest work, down through the intermediate stands to the last pass, finishing mill or finishing stand, which impresses the exact final cross section.

There still exist many rolling-mills, some producing the highest type of tool steel, which start with a small piece of metal (a 150 lb. ingot or a chunky rolled bar called a billet) and produce rods, bars, hoops or flats a fraction of an inch thick. Metal is passed back and forth by tongs in the hands of skilled labourers. Such roll stands are usually arranged side by side and the hot bars are looped from stand to stand, entering from alternate sides, until the final shape is produced. Sometimes curved guides are installed to do the work of alternate workmen; as the size of the bars increases hand labour cannot cope with the situation. Most rolled shapes start from white hot ingots, perhaps six tons in weight, which are taken from soaking pits by a travelling crane, placed on the first of a series of "tables"—power driven roller conveyors—which transport the metal wherever a distant electric switch operator directs (*see* Plate II., fig. 3).

Blooming mills are usually arranged so the ingot is passed back and forth several times through the same roll stand. This requires a screw-down device and indicating dial on top of the housing for lowering and reversing the rolls progressively as the piece becomes smaller. The spindles connecting the rolls to the driving engine or motor are of most rugged construction, for upwards of 20,000 h.p. is transmitted at times.

Heating Furnaces.—In a modern rail-mill the ingot, having been reduced to a long bloom perhaps 8 in. sq. in cross section, has its ends sheared off to sound, unpiped metal by massive guillotine shears operated by hydraulic power, and is cut into such lengths that each billet will make one or two rails of required length and cross section; these are then reheated before further rolling; other mills which reheat cold billets require special furnaces, now usually gas or oil fired, frequently having waste heat boilers or recuperators (*see* also FURNACE). Furnaces have a long rectangular hearth, slightly inclined, as wide as the billet is long, and a low roof. Water-cooled skids carry the weight of the steel and prevent scraping on the brick furnace-bottom. At the cool end billets are pushed in sideways by a plunger, one by one, moving all ahead closer to the hot end. Every time a cold piece enters the furnace, a hot one is pushed out the other end on a roller table leading to a roll stand; other continuous furnaces have water-cooled rollers or other devices built into the bottoms for moving lighter pieces such as wire coils through them at a slow steady rate.

Rail Manufacture.—A reheated bloom in a rail-mill may then be given four more passes in another reversing mill, called the first roughing stand, passing then to the first finishing stand. This is three-high, *i.e.*, there are three rolls in a stand. The forward pass is through a groove cut in the lower and the middle roll; the receiving table is then elevated bodily and a backward pass is made between a groove cut in the middle and upper roll. Four such passes and a final one through a finishing stand completes the rail; a total of 15 passes and one reheating will convert an ingot into a rail weighing 100 lb. per yard. Well equipped mills produce 50,000 tons of rails per month; a total crew of 360 men per shift is required for all operations and maintenance, for straightening, drilling, inspection, loading—in fact all the operations in the finishing department. Structural shapes such as angles, channels and I-beams, are rolled in a similar routine. Frequently rail mills, by simple change in rolls, are made to produce structural steel when there is no market for rails. Special and extra heavy equipment is necessary to roll the massive H-beams with deep flanges so popular for building columns.

Plate manufacturing departments are less complicated than a rail mill, although the machinery may be more rugged. First the ingot—6 to 10 tons or even heavier—is rolled to a flat slab in a blooming mill, sheared into pieces, and the slabs reheated. Further work is done by cylindrical (ungrooved) rolls. Sometimes a single reversing 2-high roll stand does all the work; at other times two three-high mills with elevating tables may be observed. On account of the enormous bending stresses carried by the rolls when rolling wide plates, many two-high reversing stands have been built as four-high mills, having two rather small working rolls, each backed up with a larger one for stiffness. Plates of more uniform thickness, edge to centre, may be made in this way. It should be observed that the action of a rolling-mill does not widen the piece very much—most of the change in volume results in increasing its length. Consequently a heavy slab is cut to a length which equals the width of the required plate, and it enters the plate rolls sideways. Cross rolling in this way results in a better plate; metal worked in only one direction acquires transverse weakness. This means that the tensile strength of test bars cut with their axes parallel with the direction of extension during rolling will be higher than when cut from the plate with axis in any other direction. Other interesting mechanical devices are in-

cluded in a plate mill which cannot be described here in detail. Among them are plate straighteners, cooling beds, cross cut and edge shears, turnover devices, castor beds and magnetic grips. Side shearing on narrow plates may be avoided by using a universal mill, which is a roll stand to which is added a pair of stout vertical rolls. The latter are adjustable, up to perhaps 48 in. apart, and are set a proper distance to keep the hot plastic plate the exact width during its formation. Four thousand tons of sheared plates, of a variety of sizes and thickness, would be a good weekly production of a modern mill; a universal mill, working on a single thickness and width, might produce nearly twice as much, if pushed hard.

MILLS FOR SEMI-FINISHED MATERIALS

Continuous Mills.—Four classes of semi-finished materials are manufactured in such tonnage that special mills are set up to produce them, namely: sheet bars, skelp, strip and wire rods. These products are the raw material for special manufacturing plants often located at a distance from the steel furnaces. Sheet bars are worked into tinplate, galvanized and uncoated sheet; pipe is made from skelp; strip is narrow sheet for hoops and bands; and rods are drawn into wire, from which all kinds of fencing, screening, cable, nails and springs are made. Sheet bars and skelp are made in bar mills, frequently located immediately beyond a blooming mill, which take a 6 in. square bloom hot from the shear, and roll into the thin narrow plate without reheating. Such a plan requires the most rapid handling to complete the rolling before too much heat is radiated. This is done by placing a succession of two-high roll stands in tandem, within a few feet of each other, and guiding the bar automatically from one roll to the next. Since each pass elongates the piece, the speed of each roll is higher than the preceding, and the relation between speed and reduction must be nicely adjusted so the hot bar will neither buckle nor be stretched at any stage. A succession of eight or ten such rolls, with perhaps three pairs of vertical rolls to control the width—interspersed in the train, can produce standard width 8 in. sheet bars or skelp from 6 to 20 in. wide, suitable for forming into pipe up to 6 in. diameter, and from $\frac{1}{8}$ to $\frac{3}{8}$ in. thick, at the rate of 4,000 to 20,000 tons per week depending upon the sectional area of the bars manufactured. Since a mill of this sort can easily produce material far too long to ship, flying shears are set beyond the finishing roll to cut the bars to length. Many designs have been made, capable of square cutting a rapidly moving bar. Sheet bars are sometimes quenched by travelling down a long table under a series of water spray nozzles. Interesting piling devices are also in use.

Sheet Mills.—Sheets are $\frac{1}{8}$ in. thick or less, whereas plates have sufficient mass to retain heat until rolled to proper gauge, and a surface covered with mill scale is quite good enough for most purposes. Sheets, on account of their thinness and the excellent surface demanded by such finishing operations as galvanizing or lacquering, must be rolled in an entirely different manner. Most sheet mills are still operated by hand after the methods originated in Wales two centuries ago (*see* TIN) and have larger and more rugged equipment, generally producing material 18 to 30 gauge thick, whereas tin plate is smaller in area and thinner—28 to 38 gauge.

Sheet bars are cut with length slightly greater than the width of the required sheet, heated to a dull red 850° C, and rolled sideways through a two-high mill with massive cylindrical rolls, 32 in. diameter. One workman catches the bars as they come through and passes them back to another over the top roll; a third screws down the top roll gradually to continue the reduction. The crew passes two bars back and forth very dextrously; when these bars have been flattened to about $\frac{3}{32}$ in. one is placed on top of the other, the top roll raised, and the pair rolled down until each is about twice as thick as the desired sheet. In the best practice, one pass is then given in the mill to be used for finishing, in order to "shape" the pack to this mill.

By this time, reheating is necessary; the pair is opened, that is the two sheets are separated, and placed in a furnace until the temperature is up to about 800° C. Low temperatures and a smoky flame are necessary to prevent surface oxidation in the furnace. A pair of these sheets are then further rolled to the required thickness in a finishing mill, more accurate in construction and requiring more skill to operate. For thin gauges, sheets are folded double and rolled in packs of four or even eight. Frequent opening and reheating is necessary in the latter stages of the process. They are then straightened and sheared to size.

Many surface finishes are required by customers who manufacture a multitude of objects of sheet metal. The sheets may be annealed either by being passed slowly through a long furnace with hot central zone—blue annealing—or by being piled in a tight steel box and heated for hours at a considerably lower temperature—box annealing; or the cold sheets may be given several passes through accurate rolls for a smooth surface and a somewhat stiffer temper. Interspersed with these operations, the oxide or mill scale may be removed by pickling (*q.v.*) in weak sulphuric acid. Finally the cleaned cold-rolled sheets may be dipped in white metal for a protective coat, wiped, cooled, polished and boxed. Coating with zinc is called galvanizing; tin or tin sheet is thin steel dipped in pure tin; terne sheet is thin steel dipped in an alloy of lead and tin.

Strip and Continuous Sheets.—Desire to eliminate the large amount of labour required for sheet working by the above described process has led to the recent production of sheets in continuous mills. Since 1900 it had been common to roll strip up to 3 in. wide and 16 gauge or less in thickness, in very long coils in a series of roll stands placed close together; mills have been built for wider and wider strip, until 48 in. wide strips were produced commercially in America in 1927, but no thinner than 16 gauge. In a narrow strip, hoop or cotton-tie mill, a continuous heating furnace feeds flat bars about the width of the finished piece, endwise into the first of a series of six tongue and groove rolls, perhaps 10 in. diameter. One edger may be installed after the third roll, and the remainder then be flat rolls. Then the bar passes through a series of three very accurate finishing rolls, sometimes being bent sharply, scraped, and air blasted before entering the last roll to remove the scale. These finishing rolls are cylindrical, and the guides are shifted sidewise at frequent intervals, to prevent the chilled strip from wearing the roll-surface irregularly; speeds are watched closely; the first roughing roll is very slow, the last very fast; in fact the trailing end of the billet may still be in the furnace when the front end is being reeled, 200 ft. away, at the speed of 1,000 ft. per minute. One great advantage of such close-set continuous mills is that the time of passage from furnace to finishing roll is the same for all parts of the billet; consequently the temperature at the last pass is uniform, and the thickness after cooling is also quite uniform. Finished strip is automatically turned on edge, looped back and forth on a broad slow moving conveyor belt passing through a muffle; emerging it is cool enough for reeling, cutting to length and bundling. About 40 men are required to operate such a strip mill producing from 10 to 20 tons of strip per hour, depending upon its width and gauge. Such strip has a surface covered with mill scale, or if this is scraped off, a blued colour formed during slow cooling. For higher finishes and stiffer tempers, the strip may be pickled and cold rolled rather slowly to accurate gauge and smooth surface. Wide strip is made in a very similar manner. Oxide is removed from the hot billet by strong water jets. Rolls generally are flat; edging rolls, set vertically with the exact spacing to control the width, are used more freely in the roughing train. The equipment is much more rugged and precisely built; four high stands with moderate sized working rolls backed up with very heavy stiffening rolls are utilized. Wide strip if required thinner than 16 gauge must be finished by cold rolling.

A continuous mill using more of the elements of conventional sheet mills has also been installed by the American Rolling Mill company. In this a four inch slab is rolled sidewise to rough sheets, approximately 13 gauge thick, in 14 roll-stands; midway in the line is a reheating furnace; rough sheets are sheared to length, cooled and some times pickled, then matched in pairs, and reheated in a continuous furnace. From here on the double or pair of sheets goes through a succession of rolls and furnaces placed

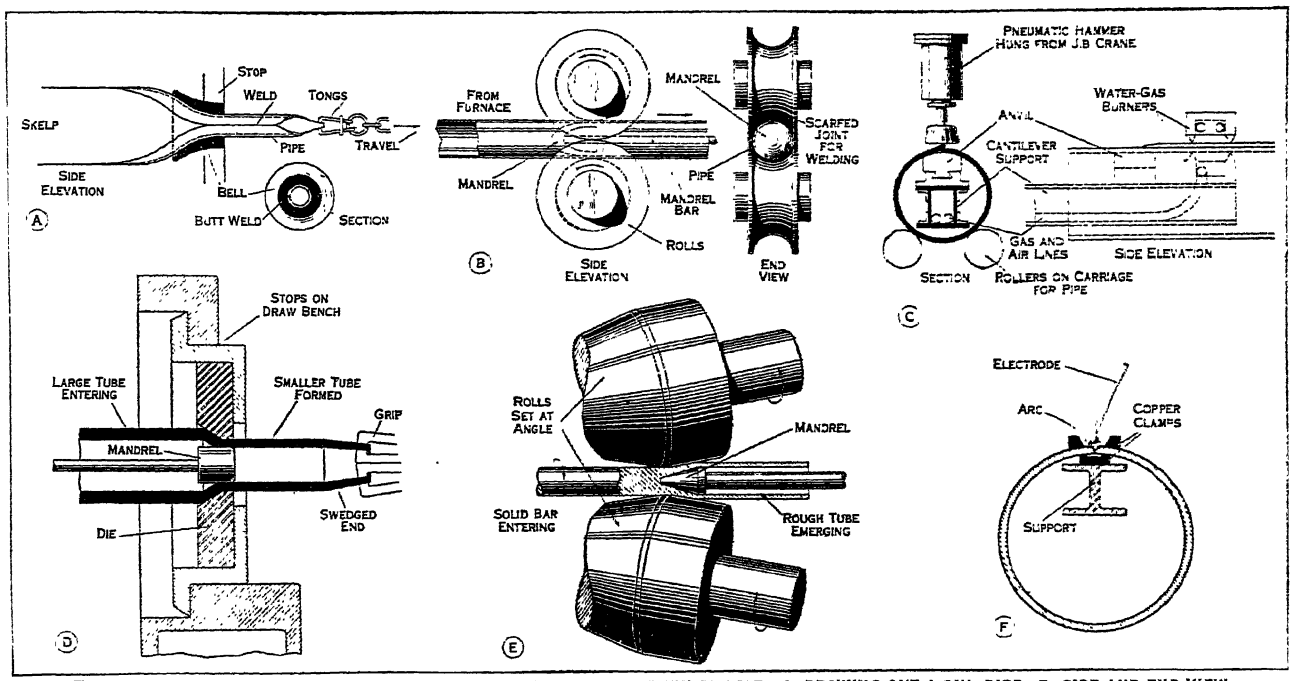


FIG. 5.—DIAGRAM ILLUSTRATING VARIOUS STEPS IN THE MANUFACTURE OF PIPE. A. DRAWING OUT A 2IN. PIPE; B. SIDE AND END VIEW OF LAP WELDING; C. HAMMER WELDING OF 30 IN. PIPE; D. DRAWING 6IN. PIPE; E. DRAWING 2IN. PIPE; F. ARC WELDING OF 30IN. PIPE

one after another in line until it reaches its proper sheet thickness; then the individual sheets are separated and stitched together into a broad ribbon for passage through annealing furnace, cooling hoods, and pickling machines; and finally cut apart and piled for shipment, cold rolling or galvanizing. Edging and guiding rolls in this system are avoided by so grinding and operating the cylindrical rolls that the sheets in process are always slightly thicker in the centre than at the edges, this convexity becoming less and less and almost vanishing in the final pass. Such a mill can produce 30,000 tons of sheets a month.

Pipe.—Skelp, the flat bars from which small sized pipe is made, is rolled in a continuous mill specially designed to produce bars true in thickness, width and properly bevelled on the edges. Frequently the finishing stand is adjustable, and a skilled workman varies the roll spacing slightly in accordance with his estimate of the temperature of the metal issuing, thus compensating for the different amounts of contraction during cooling. Skelp is cut 20 ft. long, one end pointed, and then charged into a flat hearth, properly designed to produce a uniform white heat throughout; when reaching the welding temperature the metal appears to be covered with a shiny grease, which is molten iron oxide. The operator then catches the pointed end in tongs, and by means of a draw bench (*see* WIRE) draws the white hot bar through a welding bell (fig. 5-A) forming the flat bar into a tube and pressing the butted ends together into a true weld all in one operation. Further operations reduce the pipe slightly to correct size, straighten it, remove the scale, shape and thread the ends, proof test it, and cover it with a protective coating. (*See* PIPE, PIPE ROLLS.)

Butt welding is done on pipe from $\frac{1}{8}$ to 3 in. nominal inside diameter. Common pipe from 2 to 30 in. is more usually made of flat plate by lap welding. Up to 8 in. diameter, pipe is made of plate rolled on a universal mill; for larger diameters the edges are accurately sheared (*see* fig. 5-B). Plates are piled into a furnace, heated to a dull red, and run one by one through scarfing rolls, which form the necessary bevel on the edges for an overlapping seam. The hot steel is then drawn through a forming bell which curls it up into a tube (fig. 5-A). After reheating to the welding temperature this tube is caught between a pair of rolls and rolled over a manganese steel mandrel (fig. 5-B), and the joint welded by the high heat and great pressure at the point of contact. When the length has been rolled, the bar which has been holding the mandrel in position is withdrawn from the far end of the pipe, and the latter rolled away for the finishing operations already enumerated. It requires only a few seconds to weld a standard length pipe by either of these processes. Welded pipe over 30 in. in diameter is made by hammer welding or more recently by automatic arc-welding. In the former, the wide plate is curled on plate bending rolls and the overlapping joint heated and forged shut in sections. During the heating cycle two water-gas burners play a flame on a portion of the joint from both inside and outside; when the correct temperature is reached the lower burner is replaced by an anvil and the upper by a pneumatic hammer, and the hot spot welded and hammered down flat (fig. 5-C). The next section is similarly treated. After welding the length is re-rolled for shape and annealed, the ends sized and shaped, and the pieces tested and dipped in anti-corrosive liquid.

For arc-welding, the edges of the plate are planed to a bevelled V opening (fig. 5-F), the pipe bent to shape in rolls, clamped between long copper bars, and the bevel filled with metal from a slowly travelling wire, from which an electric arc is struck to the steel plate below. Details of the welding method are given in the article on WELDING.

Seamless Tubing.—In America, seamless tubing is preferred for all purposes where the internal pressure is above a moderate amount, and a rapidly increasing amount of such pipe is being made in diameters up to 10 in. First, a round billet at full red heat is pierced by inclined rolls and mandrel. As sketched in fig. 5-E, two 36 in. rolls of special shape are set side by side, with axes crossing and about 10° askew. The shape is such that the rolls grip the end of the ingot and spin it forward slowly, forcing it over a mandrel set between them. The operation is such that the mandrel seeks and maintains a truly axial position. After piercing the inner and outer surfaces are smoothed and the tube brought to exact size by several rollings over a mandrel, as in lap welding. Further operations from straightening to shipping are performed with considerable care. Not only is such pipe more reliable for the lack of any welded seam, but the piercing operation is so strenuous that nothing but metal of good quality can endure it. Therefore the tubing can safely withstand a considerably higher pressure than the best of welded pipe. Seamless tubes after cold drawing to thin walls are much used for structural members on

bicycles, automobiles and aircraft, and for shaping into metal furniture and machine parts. Cold drawing is done as sketched (fig. 5-D). A tube somewhat too large and thick in wall has the end swaged down slightly. All oxide is then pickled off, the tube washed, dried and dipped in tallow or other lubricant. The pointed end is thrust through a round die, and gripped by draw-bench tongs. Next, a mandrel is thrust through the tube from the far end until it has a position directly within the die, and then the tube drawn forcibly through the annular opening thus formed. In this way the outer and inner diameter may both be controlled. Each draw hardens the metal and makes it more brittle; after a few such passes, if the required size is not yet reached, the pipe is given a low temperature anneal to relieve the cold-working strains, and the process continued.

Rods and Wire.—As indicated above, wire rods are frequently rolled from 2 in. billets, 30 ft. long, on continuous mills, and the sixteenth or finishing pass delivers a 0·2 in. round to reels at a speed of 45 m. an hour. Such a mill will produce 15 tons per hour, with a complete labour force of 45 men. Other arrangements utilize a continuous mill for breaking down a 4 in. billet, and about a dozen loops fed by hand in a cross-country mill to finish. Rod reels are dumped automatically, and the rod cold-drawn through dies, with frequent annealings and other intermediate operations, into wire of various diameters, finishes and tempers. The operations are described more fully under wire. Most of this wire is stranded into cable or wire rope, woven into screens, netting, or fencing or made into nails. All such is done by automatic machinery so economically that the increase in cost of nails, for instance, over wire is 15 cents per 100 lb., which not only includes manufacture, but the cost of the keg as well.

Cost of Rolling Operations.—(Average for 1927, according to *The Iron Age.*)

	Cents per lb.
Basic Open-Hearth billets	1·49
Wire rods	1·90
Plain wire	2·41
Wire nails	2·54
Heavy Section steel rails	1·92
Soft steel bars, flats, rounds	1·84
Tank plates	1·82
Structural shapes	1·83
28-gage block sheets	3·13
22-gage automobile body sheets	4·17
Hot rolled strip	2·26
Cold rolled strip	3·05
Butt-welded steel pipe	3·50

CLASSIFICATION AND USES OF PLAIN CARBON STEELS

Production and Consumption.—Any classification which accounts for the destination of steel made by any combination of the above described processes must evidently be impossible on account of its complexity. As to process, it may be said that any of them can be made to produce steel which easily passes present commercial specifications, even for so severe a duty as railroad rails. The following figures indicate the mode of American production of steel from 1922–27 according to *The Iron Age:*

Merchant bars and concrete reinforcement	18%
Sheets (except strip and tin plate)	13%
Rails and splices	12%
Plates	12%
Pipe	11%
Structural shapes	11%
Wire and wire products	9%
Tin plate	5%
Strip	5%
Miscellaneous	4%

In England the quantity of plates and tin plate is relatively larger, because of a more active ship-building industry and large exports respectively.

A similar classification of the chief lanes of consumption in the United States is given in the table which follows. It should be noted in this connection that in England and the Continent the proportion of exports is very much larger, and the relative position of automobiles and other machinery would probably be reversed.

Industry	Proportion	Chief purchases
	%	
Railways	24	Rails
Building and construction	18	Structural shapes and bars
Automobiles	12	Sheets, strip and bars
Oil, gas, water and mining	9	Pipe
Agriculture	4	Wire fencing
Food containers	4	Tin plate
Machinery	4	Bars and wire
Exports	6	..
Unclassified	19	..

Grades of Carbon Steel.—Carbon is the principal alloying element used for hardening and strengthening iron. Consequently the utility of various iron-carbon alloys—the plain carbon steels which comprise such a large majority of the entire production—depends upon the amount of carbon present, and has led to the separation of the entire possible range into approximate grades: Ingot iron, made in a basic open-hearth furnace, has the lowest possible content of carbon and other alloying elements. It is used largely for sheets on account of its corrosion resistant properties. Extra soft or dead soft steel contains from 0·08 to 0·18% carbon, used where ductility, toughness, weldability or ease in cold working is desirable, and strength or stiffness a minor consideration, *i.e.*, for pipe, rivets, sheet, wire and case hardened parts. Structural grade or mild steel contains from 0·15 to 0·25% carbon, used where a combination of strength and easy machineability is desired, for forging or flanging operations, *i.e.*, for buildings, bridges and railroad rolling stock, for boilers, drop forgings and bolts. Medium grade contains 0·25 to 0·35% carbon and is even harder and stronger than mild steel, yet it may be hot-forged without difficulty, used for ship building, shafting and forged machine parts. Medium hard steel contains from 0·35 to 0·65% carbon, and enters into the range where the final condition and reliability is much dependent upon the past mechanical and heat treatment; it is used for large forgings for locomotives and other prime movers, car axles, and in the higher carbons for railroad rails. Hard steel ranges from 0·65 to 0·85% carbon, and is used only after it is heat treated to a correct combination of strength and ductility, used for wrought steel wheels, locomotive tires, wood cutting tools and sledges. Spring grades range from 0·85 to 1·05%, used in a heat treated condition, wherein a great range of hardness, resiliency and brittleness is possible, *i.e.*, automobile springs, cold chisels, rock drills and shear blades are made of these steels. High carbon tool steels range from 1·05 to 1·20%, used only after heat treatment for railroad springs, metal cutting and forming tools. A characteristic of these carbon steels is that each 0·01% of carbon increases the ultimate strength in the annealed condition by approximately 1,000 lbs. per sq.in., but at the expense of the ductility or toughness. Hardness also is increased.

	Ultimate strength	Reduction in area	Brinell hardness
	Lbs. per sq.in.		
Rivets	50,000	30% in 8 in.	95
Medium hard forging	75,000	20%	134
Spring steel	125,000	10%	200
Same after quenching	200,000	0	600

Combinations of even higher strengths with considerable ductility and impact resistance may be had only in alloy steels, of which a number have been developed with special properties.

USE OF ALLOY STEELS

Use of alloy steels, which prior to 1910 was confined mostly to big guns, armour and projectiles, has spread rapidly of recent years into all metal working industries, among which the automotive leads. Production in America for 1925–27 was about 2¼ million gross tons of ingots annually, plus about 145,000 gross tons of castings. Three quarters of this was made by basic open-

hearth furnaces, operating under very special control (alloy steel is a special steel, not merely a carbon steel to which some alloys have been added). European and British production statistics are lacking. The world production (1928) is probably about 3¾ million gross tons.

Nickel and Chromium.—Although there are infinite possibilities in alloying, by far the most important steels are those containing nickel and chromium, used for crank shafts, axles, gears and other automotive and machine parts. Relatively few analyses are in use, the present tendency being to minimize the number of alloy steels in process so as to avoid mixtures of the stock. The popular nickel steels contain about 3·5% nickel and 0·10 to 0·50 carbon (Plate III., fig. 15 and 16). Chromium steels range from 0·60 to 1·50 chromium with the carbon in direct ratio from 0·15 to 1·10, stainless or rustless steel sheets contain over 10% chromium. Nickel-chromium steels are more numerous. For machine parts, one series has nickel about 1·50%, chromium 0·5 to 1·25% and carbon 0·10 to 0·50; another has about 3·0% nickel, 0·75% chromium and 0·10 to 0·50 carbon; a third has 3·5% nickel, chromium 1·5%, and carbon from 0·10 to 0·50. Nickel and chromium when added to steel increase its strength and hardness without a corresponding increase in brittleness; chromium also increases the corrosion resistance. As both elements depress the temperature and decrease the rate at which the hardening changes take place, such alloy steels can be hardened by quenching in oil, whereas plain carbon steels require plunging into cold water. This lessens the liability to crack the piece by drastic quenching, since the changes are more sluggish than in a plain carbon steel and the heat treatment routine can be varied within reasonable limits without introducing large variations in the physical properties of the finished steel. An indication of the possibilities of a 0·40 carbon steel containing 1¼% nickel and 0·60% chromium, is as follows:

	Ultimate strength	Elongation
	Lb. per sq. in.	% in 2 in.
Annealed	80,000	27
Quenched, tempered at 200° C	250,000	6
Quenched, tempered at 400° C	200,000	12·5

A 0·40% carbon steel without alloys would have practically zero elongation after quenching and low tempering; quenched and tempered at 400° C the elongation would be less than 12·5 and the ultimate strength only 150,000 lb. per sq.in.

Nickel steels—not heat treated—are used for structural steel in long span bridges, and high strength boiler-plates; heat treated for gun tubes, engine forgings and castings and shafting. Chromium steels are used for projectiles, for grinding rolls and for roller bearings, and with nickel or vanadium for armour plate and all sorts of heat treated machine parts, axles and gears. Rustless chromium irons, containing 12 to 18% chromium and less than 0·12% carbon, are quite workable cold. Stainless steels for cutlery have carbons over 0·30. Special alloys for corrosion resistance may contain in addition considerable nickel and silicon.

Manganese is present in all steel, but when it adds up to between 1·0 and 2·0%, and carbon 0·30 to 0·50, the steel acquires special properties. These analyses are favoured in America for high strength castings, heat treated forgings, rifle barrels and for case hardening. So-called silicon structural steel used in long span bridges and for boiler plate, is really one of the lower manganese steels of this classification. Ultimate strengths of 120,000 lb. per sq.in. and elongations of 23% are readily obtained after heat treatment. When carbon is about 0·90% and manganese 1·65, a steel is produced which has such small changes during heat treatment that it is called non-deforming or non-shrinking, and is used for intricate dies, or for gauges and other tools. The tough Hadfield manganese steel, used in castings for shock and wear resistance, contains 11 or 12% manganese and 1·0 to 1·2% carbon.

Vanadium is an element which has a powerful deoxidizing and scavenging effect; thus a vanadium-treatment on steel which shows very little of the element in the analysis makes for soundness, fine crystalline grain and reliability in forgings. From 0·5 to 2·0% is added along with other alloys to make high speed steels and tools for hot work.

Molybdenum is added to chromium and chromium-nickel steels in from 0·3 to 0·8% to widen the range of heat treatment for given values, and to improve the forging and machining properties. Some high speed steels are made where a portion of the necessary tungsten is replaced by molybdenum, but this is not favoured because molybdenum volatilizes appreciably at the high heat treatments required for those particular alloys.

Aluminium steels are useful for case hardening in ammonia gas.

High-speed Steel.—Carbon tool steels for cutting metals are heat treated by quenching from a high temperature, which gives them hardness, and then by reheating or tempering to a moderate degree to restore toughness. In use they must be operated at such low speeds that the friction between chip and tool-nose will not reheat the cutting edge above the drawing temperature, else the hardness and usefulness of the tool is destroyed. Better speeds could be made by using self-hardening tool steels, those which are hard after a slow cooling from a high temperature, such as the patented tungsten-manganese alloy invented by Robert Mushet in England sometime between 1860 and 1870, or the chromium-tungsten substitutes adapted by some American steel makers. During a 26-year research into the art of cutting metals, Frederick W. Taylor and Maunsel White discovered, 1898 to 1900, that if these steels were quenched from a sweating temperature, so high that it would utterly ruin a carbon steel, the hardness would be retained even when the cutting speed was so high that the nose of the tool and the chip leaving it were red hot. Modern high-speed steels possessing this property of red hardness fall into two general classes:

	High tungsten	Low tungsten
Carbon	0·65	0·65
Tungsten	18·0	14·0
Chromium	4·5	4·0
Vanadium	1·0	2·0

Cobalt, molybdenum and uranium have been put in as further additions by certain makers. High speed steels are made in the crucible or electric furnace, and carefully rolled or forged to break up the crystals of complex carbides forming during the solidification of the ingot and distribute them evenly throughout the bar. A well annealed bar is not very hard (Brinell 240) and can be machined into a complex tool like a milling cutter, and then heat treated; pre-heat to 850° C, heat rapidly to 1,300° C, cool in oil or an air blast, giving a Brinell hardness of at least 600. Reheating 30 min. at 600° C is then necessary to give the quality of red hardness; the Brinell hardness is even higher and the toughness materially better. As an indication of the revolution which these steels have effected in machine shop practice, a plain carbon tool steel will cut 16 ft. per min. on a medium steel forging, an air hardening steel 26 ft. per min., the same after being given the high quench 60 ft. per min. and a modern high speed steel 100 ft. per min. or more, all cuts being of same depth and feed, and on the same material.

Tungsten Steels.—Other alloys whose properties are due principally to tungsten, in addition to the air hardening tool steels and the high speed steels, are tool steels to which from 1 to 5% tungsten is added to improve the quality of the wood working or other tools which would be made of the plain carbon steels. They are also good for making finishing cuts on metal after the most of it has been removed by deep cuts with high speed steel. Magnets are also made of steels with 6% tungsten and 0·7% carbon, quenched but not tempered.

SOME FERRO-ALLOYS

Ferro-alloys are highly important and include those metallic substances used for finishing carbon steel and manufacturing alloy steel. Most of them are electric furnace alloys of iron and carbon plus the third distinguishing metal, manganese, silicon, chromium or some other, although for some purposes the carbon content

must be as low as possible. For such specifications the alloys are made using either metallic aluminium or silicon for the reducing agent.

It was early discovered that manganese must be added to make sound steel by Bessemer's process. As already noted, the usual ferro-alloy for this purpose is spiegel-eisen, a blast furnace product made from iron ore sufficiently high in manganese to smelt into a pig iron containing 10 to 30% of that element, with carbon about 5%. Spiegel cannot be used for low carbon steels because the required amount of manganese carries with it too much carbon. For such purposes, *ferro-manganese* is used, containing nominally 80% manganese and 6¾% carbon. This is also a product of the blast furnace when smelting an ore containing 40 to 50% manganese, low in iron. Since manganese and iron are so alike chemically, the actions in the furnace are very similar to those previously described. The output in ferro-manganese from 50% ore is only about one third as much as though common pig iron were produced; the blast is 250° F hotter and the coke consumption twice as much; about ⅓ of the manganese is lost in the slag. While ferro-manganese can be made in an electric furnace of the pit type (*see* ferro-silicon) it cannot compete with the blast furnace product except under special economic conditions, as in Norway, or where carbon below 0·25% is required, as for high manganese alloy steels.

Ferro-silicon is the next most important alloy. A 12% silicon pig iron may be made in the blast furnace, but alloys higher in silicon are now used to deoxidize nearly all steel for castings, to quiet most tonnage steel from basic open-hearth furnaces, and to make several silicon alloy steels. Ferro-silicons are exclusively an electric furnace product and are made in several grades—50, 75, 80 and 95%. Carbon is about 0·5%, phosphorus and sulphur less than 0·10%—the former particularly must be kept to the minimum to prevent the alloy from absorbing moisture from the air and generating poisonous phosgene gas (PH_3). A pit-type electric furnace is employed, rectangular in cross section, with bottom built of carbon blocks. Into this shaft is suspended three carbon electrodes, one for each phase of current; a granular mixture of pure quartzite, clean iron turnings and coke is shovelled into the open top, filling the entire furnace. Passage of current from electrodes to furnace bottom gives the necessary heat for the coke to reduce silicon metal from the rock. Carbon monoxide produced by the reaction rises and burns at the top of the charge column, and a molten alloy of iron and silicon collects on the hearth, from which it is tapped periodically.

Ferro-chromium.—This is one of the earliest ferro-alloys produced in an electric furnace. At present the commercial alloys contain about 67% chromium. The so-called high carbon alloys range from 4 to 8% carbon by units, whereas the low carbon alloys necessary to make stainless irons range from 0·20 to 2·0% carbon by steps. Chromium metal up to 98% pure is also commercial. Ferro-chromiums are ordinarily made in closed furnaces of the Heroult type, with bottoms laid in carbon blocks. A charge of chromium ore, iron or iron ore, anthracite coal for reducing, and flux for slagging impurities, is mixed and shovelled in, the doors closed and electric current turned on. Carbon reduces the metallic oxides in the intense localized heat; at the finish the molten charge is poured into slabs, broken, analyzed and graded for shipment. To reduce high carbon, these varieties are remelted with concentrated chromium oxide, under a lime-fluorspar slag.

Nickel is added to molten steel as shot metal, or a nickel-steel scrap may be used to make alloy steel—nickel having no tendency to enter the furnace slag.

Ferro-vanadium is one of the most difficult alloys to make, on account of the activity of the element. Pure metal has never been produced. B. D. Saklatwalla has developed various means of commercial alloy production, using a mixture of vanadium oxide, iron oxide and powdered aluminium, either in crucibles by means of the thermit reaction, or in shaft furnaces with the assistance of the electric arc. At present the ore is smelted in a reverberatory furnace, and the vanadium concentrated in the slag. This slag is ground, mixed with carbon, iron scale and fluxes (glass cullet, lime and fluorspar) and fed in a fine stream into a covered furnace, directly through the arc between graphite electrodes, thus effecting the reduction almost instantly in the intense heat. Reduced alloy and slag collect in the hearth and are tapped three or four times a day. A common analysis contains 35% vanadium.

Ferro-tungsten.—Tungsten ore is widely distributed, and the concentrate comes to the refiner in such complex mixtures of minerals that the first step is frequently the production of the oxide WO_3 by chemical means (*see* TUNGSTEN). This oxide is easily reduced to metallic powder without melting by mixing with fine carbon, sealing in a crucible and heating to 1,300° C for several hours. Ferro-tungsten, which has become more popular for making high speed steel, may contain from 60 to 85% tungsten, and is made in single-phase electric shaft furnaces. The bottom is one terminal; the electrode set above is surrounded by a shaft of loose brickwork, and a mixture of oxide ore, iron and carbon is filled in. As the reduced alloy builds up on the hearth it chills into a thicker and thicker button, because it has an unusually high melting point; when this solid metallic mass has grown to a point where its electrical resistance interferes with operations, the temporary furnace walls are torn down, the sow removed, crushed, analyzed and classified.

General Structure of Steel.—Much may be discovered about the general structure of the metal by a close scrutiny with the naked eye, or with a little magnifying glass. Such studies (macroscopy) include examination of the finished surfaces, of freshly broken fractures, and of rough polished sections etched in various ways. Information gained from a freshly broken fracture has not yet been systematized and correlated with microscopic appearance. To be of value it requires a keen eye to note small differences, and much practice and everyday familiarity with the fracture of satisfactory metal. In the hands of a skilled inspector it is the first step in securing uniformity in raw materials.

General Structure may best be exhibited on a roughly polished surface by etching in freshly prepared ammonium persulphate solution (10% $(NH_4)_2S_2O_8$). It shows immediately differences in grain size caused by differences in heat treatment or other cause.

Deep etching is much favoured in America for acceptance tests on high grade steel. It shows any non-uniformity in chemical composition or general bad quality. The smooth sample is held in hot concentrated hydrochloric acid for about 30 min. Impure spots, blowholes or cracks are eaten more deeply than elsewhere, and the result is an irregularly pitted surface (Plate III., fig. 8). During solidification of a steel ingot, excess of sulphur compounds will collect toward the centre and top part, where they are trapped and remain during further rolling and manufacture. The distribution of sulphur compounds in a smooth section may be shown by pressing it firmly for about a minute against a sheet of photographic paper moistened with 2% sulphuric acid, then washing and fixing. The dark areas indicate the location of higher sulphur in the steel (Plate III., fig. 7). Phosphorus also accumulates around the borders of the large metallic crystals which form in the ingot, and during rolling or forging are pressed out into stringers or sheets in ruling directions. Ordinary plate or forging steel will always be found thus strongly marked. In forging, these *flow lines* are arranged more or less parallel to the finished surface, and the dies are so constructed that the flow lines take an easy curve around corners. Any crinkling is associated with a weak brittle region. To show phosphorous segregations a polished surface is washed in alcohol, and immersed in 10% copper-ammonium chloride. A thin copper plate will coat out on those portions low in phosphorus, leaving high-phosphorous regions bright (Plate III., fig. 10).

METALLOGRAPHY AND HEAT TREATMENT

The fact that the hardness, toughness and general desirability of a piece of steel could be profoundly modified by a simple heating and cooling has been known since time immemorial—in fact what we now know as steel was perhaps not recognized as having great merit until the fortunate discovery of heat treatment was made. This is a quite mysterious happening, this heat treatment, and it is not surprising that down through the long centuries when the art was guarded as a closed secret, many super-

stitions arose regarding the efficacy of certain heating fires and quenching fluids, and much quackery had free scope to practice its hocus-pocus. Within the past century the chemist and physicist have done much to clear up the mystery by analyzing the various operations; we now know the essential differences between the various steels, irons, fuels, atmospheres and quenching fluids. Only since the beginning of the century, however, have intensive studies with the microscope, pyrometer, hardness and tension testing machines, brought forth a knowledge of the changes which go forward in steel or iron during a heating and cooling cycle, and working hypotheses of the causes of hardening (*see* METALLOGRAPHY).

Logically, an ingot in a soaking pit prior to rolling, or a billet in a heating furnace prior to forging, may be said to be undergoing heat treatment, but from a workshop viewpoint the term is restricted to a heating and cooling to restore original ductility and workability in a partly finished piece, or a heating and cooling —sometimes repeated—to induce special properties in the finished article.

Furnaces (*q.v.*), in regard to size, depend upon the pieces to be treated and the temperature required. A well designed furnace is one which easily attains the necessary temperature, and maintains that heat uniformly in all parts, with an atmosphere which does not deteriorate the furnace, and yet has the desired effect or no effect, upon the metal being treated. Fuels may be coke or coal, gas, oil or electricity. No source of heat, pure heat, disassociated from the products of combustion, has any virtue over another source—it is merely a matter of which is the most convenient and economical. Gas, oil and electricity are now favoured because of their ease of manipulation to give uniform temperature—choice depends upon the relative cost per thermal unit, and the atmosphere required. For instance, it is handiest to use electric resistors for heating elements in a furnace for annealing transformer sheets in a hydrogen atmosphere. Gas or oil fuel would probably be chosen for treatments on products such as roller bearings running into tons per day. Recuperators or regenerators are frequently installed to save heat. Mechanical devices for putting the metal in and taking it out, such as charging machines, furnace bottoms built on wheels or moved on rollers, revolving heating muffles and conveyors, are installed to save labour wherever the weight of material receiving uniform treatment is very great. Temperature control is most important. Well conducted shops issue definite instructions on all important work giving the rate of increase in heat, duration at heat and speed of cooling. Continuous furnaces are devised to maintain this cycle automatically. Batch furnaces are controlled by hand, or by automatic control of the fuel burners through pyrometers (*q.v.*), which are installed in all furnaces, sometimes several in a single furnace, and indicate or make a permanent record of the temperature at all times.

Atmosphere within the furnace is important. In an open flame furnace scaling (or the production of oxide on the metal's surface) may be minimized by feeding rather less air than the gas or oil requires for complete combustion. This deficiency of oxygen means that little or none will be available to react with the hot metal. In long heating of thin sheet, or long annealing of tool steel, where the surface must be preserved, the work is protected from the furnace atmosphere by closed boxes or tubes. Certain reactions may be induced during heat treatment—in this instance the material is packed in boxes with substances forming the necessary gaseous atmosphere, or the furnace is a closed muffle through which a stream of the proper gas slowly travels. Case hardening (*q.v.*), for instance, is done by packing the metal pieces in carbonaceous compounds and heating, or by piping in a gas which is principally carbon monoxide.

Quenching, to cool heated metal, may be done in various liquids, depending upon the speed required. All kinds of solutions of outlandish materials have been used, but there is no virtue in a quenching fluid except the ability to abstract heat quickly. In practice, the most drastic quench is given by a properly disposed nest of nozzles, spraying cold water at high pressure on the hot steel. Next comes a bath of iced brine; then cold water, then high flash point oil, then boiling water, then molten lead, then air blast, then quiet air, and even slower cooling may be done in 8 hours by burial in lime; a dying furnace may require from 24 hours up to seven days. Quenching baths require methods for circulating the medium, maintaining its correct temperature either by heating or refrigerating coils, and dashing it against the metal so no air or steam bubbles remain attached to the hot metal, else soft spots will occur on an otherwise hardened surface. Conveyors or other mechanical methods of getting the hot metal rapidly into the quench and removing it when cold, are installed to save labour. In order to understand what goes on during these heating and cooling cycles, an introduction to the science of metallography and the so-called iron-carbon equilibrium diagram is necessary.

Metallography (*q.v.*) is the study of the inner structure of metals and how this varies with the chemical composition of the alloy and its past heat treatment or the work that has been done on it. It also includes the study of the relationship between the inner structure of metal and the physical properties, such as strength, toughness and hardness. In this study the use of a microscope is a long step in advance of the ancient practice of breaking the metal and looking at the fracture. It enables the student to magnify the apparent size of the grains a thousandfold. A sample of the piece under study is given a high polish, etched slightly in a suitable acid, and placed on a microscope stage with a special illuminating device for opaque objects (*see* MICROSCOPE). The resulting structure may by appropriate means be photographed for permanent record, and for study in connection with information on its past history, and its physical strength, hardness or electrical characteristics.

Important physical properties affected by heat treatments include strength, toughness, hardness, electrical and magnetic characteristics, corrosion resistance. Of these, the first three are most relied upon. Machines and methods for making tension tests and determining the ultimate strength, elastic limit and ductility are described under STRENGTH OF MATERIALS. Hardness is measured by the size of impression left by a steel ball or a diamond cone weighted down by a given load. Toughness or impact strength is measured by the amount of energy absorbed from a swinging hammer by the instantaneous fracture of a standardized notched test piece.

Evidence That Metal Is Crystalline.—Viewed through a microscope, an etched metal surface presents a mosaic patchwork of interlocking and nice-fitting grains (Plate III., figs. 12 and 17). Much evidence is at hand to support the idea that these granules, despite their irregular boundaries, are crystalline: *i.e.*, the ultimate atoms are in an orderly geometric arrangement of rows and ranks. The fact was finally proven by X-rays in a manner easiest explained by this analogy: If a street lamp is viewed through a window screen the brilliant centre appears to have a series of bright rays extending outward, caused by reflections of light from every wire so placed as to throw light back into the eye. The geometric pattern of rays is caused by the geometric arrangement of the wires; arguing by analogy, if the atoms of metal are arranged in definite geometric patterns, then an X-ray beam penetrating the crystal would be reflected in definite ways and emerge in a geometric pattern, in fact, a mathematician can predict the atomic spacing and arrangement from the diffraction pattern so produced. Thus it is found that wrought iron at room temperature is in the body centred cubic arrangement. That means that if the space occupied is subdivided by imaginary planes into a space-lattice of tiny cubes regularly placed on top and to both sides of each other, the iron atoms are located at the corner of each of these imaginary cubes, and each cube will have one atom in its centre.

INFORMATION FROM TEMPERATURE CHANGES

Allotropic Changes in Pure Iron.—Much information about metal can be gained by studying the rate at which its temperature changes during uniform cooling. As long as the temperature falls uniformly, the loss by radiation is accounted for by loss in sensible heat. But suppose the surroundings are unchanged yet the

rate of cooling is arrested, or even reverses—evidently some chemical or physical change is taking place inside the metal which generates a portion of the heat which is being constantly radiated. Such spontaneous heat evolutions or absorptions, arrests in the time-temperature curves, in purest iron occur at 767, 900, 1,400 and 1,530° C. Pure iron or ferrite at room temperature consists of an aggregate of tiny crystals of so-called alpha iron, crystallized in body centered arrangement. On heating, this ferrite gradually loses its magnetism, becoming practically non-magnetic at 767° C, but without changing its atomic arrangements. This non-magnetic alpha iron has been called beta iron, and was erroneously thought to be the cause of the hardening phenomenon—it being given a fictitious hardness. At 900° C alpha iron recrystallizes on heating with absorption of considerable heat and a contraction of 1½% in volume. The elementary cubes in the space lattice now have atoms at each corner and at the centre of each face, a face-centered cubic form known as gamma iron. At 1,400° the reverse change takes place: so-called delta iron existing between 1,400° and the melting point appears to be a form of non-magnetic alpha iron, stable at high temperature. At 1,530° the metal melts, with large absorption of heat and profound change in all physical properties. Precisely the reverse changes occur on slow cooling, as noted in the following thermometric chart.

Temperature	Arrest	State
		Molten (amorphous)
1,530° C .	..	Melting and freezing point
		Delta iron (body centered cubic)
1,400° C .	A_4	Recrystallization
		Gamma iron (face centered cubic)
900° C .	A_3	Recrystallization
		Beta iron (non-magnetic alpha iron: body centered cubic)
767° C .	A_2	Magnetic point, no crystalline change
		Alpha iron (magnetic) (body centered cubic)

A_4 and A_3 lag somewhat on reversing the direction, *i.e.*, occur at slightly lower temperature on cooling than the reverse change during heating.

Solidification of Steel.—It has been found that iron containing a little carbon starts to solidify on cooling at a lower temperature than 1,530° C (the melting point of pure iron) and furthermore that this depression in the freezing point is greater and greater the more and more carbon is in the melt. This is plotted graphically in line AB in fig. 6. Line AB is called the liquidus; at all temperatures and compositions above and to the right of AB the alloy is molten. Hot solid iron at 1,130° C will dissolve 1·7% carbon, and rather less as the temperature increases. This relationship is also plotted by the line AE, called the solidus. At all temperatures and compositions below and to the left of AEB the alloy is solid. The region between the liquidus and the solidus denotes that at those temperatures and compositions the alloy is in a mushy state, part solid, part liquid.

The way a 1% carbon steel solidifies is worthy of study. Its condition at any temperature may be investigated by drawing a vertical ordinate at the composition representing 1% carbon. The diagram shows immediately that the first solid material appears on cooling to 1,450° C (point m). This solid is not pure iron, but a solid solution of carbon in iron whose chemical composition is found at point n on the solidus (about 0·2%). This solid is much richer in iron than the melt, so its appearance leaves the melt richer in carbon, and it must be cooled further before more solid appears. Thus, by continuous solidification of iron poor in carbon and drop in temperature, the sample reaches let us say 1,400° C. At 1,400° C the melted portion has acquired a composition represented by point p (about 1·6% carbon), and the solid appearing from it is a solid solution containing 0·4% carbon (point q). And so it goes: at 1,300° the remaining mother liquor has 2·7% carbon; the solidifying material has 0·8% carbon.

The first-formed solid material will act as a nucleus for the later which solidifies as the melt chills down. This causes the early-formed solid, low in carbon, to be in contact with later-formed solids higher in carbon. Yet at this lower temperature the material in the cores of the crystals has a greater capacity for carbon than it had before, since the solubility of carbon increases with decreasing temperature down to 1,130° C, and there is a pronounced tendency for carbon to pass from the high carbon melt, inward through the outer crystalline layers, until the carbon content of the solid solution becomes more nearly uniform. It requires a very slow cooling or a long annealing to cause entire equalization of carbon; the so-called solid solution alloys cast and cooled at normal rates, usually show a cored structure under the microscope, caused by systematic variations in chemical composition between the material first solidified and the last freezing mother liquid. Assuming that the cooling has been very slow, and the equalization of carbon in the solid portions perfect, the last of the mother liquor in the 1% steel disappears at 1,230° C (point r, fig. 6); the metal is entirely solid.

AUSTENITE

Solid Solution.—Since the word solution ordinarily connotes a liquid, the term solid solution appears to be a contradiction of terms. The solid solution of iron and carbon is so important that it has been given a special name, austenite, in honour of the English investigator and metallurgist, Sir W. Austen. If any steel is annealed to a temperature of 1,130° C, the temperature of maximum solubility of carbon in gamma iron, quenched so rapidly as to prevent changes on cooling, etched, and examined under the microscope it will look like a pure metal (Plate III., fig. 3); *i.e.*, a series of abutting crystalline grains of uniform appearance—saving the slight coring which may remain after insufficient anneal, or some surplus material insoluble under any conditions. Thus the solid solution has some of the essential characteristics of a liquid solution—it is a uniform dispersion of atoms of one element amongst atoms of another, and the proportions may be anything within the limits of solubility. Austenite in fact is an aggregate of crystals of gamma iron; iron atoms are arranged in the face centered cubic system, within which are tucked away the carbon atoms here and there inside the space lattice.

Decomposition of Austenite.—Another similarity between the solid solution austenite and such liquid solutions as salt in water is that the mutual solubility of carbon in iron, or iron in carbon, whichever appears to be the excess element, changes with lowering temperature, and the then unsoluble substance crystallizes out. Such changes can occur in the atomic arrangement in entirely solid metal. The latter is not a fixed and entirely rigid structure, except perhaps at absolute zero. The atoms, while they do not wander about at random, as in a liquid, are in a state of thermal agitation and are moving in small orbits or oscillating back and forth with more and more vigour as the temperature goes up. Under such circumstances considerable rearrangement may take place by interchange of position, or by stranger atoms slipping through the open spaces in the crystalline lattice. Such crystalline rearrangements generally occur in a reasonably small temperature interval, involve an evolution or absorption of heat, and consequently are recorded on time-temperature or cooling curves.

Cooling curves on a low carbon steel show that the change occurring in pure iron at 900° C from gamma to alpha form is lowered progressively with the increasing carbon content. Furthermore a new and important evolution of heat occurs in all steels at about 690° C, increasing in intensity as the carbon goes up. These two temperature arrests, called A_3 and A_1 respectively, coincide at 0·9% carbon. At higher carbons two diverging temperature effects are again noted. All these facts are noted on fig. 6, the steel end of the iron-carbon equilibrium diagram, by the lines GSE and PSK. This is an underlined V, a shape familiar to the physical chemist as noting the break up of a solution into two mutually insoluble constituents. In the case of steel, the solution is austenite; the excess constituent first precipitated out in low carbon steels is pure iron, or ferrite, while that first appearing in the highest carbon steels is not carbon but an iron carbide, Fe_3C, called cementite. A 0·9% carbon steel corresponds to the eutectic. Since it appears in a solid solution it is termed a eutectoid. If examined under the microscope, a slowly cooled 0·9%

carbon steel is made up of tiny flake-like crystals of iron and iron carbon, arranged in rough parallelism and having a pearly lustre. Hence its name pearlite (Plate III., fig. 13). A cooling eutectoid steel reaching 690° C is simultaneously saturated in both constituents—they separate out simultaneously, side by side, in closely intermixed crystals.

Structure of Low Carbon Steels.—The mechanism may be illustrated by studying a cooling steel containing 0·25% carbon

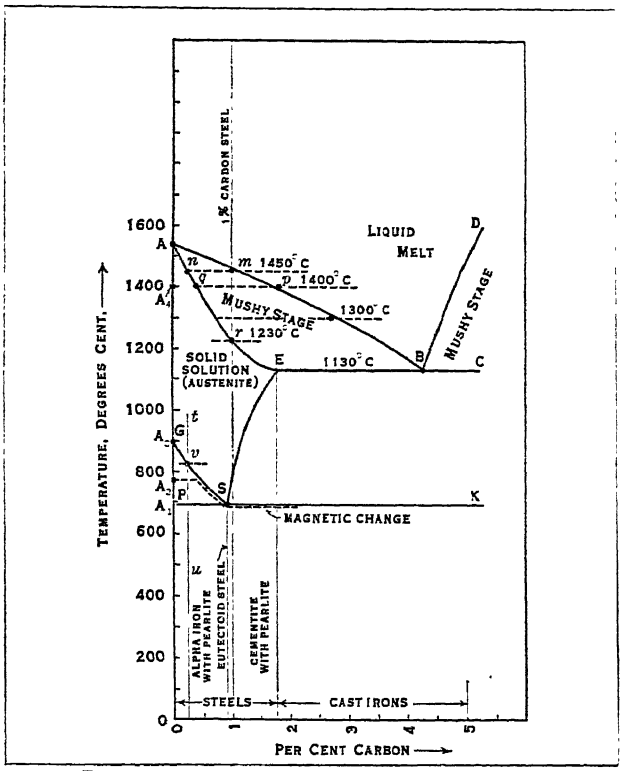


FIG. 6.—EQUILIBRIUM DIAGRAM OF IRON AND CARBON

(line t u). Pure iron starts to be precipitated when the temperature reaches 820° C (point v) and more and more pure iron crystallizes out as the temperature falls, leaving a mother substance richer and richer in carbon. This action continues until at 690° C the remaining solid solution has reached saturation (point S, 0·9% carbon, the eutectoid) and that portion then rearranges itself into pearlite. Plate III., fig. 12 shows the microstructure at the end. The larger clear crystalline grains are pure iron; the gray specks are pearlite (high magnification is necessary to show the laminated structure). Medium carbon and hard steels have relatively less and less free ferrite, and more and more pearlite. A 0·9% carbon steel is all pearlite (Plate III., fig. 13). Slow cooled higher carbon steels (so-called "hyper-eutectoid" steels) have excess cementite in white veinlets surrounding pearlite masses (Plate III., fig. 2). Reverse changes to those described above take place on heating; that is, a well crystallized slowly cooled steel again reverts to a uniform solid solution when heated above the line GSE.

Structures in Quenched Steel.—The above described changes take place in a slowly cooled steel. If cooling is more rapid, time is not given for the atomic rearrangements necessary for such complete recrystallization, and certain intermediate microstructures may be observed. The most rapid quenching of austenite may be able to preserve this structure unchanged in the cold metal. In fact this can be done, especially in steels with considerable alloying elements like manganese or chromium. X-ray investigation of such a specimen as Plate III., fig. 3 proves that the metallic atoms build up a face-centred crystalline lattice characteristic of gamma iron. The carbon atoms are more or less uniformly distributed, but not combined in any definite compound. Such quenched austentic steels are exceedingly tough; while they are not so hard as other steels under the Brinell test, it is impossible to cut them with a chisel; they resist wear, scour and impact well. High manganese steels are therefore suitable for such things as steam-shovel teeth and rail crossings.

High carbon steels, without alloying elements, can seldom be quenched rapidly enough to preserve pure austenite. Under the microscope a polished and etched surface appears to be criss crossed with sharp needles (the lighter portions of Plate III., fig. 14). This structure has been given the name martensite; it is the hardest and most brittle condition of steel. X-ray studies show that the iron has completely transformed into the body-centred crystalline lattice of alpha iron; it also indicates that the new crystals of ferrite are exceedingly small, far below the ability of the microscope to see. The needle-like markings are relics of the larger austenite grains rather than actual structures of martensite.

At the interior of a quenched high carbon steel specimen, where the cooling rate is slightly slower than on the surface, the martensite needles may be mixed with rounded areas which etch much more rapidly, appearing black in fact. This structure is called troostite (also shown in Plate III., fig. 14). Troostite also appears in a lower carbon steel rapidly quenched; or in a martensitic steel which has been reheated or drawn in boiling water. In troostite the carbon atoms, insoluble in alpha iron, have had the opportunity to form sub-microscopic crystals of cementite. None of the crystals have grown to a point where they can be seen even at 5,000 magnifications; however, the X-ray proves it to be an aggregate of excessively small crystals. Troostite, while still almost as hard as martensite is noticeably less brittle.

If the hot steel be given a slightly better chance to crystallize, as for instance, quenching a hot bar more slowly in oil, or tempering to a blue colour, the resulting structure is again changed (Plate III., fig. 1). A characteristic cloudiness appears, giving a suggestion of ill defined crystalline grains. This is called sorbite. A steel tempered to sorbitic structure has lost some of the hardness of martensite, but the added toughness is so marked that it is the desirable condition for sledge faces. Sorbite represents a further stage in the growth of ferrite and cementite crystals. When these crystals can be distinguished clearly the structure is as illustrated in Plate III., fig. 13, containing well defined regions of pearlite (intimate mixtures of iron and cementite crystals). A further stage is noted in long anneals at temperatures just under A_1. The plates of cementite break up into little balls. This condition is called divorced pearlite or spheroidized cementite—the most easily machineable condition in a high carbon steel.

THEORY OF HARDENING AND TEMPERING

"Slip Interference."—These various actions which go on within solid steel at moderate temperatures are of the greatest commercial importance, for they control the important operations of hardening and tempering steels. In the simplest example these consist of slowly heating the steel to a temperature somewhat above line GSE, holding it there long enough for it to become a uniform solid solution, then quenching it rapidly thus retarding the reverse reactions as much as possible, and finally reheating the quenched bar moderately to produce troostite or sorbite, still hard but much less brittle than the freshly quenched structures. The most widely accepted explanation of the hardening phenomenon is known as the *slip interference* theory, definitely formulated and systematized by the American metallurgists Zay Jeffries and R. S. Archer. It starts with the knowledge that metals are crystalline, and that metallic crystals when they are stressed beyond the elastic limit, do not tear apart irregularly, but one portion slides past another portion along definite crystalline planes without appearing to let go. Such motion is speedily jammed and stops because it tends to disarrange all the neighbouring crystals. The slip plane also heals immediately. Much of the hardness of quenched steel is believed to be due to the sub-microscopic size of the constituent crystals; the boundaries of each one interfere with slip under stress in all the neighbours; since slip cannot occur, the metal resists deformation, and is therefore hard. In steel another hardening factor supplements this slip interference at the grain boundaries, namely, the presence of a great number of carbon atoms, cementite molecules or even tiniest cementite crystals

uniformly dispersed through the ferrite grains. Such particles harden the entire metal from two causes: first, they prevent the start of any slip between crystalline layers as would billions of tiny staples in the leaves of a book; and second, the slips once started despite this hindrance must drag against a multitude of anchors.

Hardening by Cold Work.—Since a ductile metal like iron deforms plastically under cold work or stress beyond the elastic limit by internal slip along crystalline planes, it would appear that this slip has the effect of breaking up the original crystals into numbers of small ones. For that reason cold work hardens the metal; finer grained metals are harder. Under the microscope the slip planes are seen only in special circumstances, but the original grains appear to be flattened out and assume a shape more or less parallel to the extension. In extreme cases, as in wire for suspension bridge cables, a high carbon steel with original tensile strength of about 80,000 lb. per sq.in. can be cold worked into a condition where it will carry 220,000 lb. per sq.in. before rupture. Microstructure of such a wire parallel to the direction of drawing shows the original crystalline boundaries flattened out until the structure seems to be fibrous (Plate III., fig. 11).

Increase in hardness is accompanied by an increase in brittleness, so excessive cold work is liable to break the article, either during manufacture, or in its after history—season cracking. To avoid this danger, and to restore ductility, the piece may be annealed (*q.v.*) or reheated moderately to a point which does not affect the microscopic appearance yet the added atomic mobility at the higher temperature permits such rearrangements as necessary to relieve the stress.

Recrystallization.—A little higher heat on a cold worked piece of metal will cause the previous grain structure to be entirely replaced by a new arrangement. This is known as recrystallization. The recrystallization temperature varies with the amount of cold work previously done on the metal. Long stay at temperatures above this will cause the growth of large crystals. Such is to be avoided because it makes for a condition known as Stead's brittleness. Slip planes started across a large crystal find less supporting material at the grain boundaries, and the self-healing action ordinarily occurring during plastic deformation is absent; the big crystal splits along the cleavage plane.

Refining the Grain.—Recrystallization by moderate heat after cold work is to be distinguished from recrystallization on a higher heating to above the line GSE. The alpha iron then transforms into crystals of gamma iron. Apparently the new crystalline arrangement is almost entirely independent of the old; if the temperature is maintained for some time the new set of austenite crystals grow in average size as the temperature or time increases. On slow cooling through the transformation range these new austenite grains eject the excess constituent to the borders, and the kernels are the locus of the pearlite regions.

Thus by a heating and cooling through the transformation range, the grain size of steel can be changed, refined or enlarged, as desired. Since previous effects of work or hardening are wiped out by such an anneal, the process is frequently called normalizing.

Burning.—Excessive heating of steel ruins it by burning. A burnt steel is brittle and the brittleness cannot be removed by heat treatment. Microscopic examination shows that the grain size is unusually large, due to the high temperature experienced, and the grain boundaries contain considerable oxide. Burnt steel in fact has been heated beyond the solidus (line AE) and the high carbon regions in the austenite have actually melted. The melted metal absorbs furnace gases very quickly, which are responsible for the incurable damage done in the molten portions of the steel.

BIBLIOGRAPHY.—The fullest account of American practice is contained in J. M. Camp and C. B. Francis, *The Making, Shaping and Treating of Steel* (1925); for British and Continental *see* F. W. Harbord and J. W. Hall, *The Metallurgy of Steel* (1923); H. P. Tiemann, *Iron and Steel* (1919), a pocket dictionary of terms and a brief encyclopaedia of the whole subject. Some fine text books cover only portions of the subject, such as Robert Forsythe, *The Blast Furnace and the Manufacture of Pig Iron* (1922); D. Carnegie and S. G. Gladwyn, *Liquid Steel* (1913); A. W. and Harry Brearley, *Ingots and Ingot Moulds* (1919); D. K. Bullens, *Steel and its Heat Treatment* (1927); Z. Jeffries and R. S. Archer, *The Science of Metals* (1924), and R. M. Keeney, "Manufacture of Ferro-Alloys" (1914), in U.S. Bureau of Mines *Bulletin* 77. Professional societies which devote much attention to the manufacture of iron and steel, and whose journals contain accounts of the current state of the art are the (British) Iron and Steel Institute, The American Iron and Steel Institute, and the American Society for Steel Treating. Leading journals of the trade are *The Iron Age*, New York; *Iron and Coal Trades Review*, London; and *Stahl und Eisen, Dusseldorf*. (E. E. T.)

IRON AND STEEL: WORLD'S STATISTICS. In tracing the development of the world's iron and steel output it is necessary to commence with Great Britain, for although the output of pig iron in Great Britain was in 1927 only 8·7 per cent of the world's total and of steel only 9·2 per cent, nevertheless Great Britain was the birth-place of the modern iron and steel industry, and most of the developments connected with the industry originated there. Until 1871 the output of pig iron in Great Britain exceeded that of all other countries put together; in 1890 Great Britain was for the first time surpassed by the United States: in 1904 for the first time by Germany, and in 1921—owing to a coal stoppage—for the first time by France, who, with Alsace-Lorraine restored, surpassed Great Britain again in 1924.

According to Mushet the output of pig iron in Great Britain in 1720 was 17,350 tons but T. S. Ashton, in his *Iron and Steel in the Industrial Revolution*, gives reasons for thinking this too low, preferring the estimate of William Rea, an ironmaster of Monmouth, who put the output of pig iron at this period at about 25,000 tons per annum; he also points out that Scrivener's *History* (p. 57) wrongly gives 1740 as the date of Mushet's estimate, an error which has been followed by almost all writers since. The 25,000 tons produced in 1720 had risen to 68,300 tons by 1788; but, whereas the majority of the furnaces in 1720 had been charcoal, 55 in 1788 were coke furnaces. It is not possible to describe the reactions of improvements in blast furnaces upon the demand for iron, nor of the demand for iron (created by engineering inventions) upon blast furnace improvements; suffice it to say that by 1840 production of pig iron had risen to 1,396,000 tons; by 1860 to 3,890,000 tons; and by 1880 to 7,750,000 tons. Having nearly trebled in the 20 years between 1840 and 1860 and doubled between 1860 and 1880 the increase between 1880 and 1900, was no more than 16%, while the output in 1920—the highest post-war year—was actually less than in 1900.

It was not until Bessemer's invention in 1856 that the production of steel suitable for rails, etc., at relatively low prices was rendered possible. This was followed by the discovery of the "open hearth" process of steel manufacture by Siemens Bros. in 1864–67; but the most far reaching development, since it rendered available for steel-making large deposits of ore previously unusable, not only in this country but also in France, Luxemburg, Germany and America, was the invention conceived by Mr. Sydney Gilchrist Thomas in 1877, and perfected, in conjunction with his cousin in 1883, whereby phosphorus was removed in the Bessemer and Siemens processes. In 1870 the output of steel in Great Britain was 220,000 tons: in 1880 1,290,000 tons: in 1890 3,580,000 tons: in 1900 4,900,000 tons: in 1910 6,370,000 tons, and in 1920 9,070,000 tons: this figure having been exceeded during the war in 1917 when the output was 9,720,000 tons.

It is impossible to trace, even in this broad outline, the progress of development in the other iron and steel producing countries. In all cases except where the industry is of comparatively recent growth, iron was first smelted with charcoal, and coke but slowly won its way: *e.g.*, mineral fuel was first used in France in 1782, but by 1819 only two furnaces were using coke out of a total of 350 (*Memoirs of the Geological Survey of Great Britain*, vol. i., pt. 1, 1856, quoted by Ashton): but in all countries the great bulk of the steel output is made either by the Bessemer or Siemens process with, of course, local modifications and improvements.

Pig Iron: World Output.—The following table gives the world production of pig iron at the end of each decade from 1820 to 1920: in 1913, and in each post-World War year.

It will be seen that whereas in the hundred years ending 1910 the increase in any decade was never less than 47% and the average rate of increase throughout that period was nearly 60%, the world output in 1920 was actually less than in 1910 and even in

1927 the output was no more than 31 per cent above 1910. The major reason for the slow growth since 1913 (in 1911–13 the rate of progress was fully equal to that in the preceding decades) was the dislocation caused by the World War with a contributory minor reason that since the war a greater proportion of scrap and a smaller proportion of pig iron has been used in steel-making. The rate of progress of steel output has also been checked by the war, but, owing to the increased use of scrap, the increase in output in 1927 compared with 1910 (69 per cent) is much greater than in the case of pig iron.

TABLE I. *World Output of Pig Iron at the End of Each Decade 1820 to 1920, in 1913, and in Each Year Since 1920*

Year	Output: tons	Increase per cent per decade
1820	1,000,000	33*
1830	1,800,000	80
1840	2,700,000	50
1850	4,700,000	74
1860	7,220,000	54
1870	11,840,000	64
1880	18,160,000	53
1890	26,750,000	47
1900	39,810,000	49
1910	64,760,000	63
1913	77,900,000	..
1920	62,850,000	— 3†
1921	37,680,000	..
1922	54,780,000	..
1923	68,910,000	..
1924	67,200,000	..
1925	75,920,000	..
1926	77,700,000	..
1927	85,270,000	..

*Estimate of E. C. Eckel—*Coal, Iron and War*, p. 313. †Decrease.

Outputs of Pig Iron and Steel by Chief Countries.—The following tables give the output of pig iron and steel of the chief producing countries, of pig iron at the end of each decade from 1850 onwards, and of steel from 1870 onwards, in 1913 and in each year since 1920:—

TABLE II. *World Production of Pig Iron by Decades 1850 to 1920, in 1913, and Each Year 1920 to 1927*

(In millions of tons)

	Great Britain	United States	Germany †	Saar	France †	Belgium	Luxemburg	Other countries‡	Total
1850	2·25	0·63	0·30		0·41	0·14	*	0·97	4·70
1860	3·90	0·82	0·50		0·88	0·32	*	0·80	7·22
1870	5·96	1·67	1·24		1·16	0·56	0·13	1·12	11·84
1880	7·75	3·84	2·43		1·70	0·68	0·26	1·50	18·16
1890	7·90	9·20	4·03		1·93	0·77	0·55	2·37	26·75
1900	8·96	13·79	7·43		2·67	1·00	0·96	5·00	39·81
1910	10·01	27·30	12·89		3·97	1·82	1·66	7·11	64·76
1913	10·26	30·97	16·49		5·12	2·45	2·51	10·10	77·90
1920	8·03	36·93	6·93	0·88	3·38	1·10	0·68	4·92	62·85
1921	2·62	16·69	7·72	1·13	3·31	0·86	0·05	4·40	37·68
1922	4·90	27·22	9·25	1·14	5·14	1·59	1·65	3·89	54·78
1923	7·44	40·36	4·86	1·00	5·34	2·11	1·38	6·42	68·91
1924	7·31	31·41	7·68	1·37	7·57	2·80	2·12	6·94	67·20
1925	6·26	36·70	10·01	1·43	8·36	2·50	2·33	8·33	75·92
1926	2·46	39·37	9·50	1·61	9·28	3·35	2·52	9·61	77·70
1927	7·39	36·57	12·90	1·74	9·15	3·69	2·69	11·24	85·27

*Luxemburg is included with Germany 1850 and 1860.
†Since 1920 Lorraine is included with France. ‡Russia, Poland, Norway, Sweden, Italy, Austria-Hungary, Czecho-Slovakia, Spain, Canada, Australia, India, Japan and China.

In 1913 the output of both pig iron and steel in Great Britain was higher than in any previous year, but the capacity of British steel works was not equal to the war demand for steel especially when the requirements of the allies, much of whose steel producing area was over-run, are taken into account. Considerations of time and man power made it impossible to expand the capacity for the manufacture of pig iron to the same extent as for the manufacture of steel, and British pig iron capacity was, therefore, only increased by about 1,000,000 tons per ann. (from 11,000,000 to 12,000,000) while steel capacity was increased by about 4,000,000 per ann. (from 8,000,000 to 12,000,000). The lack of balance thus resulting was met by restricting the use of pig iron for purposes other than for steel making, by the increased use of scrap, and by importation from America.

TABLE III. *World Production of Steel Ingots and Castings by Decades 1870 to 1920, in 1913, and Each Year 1920 to 1927*

(In millions of tons)

	Great Britain	United States	Germany*	Saar	France *	Belgium	Luxemburg	Other countries†	Total
1870	0·22	0·04	0·13		0·08	..	..	0·04	0·51
1880	1·29	1·25	0·69		0·38	0·13	..	0·44	4·18
1890	3·58	4·28	2·10		0·97	0·22	0·10	1·33	12·28
1900	4·60	10·19	6·36		1·54	0·63	0·28	4·03	27·83
1910	6·37	26·02	12·89		3·36	1·91	0·59	8·12	59·33
1913	7·66	31·30	17·32		4·61	2·43	1·31	10·52	75·15
1920	9·07	42·13	8·40	0·73	3·00	1·23	0·57	6·08	71·21
1921	3·70	19·78	8·93	0·91	3·05	0·78	0·74	5·55	43·44
1922	5·88	35·60	11·53	1·24	4·46	1·54	1·37	6·24	67·86
1923	8·43	44·94	6·20	0·98	5·03	2·26	1·18	7·91	76·93
1924	8·20	37·93	9·68	1·45	6·79	2·83	1·86	8·58	77·32
1925	7·39	45·39	12·02	1·55	7·33	2·51	2·05	10·93	89·15
1926	3·60	48·29	12·15	1·71	8·30	3·32	2·21	11·24	91·82
1927	9·10	44·40	16·06	1·86	8·14	3·66	2·43	13·99	100·18

*Prior to 1920, Lorraine is included with Germany, but since that date with France. †Russia, Poland, Sweden, Italy, Austria-Hungary, Czecho-Slovakia, Spain, Canada, Australia, India, Japan and China.

The British production of steel since the war has never equalled the production of 1917, and the production of pig iron has fallen far short of pre-war years. In the case of steel this is due partly to the depression in shipbuilding since 1920 but chiefly to the decline in exports for, in spite of the depression in shipbuilding, home consumption in most post-war years has exceeded that in pre-war years owing to increased demands in other directions.

Iron and Steel Exports.—Table IV. which gives the exports of iron and steel (as far as possible according to the Board of Trade's classification) from chief producing countries shows that exports from Great Britain have not yet reached the record figure of 1913 when they amounted to nearly 5,000,000 tons. The best British post-war years have been 1923, when exports from European countries were curtailed owing to the Ruhr occupation, and 1927 when arrears accumulated during the coal stoppage of 1926 were being worked off. The decline in the British export trade has taken place in spite of great reduction in prices for, as shown by the Board of Trade's price index number, prices of iron and steel products have been falling since the end of 1920, and in March, 1928, prices were on the average only 13% above 1913.

TABLE IV. *Exports of Iron and Steel and Manufactures Thereof from Chief Producing Countries 1913, 1920, 1922 to 1927*

(In thousand tons)

	Great Britain	Germany*	France†	Belgium‡	United States
1913	4,969·2	6,302·0	620·0	1,551·0	2,906·5§
1920	3,251·2	1,723·3	870·1	920·7	4,708·5
1922	3,397·2	2,516·0	1,937·0	1,716·0	1,930·6
1923	4,317·5	1,307·0	2,183·0	2,494·5	1,944·2
1924	3,851·4	1,510·0	2,658·0	3,386·4	1,708·5
1925	3,731·4	3,211·5	3,946·5	3,153·8	1,695·7
1926	2,987·7	4,824·0	4,125·6	3,706·6	2,062·5
1927	4,199·7	4,230·3	5,602·5	4,606·9	1,942·7

*Includes Luxemburg and Saar in 1913. †Includes Saar from 1925. ‡Includes Luxemburg fr. May 1922. §Fisc. yr. ended June 30, 1913.

After a world war, during which the great bulk of iron and steel produced was immediately consumed, it is clear that the potential demand for iron and steel must be considerable, but in the early post-war years most countries were too impoverished to make that demand effective, whilst the belligerent countries who before the war supplied capital for development were no longer able to do so on the same scale. As the world slowly recovered from the effects of the war and purchasing power increased the advantages enjoyed by European countries in their depreciated exchanges, longer working hours, lower standard of living, lower

transport charges, etc., enabled them to quote substantially lower prices than Great Britain and to supply an increasing proportion of the world's needs. The table therefore shows that, while the exports from Great Britain have declined, exports from the other European countries have increased.

As in the case of Great Britain so in France the year 1913 had been one of maximum production, and France produced 5,126,000 tons of pig iron and 4,613,700 tons of steel in that year. As a result of the war, Alsace and Lorraine were added to France and these provinces produced in 1913 3,809,400 tons of pig iron and 2,250,700 tons of steel. The total production of France, as now constituted, therefore in 1913 amounted to 8,935,400 tons of pig iron and 6,864,400 tons of steel. On the other hand, a great proportion of the area in which the iron and steel works were situated was either occupied by Germany or was within range of the German gunfire, so that 63 per cent of the French iron and steel industry was out of commission during the war. France attempted to compensate for this to some extent by building new works in the non-invaded area, and, as soon as the war was over, proceeded to rebuild the devastated areas so that the French iron and steel making capacity within the 1913 boundaries is now considerably in excess of pre-war, and in 1927 France produced 9,150,000 tons of pig iron and 8,140,000 tons of steel. This increased production necessitates a much bigger export of iron and steel from France than formerly, and although the Peace Treaty and subsequent Franco-German agreements provided that a certain quantity of iron and steel should find an outlet in its former market in Germany, France has still to market a great proportion of her output on the world's markets, and this is perhaps the biggest of many factors contributing to the internecine competition which has been experienced in the past few years. It will be seen from Table IV. that French exports have been rising for the last few years and reached 5,602,500 tons in 1927.

The production of pig iron in Belgium in 1913 amounted to 2,445,900 tons, and of steel ingots and castings to 2,428,100 tons; as in the case of most other producing countries this was very nearly equal to capacity. During the war nearly all the plant was destroyed, completely or partially, and the works have had to be reconstructed and are, therefore, up to date. The effect of the rebuilding has done very much to augment the productive capacity of Belgium, and in 1927 3,693,000 tons of pig iron and 3,656,200 tons of steel were produced, or about 50% in excess of the 1913 output. A great proportion of Belgium's production of iron and steel requires to be exported, but a comparison with 1913 is no longer possible since Luxemburg is now included with Belgium whereas prior to the war Luxemburg counted with Germany. Exports of iron and steel from Belgium alone in 1913 amounted to 1,550,900 tons and from Belgium and Luxemburg together in 1927 to 4,606,900 tons.

The production of pig iron and steel in Germany in 1913 (as then constituted and excluding Luxemburg) amounted to 16,500,000 tons and 17,323,800 tons respectively. Germany was thus the second largest producer of iron and steel in the world. Having lost Lorraine, part of Silesia and the Saar as the result of the war it was only natural that she should endeavour to make good this loss by extending existing works and by building new ones within her contracted borders; so in 1927 Germany produced in her post-war area 4,000,000 tons of steel more than were produced in the same area in 1913, the total production of 1927 being equal to that of pre-war Germany in 1913. The production of pig iron and steel in 1927 was 12,897,800 tons and 16,056,700 tons respectively.

American Progress.—The output of pig iron in America in 1913 amounted to 30,966,000 tons and of steel ingots and castings to 31,301,000 tons. The enormous contracts for steel shells, guns, machine tools, etc., placed by the Allies during the war, as well as the demands for equipping her own army when the United States entered the war, necessitated the extension of existing iron and steel plants and the erection of new ones.

Stewart, in dealing with the history of iron and steel prices in America during the war, states:—

"The demand for steel was so insistent that, in spite of the increased output, prices continued to rise at an unprecedented rate. . . . In Aug. 1916, after two years of war, market prices of pig iron had risen 38%, and steel billets 130%. The effectiveness of these prices in stimulating production cannot be questioned. The prices were high enough not merely to maintain production but to persuade producers to increase their productive capacity in spite of the high cost of construction and the knowledge that the war demand for steel could not long continue. Out of the profits yielded at these prices the industry could provide for a rapid rate of depreciation and obsolescence and still show enormous gains."

After the war, the great increase in capacity for iron and steel production was absorbed by the increased internal demand, and in 1927 the output of pig iron in the United States amounted to 36,565,600 tons, and of steel to 44,940,000 tons. Exports of iron and steel which in 1913 had amounted to 2,906,500 tons amounted in 1927 to 1,942,700 tons.

With regard to the future, the British Committee on Industry and Trade (Balfour Committee) which reported on the iron and steel industries in May, 1928, pointed out that had the world's output of iron and steel continued to grow at the pre-war rate the output in 1927 would have amounted to about 140,000,000 tons of pig iron and 150,000,000 tons of steel instead of the 85,000,000 tons and 100,180,000 tons shown in Tables II. and III. above, and although world output could not be expected to increase indefinitely at the pre-war rate there is no indication that the maximum production has yet been reached. (M. S. B.)

IRONBARK, the name applied to species of *Eucalyptus* (*q.v.*) in Australia, from the hardness of the bark.

IRON CROSS. A German decoration, instituted in 1813 as a reward for distinguished service in the War of Liberation. (*See* MEDALS.)

IRON IN ART. Iron work is a term used generally to denote anything made of iron, but specifically applied to the designing and handicraft of iron as a work of art.

HISTORY

The working of iron has engaged the activities of the human race from remote antiquity, especially in the continents of Europe and America. The metal ore exists in vast quantities in the soil, indeed there seems to be no limit to it, and each succeeding year records its discovery in some new place. The pure metal is obtained from the ore by the process of smelting, some primitive form of which was known in early times even by uncivilized races. It was not difficult to fill a cavity with ore and charcoal, and leave an opening for the wind to produce the currents necessary for fanning the flame and raising heat. Wood and charcoal were employed for producing the necessary heat, but in England, in 1611, a patent was taken out for smelting iron with coal, though 100 years passed before Abraham Darby, the first of that name, brought the process into common use. The result was in the form of rough bars of iron called pigs.

The working of iron is referred to in China some thousands of years before the Christian era, and it is found in India at a later date. Its use was known in Chaldaea, Assyria and ancient Egypt. References in the Old Testament suggest that the Hebrews also were acquainted with it. The Greeks are credited with the art of casting statues in iron. Later the Romans profited by the Greeks' knowledge. Currency bars of iron which have been found by the hundred in various parts of England prove that the Roman occupiers found iron very useful as a medium of commerce.

THE MEDIAEVAL PERIOD

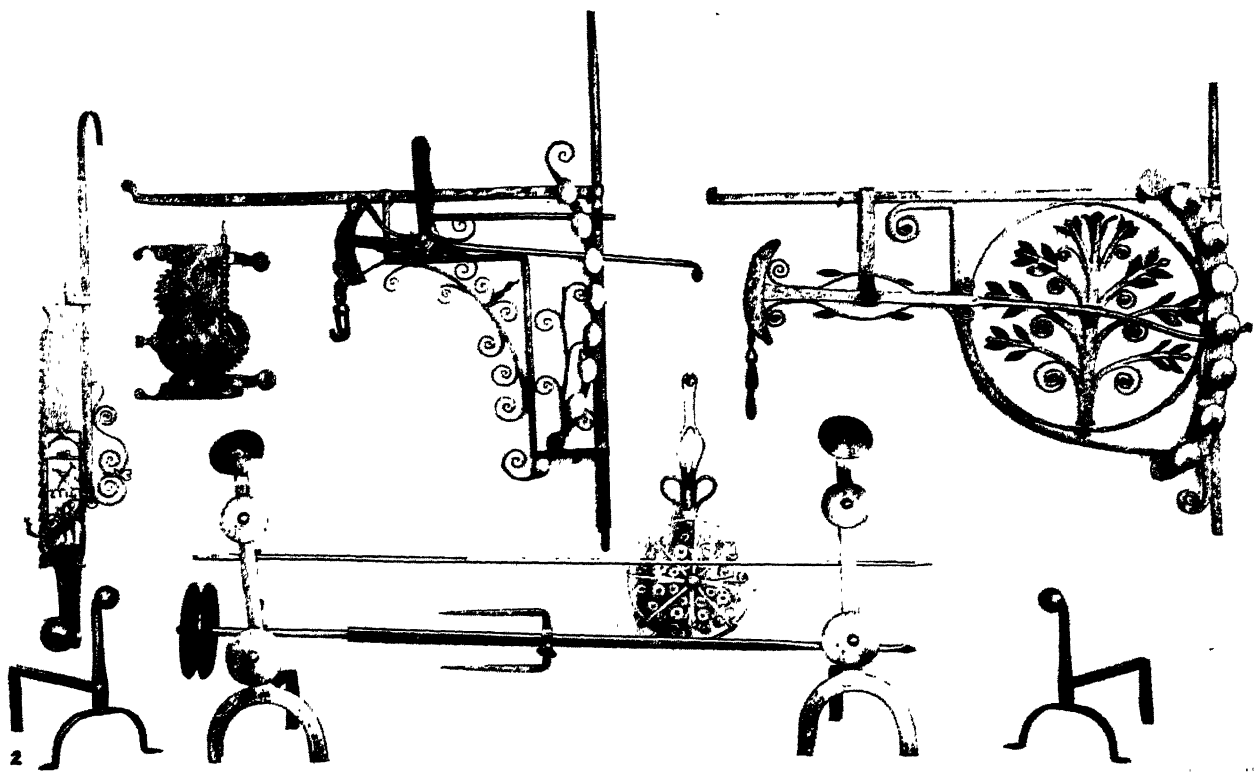
England.—By the 10th century iron-working among the English was as fully developed as at any time during the next three centuries. It appealed to the sturdy English temperament as a difficult material calling for swift action; it suggested strength, stability and protection, all of which qualities were in those days not to be ignored. Its first use was purely protective; enemy attacks were frequent, and doors had to be strengthened with massive iron-work inside and out. Window openings, especially those of the treasuries of mansions and cathedrals, were filled with strong interlacing bars of solid iron; a good example remains at Canterbury cathedral. When in course of time the need passed away, there came greater freedom of work and a

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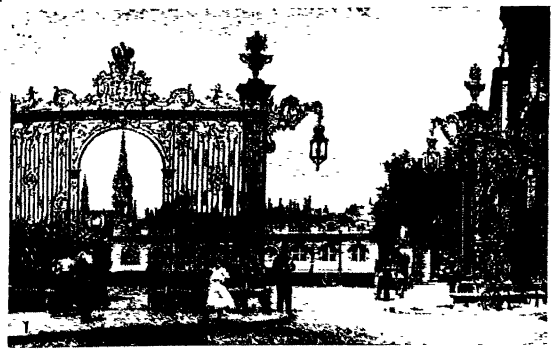
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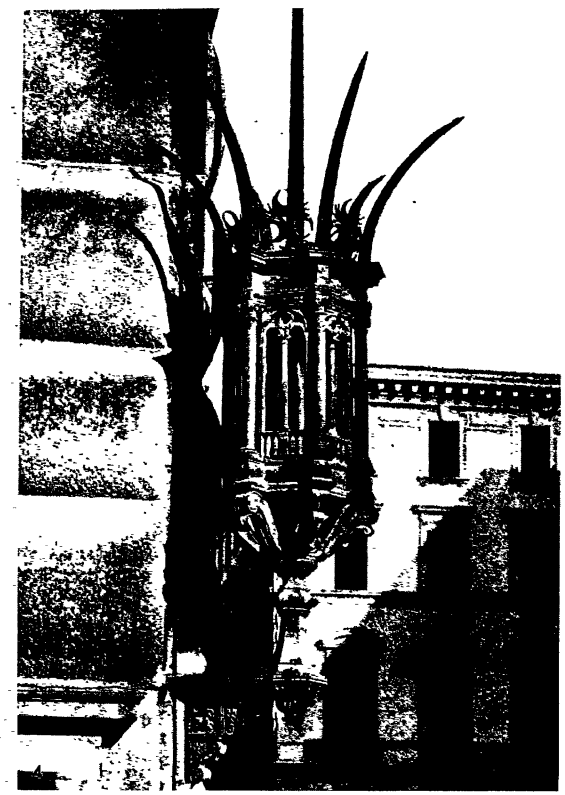
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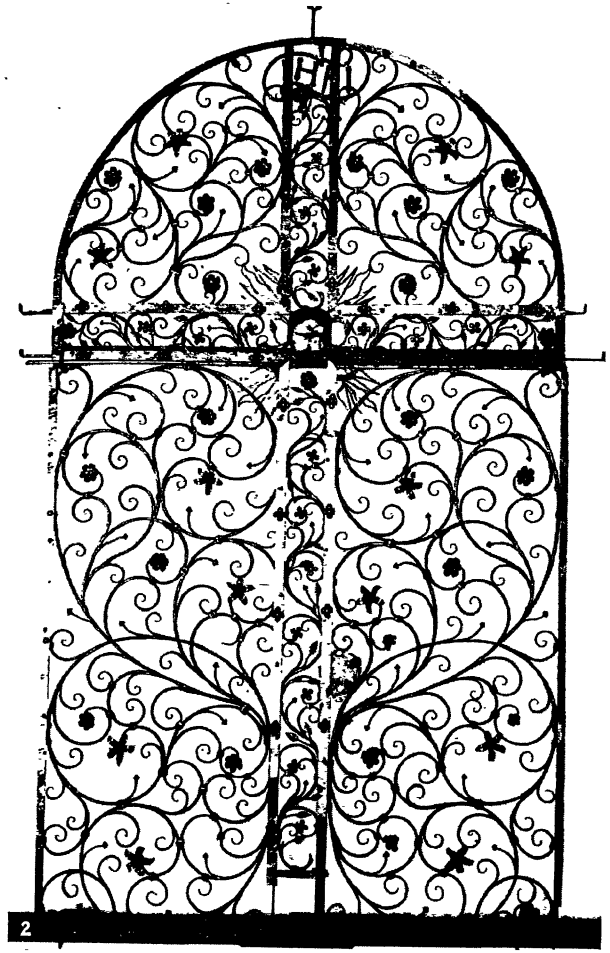
CAST IRON FIREPLACE IMPLEMENTS

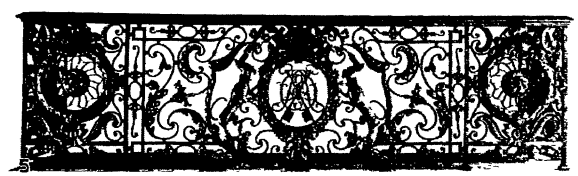
1. Iron Fire-back. The Royal Oak of the Stuarts and the arched crowns date this work in the reign of Charles II. (1660–85)

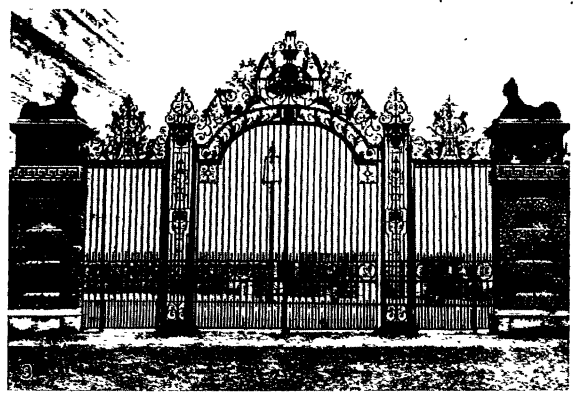
2. Fire-dogs and fire-irons of cast iron. In common use in Europe during the 16th and 17th centuries

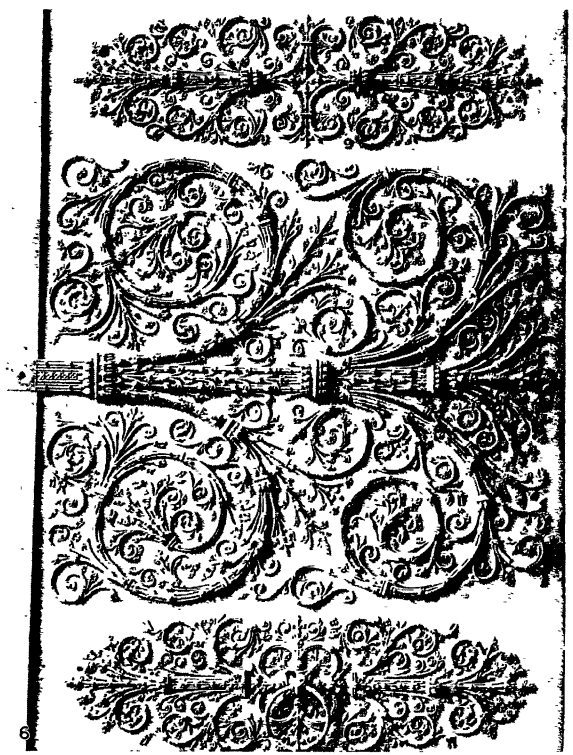










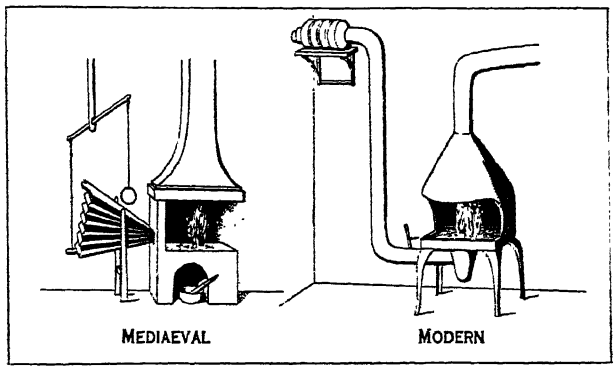


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EXAMPLES OF RENAISSANCE IRONWORK

1. Iron gate and grille at Nancy, France
2. Grille from northern Italy, showing the delicate Italian style
3. Iron gates formerly at Devonshire House, Piccadilly, London; now incorporated in railing on the opposite side of the road
4. Lantern on the Strozzi Palace, Florence, by Niccolo Grossi (*Il Caparra*), an iron worker under the patronage of Lorenzo de' Medici, end of 15th century
5. Ironwork railing around a balcony at Versailles, France. Late 18th century
6. Part of iron hinge work on central door, façade of the Cathedral of Notre Dame, Paris

definite intention of ornament. Throughout England, church doors are found with massive iron hinges, the bands worked in rich ornamental designs of scroll-work, many of them probably the work of local smiths. They vary from the plain hinge-band with crescent to the most elaborate filling of the door. Examples exist at Skipwith and Stillingfleet in Yorkshire, many in the Eastern counties and others in Gloucester, Somerset and the



FIGS. 1 & 2.—FORGES: BELLOWS OF MEDIAEVAL PERIOD, OPERATED BY HAND OR FOOT; THE MODERN HAS A MOTOR-DRIVEN AIR-PUMP

west Midlands. The next movement came with the erection of the great cathedrals and churches, whose shrines and treasures demanded protection. Winchester cathedral possesses the remains of one screen with a symmetrical arrangement of scroll-work. The grille above the tomb of Queen Eleanor at Westminster Abbey recalls the maker Thomas de Leghtone, a master-craftsman in iron who had succeeded another great smith, Henry of Lewes. Tombs were enclosed within railings of vertical bars with ornamental finials at intervals, such as that of the Black Prince at Canterbury. A third development appeared in the early years of the 14th century when the smith, working in cold iron, attempted to reproduce Gothic stone tracery in metal. This work was more like that of a joiner than of a smith, being often in small pieces chiselled and riveted, and fixed on a background of sheet-iron. A typical example is in Henry V.'s chantry at Westminster Abbey; but the most magnificent is the great grille at St. George's chapel, Windsor, made to protect the tomb of Edward IV. For many years it passed as the work of the Fleming, Quentin Matsys, but it is now known to have been executed by an Englishman, John Tresilian. Many small objects such as door-knockers, handles and escutcheons are to be found executed in the same manner. Smithing declined in England during the 16th century.

France.—In door-hinge ornaments France followed much the same line as England, and beautiful work is found on church doors, especially in central and northern France. It reaches a height of greater elaboration and magnificence than in England, the culminating point being seen on the west doors of Notre Dame, Paris, the ironwork of which is so wonderful that it was attributed to superhuman agency. Grilles at Troyes and Rouen reveal a high standard of excellence, but tomb-rails found no favour. What we have called "joiner's" work was immensely popular; it was applied to small objects such as door handles, knockers, ambry doors, and above all to locks, which exhibit an amazing amount of detail and a delicacy of finish such as could only come from a French craftsman. France has succeeded in preserving more of its mediaeval work than England.

Germany.—In Germany the door-hinges present greater stiffness than those of France. Examples exist at Nuremberg, Magdeburg and elsewhere; unusually fine locks and other objects in Gothic architectural style are common enough. Rich pierced work is also found and hammered work of an heraldic character, but the German smith of the period had not the same understanding of Gothic work as his French neighbour.

Belgium.—Belgium made a late start in the working of iron, but the number of objects still existing such as candelabra, fontcranes, lecterns and gable crosses, show an extended application and thorough knowledge of the art. The iron well-cover by the cathedral at Antwerp which dates from 1470 enjoys a wide reputation. The Matsys family of Louvain were celebrated smiths.

Spain and Italy.—Spain followed much the same lines; the craftsmen imparting to their work the characteristic richness and elaboration of their Gothic architecture. Italy seemed hardly at home with iron, and was content to adopt the easiest methods of workmanship. The screen of the Scaliger monuments at Verona, a grille at Santa Croce, Florence, and another at Siena, give an Italian rendering of Gothic tracery with panels of pierced sheet-iron.

The end of the mediaeval period in Europe found the smith departing from legitimate design in his work and indulging in methods hardly appropriate to his material: attractive as the result is, it does not satisfy our sense of what work in iron should be, nor did it serve to bring out the power of the craftsman.

THE RENAISSANCE PERIOD

Italy.—It might have been thought that in the home of the Renaissance, ironwork would have proceeded at the same pace and with the same brilliant success as architecture, sculpture, bronze-casting and the other arts. Strangely enough, little use of it is found in connection with the fine buildings of the revival. Bronze was favoured, and what in other countries is found in iron has its counterpart in Italy in bronze. The manual labour involved in the use of iron did not commend itself to the Italian temperament, and as time went on the smiths grew less inclined for the more difficult processes of hammering and welding, and contented themselves ultimately with thin riband iron, the various parts of which were fastened together by collars. Work of the later periods may be distinguished, apart from the design, by this feature, whereas the English and French smiths vigorously faced the hardest methods of work, and the German and Spanish smiths invented difficulties for the sheer pleasure of overcoming them. Notable centres of artistic ironwork were Florence, Siena, Vicenza, Venice, Lucca and Rome, where important pieces may be found in the form of gates, balconies, screens, fan-lights, well-covers and a mass of objects for domestic use such as bowl-stands, brackets and candlesticks.

In screen-work the favourite motif was the quatrefoil which is found with many variations over a long period of time. Early examples are strong and virile, later ones tend to weakness. The C-shaped scroll is used in many combinations. The churches and palaces of Venice contain many examples. Peculiar to Italy are the lanterns and banner-holders such as may still be seen at Florence, Siena and elsewhere, and the rare gondola-prows of Venice. Of the ironworkers of the early Renaissance the most famous was Niccoto Grosso of Florence, nicknamed *Il Caparra* because he gave no credit but insisted on money on account, who worked at the end of the 15th century. Vasari thus eulogizes him: "He was truly unique in his craft, and has never had and never will have an equal." From his hand is the well-known lantern on the Strozzi palace in Florence, repeated with variations elsewhere in the same city. Siena can show other lanterns and banner-holders attached to the façades of its palaces. Cressets are still to be seen at Lucca and a few other towns. The Victoria and Albert museum, London, contains two gondola-prows in fine pierced iron. Through the 16th and 17th centuries Rome produced much good work of a more virile character than that at Venice, and the same may be said of other cities. To the influence of the Rococo movement reference will be made later.

Spain.—Here the work of the Renaissance period reached a height of grandeur and magnificence attained in no other country. Of all the Spanish craftsmen the smith and the armourer were the busiest, especially during the 16th century. The particular manifestation of work in iron which for more than a century towered above all the others may be seen in the screens of monumental size (*rejas*) to be found in all the great cathedrals of Spain. These immense structures rising to 25 or 30 ft. show several tiers of balusters divided vertically by columns of hammered work and horizontally by friezes of hammered arabesque ornament, and are surmounted by a cresting which is sometimes of simple ornament, but more often a very elaborate design into

which are introduced a large number of human figures; shields of arms are freely incorporated, and the use of bright colour and gilding adds to their impressive beauty. The great balusters are always forged from the solid, and their presence in hundreds and possibly thousands demonstrates the extraordinary skill and power of the Spanish smith. The *reja* shut off the high altar of the church or cathedral, and a further opportunity came to the smith when the choir was moved westward. This necessitated a second screen to enclose the east end of the choir, and naturally this screen must be in no way inferior to that of the high altar. Thus in many cathedrals two of these monumental *rejas* are found facing one another. It was the smith's opportunity, and he availed himself of it to the full. His work may be seen in all the large cities of Spain—Barcelona, Saragossa, Toledo, Seville, Burgos, Granada, Cordova and many others. The screens follow the same lines of general design, but the balusters are sometimes of twisted iron and occasionally, as in the royal chapel at Granada, they are opened out some feet above the base into various devices—a method reminiscent of an earlier period. Similar work but on a smaller scale is found in gates, balconies and window-screens; wrought-iron pulpits also exist. The panels of hammered and pierced iron heightened with colours and gilding were used in connection with domestic architecture, and a note must be made of the fine nail-heads which ornamented many doors.

France.—The Gothic tradition survived in France until well into the 16th century, and was marked by the production of work of the highest skill largely in the form of locks, knockers and caskets of chiselled iron. The introduction of the Renaissance style made no great difference to the direction of the smith's art—a strange fact when it is remembered how Germany and Spain were fabricating works of enormous size and magnificence in wrought-iron. France, like England at that time, was content to make door furniture, in the form of locks, keys, bolts, escutcheons and the like, but did little work of any great size. A school of locksmiths came into being under Francis I. and Henry II., working from designs by Androuet du Cerceau in the 16th century and Mathurin Jousse and Antoine Jacquard in the 17th. The bows and wards of keys were of unusually intricate design, and the locks of corresponding richness. Representative pieces may be seen at the Victoria and Albert museum, London, among them the famous Strozzi key said to have been made for the apartments of Henry III., the bow of which takes the favoured form of two grotesque figures back to back. But as far as architectural ironwork was concerned, France remained almost at a standstill until the accession of Louis XIII. in 1610. Under that monarch, a worker at the forge himself, there came a great revival. It seemed to be uninfluenced from without, at first weak, as if feeling its way, but by the end of the 17th century it had attained a marvellous pitch of perfection. It proved to be the beginning of a new movement, the force of which made itself felt in the adjoining countries and inspired the workers with new energy which unfortunately at times dwindled into mere imitativeness. From the accession of Louis XIV. the French ironworkers must be acknowledged as the cleverest in Europe, combining as they did good and fitting design with masterly execution. Their designs were often very daring, reaching the limit of what was allowable in such a metal as iron. They recognized its great adaptability and took every advantage of it, at the same time being conscious of its limitations. Their opportunities were endless. Screens and gates were needed for parks, gardens and avenues, staircases for mansions and palaces, screens for churches and cathedrals. Among celebrated designers were Jean Lepautre, Daniel Marot and Jean Bérain. The earlier work is of a simple character, balconies for instance being in the form of a succession of balusters, but as the smith became more conscious of his powers they took the form of panels of flowing curved scrolls rendered with a freedom never attained before, while constructive strength was observed and symmetry maintained. Enrichments were usually attached in hammered sheet-iron. These may be considered the distinguishing features of Louis XIV. work such as that at St. Cloud, Chantilly, Fontainebleau and elsewhere. But Louis XIV. surpassed all efforts in the work for his palace at Versailles.



FIG. 3.—THE ANVIL

The art of the blacksmith received a further impetus by the introduction of what is known as the rococo style. The movement initiated in 1723 was due to the imagination of two artists, Juste-Aurèle Meissonier, architect, and Gilles Oppenord. There was no longer any symmetry or balance in the design, but fantastic and restless curves with a luxury of applied ornamentation. To the French smith it furnished the opportunity for a yet greater display of his skill. He was clever enough to secure a feeling of stability in his work by counterbalancing swirling masses or ornament with straight constructional lines; he knew how to introduce an iron screen of rococo style into a Gothic church or cathedral without giving offence to the eye or arousing any uncomfortable feeling of incongruity.

With astonishing manipulative power he worked as if the material under his hand were soft and pliable rather than solid and unyielding iron.

Later in the 18th century ironwork took on a more classical appearance, owing to the general study of ancient art, and many Greek and Roman details were introduced into the ornamentation. The amount of work executed was prodigious, and its beauty and cleverness may be seen in most cities of France.

As might have been expected, nearly all the adjacent countries were seized with the desire to imitate this French rococo style, England excepted. But their efforts in this direction were largely doomed to failure; the style was to them exotic, and consequently their imitations are, as a rule, unsatisfying. This is particularly true of the Italian rendering, which has lost the cohesion of the original design and lacks its bold workmanship; it fails to excite admiration. On the other hand, the German smith not infrequently caught the spirit of the French designer, and showed himself his equal in power of execution. Such work as that in the palace of the prince-bishop at Würzburg stands comparison with the French work of the period. Switzerland made an attempt in the French style of the end of the 18th century, and the results, though lacking the strength of the French work, are by no means unattractive.

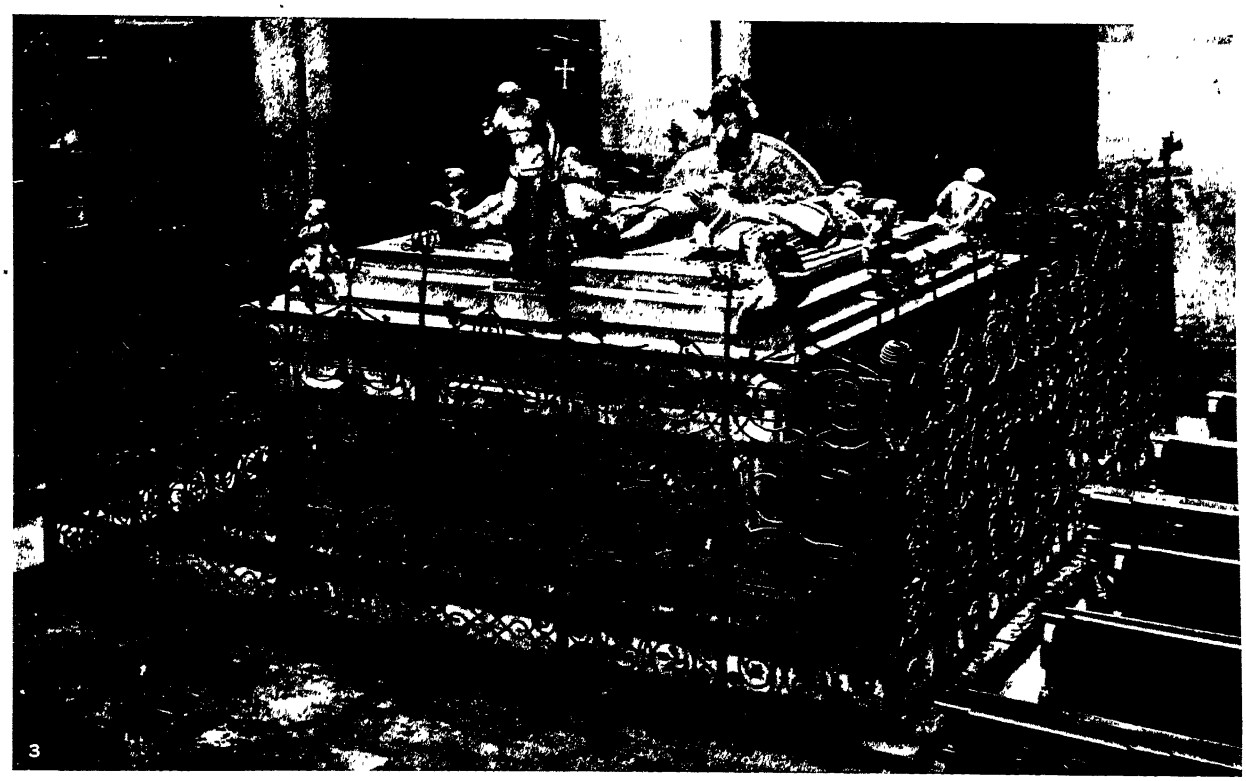
RENAISSANCE PERIOD ELSEWHERE

England.—The development of the art during the Renaissance period was very uneven in the various countries of Europe. The English smith fell behind and seemed to have lost interest, producing no very great or important work. He continued to make iron railings and indulged in a number of balconies. His activities were more or less confined to small objects for architectural application such as hinges, latches, locks and weather-cocks. To this period belong the hour-glass stands of wrought-iron generally fixed to pulpits or some convenient adjacent column; over 100 still remain in their original position. In the reign of Charles II. a revival of larger work seemed imminent, and the rebuilding of the London churches after the great fire furnished an opportunity for making hat-rails, sword and mace stands, stair-rails to pulpits and finely decorated wrought-iron suspension rods for the great brass chandeliers with which the churches were provided. The English smith was neither idle nor incompetent, but he was waiting for an impetus and an inspiration for his work.

The opportune moment came towards the end of the 17th century. There was a growing interest in beautifying houses and laying out gardens and squares, and a consequent use for balconies, staircases and garden gates; the rebuilding of St. Paul's cathedral and the London churches was in full swing. The man to whom the credit is usually given for the revival of ironwork in England was Jean Tijou, a Frenchman who together with





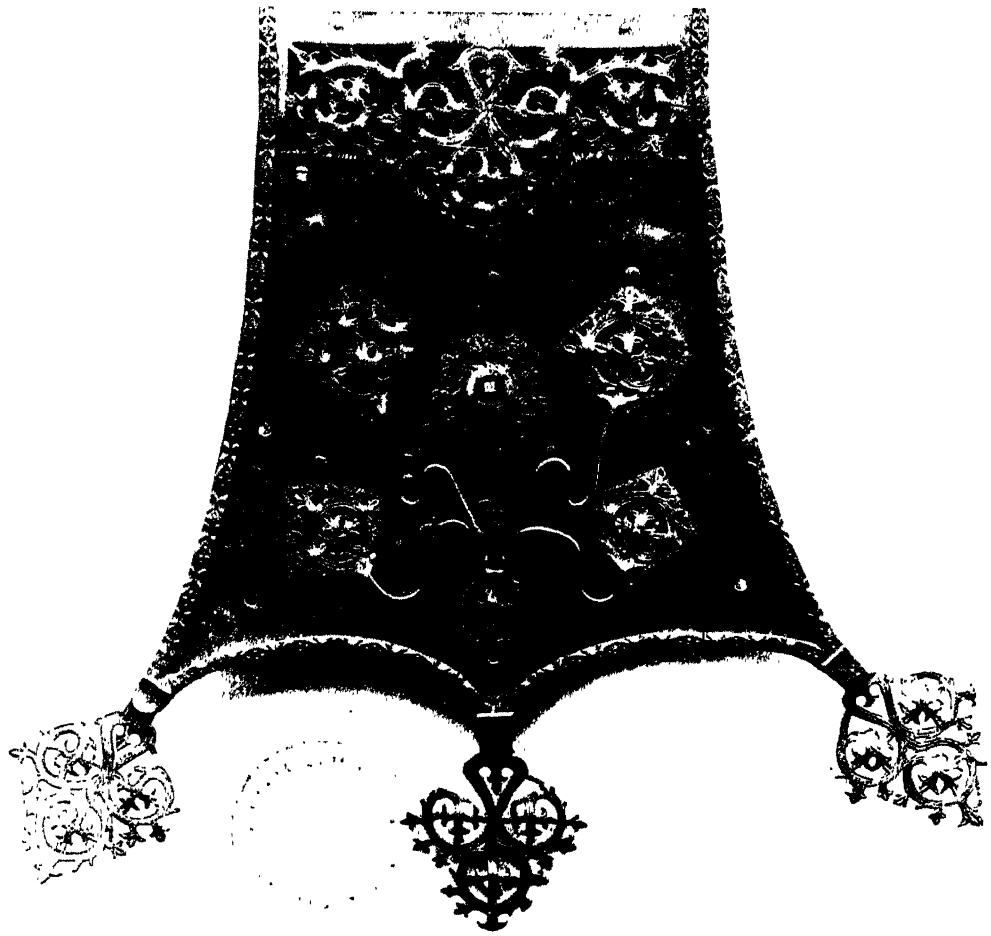


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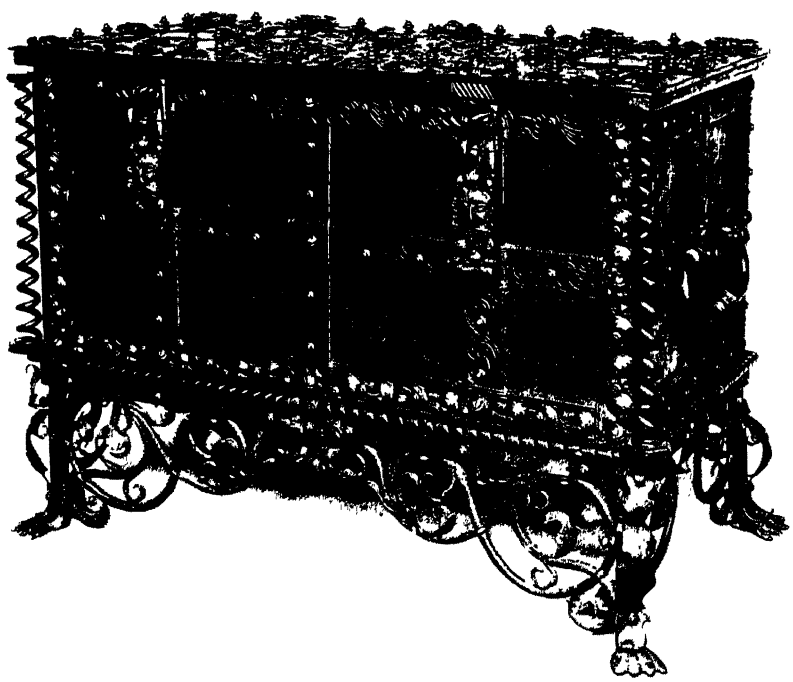
ENGLISH AND CONTINENTAL IRONWORK

1. Iron grille by John Tresilian, at St. George's Chapel, Windsor. It was originally made to protect the tomb of Edward IV.
2. Iron-mounted south door of Uffington Church, Berkshire, England
3. Iron railing, by Jorg Schmidhammer, around tomb of Maximilian I. at Prague; about 1573

IRON IN ART



1



2

BY COURTESY OF THE DIRECTOR OF THE VICTORIA AND ALBERT MUSEUM

RENAISSANCE IRONWORK IN GERMANY

1. German lock, characteristic of the Renaissance workmanship of that country. German smiths often designed such locks with complicated devices merely to show their skill in executing them

2. German coffer. Example of the type of great chests executed by German smiths during the Renaissance period. They were covered with rich iron mountings of intricate design

many of his Protestant fellow-craftsmen had been forced to leave his country owing to the revocation of the Edict of Nantes in 1685. After some years in the Netherlands he came to England in 1689 where he enjoyed the patronage and favour of William III. and his queen. His most important works are to be seen in the immense mass of screens and gates with which he embellished Hampton Court palace for his royal patrons; they show an excessive amount of foliage and other ornament in sheet-iron beneath which the construction lines are almost lost, but Tijou was primarily rather an embosser than a smith. He executed work at Burleigh house, Stamford, and elsewhere; and probably by the queen's wish was associated with Sir Christopher Wren then engaged on the rebuilding of St. Paul's cathedral. Wren apparently was not very keen on ironwork, and probably exercised some restraint on Tijou with the result that his work at St. Paul's is more serious and dignified and freer from appendages than that at Hampton Court.

How far did the English smiths follow Tijou's lead? They possessed several useful qualities; they were careful observers and not mere copyists; they seldom lost sight of construction work or ignored the sense of stability that was essential; their more staid and serious temperament was reflected in their work; consequently they developed along lines of their own and produced a definite style. The early years of the 18th century saw the erection of many fine gates in London and the vicinity. One of the best known is that formerly at Devonshire house and now on the opposite side of Piccadilly. The names are known of several English smiths who proved themselves worthy successors of Tijou though in a definitely English style. Thomas Robinson was associated with him at St. Paul's where his work is easily distinguishable from that of Tijou. He also made the great garden screen at New college, Oxford, and perhaps the gates to Trinity college.

At Derby and in the neighbourhood Robert Bakewell executed the noble screen at All Saints church, the gates to Etwall hall, Melbourne, and much other work. William Edney made the screens in the churches of St. Mary Redcliffe and St. Nicholas, Bristol, as well as the gates to Tredegar park near Newport. Robert Davies of Wrexham executed gates for Chirk castle and other work in the vicinity. In London there may be studied a great amount of fine ironwork of the 18th century in the form of gates, railings, lampholders, door brackets, balconies, staircases; in almost every suburb may be seen gates and brackets. The precincts of the colleges of Oxford and Cambridge, as well as almost every old town in England, furnish a variety of handsome work. Throughout the 18th century the smith was a busy man; the general tendency of his work, unaffected by the rococo movement, was towards a less ornate but more characteristically English style, perpendicular, severe, lofty and commanding, as contrasted with Tijou's French love of richness and mass of details. So far from Tijou dominating English work, the native craftsman brought his ideas into line with the national temperament and taste which lay in the direction of simplicity and a thoughtful recognition of the limitations of the material. At the end of the 18th century the work of the architect brothers Adam shows a departure from true smithing; its slender delicate bars are enriched with rosettes, anthemion and other ornament in brass or lead. The effect is pleasing and harmonizes with the architecture with which it is incorporated.

Germany and Austria.—During the period of the Renaissance, ironwork in Germany showed a marked contrast to that of Italy. The metal was in use everywhere and for every purpose: for screens in churches, window grilles, stove guards, gates, fountain railings, well-heads, grave-crosses, door-knockers, handles, locks, iron-signs and small objects for domestic use. Smiths were their own designers, and more often than not planned intricate devices merely to show their skill in executing them. They recognized no limits to their powers, and so far as manipulative excellence went they were the foremost nation of Europe. But clever as their workmanship undoubtedly was, their designs frequently showed a lack of stability and a tendency to run riot. Thus many of their most imposing works consist largely of filling of panels with elaborate interlacing scroll-work, and the sense of constructional and protective strength is lost sight of.

The greater amount of smiths' work is to be found in the southern parts of Germany. Iron bars of round section were most frequently used and the most common features are the threading backwards and forwards, terminations of flowers with petals and twisted centres, or of foliage or human heads. All of these characteristics occur with almost monotonous repetition, witnessing to the Teuton's skill in working, but also to his lack of imagination and power of design. The style may be studied in many German cities, *i.e.*, Augsburg, Nuremberg, Frankfort, Salzburg and Munich; the work at Innsbruck is also well known.

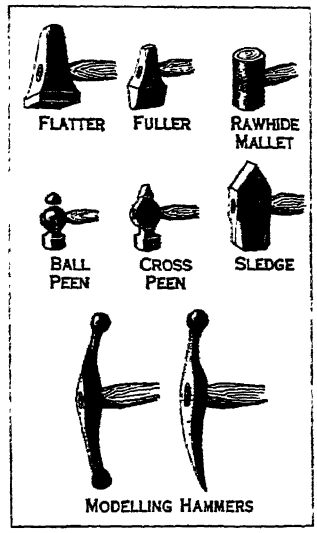


FIG. 4.—SOME OF THE VARIOUS TYPES OF HAMMERS USED IN WORKING THE IRON ON THE ANVIL

The German blacksmith gave much attention to door-knockers and handles, enclosing them in pierced and embossed escutcheons, also locks of very involved mechanism. Mention must also be made of the great boxes erroneously termed "Armada" chests, sometimes covered with rich iron mountings and having a lock with many bolts spreading over the whole of the inside of the lid.

German influence made itself strongly felt in Switzerland where the working of iron had established itself in the 17th century. The intricate grilles and screens referred to above may be met with in the Engadine, and in more central parts of the country fine door fittings are found which are claimed, and probably with truth, to be of local manufacture. Scandinavia followed Germany in design and work. It must be remembered that ironwork had been an important industry in these countries from early mediaeval times.

The Low Countries.—Holland and Belgium were influenced by their neighbours, but there is no work of the importance of that produced in France or Germany. Another metal, brass, seems to have provided the outlet for their energy, and they were content to confine their work in iron to objects for domestic purposes. Cranes for raising the covers of fonts continued to be produced for churches, and grilles of trellis-work for the tabernacles; screens were rare. The quaint streets of such towns as Bruges and Ypres were rendered more picturesque by signs hanging from brackets of wrought iron, such as may still be seen in the Rue du Fil, Bruges. The façades of houses were decorated with the date of their construction in large iron figures, or with wall-anchors whose device sometimes denoted the occupation of the owner; finials in the form of crosses or some fantastic device surmounted the gable ends; rich hinge and strap work strengthened the folding window-shutters.

Cast Iron.—The casting of iron seems to have had rather a limited existence. In England the earliest known piece is a tombstone in Burwash church, Sussex, which dates from the 14th century. And it was not until the close of the following century that the introduction of open hearths and fire-places brought fire-backs and fire-dogs into common use. Designs of backs were many and various, at first the royal arms and insignia, and later any kind of decoration, in fact any handy piece of ornament, was pressed into use. The most highly valued are those with the royal arms or crests, or with fine heraldry. Fire-dogs were simple, the uprights being in the form of a column or terminal figure, sometimes supporting a shield of arms. The making of fire-backs and fire-dogs was virtually confined to the Weald of Sussex where it came to an end with the close of the 17th century. The railing outside St. Paul's cathedral, London, is an old and important piece of cast work; however, it was not until the 19th century that cast-iron railings became general.

France also produced cast fire-dogs and fire-backs, the latter tending to greater refinement of style and execution than those of England. In Germany and the Low Countries fire-backs had their counterpart in the panels of stoves cast for the most part with scriptural subjects. Reference must also be made to the delicate "Berlin" iron jewellery cast in openwork with various designs at Ilsenburg in the Harz mountains, and as an act of patriotism substituted for the more precious metals to meet the exigencies of the Napoleonic wars. (*See* BRONZE.)

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(W. W. W.)

MODERN EUROPEAN IRONWORK

A renaissance in the art of ironwork was achieved by the end of the 19th century. At first certain workers rediscovered this fine craft with all its strength, suppleness and complexity. The wonderful balustrade of Chantilly, a work of the Moreau brothers (1880), shows the results achieved in this respect. But this was not enough. It was necessary to return again to the underlying principles of the art in order to direct the skill of the technician toward logical achievement in the art. It was also necessary that the works so achieved should not be mere imitations of the past, but creations thoroughly of the present. It was necessary to rediscover a living style, and to this end the very conditions of artistic production had to be modified by the collaboration of workers in iron (artists and industrial workers), architects, and the public, united in a single love of this art that was being born anew. This enormous task, then imposed, has not yet been wholly accomplished. The union of art and of industry, in particular, is far from being sufficiently general; and we shall see that this was one of Edgar Brandt's preoccupations. But the principal effort was supplied in the last years of the 19th century, and in the first years of the present century; and it may be said that the battle, as a whole, had been won as early as 1905.

The employment of wrought iron had again been restored to common use. Architects once more employed it in all buildings of costly and elaborate construction. The public had become conscious of its elegance and its strength. New forms had appeared and the arts of metallurgy in particular had profited more happily than other arts by the researches that were then being made in the various forms of "modern style." Then, too, though the accomplishment of this period in all branches of the applied arts may very often seem questionable to-day, the underlying principles followed were generally excellent; and the difference between the artists of the present generation and their predecessors of 1890–1905 seems to consist especially in the fact that the more recent artists applied in a more logical manner the sound principles which their elders recognized, but which they failed to observe with sufficient consistency

Émile Robert supplied more than merely strong, sane doctrines; his craft, too, was always magnificent; his works were well-composed and clearly wrought. When Brandt and his Paris workshop made their appearance, Robert had already freed iron decoration from the invariable acanthus and adorned it with the most charming flora, varied, light and wholly fresh. He had also divested it of the confused and anomalous ornamentation which to-day is so annoying in works like the Chantilly balustrade, and he had returned to simpler structure. He had put away the file and given up metal-chasing; he paid due regard to the hammer marks, significant proofs of the struggle by which man controls rebellious matter. (We shall find that Brandt does not share Robert's systematic aversion toward chasing.) Robert was the unchallenged prince of metal-work. He exercised considerable influence because he added to the skill of the technician and the talent of the draughtsman the intelligence of the theorist who can reason about his art.

In 1905, a State school of ironwork was established in France. It had following, it was guided by fruitful principles, it had found original forms, and achieved some masterpieces; but it had within itself at least two elements of weakness—on the one hand (and often in Robert himself), an excessive tendency toward the fantastic; on the other hand, among too many artists, insufficient technical equipment.

Use of Machinery.—The modern craftsman, and Edgar Brandt probably more than others, makes use of the most perfect modern tools. His preliminary work is carried out with the pneumatic hammer, the stamper, the press. Machine-tools are employed for the assembling of parts; the work is divided according to the rules of modern industrial organization. Each of the different workshops carries out its special task. All the parts so created around the same motif are then assembled in the welding-shop. Here modern methods again economize time and effort, while supplying work so exact that it could not have been achieved in the past. Then the different motifs go to the shop to be set up. Finally the complete work receives, in the last workshop, its definitive surface, the operatives darkening the deeper parts and brightening up the others. Some persons disapprove of this use of machinery. They fear that iron will lose "its qualities of animated grace and living charm." They say that it debases iron to treat it with anything but the hammer. These are the words of the editor of *Bronzes d'Art Suisse* and were quoted by Émile Robert in the first article of his review, *La Ferronnerie Ancienne et Moderne,* 1896. Brandt holds that these fears are entirely exaggerated because there is no question of abandoning the forge, from which is derived to-day a part of this life, grace and charm. To Émile Robert as to Jean Lamour, the forge is no longer a means, but an end in itself, outside of which, in their opinion, no processes can be recognized. Brandt, on the contrary, takes his place at the head of the school which may be called "eclectic," because for it the forge is only one means among several others equally interesting, and is to be employed or not according to the effect to be obtained and the purpose for which the object is

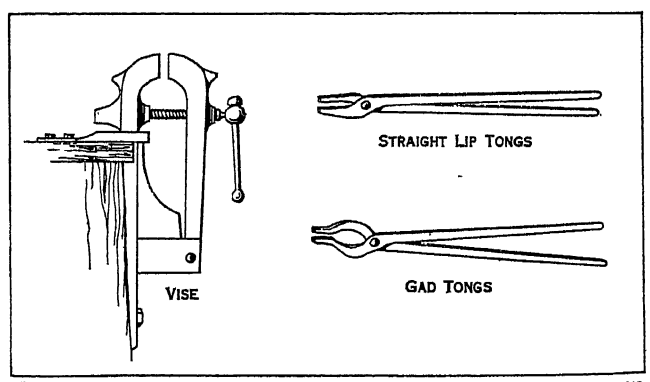


FIG. 5.—VISE AND TONGS USED TO HOLD IRON WHILE WORKING OR TO OBTAIN A GOOD GRIP ON OTHER TOOLS

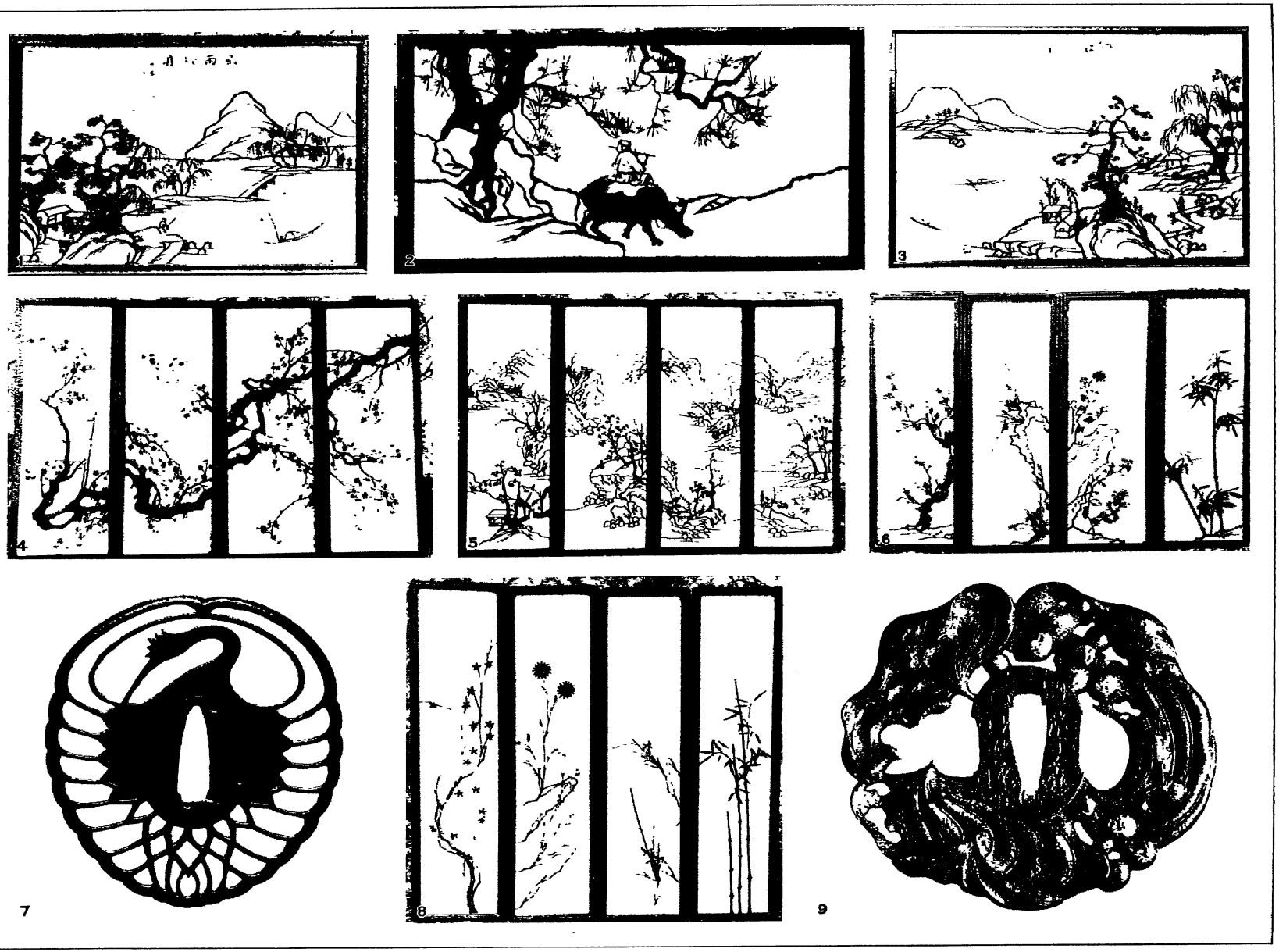
intended. This school may also be called the "modern" school because it frankly adopts for its means the processes supplied by present-day science.

It is, then, of new effects that we must now speak. Brandt, for example, succeeds in decorating large frameworks with ornaments which support one another by their borders, without the aid of bars. Bars would formerly have been necessary to strengthen screens of this kind and, therefore, would have modified the character of the whole by dividing it into a large number of small sections. Acetylene welding allowed Brandt rapidly to

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CHINESE CAST IRON WORK

1. Cast iron vessel of the Han dynasty (206 B.C.–A.D. 220)
2. Cast iron head of a Bodhisattva Sung dynasty (960–1280)
3. Cast iron figure, Ming dynasty (1368–1644); dated, equivalent to A.D. 1618
4. Cast iron bell, Sung dynasty (960–1280)
5. Cast iron statuette, Ming dynasty (1368–1644)
6. Cast iron vase, Han dynasty (206 B.C.–A.D. 220)



BY COURTESY OF (1-6, 8) JOHN REILLY, JR., (7, 9) THE MUSEUM OF FINE ARTS, BOSTON

GROUP OF CHINESE IRON PICTURES AND JAPANESE SWORD GUARDS

1 and 3. Chinese wrought iron landscapes signed by T'ang P'eng (dated equivalent to A.D. 1705)

2. Wrought iron landscapes, with figures, 18th century

4. Set of panels of the Prunus wrought in iron

5. Iron landscape panels

6 and 8. Two groups of four iron panels each, depicting the four seasons

7. Japanese iron sword guard. 17th–18th century

9. Japanese iron sword guard by Yukinaka (fl.?), 18th century

develop similar decorations of a breadth, suppleness and intricacy which literally could not be achieved in former days.

Modern technical processes open to creative activity a career hitherto unknown. As they grow more numerous, the artist's horizon is extended. His powers must increase in the same measure. A serious danger, that of mere facility, is now threatening. Every worker, without even a trace of genius, can use the acetylene blowpipe, can operate the stamper, or the press, and not only display a deceptive virtuosity, but achieve productions in which art has no share.

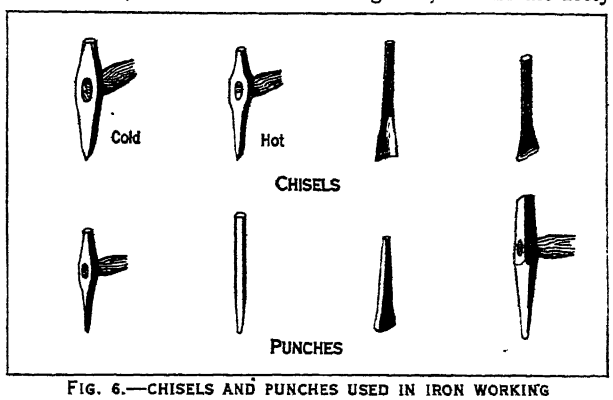


FIG. 6.—CHISELS AND PUNCHES USED IN IRON WORKING

Brandt's Workshops.—Innovations in technique correspond in detail to new methods of work. In general, it is a fact that no considerable work can to-day be produced by one man alone. The various machines, the large number of orders, and their importance make collaboration necessary. Brandt, whose beginnings were very modest, now plays the part of master of the work in his workshops; a little like the great painters, he directs some 30 draughtsmen. These different personalities add to the variety of material a variety of technique. (Brandt's principal collaborator is Favier, an architect.) None among them claims an idea as his own. While successive supervision secures perfect balance in these creations, their artistic quality is constantly refreshed by manifold researches which cause the underlying formula to stand out as they are established, and which thus sustain the fire of life. The master is obliged to supply a perpetual effort of concentration, for execution can only be achieved by obedience to the laws of unity and harmony, to the laws of architecture.

Prominent among the effective motifs which Brandt employs most frequently are pine-branches and two other motifs that seem to be his own creations. He uses them so systematically in his works and they assume so special a character that their presence alone would make us recognize their author. One is a plant of the Far East, the *Gingko biloba*. It is light and at the same time ornamental, lending itself with great suppleness to varied stylization, because it has along with its frail stems, tendrils and leaves, small fans which make a dark spot among the delicate lines. Secondly, and especially since the World War, Brandt shows a fondness for the decoration of vertical planes by a system of circles and scrolls.

But Brandt's originality lies less in the elements he employs than in the uses he makes of them. The variety of motifs, the mingling of a naturalistic flora with stylized flowers, his freedom of interpretation are so many characteristics common to Brandt's art and that of the generation of 1890–1905. In Brandt, too, are to be found the combinations of lines to which modern style has accustomed the eye, notably the metal rods, delicately sinuous, which suddenly curve back at very sharp angles. In turning over the pages of the art reviews of the first decade of the present century, we see Brandt's work, from his first attempts, integrating itself in a very normal manner with the productions of this period. This affiliation with his era does not, however, render less striking the fact that Brandt brought forth a new method of composition as harmonious as that of his predecessors was full of contrasts.

(R. RE.)

THEORY

The interest and charm which the most unpractised observer must find in the work of the early craftsmen in iron is due to the fact that the metal was worked at a red or white heat. There was no time for measuring or copying a design save by the eye. Thus we get a spontaneity and a virility in forged work which expresses the life of the metal and gives the work its unexpected charm. These old craftsmen knew every branch of their work; they lavished as much skill and creative ability on a small handle as upon a great gate. No detail was overlooked, no matter how small or insignificant. This can be seen in various examples of their works, as in the fine old chests and boxes; the wonderful old locks, keys and other decorative hardware used in the great cathedrals. The sincere nature of craftsmanship and the proper use of materials for ends to which they are well adapted is little understood to-day. This is not because there is any lack of information on the subject, but because the perfection of the mechanical means of production at our disposal has blinded many to the simplicity of the means which produced the great works of the past.

Nevertheless there is more interest shown in arts and crafts to-day and more of a trend towards the use of them than ever before. Along with the good work comparable to that of the old masters, however, there is also a profusion of bad work. This bad work includes all the work which is tritely inventive and not truly creative. It is work done in an artificial manner; work which has no tradition, and is designed by those who do not understand the possibilities and limitations of the material in which they work. These people do not possess the true craftsman's training, and so the work is done in a mechanical way. Iron is sometimes of necessity artificially welded because of designs which are not properly conceived. The new ideas and new designs being introduced for this great craft are dangerous, for no work is good unless the material is used in the way it should be, and the designs made to suit that material.

Iron not only suggests security, strength, defence and durability, but lends itself to many beautiful and useful as well as ornamental purposes. But to-day these uses are being abused and ironwork is used promiscuously by those who try to establish a vogue in this craft. Much of the ironwork found on public buildings and in homes is for cheap show only, and little thought is given to the practical or decorative value of the work. A shop window may have a delicate grille or an ornamental gate, neither of which has any practical use whatsoever. It is conspicuously placed so as to attract the attention of the passer-by; the ironwork does not play into its architecture and is not in harmony with its surroundings.

There are certain fundamental principles of design and execution to be expected in all good ironwork, and the craftsman who is trained as a designer as well as a metal worker knows every one of these. Furthermore, works of the old masters should ever be before the student of this craft, and examples in museums and documents in libraries should help him in securing the true kind of inspiration.

Although a metal worker is able to furnish drawings suggestive of the style, scale, proportion and general lay-out of the design, his real study of details can only be accomplished on the anvil. It is this actual study in the metal which gives the work its unexpectedness and charm, and this can only come from a deep knowledge and love of the material. The making of beautiful ironwork cannot be fully described and illustrated on paper; it is often necessary for the craftsman to make sketches in iron, that is, make pieces in the actual material, before he illustrates on paper.

Although iron is the least expensive of all metals, there is no material which lends itself to more beautiful treatment. Neither is there a material which can be worked more quickly. It is one of the simplest and most direct, therefore one of the most difficult mediums in which to work. Very often the craftsman to-day is asked to slur over work which does not seem important, or which will not show, and is urged to make his work as cheap and showy as possible. Again, when a metal worker has a certain appropriation to meet for the work he is doing, he will carry out the design in the cheapest possible way in order to meet this appropriation. Instead, the craftsman should simplify the designs to meet

the allowance given, in order to make the work in the best possible manner.

Materials should not be taken from their proper spheres and used by tricks and illusions in other spheres. For instance, there are workers in iron who attempt to make this metal look like wood, gold or bronze. They finish it and work it so that it tricks the observer, distorting one material into the semblance of another, thereby losing both its simplicity and significance. Sometimes colour is used on metal work. A decorator often wishes to carry his colour scheme into lighting fixtures or other metal work, but although occasionally a little gilt may be used to give warmth to a piece of work, the colour should not be used with the idea of concealing bad workmanship. The most logical way to give colour to ironwork is to incorporate another metal, such as brass of a golden colour, applied or inlaid. Colour is also used as a background for ironwork. This is especially done in cases of pierced work or when the motif is of an open design. The ironwork is then backed with some material, such as an old red velvet. This may also be done in cases of mounting ironwork on woodwork, where the woodwork is stained so as to make a suitable background for the ironwork. (S. Y.)

MODERN TECHNIQUE AND PRACTICE

In casting decorative ironwork it is first necessary to adapt or conform the ornament to suit this class of work, then to prepare the patterns for the moulder. The production of the work now becomes a mechanical repetition, and whether the castings from each pattern be few or many, the results will always be an invariable sameness.

Wrought iron contains less carbon, is not as brittle and can be hammered or cut freely. Wherever this iron is worked by hand it is impossible to get an exact sameness or repetition, which in all cases creates a natural interest of variation in design.

Technique of Hammered Ironwork.—Hammered ironwork, the term commonly used, is often misunderstood by designers who are not familiar with this craft, and instead of a natural hand-wrought texture, the iron is defaced in a very unnatural manner. For instance, a man will place a section of rather smooth iron on an anvil and begin to disfigure it with uneven hammer blows, intending to make hammered iron. The designer, in this case, does not understand the proper use of the material.

This might be well illustrated in the case of a design composed of horizontal or perpendicular members of one-inch round iron. There should be no attempt to take a one-inch round section and abuse it as described, but instead a one-inch square section should be used, forging it as near to round as the human eye can measure. The bar will then possess the quality of hand craftsmanship and be far superior in character to any disfigured work or, on the other hand, to any machine-like perfection.

Execution of Work.—First, draw a sketch to a small scale, so as to obtain the general composition, proportion, silhouette and harmony with the design of surrounding materials or conditions. This sketch should then be developed into full size to obtain details of ornament, various sections and sizes of material, and a general idea of the method of making. At this time, careful consideration must be given to the practical use of the piece of work so that it may serve its purpose in the best manner possible. Workers in iron should always attempt to make everything direct from a drawing, rather than from models. When working from a model, the object becomes more or less a reproduction, whereas the drawings allow a greater opportunity to express the craftsman's individuality.

Studies or experiments in the actual material are now made, for here many things are revealed which could not possibly be shown on paper. The character of a twisted member or the flexibility of the material might be used for example to show how difficult it would be to conceive many such things in the drawings. For this reason the true craftsman should often make a fragment or portion of the ornament in the actual material first, and make the drawings later.

Tools Used.—Methods of working and the tools used to-day differ very little from those of early times. Machinery can sometimes be used for the greater convenience of the craftsman while working, thereby increasing his efficiency and permitting a great deal more work to be accomplished, yet it cannot be used in the actual making of any piece of work where the character of the craftsman is to be expressed. In comparing a forge of early times with one of the kind used to-day, a very good illustration of the valuable use of machinery can be shown. The purpose of the forge is to heat the iron to such a temperature as to make it flexible while working. The intense heat required cannot be obtained from the draught of an ordinary burning fire; therefore air must be blown to increase the draught. Fig. 1, a forge of mediaeval times, shows air being blown through a fire by a large bellows which must be operated by hand or foot constantly, to keep the draught flowing. Fig. 2 shows one of the types of forges used to-day. A machine blows the air into the fire, thus saving much labour and loss of time, which can be applied to better purposes.

On account of the great amount of variation and quick execution required in working with wrought iron, tools must serve many purposes, especially when certain work can be done only while the iron is hot. The anvil (fig. 3), is so designed as to permit any form to be forged upon it, with the proper use of various hammers, among which the most common used are shown in fig. 4. Wherever a strong grip is required to hold a tool or some smaller fragment of iron while working, the vice and different shaped tongs are used, as in fig. 5. There are also many kinds of chisels and punches, among which the most common are illustrated, and quite often it is necessary for the craftsman to make special tools for special occasions. Fig. 6 shows a few of these.

Iron in the Working.—Considering the broad scope of metalwork, it is easily seen that many processes occur in the working. A fine piece of ornament upon a Gothic box-lock must be treated far differently from the cresting over a large set of Gothic gates. The craftsman must feel the spirit of any design and use the correct sections of the material. In a gate or grille, for example,

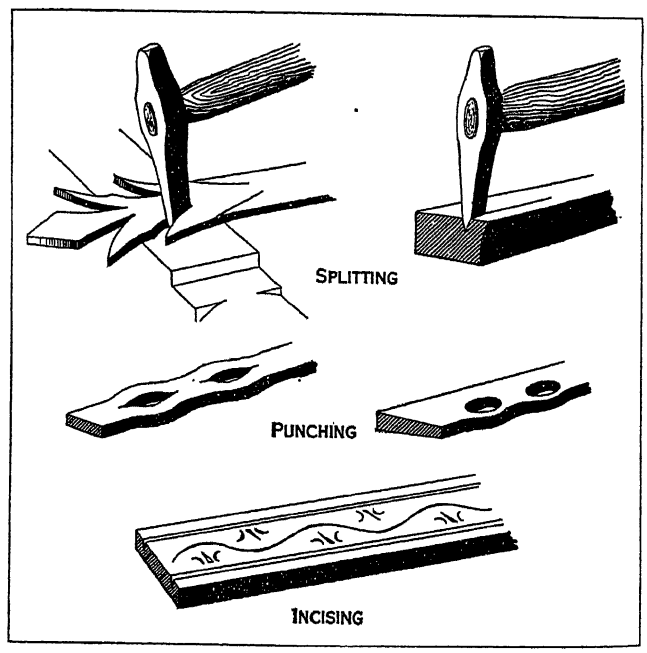
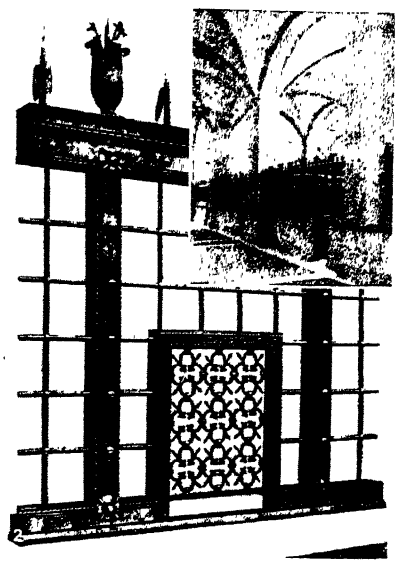


FIG. 7.—VARIOUS WAYS OF WORKING IRON

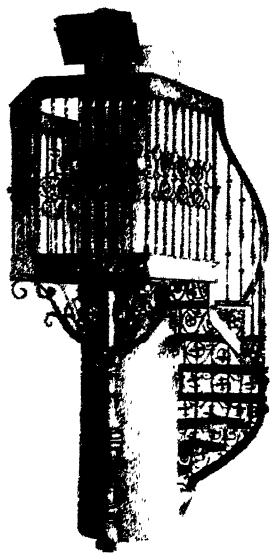
the frame or main members must be square or rectangular in section, whereas the ornamental members may be diagonal or round.

The various methods familiar to the craftsman in working are forging, splitting and punching, incising, repousée, carving, pierced work, spinning and stamping, welding, riveting, the use of collars or bands, and the different ways of finishing the material. The most fascinating work in metal is at the forge, where one who possesses the ability can produce work in iron with a spontaneity that cannot be obtained in any other way. Besides the making of

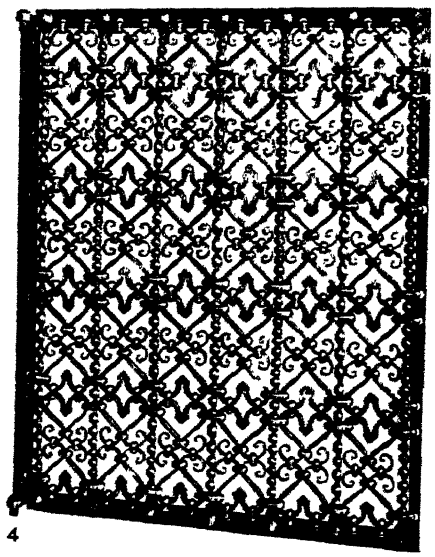




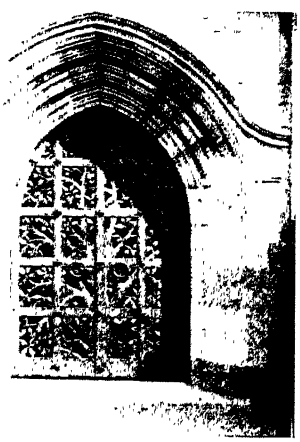
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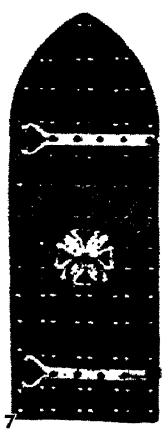


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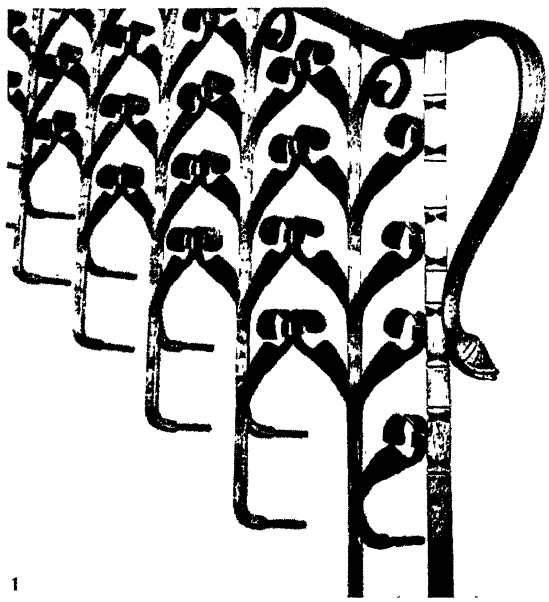
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BY COURTESY OF (1) HERBERT HUGH RIDDLE, ARCHITECT, (2, 4, 6) YORK AND SAWYER, ARCHITECTS, (3) CRAM AND FERGUSON, ARCHITECTS, (5) JAMES GAMBLE ROGERS, ARCHITECT, (7) MILTON B. MEDARY, ARCHITECT

MODERN ORNAMENTAL WROUGHT IRON FOR INTERIOR AND EXTERIOR USE

1. Cresting for wrought iron gates, Chicago Theological Seminary. This and the other examples on this page are from the designs of Samuel Yellin
2. Screen (with detail), lobby of Federal Reserve Bank, New York
3. Pulpit, St, Mary's Church, Detroit, made of decorative wrought iron
4. Grille for Central Savings Bank, New York city
5. Gates, Harkness Burial Gardens, Woodlawn Cemetery, New York
6. Detail of exterior gates, Central Savings Bank, New York city
7. Red wooden door with wrought iron trimmings in bird design, Bell tower, Mountain Lake, Florida

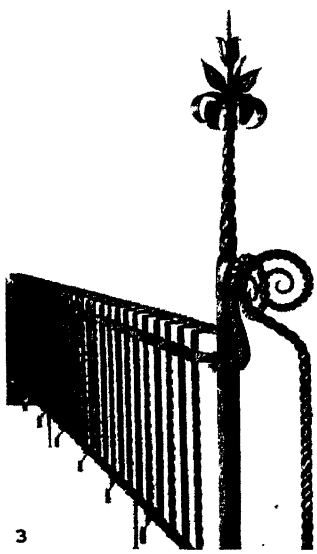
IRON IN ART



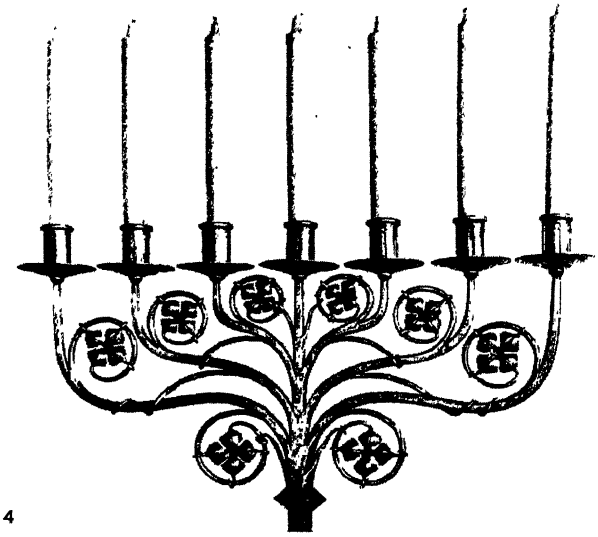
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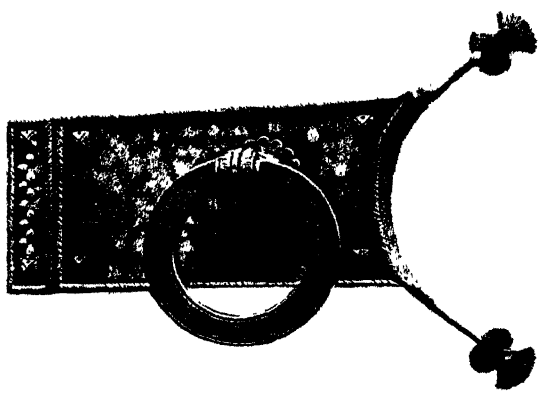
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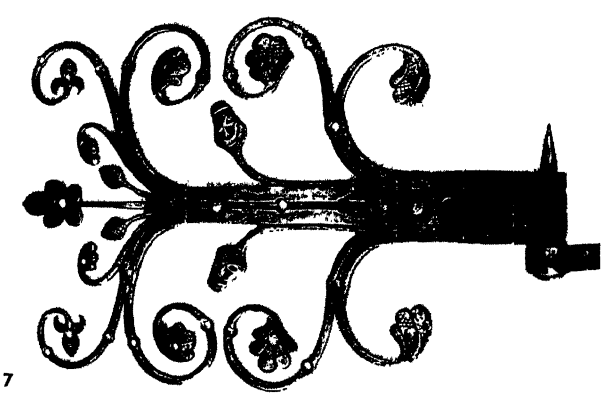
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BY COURTESY OF (1) MELLOR, MEIGS AND HOWE, ARCHITECTS, (2) YORK AND SAWYER, ARCHITECTS, (3) MILTON B. MEDARY, ARCHITECT, (4) SAMUEL YELLIN, METAL WORKER, (5, 7) FROHMAN, ROBB AND LITTLE, ARCHITECTS, (6) CRAM AND FERGUSON, ARCHITECTS

EXAMPLES OF CONTEMPORARY HAND WROUGHT DECORATIVE IRONWORK

1. Hand wrought iron stair railing for residence of Robt. McLean, Philadelphia. Stem and leaf pattern forms posts of the railing; newel post with serpent grasp. All of the examples on this page were designed by Samuel Yellin. 2. Detail of window grille for Central Savings Bank, New York city. 3. Detail of bridge railing for Bell tower, Mountain Lake, Florida. Flower and scroll designs on post; palings of twisted wrought iron. 4. Detail of memorial wrought iron candelabrum for church. Flower and tendril design forms support for stems rising to candle holders. 5. Interior iron railing for Washington Cathedral. Twisted and forged bars, joined at top by curved rail. 6. Wrought iron lock for St. George's Chapel, Newport, R. I. 7. Door hinge of hand wrought iron for Washington Cathedral

scrolls, or various forms of open design, the greatest interest is due to the metal being so pliable. For an example, in splitting or incising the conventional decorative floral motif, the chisel naturally changes the section as it digs into the iron. This is also true when various punches are used, for as can be seen by the illustrations the iron will take another form, but the material or metal is never quite lost—unless it is severed entirely. The implements for splitting, punching and incising are shown in fig. 7.

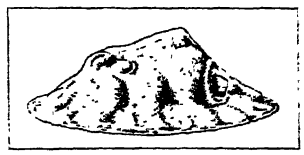


FIG. 8.—A MASK MODELLED BY HAMMERING THE METAL AGAINST A BLOCK OF LEAD

Repoussé work applies to thin metal where the material is raised from the back or under side to the greatest depth or height required, and then modelled by the use of various tools and hammers to its required form. Wherever the repoussé ornament is not very high, or requires little modelling, the work can be done with tools of various shapes, with a block of lead (fig. 8) used as a base, while hammering. If the design contains a great deal of modelling, as in a mask, after the metal has been raised to its greatest height from the back, lead is poured in to fill and act as a foundation. A margin of metal is bent around the lead so as to keep it in position, and the modelling or shaping of the face is done on the outside surface, following a fine outline scratched on the iron to act as a guide.

Incised and carved methods are used where a surface of metal requires certain decorations or designs. Of the two, carved metal requires the greater care, as it should be used only for small, fine details, and must be done in a suggestive way to preserve the metallic feeling, rather than as if copied from a sculptured model.

Another method of decoration is to pierce or cut certain designs or forms out of the thin metal so that either a coloured background or natural light will show the silhouette in the ornament. Many beautiful forms can be used to advantage in this kind of work. It is also correct to stamp certain objects in thin metal, providing the design is made for this purpose. This is usually done where a great quantity of the required design is needed, thus making a die for the exact form. By placing the die on the metal and striking it the required stamping is made. Very often the stamped object is worked over by hand to give it a hand-wrought appearance, but this is not correct and is never done by the true craftsman.

Many beautiful forms and shapes are obtained by spinning various metals. For example, a sphere or ball, which is meant to be perfectly smooth and true, can be very easily spun in two halves and then assembled. This is much more practical than attempting to hammer or beat the metal by hand.

The foremost methods of fastening or tying one fragment of iron to another are welding, riveting and the use of collars or bands of various forms. As can be seen by the illustrations of these methods, each one has a different effect upon the design; therefore each must be used in its proper place. In the case of welding, the desired forms are forged from a long piece of iron, and then, as in the case of a ring, the two ends are merged together as one. Another example of welding, which shows the great variety in this process, is that of a number of pieces of iron being welded together rather than split from one piece of metal. An illustration of welding, riveting and the use of collars or bands is shown in fig. 9.

Finish.—Without the correct finish the full beauty of metal-work cannot be appreciated. Iron, like any other material, must be finished in accordance with its use or purpose, and must also receive a certain amount of care at various times. Interior iron-work should possess the natural finish, which is of armour colour, and the metal can be polished as bright as silver. After the correct lustre is obtained, an oil or wax is applied; then, in the course of time, the object receives a very beautiful patina. In the case of exterior work, the iron should be only slightly polished and left more with the natural colour obtained from the forge.

Uses.—Whether in the home, in churches, or in various public buildings, iron will be found serving many and various purposes. Furniture, stairways, lighting fixtures, hinges, door-knobs, grilles, certain kinds of cutlery and fireplace equipment of this metal are used in homes. In the church, pulpits, crosiers, the crucifix, sanctuary lamps, baptismal fonts, lecterns and alms-boxes are works of the craftsman at the anvil. The gates or doors of many public buildings open to reveal bank-screens, grilles, enclosures and railings, serving their purposes and illustrating the beautiful character of iron. (S. Y.)

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INDIAN AND INDONESIAN

Iron and Steel.—Iron may not have been known before about 1000 B.C., but steel was certainly in use in the 3rd century B.C., and it may be safely asserted that by this time all or almost all the metals and alloys and the technique of working and decorating them in various ways were well known. With this premise, it will be desirable to proceed at once to describe from a practical point of view the various methods of working the useful metals, as traditionally practised in India.

The manufacture of iron and steel by primitive small scale methods has survived in southern India and Ceylon to the present day. The iron is smelted directly from the ore, and true carbon steel of high quality is made by melting the iron with a small proportion of green wood in a clay crucible heated to a high temperature. The slag heaps of ancient furnaces are common and the processes have probably been in use for more than two millenniums, but it is unknown whether they are of indigenous invention or acquired. In southern India iron immediately succeeds stone as a material for tools and weapons, and prehistoric iron weapons begin to come into use about 500 B.C. Alexander received a gift of Indian steel from the Punjab chiefs; steel dating from the 2nd century B.C. has been found at Besnagar and in Ceylon, and tempered steel is referred to in the *Ummagga Jātaka.* Indian iron and steel weapons have been famous throughout the middle ages, and the steel was exported to Persia and further west, where it formed the material of the Damascus blades of the Saracens. Buddhist begging-bowls are generally made of iron. The wrought iron pillar of Delhi, set up about A.D. 415 by Kumāragupta I., in honour of his father, is over 23 ft. in height and weighs more than 6 tons; it demonstrates the abilities of Indian metal workers in handling larger masses of material, for not until the latter part of the 19th century could anything of the same kind have been made in Europe. There are other large iron pillars at Dhar and at Mt. Abu. The wrought iron finials of Burmese stupas are often extremely elegant.

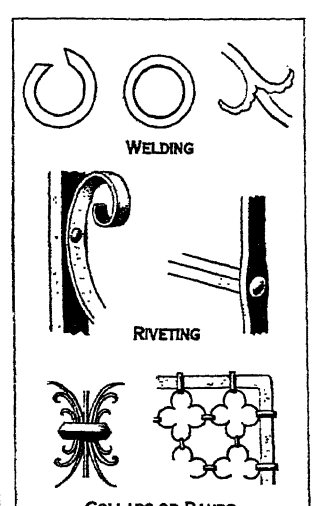


FIG. 9.—VARIOUS METHODS OF JOINING PIECES OF IRON

The decoration of iron and steel, apart from the ornamentation of the handles of weapons, which may be made of other materials, takes various forms. The shapes of weapons are usually of great elegance, and if they are further decorated by engraving or carving, this is never permitted to interfere with their utility. The most remarkable carved steel weapons are those of southern India (Tanjore), the Dekhan, and Rajputaná; but the art extended to Farther India and Indonesia, as will be seen in any of the fine chiseled kris from Bali. Decoration by the application of a second metal is effected by damascening or encrusting. In ***koftgāri,*** or true damascening, deep or shallow grooves are cut in the surface of the iron or steel to be ornamented, and gold or silver wire

being laid in the grooves is hammered until completely united with the ground metal, which may then be smoothed and polished, showing the required design, which may consist of geometrical or floral ornament or an inscription. In encrusted work, the required form is first carved on the surface of the ground metal, the edges of the carved area being slightly undercut, then a thin plate of gold or silver of the same size is applied and beaten down on to the carved surface, while the edges of the applied metal, being slipped into the undercut groove, are held tightly as a result of the hammering.

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CHINA AND JAPAN

Iron began to take its place in the brilliant bronze age culture of China about 500 B.C. By the end of the 2nd century of the present era bronze weapons had been almost completely supplanted, while iron had been generally substituted for bronze in common use in utensils and vessels of various kinds, tools, chariot-fittings and even small pieces of sculpture. These were commonly cast in sand-moulds, were patterned after bronze prototypes and were typical in style and decoration of the Han period.

The Iron age in Japan is supposed to have begun in the 2nd century B.C., though the chief early remains are weapons from the dolmens of the 2nd to the 8th centuries A.D. The Japanese iron founder attained a considerable skill at an early date and acquired a social position which was never attained by the bronze caster, or by the iron workers in China where the bronze age tradition was much stronger.

From the 9th century iron increasingly took the place of bronze in China as a material for sculpture, especially in the north and under the Sung dynasty. The few extant examples from the 11th century and later show work done on a larger scale and in coarser technique than the bronzes, though the modelling is usually more naturalistic.

Several iron pagodas, ranging in size from miniature models to towers 30 or more metres in height, and dating from the 10th to the 14th century, give further evidence of the dexterity of the Chinese iron caster. These imitate in detail both the structural and decorative effects of the more common tile-roofed brick pagodas. Iron for temple furniture has long been in use, and a large number of the braziers, censers, caldrons and bells found to-day in the temples are of iron.

In China in the 17th century the iron picture was developed, the craftsmen seeking to reproduce in permanent form through the medium of wrought iron the effects of the popular ink-sketches of the master painters. When completed, these pictorial compositions were mounted in windows, in lanterns or in frames as pictures. When in the latter form a paper or silk background often bore the signature and seal of the maker, heightening the resemblance to a painting. The craft flourished in Anwhei province and is still practised, though with less patience and fineness than formerly.

Embellishment of Armour.—It is apparent that iron has been used in China chiefly as a substitute or imitative medium, worked often with great skill but with little artistic invention. In Japan, however, the iron worker developed a distinctive and original means of expression and high artistic attainment in furniture for the sword. With the rise of feudalism and the establishment of the samurai class after the wars of the 12th century, the equipment of the warriors became an object for the efforts of the artist. At first these efforts were devoted to the embellishment of defensive armour, but from the 15th century the sword became the centre of attention. The blade is not properly part of our subject, but in the mountings, especially the guards (*tsuba*), we find exquisite artistry expressed chiefly in iron. A remarkably soft and pure variety of the metal especially free from sulphur was employed. It was worked by casting, hammering and chiselling; and innumerable surface effects were obtained by tooling, inlaying, incrustation, combination with other metals and patination by various, usually secret, processes. Simple conventional patterns, crests and pictorial designs were the bases for the decoration. As these were often furnished by painters or designers the criterion of connoisseurship in Japan is the unsurpassed technical quality of the handling of the iron itself. With the promulgation of the edict of 1876, prohibiting the wearing of swords, this art came to an end, but the skill of the Japanese iron worker may still be noted in numerous small decorative objects.

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IRON MASK (*masque de fer*). The identity of the "man in the iron mask," one of Louis XIV.'s political prisoners who died in the Bastille in 1703, is a famous historical mystery. In 1698, Saint-Mars, the new governor of the Bastille, brought with him from Pinerolo in Piedmont a prisoner whom he kept masked and whose real name was not known. This prisoner died on Nov. 19, 1703; and his name was entered in the register of Saint Paul as "Marchioly," "aged about 45." Even during his lifetime, legend grew up around this mysterious person, and Saint-Mars himself admitted circulating "fairy tales" (*contes jaunes*) about him. He was soon suspected of being connected with the royal family; whilst Voltaire added immensely to the legend by describing the mask as of iron, and the man as a natural brother of Louis XIV.—a theory which Dumas in the *Vicomte de Bragelonne* did much to popularize. It was even asserted that this Bourbon prince had a son who founded the Bonaparte family in Corsica; whilst other wild speculations identified him with Monmouth, Beaufort, Fouquet, and even Molière.

It is now evident that the man in the mask was either Count Mattioli or "Eustache Dauger." Mattioli was the Mantuan minister who attempted to sell to France the frontier fortress of Casale, but revealed the transaction at the last moment, and was eventually secured by Louis' agents. In spite of the support of M. Funck-Brentano and of the tempting argument from the name under which the prisoner was buried—in fact, almost certainly a false name—it is difficult to accept a solution which seeks to identify the mysterious "mask" with a man whose career and identity were so well and so generally known. The other candidate, much more likely, is Eustache Dauger; but to admit his claim is only to postpone the difficulty. In fact, after the researches of Monsignor Barnes and Andrew Lang, the principal problem for the investigator remains: who was Dauger? Several theories have been put forward on very slight evidence. It seems clear that he was a Catholic and not an Englishman; but the fact that at a time of emergency he was allowed to act as valet to Fouquet has drawn a red herring across the trail; and Andrew Lang has used the phrase "he is only a valet" in a letter from Louvois to Saint-Mars as the basis of a theory identifying the man with the valet of a Huguenot emissary to England. It is, however, unlikely that the phrase referred to the masked prisoner at all. Monsignor Barnes has identified him with the Abbé Pregnani, involved in the religious affairs of Charles II., and for that reason possessing dangerous information. That the prisoner was sent to Pinerolo from Dunkirk favours the idea of some connection with England; and Monsignor Barnes at first went on to claim that the abbé was a natural son of the English king. This hypothesis linked up the problem with a second—that of James de la Cloche—and soon

proved untenable.

The problem is probably more difficult than important. The mask itself was of no harder material than velvet: and the man would surely not have been used as a valet if he had been near to the blood royal. There is, however, a fascination in the peculiarly interesting evidence, and in the possible theories which may be constructed from it. The period was one in which intrigue was at its height, and the affairs of individuals were so intertwined with those of states that every figure of importance appears as the centre of a labyrinth whose key may be anywhere in western Europe. Romantic imagination has done the rest.

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IRON MOUNTAIN, a city of Michigan, U.S.A., on the western edge of the Upper Peninsula, near the Wisconsin State line (the Menominee river), at an altitude of 1,160ft.; the county seat of Dickinson county. It is on Federal highway 2, and is served by the Chicago and North Western, the Chicago, Milwaukee, St. Paul and Pacific, and (for freight only) the Wisconsin and Michigan railways. The population was 8,251 in 1920 (30·5% foreign-born white) and was estimated locally at 14,000 in 1928. The Chapin mine, employing 700 men, and other rich iron mines, are in the vicinity; and the Ford Motor company has mines, lumber mills and plants here, with an aggregate force of about 2,500. Iron Mountain was settled in 1879 and incorporated in 1887. When the first train came in (July 1880) the population was 150, and by 1887 it had grown to 8,000.

IRON RIVER, a city of Iron county, Michigan, U.S.A., in the western part of the Upper Peninsula, 5 m. from the Wisconsin State line (the Menominee river). It is on Federal highway 2, and is served by the Chicago and North Western and the Chicago, Milwaukee, St. Paul and Pacific railways. The population was 4,295 in 1920 (27% foreign-born white). Twenty-five active iron mines in the county in 1926 produced 4,271,358 gross tons of ore. Lumbering and agriculture also are important in the region, and the city has several manufacturing plants. Iron River was settled about 1875 and was incorporated in 1926 with a city-manager form of government.

IRONSIDES, a nickname given to one of great bravery, strength or endurance, particularly as exhibited in a soldier. In English history Ironside or Ironsides first appears as the name of Edmund II., king of the English. In the Great Rebellion it was first given by Prince Rupert to Cromwell, after the battle of Marston Moor in 1644. From Cromwell it was transferred to the troopers of his cavalry, those "god-fearing men," raised and trained by him in an iron discipline.

IRONTON, a city of southern Ohio, U.S.A., on the Ohio river, 142m. E.S.E. of Cincinnati, opposite Russell, Ky.; the county seat of Lawrence county. It is on Federal highway 52, and is served by the Chesapeake and Ohio, the Detroit, Toledo and Ironton and the Norfolk and Western railways, and by river boats. The population was 14,007 in 1920 (92% native white) and was estimated locally at 22,500 in 1928. The hills, which rise from the river bottom, are rich in iron ore, coal, limestone and fire-clay. The city has large mining and lumber interests, and important iron manufactures and cement works. The output of its factories in 1925 was valued at $10,878,919. Ironton was settled in 1848 and incorporated as a city in 1851.

IRONWOOD, a city of Gogebic county, Michigan, U.S.A., in the western tip of the Upper Peninsula, on the Montreal river. It is on Federal highway 2, and is served by the Chicago and North Western, the Duluth, South Shore and Atlantic and the Soo Line railways. The population was 15,739 in 1920 (37% foreign-born white) and was estimated locally at 20,000 in 1928. It is the metropolis of Gogebic county, which in 1926 mined 5,756,380 gross tons of iron ore, and some of the largest mines are within the city limits. Lumbering, stock-raising and farming also are important. Ironwood was settled in 1884, chartered as a city in 1889, and in 1890 had already a population of 7,745. Since 1925 it has had a city-manager form of government.

IRON-WOOD, the name applied to several kinds of timber, the produce of trees from different parts of the tropics, and belonging to very different natural families. Usually the wood is extremely hard, dense and dark-coloured, and sinks in water. Several species of *Sideroxylon* (*Sapotaceae*) yield iron-wood, *Sideroxylon cinereum* or *Bojerianum* being the *bois de fer blanc* of Africa and Mauritius, and the name is also given to species of *Metrosideros* (*Myrtaceae*) and *Diospyros* (*Ebenaceae*).

West Indian iron-wood is the produce of *Colubrina reclinata* and *C. ferruginosa* (*Rhamnaceae*), and of *Aegiphila martinicensis* (*Verbenaceae*). *Ixora triflorum* (*Rubiaceae*) is the *bois de fer* of Martinique, and *Zanthoxylum Pterota* (*Rutaceae*) is the iron-wood of Jamaica, while *Robinia Ponacoco* (*Leguminosae*) is described as the iron-wood of Guiana. The iron-wood of India and Ceylon is the produce of *Mesua ferrea* (*Guttiferae*). The iron-wood tree of Pegu and Arracan is *Xylia dolabriformis* (*Leguminosae*), described as the most important timber-tree of Burma after teak, and known as *pyingado*. The endemic *bois de fer* of Mauritius, once frequent in the primeval woods, but now becoming very scarce, is *Stadtmannia Sideroxylon* (*Sapindaceae*), while *Cossignya pinnata* is known as the *bois de fer de Judas*. In Australia species of *Acacia*, *Casuarina*, *Eucalyptus*, *Melaleuca*, *Myrtus*, and other genera are known more or less widely as iron-wood. Tasmanian iron-wood is the produce of *Notelaea ligustrina* (*Oleaceae*), and is chiefly used for making ships' blocks. The iron-wood or lever-wood chiefly used in North America is the timber of the American hop hornbeam, *Ostrya virginica* (*Betulaceae*). In the United States various other trees are also known as iron-wood, as the desert iron-wood (*Olneya Tesota*), of south-western deserts; the Catalina iron-wood (*Lyonothamnus floribundus*), of southern California islands; the southern iron-wood (*Bumelia lycioides*), of the south-eastern States, and several subtropical trees found near the coast from Florida to Texas. In Brazil *Apuleia ferrea* and *Caesalpinia ferrea* (both *Leguminosae*) yield a kind of iron-wood, called, however, the *Pao ferro* or false iron-wood.

IRONY, a form of speech in which the real meaning is concealed or contradicted by the words used (Gr. εἰρωνεία from εἴρων, "one who says less than he means"). It is particularly employed for the purpose of mockery or contempt. The Greek word was used for an understatement in the nature of dissimulation. It is especially exemplified in the assumed ignorance which Socrates adopted as a method of dialectic, the "Socratic irony" (*see* SOCRATES). In tragedy, what is called "tragic irony" is the device of making a character use words which mean one thing to him and another to those acquainted with the real issue.

IROQUOIS (ĭr'ǫ-kwŏ or -kwoi). During the colonial period the Iroquois were, north of Mexico, the native American people of greatest political importance. The name has been adopted for the entire linguistic family of which they were the most conspicuous representatives. The *Iroquoian family* occupied three territories, a northern, southern, and south-eastern. In the northern area there lived, besides the Iroquois proper, the Conestoga or Susquehanna in Pennsylvania; the Erie and Neutrals south and north of Lake Erie; the Tionontati or Tobacco nation, and the Huron (*q.v.*) in Ontario; and a series of tribes on the St. Lawrence later merged with the Huron. The southern division consisted of the Cherokee (*q.v.*); the south-eastern, of the Tuscarora (*q.v.*), Nottoway, and Meherrin. These tribes were all semi-sedentary, practised maize agriculture, lived in villages palisaded in time of need, were divided into totemic, matrilineal clans, and manifested tendencies toward the formation of fairly cohesive confederacies, in which blood lineages integrated in clans, clans in tribes, and tribes in leagues. Religion was relatively simple on the ritualistic side, and somewhat interwoven with political ceremonial. Warfare was frequent and ruthless, captives being either tortured, enslaved, or adopted. In all these traits the Iroquoian tribes resembled the Muskogian (*q.v.*), and differed somewhat from the Algonkin (*q.v.*), who were patrilineal, on the whole less given to farming, less developed in political sense and cohesiveness, and less aggressive in warfare though perhaps equally brave. It is therefore likely that a culture of Algonkin type, probably carried by Algonkin peoples, once prevailed uniformly over north-eastern

United States and eastern Canada, and that into this there intruded cultures and peoples of south-eastern origin, first the Mound Builders (*q.v.*) in the Ohio valley, and later the northern Iroquoians in the region of the lower Great Lakes; the aboriginal Algonkin, however, surviving as a fringe completely surrounding these north Iroquoians. In New York, where archaeological exploration has been unusually well co-ordinated, its results confirm this view. The most notable point of difference between the northern Iroquoians and the Cherokee and Muskogi of the south-east seems to be the somewhat higher status of woman among the former.

LEAGUE OF THE IROQUOIS

The *Iroquois proper* of history comprise the Mohawk, Oneida, Onondaga, Cayuga, and Seneca, living in this order from east to west in central New York. According to tradition, Hiawatha, a Mohawk, and Dekanawida, reputed a Huron by birth, induced the five tribes to form a league which preserved the integrity of each, but united them in a common council, and common ceremonies, with a fixed number of chiefly delegates from each tribe. In a sense this was representative democracy; and each delegate was elected; but he was chosen by the members of a lineage as representative of that lineage, and therewith of a clan and tribe, so that a group-hereditary principle prevailed. Each such clan delegate had further to be approved by the tribal and league council. There was no head of the league; and deliberate action usually became effective only upon unanimity. Apparently this league differed from other native confederacies, which were common in the eastern United States and south-eastern Canada, in being more precisely defined and organized. It allowed of the development of a tradition of political sagacity independent of the occasional superior individual, and this in turn permitted the fruits of wars to be conserved instead of dissipated, with success still further strengthening the established policy.

The league in its historic form is estimated to have been constituted only a generation before the coming of the whites among the Iroquois, about 1570. During this formative period the Iroquois drove from the St. Lawrence a series of tribes who joined the Huron. In the first half of the 17th century they harried and wore down the Conestoga, their kinsmen on the south, and the Algonkin tribes on their east. Their most striking successes came about the middle of the century, after they had acquired guns in friendly trade with the Dutch. In rapid succession they attacked and broke up four Iroquoian tribal aggregations to the west of them: Huron, 1648–50; Tionontati, 1649; Neutral, 1650–51; Erie, 1653–56. Parts of some of these nations were transplanted among the Iroquois, where they gradually became absorbed; remnants fled, scattered, joined one another or alien tribes, and became lost to history. The completeness of their destruction was perhaps partly due to their habit of concentration in large palisaded towns; the more scattered Algonkin generally withstood the Iroquois longer. The Illinois suffered badly at the hands of the Iroquois, the Delaware submitted in 1720, and all Virginia was harassed. Only the distant Ojibwa set a boundary to the Iroquois conquests in the west, and the Cherokee and Catawba of North Carolina to the south, though the latter were almost worn down in the struggle. The Tuscarora, an Iroquoian tribe of North Carolina who had voluntarily moved to New York, were formally admitted into the confederacy about 1715, this being henceforth the League of Six Nations. Other tribal remnants of various origin sought shelter with them, and these, with the absorption of captives, helped to make up the Iroquois losses in constant warfare. At that, the five tribes probably never numbered more than at present, 16,000.

From the first, the Iroquois were consistent and bitter enemies of the French, who had shown amity to their traditional foes. They remained in friendship and trade with first the Dutch and then the English, who utilized them against their Indian enemies and the French, whereas the Iroquois profited in fire-arms, other trade articles, and the sanction if not protection of civilized powers. They undoubtedly greatly hampered French extension from Canada southward; but for the consistent Iroquois check, the English colonies would have been flanked behind by the French and the history of their development might have been very different. This is a remarkable achievement for a savage people that never put into the field an army greater than 2,000 men.

When the American Revolution broke out, the league as such took no part, but most of the tribes sided with the British, and were defeated by the Americans. The Mohawk and Cayuga mainly withdrew to Ontario, many of the Onondaga and Seneca remained on reservations in western New York, and part of the Oneida after a time moved to Wisconsin. The present population is considerably diluted with white blood; two-thirds are on Canadian soil, including the descendants of seceding groups won over to the French interest at the end of the 17th century. A shadow of the league is still perpetuated as a ceremonial form.

See L. H. Morgan, *League of the Iroquois* (1851); *Ancient Society* (1877); H. Hale, *The Iroquois Book of Rites* (1883); J. N. B. Hewitt, *Bur. Am. Ethn. Rep. xxi.* (1903), xxxii. (1918). (A. L. K.)

IRRATIONAL: *see* NUMBER, *Irrational.*

IRRAWADDY or **IRAWADI,** the principal river in the province of Burma, traversing the centre of the country, and running throughout its entire course in British territory. It is formed by the confluence of the Mali and N'mai rivers (usually called Mali-kha and N'mai-kha, the *kha* being the Kachin word for river) in 25° 45′ N. The N'mai is the eastern branch. The definite position of its source is still uncertain, and it seems to be made up of a number of considerable streams, all rising within a short distance of each other in about 28° 30′ N. It is shown on old maps as the Lu river of Tibet; but it is now quite certain that the Tibetan Lu river is the Salween, and that the N'mai has its source or sources near the southern boundary of Tibet, to the north-east or east of the source of the Mali. At the confluence the N'mai is larger than the Mali. The general width of its channel just above the confluence is 350 or 400 yards. In the rains this channel is filled up, but in the cold weather the average breadth of the river is from 150 to 200 yards. The N'mai is practically unnavigable. The Mali is the western branch. Like the main river, it is called Nam Kiu by the Shans. It rises in the hills to the north of the Hkamti country, in about 27° 50′ N. Between Hkamti (*q.v.*) and the confluence it runs in a narrow channel through continuous hills. About 1 m. above the confluence it is 150 yd. wide in January and 17 ft. deep, with a current of $3\frac{3}{4}$ m. an hour.

Steam launches can only ascend from Myitkyina to the confluence in the height of the rains. Native boats ascend to Laikaw or Sawan 26° 2′ N., all the year around, but can get no farther at any season. From the confluence the river flows in a southerly direction as far as Bhamo, then turns west as far as the confluence of the Kaukkwe stream, a little above Katha, where it again turns in a southerly direction, as far as the great bend near Mandalay, where it is joined by the Myit-nge. Thence it follows a westerly course and is joined by the Mu stream—an important source of water for irrigation in the Shwebo district—on the north bank. Beyond Myinmu it again assumes a southerly direction and is joined by its chief tributary, the Chindwin, described below. Between the confluence and Mandalay the river varies in width from 50 to 4,000 yards. It is narrowest in the three well-known "defiles." The third or upper defile lies between Myitkyina and Bhamo and is entered 3 m. below Sinbo by a channel only about 50 yd. wide and below this, throughout the defile, it averages about 100 yd. wide.

At the "Gates of the Irrawaddy" at Poshaw two prism-shaped rocks narrow the river to 50 yd., and the water banks up in the middle with a whirlpool on each side of the raised pathway. All navigation ceases here in the floods. The defile ends at Hpatin, and below this the river widens out to a wet-season channel of 2 m., and a breadth in the dry season of about 1 mile. At Sinkan, below Bhamo, the second defile begins. It is not so narrow nor is the current so strong as in the third defile. The narrowest place is more than 100 yd. wide. The hills are higher, but the defile is much shorter. At Shwegu the river leaves the hills and becomes a broad stream, flowing through a wide plain. The first defile is tame compared with the others. The river merely flows

between low hills or high wooded banks. The banks are covered at this point with dense vegetation, and slope down to the water's edge. Here and there are places which are almost perpendicular, but are covered with forest growth. The course of the Irrawaddy after receiving the waters of the Myit-nge opposite Sagaing, as far as 17° N. lat., is exceedingly tortuous. Below the junction of the Chindwin and Irrawaddy, the tributary streams throughout the dry belt are but small, though some, especially those in the Minbu district, are important sources of water for irrigation, and others, like the Yaw river, are used for floating teak logs to the main river. At Akauktaung, where a spur of the Arakan hills ends in a cliff 300 ft. high, the river enters the delta, the hills giving place to low alluvial plains, now protected on the west by embankments. From 17° N. lat. the Irrawaddy divides and subdivides, converting the lower portion of its valley into a network of intercommunicating tidal creeks. It reaches the sea in about 16° N. lat. by nine principal mouths. Practically no water, however, now reaches the sea through the western and eastern mouths (the Bassein and Rangoon rivers respectively) though these are the ones used by sea-going ships to reach the ports of Bassein and Rangoon.

The largest tributary of the Irrawaddy is the Chindwin, its entire course being in Burmese territory. It is called Ningthi by the Manipuris. The Chindwin is formed by the junction of the Tanai, the Tawan and the Tarôn or Turông, but it is still uncertain which is the main stream. The Tanai his hitherto been looked on as the chief source. It rises in about 25° 30′ N. and 97° E., on the Shwedaung-gyi peak of the Kumôn range, 12 m. N. of Mogaung, and flows due north for the first part of its course until it reaches the Hukawng valley, when it turns to the west and flows through the middle of the plain to the end of the valley proper. There it curves round to the south, passes through the Tarôn or Turông valley, takes the name of the Chindwin, and maintains a general southerly course until it enters the Irrawaddy, after flowing through the entire length of the Upper and Lower Chindwin districts.

The Tarôn, Turông or Towang river seems to be the real main source of the Chindwin. It flows into the Hukawng valley from the north, and has a swift current with a succession of rapids. Its sources are in the hills to the south of Sadiya, rising from 10,000 to 11,000 ft. above sea-level—mountains that are covered at least with winter snows. Below the Hukawng valley the Chindwin is interrupted at several places by falls or transverse reefs. At the village of Haksa there is a fall, which necessitates transhipment from large boats to canoes. Not far below this the Uyu river comes in on the left bank at Homalin, and from this point downwards the steamers of the Irrawaddy Flotilla Company ply for the greater part of the year. The Uyu flows through a fertile and well-cultivated valley, and during the rainy season it is navigable for a distance of 150 m. from its mouth by steamers of light draught.

The area of the catchment basin of the Irrawaddy is 158,000 sq.m.; the total length of the main river from its known source to the sea is about 1,300 miles. Throughout its course, except through the defiles, it is full of islands and sandbanks; its waters are extremely muddy, the mud being deposited partly in the delta, in part being carried far out to sea. The river commences to rise in March; about June it rises rapidly, and attains its maximum height about September. The total flood discharge is between four and five hundred million metric tons of 37 cubic feet. From Mandalay up to Bhamo the river is navigable a distance of nearly 1,000 m. for large steamers all the year round; but small launches and steamers with weak engines are often unable to get up the second defile in the months of July, August and September, owing to the strong current. The Irrawaddy Flotilla Company's steamers go up and down several times a week, but the mails are carried to Bhamo by a ferry-boat from the railway terminus at Katha.

The river Irrawaddy itself supplies no main irrigation works; the great value of the river is as a highway. It is the only means of reaching such important centres as the oilfields of Yenangyaung and Singu, which are served as yet neither by road nor railway. The Irrawaddy is nowhere bridged, though crossed by two steam ferries (at Henzada and at Sagaing) to connect the railway system on either bank. (L. D. S.)

IRREDENTISTS, an Italian patriotic and political party which was prominent in the last quarter of the 19th century. The name was formed from the words *Italia irredenta*—unredeemed Italy—and the party had for its object the emancipation of all Italian lands still subject to foreign rule. The lands which they claimed as Italian were south Tirol (Trentino), Görz, Istria, Trieste, Tessino, Nice, Corsica and Malta. The agitation was, however, mainly superficial, and sank into insignificance when the French occupation of Tunis in 1881 offended the Italians deeply, and their government entered into those relations with Austria and Germany which led to the Triple Alliance. The name "Irredentists" is also used of any other nationalist group aiming at the emancipation of any of their countrymen subject to foreign control.

IRRIGATION. The artificial application of water to land (Lat. *in,* and *rigare,* to water or wet).

Normally vegetation grows on soil saturated by rain. Where rain is seasonal, deficient or practically nonexistent, as it is, for instance, in Egypt, the desiccation of the soil prevents vegetable growth. In such areas irrigation can give even better results than nature herself produces, because water is given just when it is wanted, instead of at the fitful times of rainfall. Irrigation water must be "sweet" or fresh. All ordinary fresh water contains a small percentage of salt. Vegetation, however, will tolerate a much larger percentage, more especially if the drainage is good. The use of irrigation as an aid to the growth of vegetation is indeed an ancient art, as is shown by the biblical reference: "And a river went out of Eden to water the garden" (Gen. ii. 10). The probabilities seem to point to Egypt as its place of origin. The irregularity of watering, caused by the small though potent degree of variation in height of each annual Nile flood, would prevent the Egyptian from regularly garnering such crops as were naturally producible in specific areas, and he must quickly have realized that he could take steps to correct the variation by artificially supplying water directly, by his own labour, to the fields he found it most convenient to depend upon, and thus have begun, at least in the Nile valley, the art of irrigation. The paintings and sculptures of ancient Egypt do show that the peasantry baled up water at least 4,000 years ago. From Egypt the art may have spread to the ancient empires whose territories are now covered, at least in part, by the modern State of 'Iraq. Certainly the conditions on the Euphrates and the Tigris are comparable to those on the Nile.

Carthage, Phoenicia, Greece and Italy may have followed the same example. India and China are also countries which have progressed in this early art. The westward sweep of the Moors is no doubt responsible for its development in Spain. Wherever the Mohammedan penetrated, and circumstances proved favourable, he introduced irrigation.

METHODS OF LIFTING WATER BY CONTINUALLY RENEWED LABOUR

Shadoof.—Baling up water by hand (obviously the earliest system and that by which many acres are still watered throughout the world) is slow and expensive in labour. Inventive minds soon devised mechanical aids. About the earliest must have been the contrivance made up of two upright poles with a cross-beam joining them at a point 8 ft. or 10 ft. above ground level. Over the cross-beam (if there is no cross-beam, from the meeting point of the two poles) is slung a long tapering pole, the greater part of its length being on one side of the uprights. From the tip of the longer and slimmer portion is hung a rope ending in a skin or bucket, to the shorter end is attached a mass of clay or other weight sufficient to counterbalance the bucket when full of water, the worker pulls on the rope until the bucket dips into the well or stream; when it is filled he lets go and the counterbalance causes the bucket to rise with its water. In India this contrivance is known as the denkli or paecottah. In Egypt it is called the shadoof. Where the soil level is high above the water the lift is overcome by installing extra shadoofs, the lower one feeding the

next higher and so on until the required height is attained. One shadoof can irrigate about 4 acres.

Sakia.—Another ancient aid to irrigation is the water-wheel known in Egypt as the sakia, and the harat or Persian wheel in northern India. In this instrument a beam is attached horizontally to a toothed wheel. To the outer end of the beam, cattle, usually a pair of oxen, are yoked and travel in a circular path, pulling the

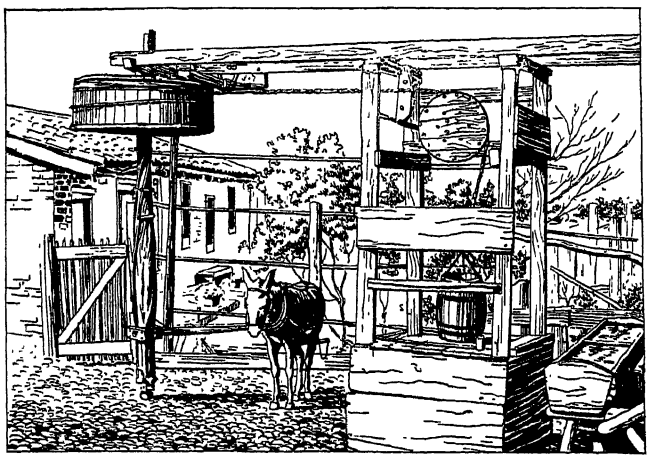


FIG. 1.—PRIMITIVE METHOD OF IRRIGATION EMPLOYED BY THE MEXICANS

beam with them, thus making the wheel revolve. The latter engages in its teeth a similar vertical wheel which thus also revolves, and in turn lifts up an endless rope to which buckets are attached at short distances apart. As the machine turns, the buckets, one by one, dip into the well in which they are hung. When the buckets reach the top of their course they tilt over and empty into a prepared channel leading to the fields. When empty the buckets descend again, mouth downwards for another fill. One such machine can irrigate 5 ac. to 12 ac., dependent on the height of the lift. The not unpleasing sound made by the movements of this contrivance is said to have influenced the music of the East.

Archimedes' Screw.—Probably the most intriguing of all these anciently devised implements is the screw invented by Archimedes of Syracuse about 200 B.C. This consists of a wooden cylinder, 1 ft. or 2 ft. in diameter, in which there is placed a corkscrew-shaped diaphragm running from end to end. The cylinder is usually about 8 ft. to 12 ft. long, and is placed with its lower end in the water and its top lying inclined on the bank of the canal or stream, the lift usually being about 3 feet. To the centre point of the diameter of the cylinder there is a crank-handle attached, by which the whole contrivance can be revolved, the act of revolution causes the water to proceed up the internal screw and flow on to the soil. Shadoof, sakia and screw are all still in constant use.

Power Plants.—Not until the arrival of the age of steam, which brought with it the power to drive pumping plants of all kinds, has human and animal life been relieved of a great part of the duty of directly lifting water on to the soil. Irrigation makes use of such pumping plants in all sizes, ranging from the tiniest 3 h.p. or 4 h.p. engine, up to the huge installations whose power can be measured in thousands of h.p's., and capable of dealing with great volumes of water. The introduction of oil as a fuel has naturally been taken advantage of in many cases as a substitute for steam.

METHODS OF LIFTING WATER BY PERMANENT WORKS

Canals.—Man early saw that he could assist nature by taking water out of a river at a point higher upstream than immediately opposite his own particular field, and thus take advantage of the fall or slope between these two points. In the case of the Nile the fall is only about 6 in. in 1 mile. As some slope must be given to the water in a canal to make it flow, and if this is, say, 3 in. to 1 m., only 3 in. can be gained in each mile of length and thus land can be irrigated that is somewhat higher in level than could be commanded by the river directly opposite any particular field. Canals, to be really effective, must take off a river usually many miles upstream of the areas they serve. In the case of the Nile they are only dug deep enough to catch a supply from the river when in flood or artificially heightened by weirs.

Weirs or Barrages.—That the weir, or, as it is often called, the barrage, as an aid to lifting water is old, there is no doubt, yet only in modern times has the idea been used to any great extent. A weir or barrage is a structure built across a river, not for the purpose of storing water, but simply to produce a higher level of water on the upstream side of the building, to enable it to flow easily into canals taking off from either bank and command the land with free flow of water. Thus the weir or barrage is a method of providing for doing, practically for ever, without further labour, what hitherto had to be done continuously by the aid of manual or mechanical work. The artificial upstream level is produced by shutting as much or as many as may be necessary of the doors or gates with which each structure is provided. As these buildings are most often necessary in those parts of a river's course where there is no other foundation than sand or silt, very naturally no great heading up can be provided for. A head of 20 ft. is seldom reached. More usually the upstream levels are only increased by 10 ft. to 14 feet. Whatever heading up of the waters is required, it is never so great as to interfere with the silt-carrying property of the river. Fortunately in such situations great heights of lift are seldom necessary.

WORKS TO ASSURE SUPPLIES OF WATER

Reservoirs.—Man did not long remain content with the supplies river or well provided him with. He must early have realized the advantage of storing water against times of shortage, as rivers and wells run low if they do not even run dry. At what date reservoirs first came into use as an additional aid to a regular supply is unknown, the remains of ancient reservoirs throughout the world, however, testify to the antiquity of the idea; the earliest form probably consisted of earthen embanked reservoirs, or tanks as they are known in India. The tank suffers from the disadvantage of retaining all the silt contained in the water stored in it. In time this leads to practical obliteration and a new tank has to be constructed elsewhere. Reservoirs with masonry dams also were built. These too became filled with silt in time, and not until recent years, and until the Periyar dam was built in India, with sufficient sluiceway near its base to pass all the flood waters and only arrest the later clean supply, was the problem met and a reservoir constructed which, in a silty river area, could be depended upon to keep itself clear of detritus. The most magnificent example is the Aswan dam in Egypt where the whole of the heavy Nile flood passes through the building without dropping any of its silt content and only clear water is stored; thus guaranteeing a practically perpetual life to the reservoir notwithstanding the vast volume of water it annually contains.

FORMS OF IRRIGATION

Basin System.—There are two main forms of irrigation. In the more ancient system the area to be served is surrounded by embankments, and is thus called a "basin"; into it a canal leads the waters from the river until a depth of 3 ft. or 4 ft. is attained. In Egypt many of the basins are of great size, some covering as much as 50,000 ac.; the water is run off after a time and the exposed area is sown with crops which need no further watering to bring them to maturity. The system obviously originated in the fact that a river can be easily made to give a supply once a year during its flood period, whereas enormous expense would be required to make it do so at other times. It happens, also, that the production of food crops follows the flood season in rivers like the Nile; very naturally, therefore, the system devised was one which took advantage of a river's flood season.

Fig. 2 will serve to explain this system of irrigation, the firm lines representing canals, the dotted lines embankments. It will be seen, beginning on the east or right bank of the river, that a high level canal from an upper system divides into two. The right branch waters all the desert slopes within its reach. The left branch passes by a syphon aqueduct, under the main canal of the

system, taken from the river close at hand (and therefore at a lower level). This left branch irrigates the high lands bordering on the river. In years of very favourable flood this high level canal may not be wanted at all; irrigation could be done from the main canal, and with this great advantage, that the main canal water would carry with it much more silt than would be got from the tail end of the high level canal, which left the river

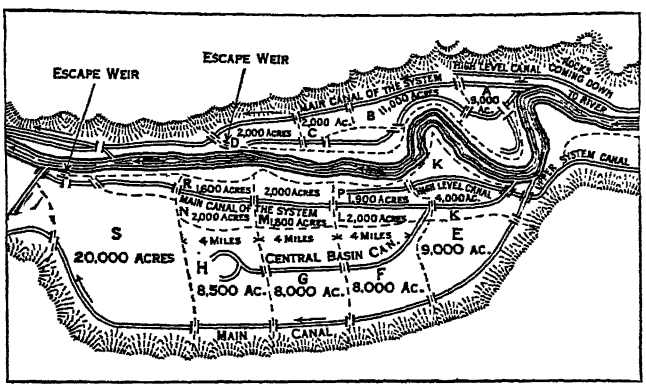


FIG. 2.—MAP OF A BASIN SYSTEM OF IRRIGATION
A, B, C, D, flat lands irrigated by the main canal
E, K, P, L, large basins irrigated by the high level canal
F, G, H, S, basins irrigated by the central basin canal

perhaps 25 m. further upstream. The main canal flows freely over the areas *C* and *D* and if the flood is good, over *B* and a part of *A*. It is carried round the next desert point, and to the north becomes the high level canal. The masonry works required for this system are a syphon to pass the high level under the main canal near its head, bridges fitted with sluices where each canal passes through an embankment, and an escape weir at the tail of the system, just south of the desert point, to return the water to the river.

Perennial System.—The other system where a perennial supply of water is made use of is also fed by canals, but in this case the canal system is enormously developed when compared with that of the basin system. In the latter one canal only may be required to feed many basins, this one canal running simply through the higher level basins and terminating at the middle of the last one of the series. In the perennial system branch canals lead off from the main canal, and lesser branches lead off from the main branches, and so on in ever decreasing size until, as a last branch, the smallest runlet is reached. The cost of this canalization is great, but the returns are correspondingly valuable, as usually about two crops can be grown under it instead of the one crop only per annum of basin irrigation.

The diagrams (figs. 2 and 3) show a perennial canal system. Only the main canals and branches are shown as such a system may extend over any distance up to 200 m. or even more. This plan also shows how efficient drainage should be provided between the canals. The more detailed canalization from the branches is shown in fig. 4.

DISTRIBUTION AND VOLUME OF WATER REQUIRED

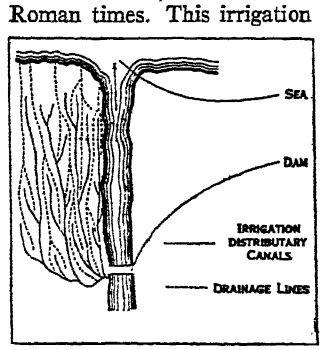
Distribution.—Where irrigation is carried on throughout the whole year its proper distribution becomes a most important operation. It is generally considered sufficient if during any one season one-third of the area commanded is actually supplied with water. This encourages that rotation of crops which is a necessity of good farming, and also the lying fallow of some part of the soil, which also appears to be a necessity in hot and arid countries during a portion of each year. Some crops, of course, require water much oftener than others, and much depends on the temperature at the time of irrigation. During the winter months in Northern India magnificent wheat crops can be produced which have to be watered only twice or thrice. But to keep sugar cane, indigo, or cotton alive in summer before the monsoon sets in in India, or the Nile rises in Egypt, the fields should be watered every 15 to 20 days, while rice requires an almost constant supply of water.

Volume of Water.—Even if the crops grown under irrigation were in each case identical, the conditions in different countries and at different seasons are so variable as to preclude a statement of volumes of water which would suit all places and conditions. The volume of water varies with its quality, purpose and temperature, with the climate, season, soil, sub-soil, drainage, slope, aspect and crop. Two hundred tons to 600 tons of water may be given per watering under the perennial system, whereas the one watering of the basin system may take 3,000 tons to 6,000 tons per acre. But whatever the volume, its accurate estimation for the purpose of proper division in each particular case is essential to ensure the maximum area being fed from any particular source.

Measurement.—Measurements of the volume of water flowing in a river or canal were formerly obtained by noting the speed of objects floating with the stream. In the last 30 years current meters replaced floats and give more regular results, but it was not definitely known, just as in the case of floats, whether these results indicated actual volumes or not. This doubt has now been set at rest by the calibration of water passing through the sluices of the Aswan dam in Egypt soon after its construction in 1902. This calibration was itself definitely proved correct by the full scale measurements of the volume passing in a given time by one sluice into a tank built below the dam about 1905: thus the amount of opening of the sluices indicates the actual volume of water passing in the river, at any level, to within an error of 1%. It was subsequently found that current meter discharges, repeated a few times to obtain a mean result, and taken simultaneously with the measurements at the dam, gave very similar results to the latter; thus the accuracy of current meters also became proved. It has further been shown that the data obtained from carefully prepared small scale models can be relied upon as correct to within a very small percentage of error. This indicates a very great advance on the previous state of such knowledge.

MINOR SYSTEMS OF IRRIGATION

Water Meadows.—In addition to the two major systems of irrigation, there are a number of minor systems with special objects in view. Nowhere in England can it be said that irrigation is necessary to ordinary agriculture, but it is occasionally employed to stimulate the growth of grass and meadow herbage in what are known as water meadows. On the Avon, in Wiltshire, and the Churn, in Worcestershire, these may be traced back to Roman times. This irrigation is not practised in the drought of summer, but in the coldest and wettest months of the year. The water employed being warmer than the natural moisture of the soil, proves a valuable protection against frost. Before the conversion of land into water meadows care must be taken to have good drainage, a sufficient supply of water, and of good quality. It might be thought that drainage would be unnecessary, but porous sub-soils or efficient drains do not act merely by carrying away stagnant water which would otherwise cool the earth, encrust the surface, and retard plant growth. They cause the soil to perform the offices of a filter; thus the earth and the roots of vegetation absorb the useful matter from the water which passes through it.



BY COURTESY OF THE U.S. BUREAU OF RECLAMATION
FIG. 3.—DIAGRAM SHOWING IRRIGATION PROPERLY COMBINED WITH DRAINAGE

Warping.—Warping is the name of a system which produces its results by a temporary use of the basin form of irrigation. In this system the suspended solid matters are of importance as a material addition to the ground. That is to say, the solid matter is used to make a new surface of soil on which, when a satisfactory depth of it is obtained, and where adequate drainage is provided, crops may be grown in the ordinary man-

ner from rainfall. The warping practised in England is almost exclusively confined to the overflowing of land lying below tide mark within the districts commanded by estuaries or tidal rivers. A good example of the process may be seen when sailing up the Trent from the Humber to Gainsborough. Here the banks of the river were constructed centuries ago to protect the land within them from the encroachment of the tide. The warping begun in the 18th century has become a regular system in recent times. Large masonry sluices, with strong doors to shut off the tide when necessary, may be seen in both banks of the river. From these sluices canals are carried in some cases many miles inland through the flat country to the point previously surrounded by embankments within which the muddy waters are to be allowed to spread. As the waters settle the mud is deposited and the clear water returns with the falling tide to the bed of the river. Spring tides, of course, are preferred. Peat mosses of the most sterile character have been by this process covered with soil of the greatest fertility and converted into firm and fertile fields. Three years are often spent in this process. One year in warping, one year drying and consolidating, and one year growing the first crop. The latter is generally hoed in by hand, as the mud is at first too soft to admit of horse labour. The drainage of peat soils has the effect of lowering the whole level through shrinkage of the peat. It is said lowering to a depth of 10 ft. to 12 ft. has occurred in some of the marsh areas drained. Of course warping to some extent makes up for the lowering caused by drainage.

Sewage Farming.—Many towns situated in inland districts, instead of passing their sewage into the nearest stream, deal with it under modern settling tank systems, from which the effluent is run off into small canals, which irrigate suitable cultivable areas. The yield of crop produced is great, as such waters contain a very high percentage of nitrogenous matter. The drainage from the city of Cairo, for instance, is said to be 30 times as valuable as the equivalent of Nile water even in flood time, when the latter bears what is said to be its fertilizing silt.

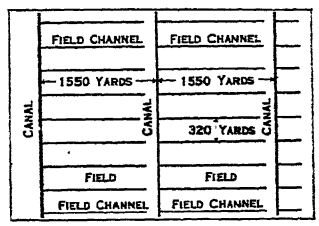
Drainage.—An absolutely necessary concomitant to irrigation is drainage of the soil. In few areas does nature provide this without further artificial aid. For many years the supply of irrigation water was the only problem considered by engineers; the disastrous results which have followed in many, if not in all, cases, from a neglect of the provision of adequate drainage has, however, awakened everyone to the necessity of supplying it if fields are to continue fertile. Very recent work on this subject in Cambridge shows its importance and, incidentally, that in the case of the Nile it is not alone the addition of Nile silt to the surface of the soil which induces fertility, but the period of rest and drainage which, in particular, the basin system of irrigation provides to a very great degree, that is so valuable. The perennial system can also be so arranged as to give a suitable, though much shorter, period of rest. Only education, experience and scientific teaching can prevent a farmer from overcultivating. In most irrigation systems, however, the collective opinion of the majority can compel the restriction of the supply of water at times when scientific opinion shows that the land should be left fallow.

COUNTRIES WHERE IRRIGATION IS DEVELOPED

Egypt and the Sudan.—In describing the areas where irrigation has been developed in various countries it is only necessary to give a more detailed statement regarding one of them, and Egypt has been selected, as its very life depends on its irrigation, whereas in most other cases irrigation is subsidiary to rainfall. Ancient as irrigation is in Egypt, it was never practised on a really scientific system until after the British occupation. As everyone knows, the valley of the Nile outside the Tropics is practically rainless. Yet it was the produce of this valley that formed the chief granary of the Roman empire. Probably nowhere in the world is there so large a population per square mile depending solely on agriculture, and so free from the risk of a season of drought or of flood. This is due to a remarkable property of the Nile. The regimen of the river is nearly constant. The season of its rise and fall, and the height attained by its waters, vary from year to year to a comparatively small extent. Each year the river begins to rise in Egypt about the beginning of June, attains its maximum in September, diminishes at first rapidly, and then more slowly, until the following June brings a new cycle. A late rise is not usually more than about three weeks later than an early rise. From the lowest level in summer to the highest level in flood the rise is, on an average, about 30 ft. at Aswan. The highest flood may be about 5 ft. more, and this extra height may mean disaster to life in Lower Egypt if the Nile banks are not carefully maintained so that they may contain the flood between them, train it to the sea, and not allow of its spreading over the land, except as permitted for irrigation. The lowest flood since 1737 occurred in 1913 and rose only to about 8 ft. below the average. The next lowest Nile occurred in 1877, and caused widespread famine throughout Upper Egypt, as 947,000 ac. remained barren there because the water did not rise high enough to flow properly into the canals. The land revenue lost in that year, as it is chargeable only on areas watered, was £1,112,000. The thorough remodelling of the whole system of canals since 1883 abolished all danger of famine and disaster in other low years, and the loss of revenue in each of these years was comparatively slight. In 1907, for instance, when the flood was nearly as low as in 1877, the area left unwatered was little more than 10% of the area affected in 1877. The area of all Egypt is over 240,000,000 ac., of which about 5,200,000 ac. are cultivated; but about 7,200,000 ac. can be cultivated from the waters of the Nile. All the remainder, lying in plateau and hilly country high above the Nile, must continue in its present inhospitable state of bare rock and sand until a climatic change occurs.

Irrigation During Low Nile.—The khedive, Mehemet Ali, was advised to deepen the canals of Lower Egypt to draw water at even the lowest stage of the river, a gigantic and futile task for, as they were not laid out on scientific principles, the deep channels became filled with silt during the succeeding flood, and all the excavation had to be done over again year after year. Since they were never dug deep enough throughout to draw water from the very bottom of the river, the canals occasionally ran dry altogether in the month of June, when the river was at its lowest, and when, being the month of greatest need, water was most necessary for the cotton crop. Thus large tracts which had been sown, irrigated and nurtured for, perhaps, three months, perished in the fourth, while all the time the required precious Nile water was flowing uselessly to the sea. The obvious remedy was to throw a weir or barrage across each branch of the river to control the water, and so heighten the levels at which it flowed that it could pass into canals taken from upstream of the weirs. The task of designing such weirs was committed to Mougel Bey, a French engineer of ability, who constructed them at the apex of the Delta, about 12 m. north of Cairo, in 1861. The barrage consists of masonry platforms on which are built two stone bridges —one over the Damietta branch of the river having 71 spans, the other over the Rosetta branch, having 61 spans of 16·4 ft. each. The height of pier is 28·7 ft. from flooring to spring of arch, the latter being placed just above the surface level of a maximum flood. The movable gates placed between each of the piers were intended to increase the river level above the buildings by about 15 ft. The river supply could thus be made use of, and flow through a whole network of canals branching off the main canals taken off the river upstream of the barrage, and thus feed all Lower Egypt. For many reasons it would be unfair to blame Mougel because the work was condemned as being really a hopeless failure, until it fell, in 1884, into the hands of British engineers, with Sir Colin Scott Moncrieff at their head. The latter resolved that the barrage could be strengthened sufficiently to carry out its work. The strengthening works which enabled this to be done mainly concerned the masonry platforms, which were thoroughly grouted and extended. Further strengthening by means of subsidiary weirs erected immediately downstream of the various weirs was carried out, and the building as a whole made capable of carrying a designed head of water against it. Since 1901 a second weir has been constructed opposite Zifta, across the Damietta branch of the Nile, to improve the irrigation of the Dakhilia province.

The first alteration in Upper Egypt from the basin to the perennial system of irrigation was due to the khedive Ismail, who acquired vast estates in the province of Assiut, Miniah, Beni Suef and the Fayoum, and resolved to grow sugar-cane on a large scale, and with this object constructed a canal, named the Ibrahimia, taking out of the left bank of the Nile at the town of Assiut, and flowing parallel to the river for about 200 miles. This canal had one defect; it could not receive water in summer, as the river then was too low. It was decided, therefore, to construct a barrage across the river for the same purpose as the Delta barrage, viz., to increase the level so that summer water could be made available as well as flood water. This structure was built at Assiut on a design very similar to that of the Delta barrage.



PLAN OF FIELD CHANNEL IRRIGATION

It consists of a wide masonry platform carrying a bridge of 111 arches each 5 metres' span, with piers of 2 metres' thickness. In each opening between piers are fitted two gates. The weir is about half-a-mile long. The work was begun at the end of 1898 and finished in 1902, and cost about £800,000.

The flood of 1902 was extremely low and would have, if unaided, resulted in great loss of crop and revenue; fortunately Mr. Webb (afterwards Sir Arthur Webb) grasped the significance of the power of control the new weir gave him over the height of the river upstream of the work, and used it for the novel purpose of heading up the flood. It was the bold action of a competent engineer and was more than amply justified by the result. Further strengthening of the downstream toe of the floor became necessary, but was not costly. This system of heading up low floods has ever since been continued at Assiut, and its advantages have been the justification for the construction of the Esna barrage in 1909, at the cost of about £900,000; this work renders the basin lands of the Kena province independent of a bad flood, but, like the Assiut barrage, it can be ultimately used to give summer water when such is available. Another similar structure with a similar object is now being erected at Nag Hamadi. With its completion Upper Egypt need never fear the effects of a low flood. It may be as well to say here that while a bad flood means low level in the river, yet no flood has ever been so low that there has not been enough water flowing to carry out all the irrigation required. What is really necessary is to make the water that is available flow at a high enough level, and it is this these barrages accomplish.

Storage.—These works, as well as those in Lower Egypt, are intended to raise the water surface above them and to control the distribution of supply, but in no way to store that supply. The necessity of storing up, for use at a future period of scarcity, of the superfluous flood discharge of the river, became apparent as a result of the development of Lower Egypt and the demand for perennial irrigation in Upper Egypt. The idea, however, was not a new one, and, if Herodotus is to be believed, it was a system actually pursued at a very early period of Egyptian history, when Lake Moeris, in the Fayoum, was filled at each Nile flood and drawn upon as the river ran down. When Sir Colin Scott Moncrieff first undertook the management of Egyptian irrigation many representations were made to him of the advantage of storing the Nile water; but he consistently maintained that before entering on that subject it was his duty to utilize every drop of the water at his disposal. This seemed all the more evident as at that time financial reasons made the construction of a costly Nile dam, to form a reservoir, out of the question. Every year, however, between 1890 and 1902 the supply of the Nile during May and June was actually exhausted, no water at all being allowed then to flow out into the sea. In these years, too, owing to the extension of drainage works, the irrigable area of Egypt was greatly enlarged, so that if perennial cultivation was to be further increased it would be necessary to augment the volume of the river, and this could only be done by storing up some of the unused flood supply. The first difficulty that presented itself in carrying this out was that, during the months of high flood, the Nile is so charged with silt that to pond water up then would probably lead to the silt being deposited in the reservoir; this might in no great number of years render the reservoir useless. It was seen, however, that yearly, by the middle of November, the flood water was fairly free from deposit, while the volume of water was still so great that, without injuring irrigation, sufficient water might be stored to fill a great reservoir. Accordingly, when it was determined to construct a dam, it was decided that it should be supplied with sluices large enough to discharge, unchecked, the whole volume of the river until the middle of November, and then to begin storage.

Sir Benjamin Baker, K.C.M.G., was entrusted with carrying out the work. He was one of the three eminent engineers, Mons. Boule (French) and Sig. Torricilli (Italian), being the others, who formed the commission to decide on the preliminary scheme prepared for the Government, but which was abandoned on Sir Benjamin Baker's advice. Then a new site was chosen. The new site for this great Nile dam was at the head of the first cataract above Aswan. A dike of syenitic granite here crosses the valley; so hard is it that the river had nowhere scoured a really deep channel through it, and on this the dam was erected, at a cost of about £3,000,000. The greatest head of water which could be put on the building was about 103 ft. It is pierced by 140 under sluices of 150 sq.ft. each, and by 40 upper sluices, each of 75 sq.ft. The reservoir could contain 1,000 million tons of water. In the few years following 1902 the need for an immediate further increase in the volume of water available for summer irrigation became pressing. As a consequence, it was decided to heighten the dam about 23 ft., thus increasing the reservoir capacity to 2,400,000,000 tons of water. However, this was only done after the work of protecting the toe of the dam by aprons was completed. These aprons reduce the effective head of water against the dam so that, even when heightened 23 ft., the dam has not now so great an effective head against it as before, as may be seen from fig. 5.

The work of heightening was begun in 1907 and finished in 1912, at a cost of about £1,500,000. The need of existing areas for all the water available was accentuated by the phenomenally low flood of 1913, which was followed, as a natural consequence, by a poor spring and summer supply in 1914. The 1913 flood was estimated to be the lowest for 150 years, and except for the existence of the various barrages and the dam across the river, would have meant famine as well as financial disaster to the country.

The Sudan.—Previous to 1910, except for a few thousand acres served by pumps, all the crops grown in the Sudan along the main Nile from Wadi Halfa to Khartoum, and along the White Nile from Khartoum to the Sudd region, were sown on land naturally inundated on its low banks by the annual rise of the

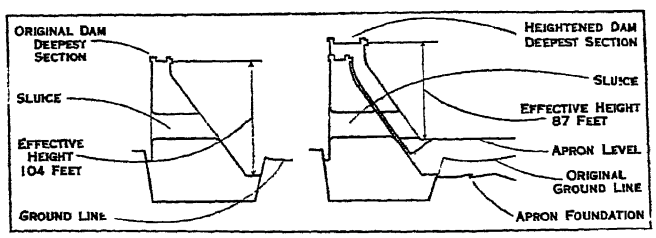


FIG. 5.—ASWAN DAM. CROSS-SECTIONS OF THE ORIGINAL AND HEIGHTENED DAM

Nile. On the Blue Nile, however, rainfall alone was depended on to fertilize the crops grown. About 1909 one of the few uncultivated areas below Khartoum was turned into a perennial irrigation farm, and was among the first to produce cotton in the Sudan by means of water pumped from the Nile. Soon after that date the possibility of growing cotton in the Gezira, that huge tract which lies in the fork of the Blue and White Niles, was suggested by Lord Lovat. Here some 5,000,000 ac. form a gently sloping plain stretching along between both rivers for about 200 m. from Khartoum. From this point southwards the plain is interspersed with small, isolated granitic hills. Of the 5,000,000 ac.

in this plain, probably 3,000,000 ac. will form the maximum area cultivable. On the remaining 2,000,000 ac. near Khartoum the soil is said not to be so good; it is of a more sandy nature.

Two experimental farms of a few hundred acres each were set down in the cultivable area. The summer climate in the Gezira was found to be too trying, although below Khartoum and in Egypt cotton is entirely a summer crop. An experiment was, however, made of sowing cotton in mid-July which could be picked in the following spring; this gave a return, on an average, of 400 lb. per acre, a figure equal to the normal Egyptian production. This result was obtained at a season of the year when there is usually an abundance of water in the river, a most fortunate arrangement. In exceptional circumstances a final watering may be necessary as late as April 15, though normally the last watering is expected to be given by March 31. Before either of these dates Egypt, notwithstanding her great reservoir at Aswan, in years of low river requires all that the Blue Nile can supply. It became necessary, therefore, to devise a building which would act as a combined barrage and dam on the Blue Nile, to enable the ordinary river supply to flow on to the plain; and at the same time store a sufficient volume of it to meet the demands in the Gezira in those months when Egypt requires all that flows in the river. It was decided to build such a structure at a point 5 m. south of Sennar, where a narrow belt of gabbro rock, which scarcely rises above the level of the plain on either side, runs across the river.

Construction was proceeded with and completed in July 1925 at a cost of about £6,000,000, the canal system bringing the total to about £9,000,000. The dam can store about 600 million tons of water for use in the critical period, which extends from January to March inclusive, when Egypt requires all that passes down in a very low year. The main canal leading from the dam is some 36 m. long before reaching the point where branch canals spread out from it on to the land to be irrigated. The area judged sufficient to form a commercial proposition, in view of the cost of the works, and at the same time not to injure Egypt even in a phenomenally low year, was 300,000 ac.; it is now known that this area can be considerably increased without endangering Egypt's supply.

Tokar.—Besides the Gezira plain the Sudan has other irrigation areas where great improvements have taken place, as at Tokar and Kassala. The river Barakat rises in the rainy season in the Abyssinian hills, and rushes as a chocolate-coloured, thick stream on to the Tokar plain, where it eventually spreads out into a thin film which is sucked up by the thirsty soil. The plain, however, is much greater in extent than the water can cover, although some finds its way to the sea, as recorded in 1921. The flood is liable to break away into areas not hitherto cultivated or, even if cultivated, so far from Tokar as to be inconvenient for transport. In recent years work was carried out for the purpose of exercising some control over the direction of flow, and has so far been successful. The annual area served varies greatly. In 1921–22 about 55,000 ac. were flooded, though not all were cultivated.

Kassala.—The river Gash rises in the Abyssinian foothills, and becomes of considerable volume, in the flood season, by the time it reaches Kassala. Here it spreads itself over the plain in such a manner that none of its waters ever reach the Nile. Some control has been exercised over the flow to keep the water annually to definite areas. In a really good year, with the supply of water at a maximum, 50,000 ac. of cotton might be cultivated. Owing to a poor flood only 11,000 ac. were sown in 1925.

India.—Irrigation gives valuable aid in the fight against those periodic famines which always happen after monsoon rainfall failures in India, and it also causes an increase in production through its extension into new and suitable areas hitherto lying fallow. During 40 years, 1885–1925 in particular, developments have steadily progressed. Some 10,500,000 ac. were irrigated in 1878–79; 19,250,000 ac. at the beginning of the century and 28,000,000 ac. in 1923–24. Additional works now under construction will add 2,500,000 acres. New schemes are contemplated which will add a further 4,750,000 acres. When completed they will bring the irrigated area of British India up to about 36,000,000 acres. These figures exclude the water supplied from the Punjab canals to 650,000 ac. in the native States. The Sutlej valley project, mainly for the benefit of native States, will increase the total by a further 3,250,000 ac., making in the proximate future a grand total of about 40,000,000 ac. of irrigated land in all India.

In 1900–01 39,142 m. of channels were in operation; by 1920–21 this had increased to 55,202 m. or an average addition of about 800 m. of channels per annum. The annual revenue return is between 7% and 8% on the capital invested in Government irrigation works. The following table shows the acreage of crops matured during 1923–24 by means of Government irrigation systems compared with the total area under cultivation in the several provinces of India:

Province	Net area cropped	Area irrigated by Government irrigation works	Percentage of area irrigated to total cropped area	Capital cost of Government irrigation and navigation works to end of 1923–24	Estimated value of crops raised on areas receiving State irrigation
	Acres	Acres	%	Lakhs of rupees	Lakhs of rupees
Madras.	36,424,000	6,891,000	18·9	1,207	3,556
Bombay Deccan	39,000,000	418,000	1·0	881	538
Sind	4,134,000	3,427,000	82·9	479	1,054
Bengal	22,806,000	93,000	0·4	422	78
United Provinces.	35,011,000	1,979,000	5·6	1,577	1,348
Punjab.	26,731,000	10,207,000	38·2	2,543	5,505
Burma	13,857,000	1,730,000	12·5	363	812
Bihar and Orissa	24,665,000	954,000	3·9	627	622
Central Provinces.	17,427,000	438,000	2·5	483	281
North-west Frontier Province	2,583,000	359,000	13·9	276	226
Rajputana	281,000	16,000	5·7	35	5
Baluchistan.	286,000	26,000	9·0	32	5
	223,205,000	26,538,000	11·9	8,925	14,030

Canada.—Irrigation in Canada has been, so far, very partially developed, and only in those provinces where extensive farming operations are in progress, such as Alberta, Saskatchewan and Manitoba. Developments are based upon the Federal Irrigation Act of 1894, under which the ownership of all surface water supply is vested in the Crown, which grants the necessary licences for its use. Occasional droughts occur all over the wheat-growing belts; provision, however, is steadily and systematically being made to supply irrigation water, to counteract as much as possible their effects. On the eastern section of the Canadian Pacific Railway company a census of the yields obtained and the water used by a group of ten farmers during 1924, shows that the average yield of wheat was 19½ bu. per ac. with an irrigation of 4 in. deep plus rainfall; with two 4 in. irrigations the yields were from 30 to 35 bu. and with three 4 in. irrigations were as high as 43 bu. per acre. In this district the rainfall was 11·24 in.; of which 9·68 in. fell during the growing season.

Australia.—Owing to the lack of an adequate rainfall the advantages of irrigation appealed many years ago to Australians. At first the object aimed at was to develop in unoccupied territory. While these efforts generally proved successful, in recent years the policy has been to extend irrigation to existing pastoral settlements; and some very large conservations of flood water schemes have been carried out, under which considerable areas of land are now in process of more intensive settlement.

The Murrumbidgee river (N.S.W.), is controlled by a dam 240 ft. high, at Burrinjack, which can conserve about 960,000,000 tons of water. The scheme is to irrigate about 200,000 ac., of which 120,000 ac. were settled by June 1923. They are mainly devoted











BY COURTESY OF (2, 3, 4, 5) THE U.S. DEPARTMENT OF THE INTERIOR; PHOTOGRAPH, (1) GEORGE STONE, FROM EWING GALLOWAY

DESERT LAND AREAS BEFORE AND AFTER RECLAMATION

1. Preparing a carrot field on a south-western American farm or ranch. Water is conveyed through the ditches between rows in which carrots are planted. A transverse canal, not shown in illustration, carries the water from main canal. Workman uses shovel to keep ditches open. Quantity of water varied according to needs of different crops
2. Expanse of desert in the State of Washington, before irrigation. Because of dry climate and lack of water for cultivation, only sagebrush bushes can grow in these regions under natural conditions
3. The Yakima Project, Washington. Land shown in fig. 2, after reclamation and irrigation. Hayrakes are shown gathering hay into windrows. Water for irrigation purposes is obtained from the mountainous regions where rainfall is plentiful. There it is stored in reservoirs made by damming up valleys, and is conveyed thence by canals to the land where it is needed for the raising of crops
4. Unreclaimed desert land, Rio Grande Project, New Mexico and Texas. Large areas of this kind have been made useful by irrigation
5. Rio Grande Project after reclamation and irrigation, showing field of grain standing ready for harvest

to vegetable and fruit growing and dairying purposes.

In Victoria the principal irrigation works are on the Goulbourne, Murray, Loddon, Werribee and MacAllister rivers. While the works for some of these schemes were completed before 1910 the areas to be irrigated are still only in process of settlement, and extension of the works are from time to time taking place. In 1923, 350,727 ac. were irrigated.

The Dawson Valley scheme (Queensland), under construction in 1928, comprises a dam 140 ft. high, at Nathans Gorge, to impound about 3,100,000,000 tons of water. When completed it will be the second largest reservoir in the world. The area to be served is about 250,000 ac.; the Inkerman irrigation area of 4,500 ac. is served by 230 shallow well pumps. Provision is being made to increase it to 10,000 acres. There are a number of smaller pump schemes at Townsville, Rockhampton, Gingera and Fairymead, which collectively serve about 4,000 acres.

In South Australia the Rennearth scheme serves 7,850 ac., mainly fruit producing. The Murray river pumping plants serve 17,800 ac., and are being extended to serve a further 11,000 acres. The Cadett scheme serves about 1,200 ac., and is supplied with water pumped through 90 ft. of height. The Waikerie scheme serves about 9,800 ac. and has the water lifted through 150 ft. of head. The Kingston scheme serves 500 ac.; the Moorook scheme serves 1,000 ac.; the Coodoyla scheme is ready to serve about 3,600 ac.; which can be increased to 30,000 ac. of irrigable land. The Berni scheme serves 7,700 ac.; the Chaffey scheme will serve 14,000 ac.; the Murray swamp land scheme will eventually make available for irrigation 13,700 ac., of which 5,800 ac. are now cultivated. Smaller schemes serve about 10,000 ac. in all. In Western Australia the Harvey irrigation scheme serves 4,000 acres.

Union of South Africa.—Irrigation was at first confined to small schemes whose entire works usually lay within the boundary of one farm. Works of greater magnitude were made easier of accomplishment when the Cape Government, to encourage irrigation, passed Acts in 1876–77. Completed irrigation schemes, although numerous, are individually small in area, none exceeding 10,000 acres. Among those under construction or development are some of considerable magnitude. These latter include the Great Fish river scheme, where 75,000 ac. are to be irrigated; the Sundays river scheme of 36,000 ac., and the Kamanassie river scheme of 28,000 acres.

The total area of land in South Africa under irrigation or in process of being brought under irrigation under Board schemes is about 350,000 acres.

China.—China, with its huge population of about 300 millions, has, no doubt, a very large area of irrigated land, but no statistics are available as to its extent except in a few small special districts where Europeans reside or have commercial interests. Hitherto engineering has been largely devoted to preventing the rivers in more than average floods overflowing their banks and inundating the land, an effect which has been many times accompanied by great loss of life. Commissioners have studied river control and the conservancy boards in recent years have reported on and carried out important works with this end in view. Quite obviously there is a large field in China for this form of development, and no doubt it will in time be followed by the more usual irrigation works.

'Iraq.—The construction of the Hindia barrage was one of the first steps undertaken in the modern regeneration of irrigation in this historical area. In 1925 the Diala Cotton company inaugurated a great scheme whereby 108,000 ac. will be fertilized by water from the Diala river, a tributary of the Tigris. The company, it is understood, intends to extend its operations as fast as possible under its concession; and a time can be envisaged when adequate control of the Euphrates and Tigris under conditions of peace and good government will allow of great areas of the arid plains of 'Iraq to be once again cultivated.

Italy.—The most highly developed irrigation in the world is probably that practised in the plains of Piedmont and Lombardy, where every variety of condition is to be found. The engineering works are of a high-class order, and from long generations of experience the farmer knows how best to use his water. The principal river of northern Italy is the Po, which rises to the west of Piedmont and is fed, not from glaciers like the Swiss torrents, but by rain and snow, so that the water has a somewhat high temperature, a point of importance to the valuable meadow irrigation known as Marcite. This is only practised in winter, when there is abundance of water available, and much resembles the water meadow irrigation of England. The great Cavour canal is drawn from the left bank of the Po a few miles below Turin, and it is carried right across the drainage of the country. Its full flood discharge is 3,800 cu.ft. per second, which happens between October and May. For summer irrigation Italy depends on the glaciers of the Alps and the great torrents of the Dora Baltea, and Sesia can be counted on for a volume exceeding 6,000 cu.ft. per second. Lombardy is quite as well off as Piedmont for the means of irrigation. The Naviglio Grande of Lombardy is a very fine work drawn from the left bank of the Ticino, and useful for navigation as well as irrigation. It discharges between 3,000 and 4,000 cu.ft. per second, and probably nowhere is irrigation carried on with less expense. Another canal, the Villoresi, drawn from the same bank as the Ticino, further upstream, is capable of carrying 6,700 cu.ft. per second. Like the Cavour canal the Villoresi is taken across the drainage of the country, entailing a number of very bold and costly works.

Spain and Portugal.—Irrigation has developed in a number of places in the peninsula since the beginning of the century and schemes for further works are being considered. None of those so far completed are of any great magnitude, but among the proposals there is one for the irrigation of 120,000 ac. of the Guadalquivir. The possibilities of this river are being studied for other areas, and are great if, by regulations of its excess flow in flood time, its water can be conserved for use in the drier periods of the year. On the Tagus a scheme near Villa Franca is now being surveyed which, if carried out, will enable 30,000 ac. to be irrigated.

Greece.—Greece has recently entered into a contract to reclaim and develop a great area of land in the Vardar valley in the region of Salonika and is at the present moment considering tenders for similar works in the plain of Thessaly and the Struma and Drama valleys. These works will largely consist of draining the rivers which at present flow through the plains, so as to avoid the disastrous flooding which now constantly takes place, but it is also intended to utilize the waters running in the streams as much as possible for irrigation. With these works completed Greece will have somewhere in the region of 1,500,000 ac. added to her cultivated land, of which at least 500,000 ac. will be irrigated. It is said that in addition to the wonderful type of "Turkish" tobacco (the area where this is grown centres round Kavalla and is now Greek territory) cotton of the Egyptian type can also be grown on these plains.

Arabia.—An interesting irrigation development is the possibility of reviving agriculture by its aid in the Yemen. A syndicate has been studying a project to examine the many reservoirs which in ancient times controlled flood waters for the benefit of agriculture in that region. However, the prosecution of this scheme must await the settlement of political problems in that region.

Mexico.—In Mexico, and in particular in northern Mexico, where the rainfall is negligible in the lower or plain country, strips of land are cultivated near the rivers by irrigation. The total area is considerable, but there are no records of its extent. The works are individually limited in extent, but have been constructed entirely by private enterprise, and good results in crop are obtained from them.

South America.—An irrigation scheme on the Rio Negro was carried out in 1914 whereby 230,000 ac. are being developed. There are other minor irrigation works in the country. Many irrigation works have been carried out in the South and Central American republics but almost entirely by private enterprise.

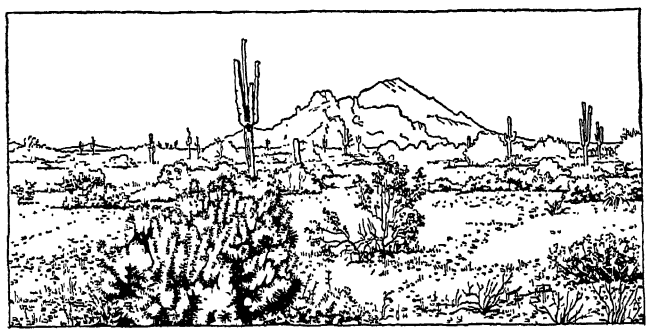
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Practice (1907); United States Bureau of Reclamation, *Papers*.

(M. M.)

UNITED STATES

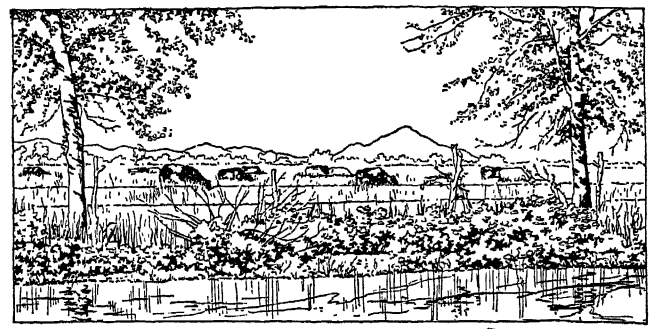
Irrigation as an aid to crop production is confined mainly to the arable lands of the Western States which receive an annual precipitation of 5 to 20 in. and a summer rainfall between April 1 and Oct. 1, of 1 to 10 in., although nearly 1,000,000 ac. of rice is irrigated in Louisiana, Arkansas, Mississippi and Texas, where the annual rainfall is 40 to 50 inches. A relatively small quantity of water is used in drought periods in some of the Atlantic coast States in the production of truck and fruit crops. In 1919 the area irrigated in the United States, exclusive of the Atlantic coast States, was 19,191,716 ac., the States ranking first in the area



BY COURTESY OF THE U.S. BUREAU OF RECLAMATION

FIG. 6.—DESERT WASTE LANDS IN ARIZONA AWAITING RECLAMATION

irrigated being California, Colorado, Idaho, Montana, Utah and Wyoming, in the order named. The capital invested in irrigation enterprises was $697,657,328, or $36.35 an acre. The cost of preparing land for irrigation is estimated at $345,450,000, or $18 an acre, and the gross annual value of the principal irrigated crops was $800,982,440 or $41.74 an acre. Relatively small areas were irrigated by the inhabitants of the south-western portion of the United States in prehistoric times. The customs and methods used were improved by the Spanish conquerors and their descendants. Modern irrigation by the Anglo-Saxon race began in 1847 and its progress has been recorded by each decennial census since 1889. In that year the area irrigated was 3,564,416 ac.; in 1909 it was 14,433,285 ac.; and in 1919 it was as stated, 19,191,716 acres. The latter figure represents the present status of development approximately, no large extensions having taken place since 1920, because of the general depression in agriculture.

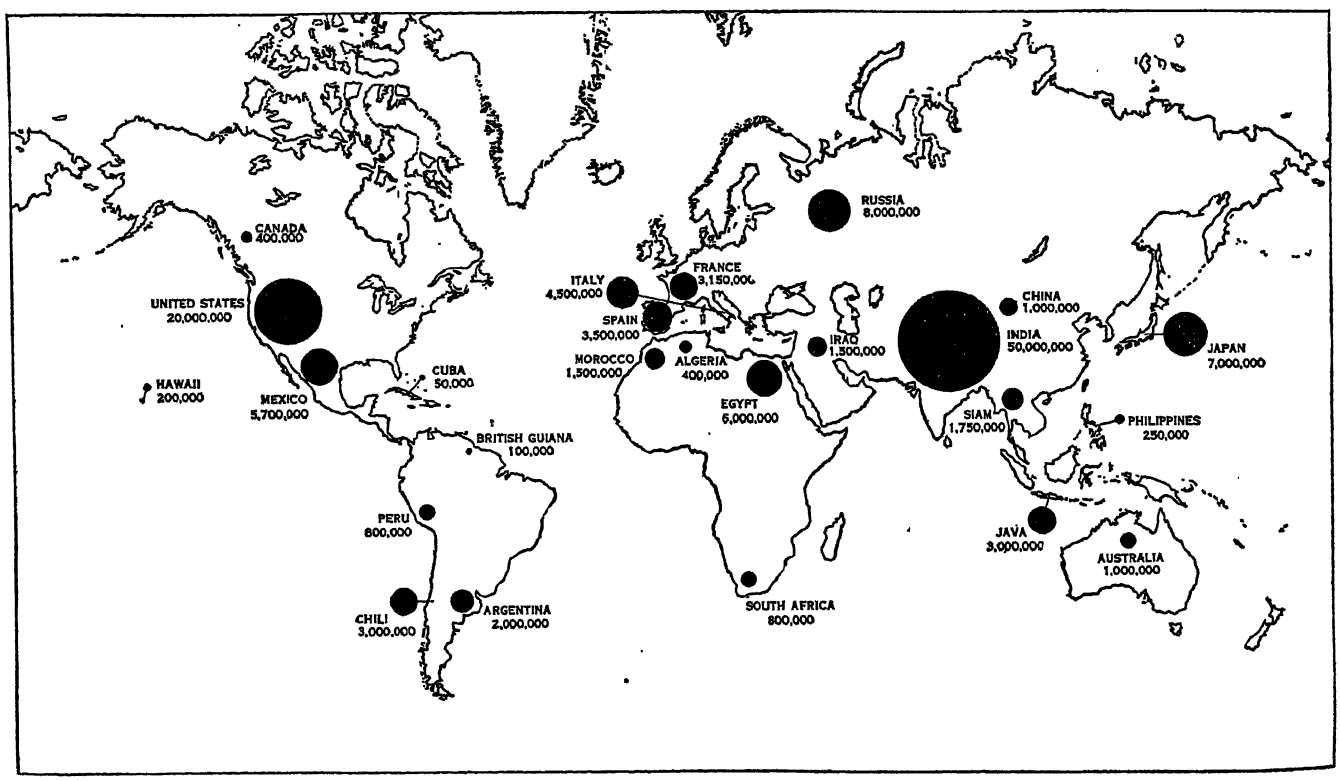


BY COURTESY OF THE U.S. BUREAU OF RECLAMATION

FIG. 7.—RECLAIMED LANDS UTILIZED FOR PASTURAGE

Seven agencies have been instrumental in accomplishing this development. The individual irrigator who either built a ditch himself or formed a partnership with one or more neighbours, and the co-operative companies, which are in reality larger groups of farmers acting together in building the necessary works, had to their credit 70% of the area reclaimed up to 1920. Public irrigation corporations, known as irrigation districts, and commercial enterprises, have each reclaimed 9½%; the United States bureau of reclamation 7%; private corporations operating under the Carey Act, 2¾%; and the U.S. Indian service, 1¼%. Competent authorities have estimated that there is in the Western States an area aggregating 44,000,000 ac. in addition to that already irrigated, which it is feasible to irrigate when agricultural and economic conditions warrant. Thus the possibilities of irrigated agriculture in the Western States may be said to include a total area of 63,000,000 acres.

In outlining the salient features of irrigation in the United



BY COURTESY OF THE U.S. BUREAU OF RECLAMATION

FIG. 8.—IRRIGATED AREAS OF THE WORLD, REPRESENTED IN ACREAGE

States other than by the statistics given above, it may be remarked that the principles of hydraulics and hydrology which govern to so large an extent the design of irrigation structures, are identical for all countries, and where differences are created they are caused mainly by differences in building materials, in the standards of engineering design and construction, or in the demands and requirements of the water users. As has been indicated, the greater part of arid land reclamation has been brought about by farmers acting singly or in groups and organizations. These settlers were not financially able to build costly works and common practice involved the use of wood and temporary structures. In course of time, however, many land and water corporations were formed by the aid of foreign as well as domestic capital, for the purpose of exploiting the agricultural resources of the West. These were followed by legislative action by many of the States to enlarge the powers of farmers' organizations, principally by permitting them to bond their land holdings, so raising funds with which to build, purchase, and reconstruct irrigation systems. In 1902 Congress passed the Reclamation Act by which the Federal Government became an active participant in reclamation work. These three agencies, viz., the commercial enterprises, the irrigation districts and the nation, were financially able to employ experienced engineers to design and construct permanent irrigation works. The work of building new systems, and remodelling and reconstructing existing enterprises, has been going on for 25 years and is still in progress, with the result that the makeshifts of earlier periods are being replaced gradually by substantial structures of concrete, plain or reinforced; and a degree of efficiency and permanency is being attained in irrigation systems that will compare favourably with those of any other country. It is believed the United States ranks first in the number, dimensions and permanency of its concrete dams built to impound water for irrigation, in the efficiency of the mechanical equipment used to pump water for irrigation, and in the effectiveness of the appliances used to distribute water on farms.

The quantity of delivered water required for the irrigable lands of the Western States depends primarily upon such climatic influences as rainfall, temperature, sunshine, and evaporation, and to a less degree upon such factors as time and quantity of application, soils and crops. Based on sectional averages, the seasonal net requirements of delivered water range from 1·25 acre-feet per acre, where the effective rainfall is 12 in. during the crop-growing period, to as high as 3 acre-feet per acre where the annual precipitation is less than 10 in., the crop-growing period long, and the temperature high.

The most notable achievements in irrigation in the United States in recent years consist in (1) the large number of pumping plants installed in Arizona and California for the dual purpose of lowering the ground water level, thereby effecting cheap drainage and providing water for irrigation; (2) the development and extended use of the border method of applying water (see *Farmers' Bulletin* No. 1,243 U.S. Department of Agriculture); and (3) the results of intensive and extensive studies of soil moisture in relation to crop production and drainage. (S. Fo.)

IRULA, the darkest-skinned tribe of the Nīlgirī Hills in South India (from Tamil *irul,* "darkness"), as the Badagas (*q.v.*) are the fairest. Speaking corrupt Tamil and practising a rude form of Vishnu-worship, the Irulas have as yet no marriage-rite beyond a feast. They bury their dead in a sitting posture with legs crossed or face downwards with head to the north. Though miserably poor, they are in much request as fortune-tellers.

IRUN, a frontier town of northern Spain, in the province of Guipúzcoa, on the left bank of the river Bidasoa. Pop. (1920) 14,161. Irun is the northern terminus of the Spanish Northern railway, and a thriving industrial town, with ironworks, tan-yards, potteries and paper mills. It derives its prosperity from the fact that it is the most important custom-house in Spain for the overland trade with the rest of Europe. Irun is also on the chief highway for travellers and mails. It is the terminus of some important narrow-gauge mining railways and steam tramways, which place it in communication with the mining districts of Guipúzcoa and Navarre, and with the valuable oak, pine and beech forests of both provinces.

IRVINE, a royal burgh, parish and seaport of Ayrshire, Scotland. Pop. (1921) 11,826. It is situated on the north bank of the estuary of the Irvine, 29½ m. S.W. of Glasgow by the L.M.S. railway. It is connected with the suburb of Fullarton on the south side of the river by a fine bridge. Alexander II. granted it a charter, which was confirmed by Robert Bruce. Towards the end of the 17th century it was reckoned the third shipping port in Scotland, and though its importance in this respect declined owing to the partial silting-up of the harbour, its water-borne trade revived after 1875, the sandy bar having been removed and the wharfage extended and improved. The Academy is a pre-Reformation foundation. The industries include engine-making, shipbuilding, iron founding, the manufacture of chemicals and hosiery, saw-mills and spelter works. Irvine unites with Ayr, Ardrossan, Prestwick, Saltcoats and Troon in sending one member to parliament. The exports consist principally of coal, iron, fireclay goods and chemical products, and the imports of grain, timber, limestone, ores and salt. At DREGHORN, 2 m. to the S.E. coal and fireclay are worked and bricks made.

IRVING, EDWARD (1792–1834), Scottish church divine, generally regarded as the founder of the "Catholic Apostolic Church" (*q.v.*), was born at Annan, Dumfriesshire, on Aug. 4, 1792. At the age of 13 he entered the University of Edinburgh. In 1809 he graduated M.A.; and in 1810, on the recommendation of Sir John Leslie, he was chosen master of an academy newly established at Haddington, where he became the tutor of Jane Welsh, afterwards Mrs. Carlyle. He became engaged in 1812 to Isabella Martin, whom in 1823 he married; but meanwhile he gradually fell in love with Jane Welsh, and she with him. He tried to get out of his engagement with Miss Martin, but was prevented by her family. Irving introduced Carlyle to Jane Welsh in 1821. Irving left Haddington for Kirkcaldy in 1812. Completing his divinity studies by a series of partial sessions, he was "licensed" to preach in June 1815, but continued to teach for three years. In the summer of 1818 he resigned his mastership and went to Edinburgh. He was meditating a missionary tour in Persia when, in 1819, he was appointed assistant to Dr. Chalmers in St. John's parish, Glasgow. Irving's preaching awakened little interest among the congregation of Chalmers, Chalmers himself, with no partiality for its bravuras and flourishes, comparing it to "Italian music, appreciated only by connoisseurs"; but as a missionary among the poorer classes he wielded an influence that was altogether unique. In 1822 he was ordained minister of the Caledonian church, Hatton Garden, London. There his sermons at once attracted a crowd of fashionable people.

For years the subject of prophecy had occupied much of his thoughts, and his belief in the near approach of the second advent had received corroboration in the work of a Jesuit priest, writing under the assumed Jewish name of Juan Josafat Ben-Ezra. In 1827 he published a translation of it, accompanied with an eloquent preface. Probably the religious opinions of Irving had gained breadth and comprehensiveness from his intercourse with Coleridge, but gradually his chief interest in Coleridge's philosophy centred round that which was mystical and obscure, and it probably accounts for his adoption of the doctrine of millenarianism. The first stage of his later development, which resulted in the establishment of the "Irvingite" or "Holy Catholic Apostolic Church," in 1832, was associated with conferences at his friend Henry Drummond's seat at Albury concerning unfulfilled prophecy, followed by study of the prophetical books and especially of the Apocalypse, and by several series of sermons on prophecy both in London and the provinces. Crowds filled the largest churches of Edinburgh in the early summer mornings to hear his apocalyptic lectures in 1828. In 1830 his hopes were aroused by the seeming actual revival in a remote corner of Scotland of those apostolic gifts of prophecy and healing which he believed to be kept in abeyance by the absence of faith.

Irving welcomed the new "power" with a conviction which was unshaken by the remonstrances or desertion of his dearest friends, the recantation of some of the principal agents of the "gifts," his own declension into a subordinate position, the meagre and

barren results of the manifestations and their general rejection both by the church and the world. His excommunication by the presbytery of London, in 1830, for publishing his doctrines regarding the humanity of Jesus Christ, and the condemnation of these opinions by the General Assembly of the Church of Scotland in the following year, were secondary episodes. The "irregularities" connected with the manifestation of the "gifts" gradually estranged his own congregation, and on the complaint of the trustees to the presbytery of London, whose authority they had formerly rejected, he was declared unfit to remain the minister of the National Scotch Church of Regent square. After he and those who adhered to him (describing themselves as of the Holy Catholic Apostolic Church) had in 1832 removed to a new building in Newman street, he was in March 1833 deposed from the ministry of the Church of Scotland by the presbytery of Annan on the original charge of heresy. With the sanction of the "power" he was now after some delay reordained "chief pastor of the church assembled in Newman street." He died on Dec. 7, 1834.

The writings of Edward Irving published during his lifetime were *For the Oracles of God, Four Orations* (1823); *For Judgment to come* (1823); *Babylon and Infidelity foredoomed* (1826); *Sermons,* etc. (3 vols., 1828); *Exposition of the Book of Revelation* (1831); an introduction to a translation of Ben-Ezra; and an introduction to Horne's *Commentary on the Psalms.* His collected works were published in 5 volumes, edited by Gavin Carlyle. *See* also the article CATHOLIC APOSTOLIC CHURCH.

The *Life of Edward Irving,* by Mrs. Oliphant, appeared in 1862 in 2 vols. Among a large number of biographies published previously, that by Washington Wilks (1854) has some merit. *See* also Hazlitt's *Spirit of the Age;* Coleridge's *Notes on English Divines;* Carlyle's *Miscellanies,* and Carlyle's *Reminiscences,* vol. i. (1881).

IRVING, SIR HENRY (1838–1905), English actor, whose original name was John Brodribb, was born at Keinton-Mandeville, Somerset, Feb. 6, 1838. After a brief experience as clerk in a city firm he started as an actor. He made his first appearance (Sept. 29, 1856) at Sunderland as Gaston, duke of Orleans, in Bulwer Lytton's *Richelieu,* billed as Henry Irving. This name he eventually assumed by royal licence. For ten years he played in various provincial stock companies, acting in more than 500 parts. In 1866 he obtained an engagement at the St. James's theatre, London, to play Doricourt in *The Belle's Stratagem.* A year later he joined the company of the newly-opened Queen's theatre, where he acted with Charles Wyndham, J. L. Toole, Lionel Brough, John Clayton, Mr. and Mrs. Alfred Wigan, Ellen Terry and Nelly Farren. This was followed by short engagements at the Haymarket, Drury Lane and Gaiety. He made his first conspicuous success as Digby Grant in James Albery's *The Two Roses* (Vaudeville, June 4, 1870), which ran for 300 nights. In 1871 he began his association with the Lyceum theatre by an engagement under Bateman's management. The fortunes of the house were saved by Irving's immediate success as Mathias in *The Bells,* a version of Erckmann-Chatrian's *Le Juif Polonais* by Leopold Lewis. The play ran for 150 nights. With Miss Bateman, Irving was seen in W. G. Wills's *Charles I.* and *Eugene Aram,* in *Richelieu,* and in 1874 in *Hamlet.* The unconventionality of this last performance, during a run of 200 nights, singled him out as the most interesting English actor of his day. In 1875, still with Miss Bateman, he was seen as Macbeth; in 1876 as Othello, and as Philip in Tennyson's *Queen Mary;* in 1877 in *Richard III.* and *The Lyons Mail.*

In 1878 Irving opened the Lyceum under his own management. With Ellen Terry as Ophelia and Portia, he revived *Hamlet* and produced *The Merchant of Venice* (1879). His Shylock was as much discussed as his Hamlet had been, the dignity with which he invested the Jew marking a departure from the traditional interpretation of the rôle, and pleasing some as much as it offended others. After the production of Tennyson's *The Cup,* a revival of *Othello* (in which Irving played Iago to the Othello of Edwin Booth) and of *Romeo and Juliet,* there began a period at the Lyceum which had a potent effect on the English stage. The Lyceum stage management, and the brilliancy of its productions in scenery, dressing and accessories, were revelations in the art of *mise-en-scène. Much Ado about Nothing* (1882) was followed by *Twelfth Night* (1884); *Olivia*—an adaptation of Goldsmith's *Vicar of Wakefield* by W. G. Wills (1885); *Faust* (1886); *Macbeth* (1888); *The Dead Heart,* by Watts Phillips (1889); and *Ravenswood*—Herman Merivale's dramatic version of Scott's *Bride of Lammermoor* (1890). Irving's magnificent presentment in 1892 of Wolsey in *Henry VIII.* and of King Lear were followed in 1893 by a fine performance of Becket in Tennyson's play of that name. During these years Irving, with the whole Lyceum company, paid several visits to America. The chief remaining novelties at the Lyceum during Irving's sole managership (the theatre passed, at the beginning of 1899, into the hands of a limited liability company) were Comyns Carr's *King Arthur* in 1895; *Cymbeline,* in which Irving played Iachimo, in 1896; Sardou's *Madame Sans-Gêne* in 1897; *Peter the Great,* a play by Laurence Irving, the actor's second son, in 1898; and Conan Doyle's *Waterloo* (1894). The new *régime* at the Lyceum was signalized by the production of Sardou's *Robespierre* in 1899, in which Irving reappeared after a serious illness, and in 1901 by an elaborate revival of *Coriolanus.* Irving's only subsequent production in London was Sardou's *Dante* (1903), a vast spectacular drama, staged at Drury Lane. He died "on tour" at Bradford on Oct. 13, 1905, and was buried in Westminster Abbey.

Both on and off the stage Irving always maintained a high ideal of his profession, and in 1895 he received the honour of knighthood, the first ever accorded an actor. He was also the recipient of honorary degrees from the universities of Dublin, Cambridge and Glasgow. His acting, apart from his genius as a presenter of plays, divided criticism, opinions differing as to the extent to which his mannerisms of voice and deportment interfered with or assisted the expression of his ideas. So strongly marked a personality as his could not help giving its own colouring to whatever part he might assume, but the richness and originality of this colouring at its best cannot be denied, any more than the spirit and intellect which characterized his renderings. Extraordinary versatility must be conceded to an actor who could satisfy exacting audiences in rôles so widely different as Digby Grant and Louis XI., Richard III. and Becket, Benedick and Shylock, Mathias and Dr. Primrose.

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IRVING, HENRY BRODRIBB (1870–1919), English actor, elder son of Sir Henry Irving (*q.v.*), was born in London on Aug. 5, 1870. He was educated at Marlborough and New College, Oxford, and was called to the bar in 1894; but he abandoned this profession for that of the stage, for which his inherited aptitude had always been very marked. At Oxford he belonged to the O.U.D.S. and played the leading parts in Browning's *Strafford* and Shakespeare's *King John.* His first professional appearance in London was made in Sept. 1891, with John Hare at the Garrick theatre in Robertson's *School.* In 1894 he joined Ben Greet's company, and met Miss Dorothea Baird, whom he married in 1896 at the time of her great popular success in Du Maurier's *Trilby.* His earliest notable success was in Barrie's *The Admirable Crichton* (1903). He repeated many of his father's famous parts, but did original work of a high order in Stevenson's *Dr. Jekyll and Mr. Hyde,* Stephen Phillips's *The Sin of David,* and many other productions. He was manager of the Savoy theatre from 1913 until his death. He was a keen student of criminology, and published a *Life of Judge Jeffreys* (1898); *French Criminals of the 19th Century* (1901); and *A Book of Remarkable Criminals* (1918). He died in London on Oct. 17, 1919. *See* A. Brereton, *"H.B." and Laurence Irving* (1922).

IRVING, LAURENCE SYDNEY BRODRIBB (1871–1914), English actor, younger son of Sir Henry Irving (*q.v.*), was born in London on Dec. 21, 1871. He was educated at Marlborough and abroad, being destined for the diplomatic service; but he joined Frank Benson's Shakespearean company in 1893, and made his first professional appearance in London in 1894 in Barrie's *Walker, London.* He married Mabel Hackney, the actress, and with his wife played in Brieux's *The Three Daughters of M.*

Dupont, and *The Incubus*, as well as in *The Unwritten Law*—his own adaptation of Dostoievsky's *Crime and Punishment*—and in Lengyell's *Typhoon*. He wrote *Peter the Great* (produced by his father in 1898), *Bonnie Dundee* and *Richard Lovelace*, as well as a number of translations and adaptations of plays. Both he and his wife lost their lives when the "Empress of Ireland" sank in the St. Lawrence river on May 29, 1914. *See* A. Brereton, *"H.B." and Laurence Irving* (1922).

IRVING, WASHINGTON (1783–1859), American man of letters, was born in New York city on April 3, 1783. Both his parents were immigrants from Great Britain, his father—originally an officer in the merchant service, but at the time of Irving's birth a considerable merchant—having come from the Orkneys and his mother from Falmouth. Irving was intended for the legal profession, but his studies were interrupted by an illness necessitating a voyage to Europe, in the course of which he proceeded as far as Rome and made the acquaintance of Washington Allston.

He was called to the bar upon his return, but made little effort to practise, preferring to amuse himself with literary ventures. The first of these of any importance, a satirical miscellany entitled *Salmagundi, or the Whim-Whams and Opinions of Launcelot Langstaff and Others*, written in conjunction with his brother William and J. K. Paulding, gave ample proof of his talents as a humorist. These were still more conspicuously displayed in his next attempt, *A History of New York from the Beginning of the World to the End of the Dutch Dynasty*, by "Diedrich Knickerbocker" (1809). The satire of *Salmagundi* had been principally local, and the original design of "Knickerbocker's" *History* was only to burlesque a pretentious disquisition on the history of the city in a guide-book by Dr. Samuel Mitchell. The idea expanded as Irving proceeded, and he ended by creating a distinct literary type out of the solid Dutch burgher whose phlegm had long been an object of ridicule to the mercurial Americans. Though far from the most finished of Irving's productions, "Knickerbocker" manifests the most original power, and is the most genuinely national in its quaintness and drollery. The very tardiness and prolixity of the story are skilfully made to heighten the humorous effect.

Upon the death of his father, Irving had become a sleeping partner in his brother's commercial house, a branch of which was established at Liverpool. This, combined with the restoration of peace, induced him to visit England in 1815, when he found the stability of the firm seriously compromised. After some years of ineffectual struggle it became bankrupt. This misfortune compelled Irving to resume his pen as a means of subsistence. His reputation had preceded him to England, and the curiosity naturally excited by the then unwonted apparition of a successful American author procured him admission into the highest literary circles, where his popularity was ensured by his amiable temper and polished manners. As an American, moreover, he stood aloof from the political and literary disputes which then divided England. Campbell, Jeffrey, Moore, Scott, were counted among his friends, and the last-named zealously recommended him to the publisher Murray, who consented (1820) to bring out *The Sketch Book of Geoffrey Crayon, Gent.* (1819–20). The most interesting part of this work is the description of an English Christmas, which displays a delicate humour not unworthy of the writer's evident model, Addison. Some stories and sketches on American themes contribute to give it variety; of these "Rip van Winkle" is the most remarkable. It speedily obtained the greatest success on both sides of the Atlantic. *Bracebridge Hall, or the Humourists*, a work purely English in subject, followed in 1822, and showed to what account the American observer had turned his experience of English country life. The humour is, nevertheless, much more English than American.

Tales of a Traveller (4 pts.) appeared in 1824 at Philadelphia, and Irving, now in comfortable circumstances, determined to enlarge his sphere of observation by a journey on the Continent. After a long course of travel he settled down at Madrid in the house of the American consul, Rich. His intention at the time was to translate the *Coleccion de los Viajes y Descubrimientos* (Madrid, 1825–37) of Martin Fernandez de Navarrete; finding, however, that this was rather a collection of valuable materials than a systematic biography, he determined to compose a biography of his own by its assistance, supplemented by independent researches in the Spanish archives. His *History of the Life and Voyages of Christopher Columbus* (London, 4 vols.) appeared in 1828, and obtained a merited success. *The Voyages and Discoveries of the Companions of Columbus* (Philadelphia, 1831) followed; and a prolonged residence in the south of Spain gave Irving materials for two highly picturesque books. *A Chronicle of the Conquest of Granada from the MSS. of* [an imaginary] *Fray Antonio Agapida* (1829), and *The Alhambra: a series of tales and sketches of the Moors and Spaniards* (1832). Previous to their appearance he had been appointed secretary to the embassy at London, an office as purely complimentary to his literary ability as the legal degree which he about the same time received from the University of Oxford.

Returning to the United States in 1832, after 17 years' absence, he found his name a household word, and himself universally honoured as the first American who had won for his country recognition on equal terms in the literary republic. After the rush of fêtes and public compliments had subsided, he undertook a tour in the western prairies, and returning to the neighbourhood of New York built for himself a delightful retreat on the Hudson, to which he gave the name of "Sunnyside."

BIOGRAPHICAL WORKS

His acquaintance with the New York millionaire, John Jacob Astor, prompted his next important work—*Astoria* (1836), a history of the fur-trading settlement founded by Astor in Oregon, deduced with singular literary ability from dry commercial records, and, without laboured attempts at word-painting, evincing a remarkable faculty for bringing scenes and incidents vividly before the eye. *The Adventures of Captain Bonneville* (1837), based upon the unpublished memoirs of a veteran explorer, was another work of the same class. In 1842 Irving was appointed ambassador to Spain. He spent four years in the country, without this time turning his residence to literary account; and it was not until two years after his return that Forster's life of Goldsmith, by reminding him of a slight essay of his own which he now thought too imperfect by comparison to be included among his collected writings, stimulated him to the production of his *Life of Oliver Goldsmith, with Selections from his Writings* (1849). Without pretensions to original research, the book displays an admirable talent for employing existing material to the best effect. The same may be said of *The Lives of Mahomet and his Successors* (1849–50). Here as elsewhere Irving correctly discriminated the biographer's province from the historian's, and, leaving the philosophical investigation of cause and effect to writers of Gibbon's calibre, applied himself to represent the picturesque features of the age as embodied in the actions and utterances of its most characteristic representatives.

His last days were devoted to his *Life of George Washington* (5 vols., 1855–59, New York and London), undertaken in an enthusiastic spirit, but which the author found exhausting and his readers tame. His genius required a more poetical theme, and indeed the biographer of Washington must be at least a potential soldier and statesman. Irving lived to complete this work, dying of heart disease at Sunnyside, on Nov. 28, 1859.

Although one of the chief ornaments of American literature, Irving was not characteristically American. But he was one of the few authors of his period who really manifested traces of a vein of national peculiarity which might under other circumstances have been productive. "Knickerbocker's" *History of New York*, although the air of mock solemnity which constitutes the staple of its humour is peculiar to no literature, manifests nevertheless a power of reproducing a distinct national type. Had circumstances taken Irving to the West, and placed him amid a society teeming with quaint and genial eccentricity, he might possibly have been the first Western humorist, and his humour might have gained in depth and richness.

In England, on the other hand, everything encouraged his natural fastidiousness; he became a refined writer, but by no means

a robust one. His biographies bear the stamp of genuine artistic intelligence, equally remote from compilation and disquisition. In execution they are almost faultless; the narrative is easy, the style pellucid, and the writer's judgment nearly always in accordance with the general verdict of history. Without ostentation or affectation, he was exquisite in all things, a mirror of loyalty, courtesy and good taste in all his literary connections, and exemplary in all the relations of domestic life. He never married, remaining true to the memory of an early attachment blighted by death.

BIBLIOGRAPHY.—The principal edition of Irving's works is the "Geoffrey Crayon," published at New York in 1880 in 26 volumes. His *Life and Letters* was published by his nephew Pierre M. Irving (1862–64; German abridgment by Adolf Laun, 1870). There is a good deal of miscellaneous information in a compilation entitled *Irvingiana* (1860); and W. C. Bryant's memorial oration, though somewhat too uniformly laudatory, may be consulted with advantage. It was republished in *Studies of Irving* (1880), along with C. Dudley Warner's introduction to the "Geoffrey Crayon" edition and Mr. G. P. Putnam's personal reminiscences of Irving, which originally appeared in the *Atlantic Monthly*. *See* also *Washington Irving* (1881), by C. D. Warner, in the "American Men of Letters" series; H. R. Haweis, *American Humourists* (1883); William Morton Payne, *Leading American Essayists* (1910); *Notes while Preparing The Sketch Book, 1817* (1927), and *A Tour in Scotland* (1817), edited by Farley Williams.

(R. G.)

IRVINGTON, a town of Essex county, New Jersey, U.S.A., just S.W. of Newark; served by the Lehigh Valley railroad and by electric trolley and motor-coach lines. The population was 25,480 in 1920, and was estimated locally at 47,000 in 1928. It is a residential suburb of Newark and New York; and has numerous and varied manufacturing industries (including chemical plants, metal refineries, foundries, lumber mills and sash factories), with an aggregate output in 1925 valued at $26,979,051. Irvington was settled in 1692, and was called Camptown until 1852, when the present name was adopted in honour of Washington Irving. It was incorporated as a village in 1835, as a town in 1898; and has a commission form of government.

IRWIN, EDWARD FREDERICK LINDLEY WOOD, 1ST BARON (1881–), British politician, was born April 16, 1881. The only surviving son of the 2nd Viscount Halifax, he was educated at Eton and at Christ Church, Oxford, being elected fellow of All Souls college in 1903. In Jan. 1910 he was returned to parliament as Conservative member for the Ripon division of Yorkshire, and retained his seat until 1925. During the World War he served in France (1915–17) with the Yorkshire Dragoons, in which he held the rank of major, being mentioned in dispatches, and was an assistant secretary to the minister of national service, 1916–18. In April 1921 he was appointed under-secretary of State for the colonies. In this capacity he made a tour of the West Indian colonies, and published his conclusions on the administrative and economic problems which he encountered in a report issued in June 1922. From Oct. 1922 to Jan. 1924 he was president of the Board of Education. In Nov. 1924 he became minister of agriculture and fisheries in Mr. Baldwin's second Government.

In Oct. 1925 he was appointed governor-general of India in succession to the marquess (then earl) of Reading, being raised to the peerage as Baron Irwin of Kirkby Underdale two months later. Arriving in India in April, 1926, he sought eagerly to stay the rapid development of old antagonisms between Hindus and Mohammedans, leading to embittered and widespread inter-communal disorder. His offer in Aug. 1927, to convene a conference of leaders with the object of frankly facing the causes of these miserable differences did not meet with an adequate response, but it encouraged efforts to bring about agreement by mutual compact. One cause of friction was the approach of the time prescribed in the Government of India Act, 1919, for examination of the Montagu-Chelmsford reforms. The date was accelerated by two years and a parliamentary commission under the chairmanship of Sir John Simon was appointed in Nov. 1927. Though hampered by the strength and obstructiveness of the Swarajist element in the Legislative Assembly, Lord Irwin showed remarkable patience and perseverance in his efforts to overcome the boycott which the Swarajist and Liberal politicians sought to impose on the ground of the non-inclusion of Indians in the commission. Indian participation on equal terms was secured by means of committees of the central and provincial legislatures sitting with the commission. The great bulk of the Muslims, the depressed Hindu classes and other important minorities gave their co-operation. Lord Irwin came into exceptionally friendly contact with the Indian princes and a committee under Sir Harcourt Butler examined the relations between the Paramount Power and the States. His high character, linked with approachableness, made a great impression on the Indian mind.

Like his father, Lord Irwin, who had been sworn a member of the privy council in 1922, took a keen interest in ecclesiastical affairs, and published a study of John Keble in the "Leaders of the Church Series."

(F. H. BR.)

ISAAC, the only son of Abraham and Sarah and father of Jacob and Esau. He thus occupies a middle position between the two major figures in the ancestry of Israel. Apart from the incidents described in Gen. xxii. (the rescue of Isaac from the sacrificial altar), Gen. xxiv. (the wooing of Rebecca by proxy) and Gen. xxvii. (the rivalry between his sons), the only incidents of his life are those included in Gen. xxvi., which describes mainly his dealings with Abimelech, king of Gerar. It is to be noted that these events can be closely paralleled from the Abraham narratives. Isaac is, in fact, the least distinguished and most vague of the three great patriarchal characters, and the most significant points in the passages which deal with him are (i.) the mention of Beersheba as his home (*e.g.*, Gen. xxvi. 23, 33) and (ii.) the fact of his sowing corn, thus passing from the stage of pure nomadism to that of semi-nomadism (Gen. xxvi. 12). (*See* GENESIS.)

ISAAC I. (COMNENUS), emperor of the East (1057–1059), was the son of an officer of Basil II. named Manuel Comnenus, who on his deathbed commended his two sons Isaac and John to the emperor's care. Basil had them carefully educated at the monastery of Studion, and advanced them to high official positions. During the disturbed reigns of Basil's seven immediate successors, Isaac by his prudent conduct won the confidence of the army; in 1057 he joined with the nobles of the capital in a conspiracy against Michael VI., and after the latter's deposition was invested with the crown, thus founding the new dynasty of the Comneni. The first care of the new emperor was to reward his noble partisans with appointments that removed them from Constantinople, and his next was to repair the beggared finances of the empire. He revoked numerous pensions and grants conferred by his predecessors upon idle courtiers, and, meeting the reproach of sacrilege made by the patriarch of Constantinople by a decree of exile, resumed a proportion of the revenues of the wealthy monasteries. Isaac's only military expedition was against the Hungarians and Petchenegs, who began to ravage the northern frontiers in 1059. Shortly after this successful campaign he was seized with an illness, and believing it mortal appointed as his successor Constantine Ducas, to the exclusion of his own brother John. Although he recovered Isaac did not resume the purple, but retired to the monastery of Studion and spent the remaining two years of his life as a monk, alternating menial offices with literary studies. His *Scholia* to the *Iliad* and other works on the Homeric poems are still extant in ms. He died in 1061. Isaac's great aim was to restore the former strict organization of the government, and his reforms, though unpopular with the aristocracy and the clergy, and not understood by the people, certainly contributed to stave off for a while the final ruin of the Byzantine empire.

See E. Gibbon, *The Decline and Fall of the Roman Empire* (ed. J. Bury, London, 1896, vol. v.); G. Finlay, *History of Greece* (ed. 1877, Oxford, vols. ii. and iii.); and J. Bury in *English Historical Review*, iv., 251 *ff.* (1889).

ISAAC II. (ANGELUS), emperor of the East 1185–1195, and again 1203–1204, was the successor of Andronicus I. He inaugurated his reign by a decisive victory over the Normans in Sicily, but elsewhere his policy was less successful. He failed in an attempt to recover Cyprus from a rebellious noble, and by the oppressiveness of his taxes drove the Bulgarians and Vlachs to revolt (1186). In 1187 Alexis Branas, the general sent against

the rebels, treacherously turned against his master, and attempted to seize Constantinople, but was defeated and slain. The emperor's attention was next demanded in the east, where several claimants to the throne successively rose and fell. In 1189 Frederick Barbarossa of Germany sought and obtained leave to lead his troops on the third crusade through the Byzantine territory; but he had no sooner crossed the border than Isaac, who had meanwhile sought an alliance with Saladin, threw every impediment in his way, and was only compelled by force of arms to fulfil his engagements. The next five years were disturbed by fresh rebellions of the Vlachs, against whom Isaac led several expeditions in person. During one of these, in 1195, Alexius, the emperor's brother, taking advantage of the latter's absence from camp on a hunting expedition, proclaimed himself emperor, and was readily recognised by the soldiers. Isaac was blinded and imprisoned in Constantinople. After eight years he was raised for six months from his dungeon to his throne once more. (*See* CRUSADES.) But both mind and body had been enfeebled by captivity, and his son Alexius IV. was the actual monarch. Isaac died in 1204, shortly after the usurpation of his general, Mourzouphles. He was one of the weakest and most vicious princes that occupied the Byzantine throne.

See Gibbon, *Decline and Fall* (ed. J. Bury, London, 1896, vol. vi.); G. Finlay, *History of Greece* (ed. 1877, Oxford, vols. iii. and iv.); V. N. Zlarski, *Geschichte der Bulgaren* (Leipzig, 1918).

ISAAC, HEINRICH (born *c.* 1450), Belgian composer. The exact date and place of his birth are unknown but Cambrai has been assigned as his place of origin by some writers. About 1477 he appears to have gone to Florence and for many years he was organist at the Medici chapel. After Lorenzo di Medici's death he found his way to Vienna and obtained an appointment as composer at Maximilian's court at Innsbruck. In 1515 he returned to Florence with a yearly pension of 150 florins. Few biographical facts have been established with certainty but the allusions found here and there in contemporary and later writings show him to have been recognized as one of the great musicians of his time. Until recently he was included in the group of German composers—Finck, Stolzer, Agricola and others—among whom he was the outstanding figure. The Italians called him "Arrhigo Tedesco," and his fame as a writer of German songs in the latter part of his life was an added reason for assuming him to be a German; but there seems now no doubt that he came from the Netherlands. His church music, of which much has been preserved, is masterly in form and shows great skill and ingenuity in the leading of the parts. But side by side with monumental masses he wrote, while in Florence, light secular compositions of a kind suited to the atmosphere of the Medici court. He also helped Lorenzo with his *canti carnascialeschi* for May Day celebrations. Later, at Innsbruck, he wrote the very simple and beautiful German songs on which his fame rests. Many of his melodies, some of them no doubt traditional, were treasured among the people and revived again and again to suit new words. Thus, *Innsbruck ich muss dich lassen,* written it is said to words by the emperor Maximilian, served for the hymn *O Welt, ich muss dich lassen,* for Paul Fleming's *In allen meinen Taten,* and for two chorales in Bach's *Matthew Passion* (Nos. 16, 44).

Of Isaac's ten published masses, five are included in *Misse Heinrici Izac* (Petrucci 1906); two in the Wittenberg edition (1541); *Carminum* and *Une musque de Biscay;* one in the *Liber quindecim missarum* (Nuremberg 1539), the famous *O praeclara,* written on one four-note subject throughout; and two in Ott's collection: *Missae 13 vocum* (Nuremberg 1539). There are also thirteen ms. masses preserved in the libraries in Vienna, Munich and Brussels. Motets and Psalms are contained in upwards of forty collections published up to 1564. (*See* Eitner: *Bibl. der Musiksammelwerke,* Berlin 1877.)

ISAAC OF ANTIOCH, Syriac author, is said to have flourished under Theodosius II. (408–450), and was a native either of Amid (Diarbekr) or of Edessa. Several writers identify him with Isaac, the disciple of S. Ephraim, who is mentioned in the anonymous *Life* of that father; but according to the patriarch Bar Shūshan (d. 1073), who made a collection of his homilies, his master was Ephraim's disciple Zenobius. He is supposed to have migrated to Antioch, and to have become abbot of one of the convents in its neighbourhood. According to Zacharias Rhetor he visited Rome and other cities, and the chronicle of Pseudo-Dionysius of Tell-Mahrē informs us that he composed poems on the secular games of 404, and wrote on the destruction of Rome by Alaric in 410. He also commemorated the destruction of Antioch by an earthquake in 459, so that he must have lived till about 460. Unfortunately these poems have perished.

It seems safe to conclude with his editor, Bedjan (p. ix.), that works by at least two authors have been included in the collection attributed to Isaac of Antioch. Still the majority of the poems are the work of one hand—the 5th-century Monophysite who wrote the poem on the parrot. A full list of the 191 poems existing in European mss. is given by Bickell, who copied out 181 with a view to publishing them all: the other 10 had been previously copied by Zingerle.

ISAAC OF KAIRAWAN: *see* ISRAELI.

ISAACS, JORGE (1837–1895), Colombian poet and novelist, was born at Cali, in the province of Cauca, Colombia, in April 1837, the son of a prosperous English Jew. He received an excellent education, first at Bogotá and later in England. During the War of the Cauca (1860–63), he was reduced to poverty by the destruction of his patrimony in the Cauca valley. Settling in Bogotá, in 1864 he published a slight volume of *Poesías* that attracted considerable attention, and in 1867, a novel, *María,* which won immediate recognition and remains his chief title to fame. Seizing the opportunity thus opened to him for a political career, he entered public life, and in 1871–72 was appointed consul-general in Chile. On his return he served in the provincial legislatures of Cauca, Cundinamarca and Antioquia, and filled numerous political, educational and editorial positions. He died in Abagüé on April 17, 1895. Although he continued to write until his death, and was a generous contributor to periodical literature, none of his later efforts fulfilled the promise of his first two volumes. *María,* his best work, is the most famous Spanish-American novel. An idyllic picture, very likely autobiographical, of life among the Cordilleras of his native Cauca valley, it has been called by one eminent critic "the poem of America," and has been translated into several foreign languages. Among his poems, notable are "Río Moro" (River Moro), "La Noche Callada" (The Silent Night), and "La Tumba del Soldado" (The Soldier's Tomb); *Saulo* is part of an uncompleted drama; *La revolución radical en Antioquia* is his most important prose work outside of fiction.

See Antonio Gómez Restrepo: "La literatura colombiana," *Revue Hispanique,* vol. xliii. (Paris, 1918).

ISABELLA (1451–1504), *la Católica,* queen of Castile, daughter of John II. of Castile, by his second wife Isabella, granddaughter of John I. of Portugal (thus being through both parents a descendant of John of Gaunt), was born at Madrigal on April 22, 1451. On the accession of her brother, Henry IV. (1454), she was withdrawn by her mother to Arevals, where her early education was conducted in the deepest seclusion. Removed by Henry to the court, her hand was sought in application by many suitors, among whom were Alphonso of Portugal, Pedro Giron, and Ferdinand of Aragon, whom she ultimately married at Valladolid on Oct. 19, 1469. An offer of the crown of Castile was made to her by the revolutionary leaders in the civil war; she declined it and in 1468 was recognized by her brother as lawful heir. On his death, she was proclaimed queen of Castile and Leon (Dec. 13, 1474).

Spain undoubtedly owed to Isabella's clear intellect, resolute energy and unselfish patriotism much of that greatness which it acquired under "the Catholic sovereigns." The moral influence of the queen's personal character over the Castilian court was incalculably great; from the debasement and degradation of the preceding reign she raised it to being "the nursery of virtue and of generous ambition." She did much for letters in Spain by founding the palace school and by her protection of Peter Martyr d'Anghiera. The very sincerity of her piety and strength of her religious convictions led her at times into great errors of State policy; her efforts for the introduction of the Inquisition into Castile and for the proscription of the Jews are cases in point. It was a happy intuition that led her to give credence to the

scheme of Columbus and to finance his undertaking, offering in a generous impulse to pawn her personal jewels if the Treasury funds proved inadequate. She died at Medina del Campo on Nov. 24, 1504.

See W. H. Prescott, *History of the Reign of Ferdinand and Isabella . . .* (1837); Baron de Nervo, *Isabelle la Catholique . . .* (Paris, 1874; Eng. trans. by Lieut.-col. Temple-West, 1897).

ISABELLA II. (1830–1904), queen of Spain, daughter of Ferdinand VII. and his fourth wife, Maria Christina, was born in Madrid on Oct. 10, 1830. In virtue of the Salic law, set aside by the Cortes at Ferdinand VII.'s persuasion in 1830, Don Carlos disputed Isabella's title on her proclamation (Sept. 29, 1833), and the seven years' Carlist War ensued. A constitutional and parliamentary Government was established, which dissolved the religious orders, confiscated the property of the Church and sought to restore order in finances. In 1840 the queen-regent, Maria Christina, resigned in favour of Espartero. A military and political *pronunciamiento* by O'Donnell and Narvaez turned out Espartero in 1843 and declared Isabella of age. She married her cousin, Prince Francisco de Assisi de Bourbon (1822–1902). Her reign (1843–68) was one long succession of palace intrigues and military *pronunciamientos* to further the ends of the political parties—Moderados (1846–54), Progressists (1854–56), Union Liberal (1856–63). In 1868 Serrano and Prim defeated Isabella's Moderado generals at Alcolea, and Isabella was exiled. She was induced to abdicate in Paris on June 25, 1870, in favour of her son, Alphonso XII. Isabella was the tool of profligate courtiers who gave her court a deservedly bad name, and her wayward, unscrupulous interference in politics made her unpopular. She continued to live in France after the Restoration (1874) and died on April 10, 1904.

ISABELLA, ISABEAU, or ELIZABETH OF BAVARIA (1370–1435), wife of Charles VI. of France, was the daughter of Stephen II., duke of Bavaria. She was born in 1370, was married to Charles VI. on July 17, 1385, and crowned at Paris on Aug. 22, 1389. She fell under the influence of the dissolute court in which she lived, and the king having become insane (August 1392) she consorted chiefly with Louis of Orleans. After the assassination of the duke of Orleans (Nov. 23, 1407) she attached herself sometimes to the Armagnacs, sometimes to the Burgundians, and led a scandalous life. Following the murder of John the Fearless she went over to the side of the English, into whose hands she surrendered France by the treaty of Troyes (May 21, 1420), at the same time giving her daughter Catherine in marriage to the king of England, Henry V. She died in Sept. 1435, and was interred without funeral honours in the abbey of St. Denis.

See Vallet de Viriville, *Isabeau de Bavière* (1859); Marcel Thibault, *Isabeau de Bavière, Reine de France, La Jeunesse, 1370–1405* (1903).

ISABELLA OF HAINAUT (1170–1190), queen of France, was the daughter of Baldwin V., count of Hainaut, and Margaret, sister of Philip of Alsace, and was born in 1170 at Lille. She was married to Philip Augustus, and brought to him as her dowry the province of Artois. She was crowned at St. Denis on May 29, 1180. As Baldwin V. claimed to be a descendant of Charlemagne, the chroniclers of the time saw in this marriage a union of the Carolingian and Capetian dynasties. In 1184, Philip, waging war against Flanders, was angered at seeing Baldwin support his enemies, and called a council at Sens for the purpose of repudiating his wife. Robert, the king's uncle, successfully interposed. She died in 1190. Her son became Louis VIII. of France.

See Cartellieri, "L'Avènement de Phil. Aug." in *Rev. hist.* liii. 262 *et seq.*

ISABEY, JEAN BAPTISTE (1767–1855), French painter, was born at Nancy on April 11, 1767. He went to Paris in 1785 and became a pupil of David. Employed at Versailles on portraits of the dukes of Angoulême and Berry, he was given a commission by the queen, which opens the long list of those which he received, up to the date of his death in 1855, from the successive rulers of France. Patronized by Josephine and Napoleon, he arranged the ceremonies of their coronation, and prepared drawings for the publication intended as its official commemoration, a work for which he was paid by Louis XVIII., whose portrait he executed in 1814. Although Isabey did homage to Napoleon on his return from Elba, he continued to enjoy the favour of the Restoration, and took part in arrangements for the coronation of Charles X. The monarchy of July conferred on him an important post in connexion with the royal collections, and Napoleon III. granted him a pension, and the cross of commander of the Legion of Honour. "Review of Troops by the First Consul" was one of his most important compositions, and "Isabey's Boat,"—a charming drawing of himself and family—produced at a time when he was much occupied with lithography—had an immense success at the Salon of 1820 (engraved, Landon, *Annales*, i. 125). His portrait of "Napoleon at Malmaison" is held to be the best ever executed.

See Madame de Basily-Callimaki, *J. B. Isabey, sa vie et son temps* (1909).

ISABNORMAL LINES, in meteorology, lines upon a map connecting places having equal departures from the normal. A better term is *isanomalous lines*. Each parallel of latitude can be considered as having a certain normal temperature based on a general mean of temperatures at stations along that parallel. Places which are relatively warm for their latitude have a positive anomaly, while abnormally cold places have a negative anomaly. As these anomalies are expressed in degrees it is easy to interpolate isanomalous lines, which can then be used to analyse the effects of ocean currents, continentality, etc. The method can also be applied to the mapping of abnormal weather compared with average climate for any selected small area.

ISAEUS (*c.* 420 B.C.–*c.* 350 B.C.), Attic orator, the chronological limits of whose extant work fall between the years 390 and 353 B.C., is described in the Plutarchic life as a Chalcidian; by Suidas, whom Dionysius follows, as an Athenian. The accounts have been reconciled by supposing that his family sprang from the settlement (κληρουχία) of Athenian citizens among whom the lands of the Chalcidian *hippobotai* (knights) had been divided about 509 B.C. A connection with Euboea would explain the non-Athenian name Diagoras which is borne by the father of Isaeus, while the latter is said to have been "an Athenian by descent" (Ἀθηναῖος τὸ γένος). So far as we know, Isaeus took no part in the public affairs of Athens. "I cannot tell," says Dionysius, "what were the politics of Isaeus—or whether he had any politics at all."

Isaeus (who was born probably about 420 B.C.) is believed to have been an early pupil of Isocrates, and he certainly was a student of Lysias. The profession of Isaeus was that of which Antiphon had been the first representative at Athens—that of a λογόγραφος, who composed speeches which his clients were to deliver in the law courts. But, while Antiphon had written such speeches chiefly (as Lysias frequently) for public causes, it was with private causes that Isaeus was almost exclusively concerned.

The most interesting recorded event in the career of Isaeus is his connection with Demosthenes, who attained his civic majority in 366. He had resolved to prosecute his fraudulent guardians, and sought the aid of Isaeus. Plutarch states that Demosthenes "employed Isaeus as his master in rhetoric, though Isocrates was then teaching, either (as some say) because he could not pay Isocrates the prescribed fee of ten minae, or because he preferred the style of Isaeus for his purpose, as being *vigorous and astute*" (δραστήριον καὶ πανοῦργον). The speeches of Demosthenes against Aphobus and Onetor (363–362 B.C.) afford the best possible gauge of the sense and the measure in which he was the disciple of Isaeus; the intercourse between them can scarcely have been either very close or very long. The date at which Isaeus died can only be conjectured from his work. It may be placed about 350 B.C.

Isaeus has a double claim on the student of Greek literature. He is the first Greek writer who comes before us as a consummate master of strict forensic controversy. He also holds a most important place in the general development of practical oratory, and therefore in the history of Attic prose. Antiphon marks the beginning of that development, Demosthenes its consummation. Between them stand Lysias and Isaeus. The open, even ostentatious, art of Antiphon had been austere and rigid. The con-

cealed art of Lysias had charmed and persuaded by a versatile semblance of natural grace and simplicity. Isaeus brings us to a final stage of transition, in which the gifts distinctive of Lysias were to be fused into a perfect harmony with that masterly art which receives its most powerful expression in Demosthenes. Here, then, are the two cardinal points by which the place of Isaeus must be determined. We must consider, first, his relation to Lysias; secondly, his relation to Demosthenes.

With less love of antithesis than Lysias, and with a diction almost equally pure and plain, Isaeus yet habitually conveys the impression of conscious and confident art. Hence he is least effective in adapting his style to those characters in which Lysias peculiarly excelled—the ingenuous youth, the homely and peace-loving citizen. On the other hand, his more open and vigorous art does not interfere with his moral persuasiveness where there is scope for reasoned remonstrance, for keen argument or for powerful denunciation. Passing from diction and composition to the treatment of subject-matter, we find the divergence wider still. Lysias usually adheres to a simple four-fold division—proem, narrative, proof, epilogue. Isaeus frequently interweaves the narrative with the proof. He shows the most dexterous ingenuity in adapting his manifold tactics to the case in hand, and often "out-generals" (*καταστρατηγεῖ*) his adversary by some novel and daring disposition of his forces. Lysias, again, usually contents himself with a merely rhetorical or sketchy proof; Isaeus aims at strict logical demonstration, worked out through all its steps. As Sir William Jones well remarks, Isaeus lays close siege to the understandings of the jury.

What, we must next ask, is the relation of Isaeus to Demosthenes? The Greek critic who had so carefully studied both authors states his own view in broad terms when he declares that "the power of Demosthenes took its seeds and its beginnings from Isaeus" (Dion. Halic. *Isaeus* 20). Attic prose expression had been continuously developed as an art; the true link between Isaeus and Demosthenes is technical, depending on their continuity. The *composition* of Demosthenes resembles that of Isaeus in blending terse and vigorous periods with passages of more lax and fluent ease, as well as in that dramatic vivacity which is given by rhetorical question and similar devices. In the versatile disposition of subject-matter, the divisions of "narrative" and "proof" being shifted and interwoven according to circumstances, Demosthenes has clearly been instructed by the example of Isaeus. Still more plainly and strikingly is this so in regard to the elaboration of systematic proof; here Demosthenes invites direct and close comparison with Isaeus by his method of drawing out a chain of arguments, or enforcing a proposition by strict legal argument. And, more generally, Demosthenes is the pupil of Isaeus, though here the pupil became even greater than the master, in that faculty of grappling with an adversary's case point by point, in that aptitude for close and strenuous conflict which is expressed by the words *ἀγών*, *ἐναγώνιος*.

EXTANT SPEECHES

The pseudo-Plutarch, in his life of Isaeus, mentions an *Art of Rhetoric* and 64 speeches, of which 50 were accounted genuine. From a passage of Photius it appears that at least[1] the 50 speeches of recognized authenticity were extant as late as A.D. 850. Only eleven, with a large part of a twelfth, have come down to us; but the titles of forty-two[2] others are known.[3]

The titles of the lost speeches confirm the statement of Dionysius that the speeches of Isaeus were exclusively forensic; and only three titles indicate speeches made in public causes. The remainder, concerned with private causes, may be classed under six heads: (1) *κληρικοί*—cases of claim to an inheritance; (2) *ἐπικληρικοί*—cases of claim to the hand of an heiress; (3) *διαδικασίαι*—cases of claim of property; (4) *ἀποστασίου*—cases of claim to the ownership of a slave; (5) *ἐγγύης*—action brought against a surety whose principal had made default; (6) *ἀντωμοσία* (as=*παραγραφή*)—a special plea; (7) *ἔφεσις*—appeal from one jurisdiction to another.

Eleven of the 12 extant speeches belong to class (1), the *κληρικοί*, or claims to an inheritance. This was probably the branch of practice in which Isaeus had done his most important and most characteristic work. And, according to the ancient custom, this class of speeches would therefore stand first in the manuscript collections of his writings. The case of Antiphon is parallel: his speeches in cases of homicide (*φονικοί*) were those on which his reputation mainly depended, and stood first in the manuscripts. Their exclusive preservation, like that of the speeches made by Isaeus in will-cases, is thus primarily an accident of manuscript tradition, but partly also the result of the writer's special prestige.

Six of the 12 extant speeches are directly concerned with claims to an estate; five others are connected with legal proceedings arising out of such a claim.

The speeches of Isaeus supply valuable illustrations to the early history of testamentary law. They show us the faculty of adoption, still, indeed, associated with the religious motive in which it originated, as a mode of securing that the sacred rites of the family shall continue to be discharged by one who can call himself the son of the deceased. But practically the civil aspect of adoption is, for the Athenian citizen, predominant over the religious; he adopts a son in order to bestow property on a person to whom he wishes to bequeath it. The Athenian system, as interpreted by Isaeus, is thus intermediate, at least in spirit, between the purely religious standpoint of the Hindu and the maturer form which Roman testamentary law had reached before the time of Cicero.[1] As to the form of the speeches, it is remarkable for its variety. There are three which, taken together, may be considered as best representing the diversity and range of their author's power. The fifth, with its simple but lively diction, its graceful and persuasive narrative, recalls the qualities of Lysias. The 11th, with its sustained and impetuous power, has no slight resemblance to the manner of Demosthenes. The eighth is, of all, the most characteristic, alike in narrative and in argument. Isaeus is here seen at his best. No reader who is interested in the social life of ancient Greece need find Isaeus dull. If the glimpses of Greek society which he gives us are seldom so gay and picturesque as those which enliven the pages of Lysias, they are certainly not less suggestive. Here, where the innermost relations and central interests of the family are in question, we touch the springs of social life; we are not merely presented with scenic details of dress and furniture, but are enabled in no small degree to conceive the feelings of the actors.

The best manuscript of Isaeus is in the British Museum—Crippsianus A (=Burneianus 95, 13th century), which contains also Antiphon, Andocides, Lycurgus and Deinarchus. The next best is Bekker's Laurentianus B (Florence), of the 15th century. Besides these, he used Marcianus L (Venice), saec. 14, Vratislaviensis Z saec. 14[2] and two very inferior mss., Ambrosianus A. 99 P (which he dismissed after Or. i.), and Ambrosianus D. 42, Q (which contains only Or. i., ii.). Schömann, in his edition of 1831, generally followed Bekker's text; he had no fresh apparatus beyond a collation of a Paris ms. R in part of Or. i.; but he had sifted the Aldine more carefully. Baiterus and Sauppe (1850) had a new collation of A, and also used a collation of Burneianus 96, M, given by Dobson in vol. iv. of his edition (1828). C.

[1] For the words of Photius (cod. 263), *τούτων δὲ ὃι τὸ γνήσιον μαρτυρηθέντες ν' καταλείπονται μόνον*, might be so rendered as to imply that, besides these 50, others also were extant. See *Att. Orat.* ii. 311, note 2.

[2] Forty-four are given in Thalheim's ed.

[3] The second of our speeches (the Meneclean) was discovered in the Laurentian Library in 1785, and was edited in that year by Tyrwhitt. In editions previous to that date, Oration i. is made to conclude with a few lines which really belong to the end of Orat. ii. (s. 47, *ἀλλ' ἐπειδὴ τὸ πρᾶγμα . . . ψηφίσασθε*), and this arrangement is followed in the translation of Isaeus by Sir William Jones, to whom our second oration was, of course, then (1779) unknown. In Oration i. all that follows the words *μὴ ποιήσαντες* in s. 22 was first published in 1815 by Mai, from a ms. in the Ambrosian Library at Milan.

[1] *Cf.* Sir H. J. F. Maine's *Ancient Law* (1906); ch. vi., and the *Tagore Law Lectures* (1870) by Herbert Cowell, lect. ix., "On the Rite of Adoption," pp. 208 f.

[2] The date of L and Z is given as the end of the 15th century in the introduction to Wyse's edition.

Scheibe (Teubner, 1860) made it his especial aim to complete the work of his predecessors by restoring the correct Attic forms of words; thus (*e.g.*) he gives ἠγγύα for ἐνεγύα, δέδιμεν for δεδίαμεν, and the like,—following the consent of the mss., however, in such forms as the accusative of proper names in ην rather than η, or (*e.g.*) the future φανήσομαι rather than φανοῦμαι, etc., and on such doubtful points as φράτερες instead of φράτορες, or Ἐλληθυίας instead of Εἰλειθυίας.

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ISAIAH. It is important to realize that practically all we know of the life and career of the Prophet Isaiah of Jerusalem is contained in the book of Isaiah. But the book itself, as it lies before us in our Bibles contains much more material than that which is directly concerned with the life and work of the prophet. In its present form, as a book, it is a comparatively late production, compiled out of a series of prophetic collections made by a succession of redactors and editors. "These collections embody a nucleus of Isaianic material—the actual prophecies of Isaiah himself—which was added to and enlarged as time went on. But even in the earliest form of compilation which critical analysis can detect this Isaianic material has been combined with non-Isaianic matter." As we shall see, at least one, if not two other writers contributed largely to the book as we have it. As the late G. Buchanan Gray well remarks in his commentary on Isaiah (p. xii.), "No full justice can be done to a book which is a great monument to Jewish religion after the exile if all our attention is devoted to determining whether this or that passage is genuine and dismissing it as not 'genuine' if it is not the work of Isaiah. In reference to works such as the Book of Isaiah the term 'genuine' is indeed misleading. None of the nameless writers may have possessed the religious genius of Isaiah, but together they represent the play of the earlier prophetic teaching on the Jewish Church. In religion as elsewhere, great personalities count first, and it is the privilege of a student of the Book of Isaiah to come face to face with one, if not two, such personalities; but the religious community is the necessary outcome, or field of action, of the great religious personality and his teaching, and the student of the Book of Isaiah has but half entered into his inheritance if he communes with Isaiah and the great exilic prophet, but fails to feel the life of that post-exilic community, which not only preserved for themselves and for us the words of the earlier prophets, but preserved them in books which were also made to breathe the hopes and aspirations that sustained the Jews through centuries of isolation, oppression and temptation."

The book falls into two main divisions: (*a*) Chapters i.–xxxix.; (*b*) Chapters xl.–lxvi. The whole of the material contained in (*b*) is post-exilic in date; that contained in (*a*) is partly post-exilic and partly earlier. The material directly or indirectly connected with the prophet Isaiah of Jerusalem is all contained in (*a*).

Analysis of the Book.—One of the great triumphs of Old Testament Criticism is revealed by the critical analysis of the Book of Isaiah. It is no part of our present task to trace the history of the development of this criticism. Suffice it to say that it reached its high watermark in the works of Duhm (*Jesaia*) 2nd ed. 1902 and Marti (*Jesaia*) 1900. Invaluable work had been done in this country by T. K. Cheyne in a succession of works, the most important of which for our present purpose is the *Introduction to the Book of Isaiah*, 1898. Since the publication of these treatises a certain amount of reaction has taken place in Isaianic criticism. It will be convenient for our purpose to follow Duhm and Marti as guides and to notice as we proceed the more important modifications that have come to the front since.

Chapter 1 forms a general preface to the whole Isaianic collection. The chapter is itself composite and was probably put together in its present shape by editors. The themes it deals with may be summarized as follows:—(1) An address on Israel's faithlessness *c.* 701 B.C. (*vv.* 2–17), (2) the sin of Judah and the choice given (*vv.* 18–20) *c.* 701 B.C., (3) a dirge over Jerusalem's declension, passing over into a threat (*vv.* 21–26) before 701 B.C.; (4) a post-exilic addition dealing with the deliverance of a remnant and the annihilation of Apostates (*vv.* 27–28); (5) a fragment against nature-worship (*vv.* 29–31) *c.* 722 B.C. All these passages may be regarded as Isaianic except *vv.* 27–28. Note the heading v.1 which was added by an editor to the whole book of collected prophecies. The rest of chapters i.–xxxix. can broadly be divided into four books, viz., Bk. 1 first collection of Isaiah's prophecies, Chapters ii.–xii.; Bk. 2 an intermediate collection of oracles mainly concerning foreign nations, Chapters xiii.–xxiii.; Bk. 3 a third collection of Isaianic prophecies dealing mainly with the deliverance of Jerusalem with an eschatological preface and appendix, chapters xxiv.–xxxv.; Bk. 4 a historical appendix to the collected form of Isaianic prophecies, chapters xxxvi.–xxxix.

1. The first collection of Isaiah's prophecies, Chapters ii.–xii. This is itself composed of minor collections (notice ii.1–iv.6 and vi.1–ix.7). We come to the earliest minor collection contained in chapter ii.1–iv.6. These chapters are carefully arranged being provided with an eschatological preface ii.2–4–, and a Messianic appendix iv. 2–6. Both these apocalyptic passages may be regarded as dependent upon Old Tradition (so Gressmann) and are probably older than Isaiah himself. Thus in the striking section ii. 2–4, which recurs in Micah iv. 1–4 both prophets are probably citing from a common source containing early features, *e.g.*, that Mount Zion is made higher than all the mountains and here assumes the position of the Mountain of the Gods of old myth. Isaiah takes this old story as a sort of text with its idealistic description of the future and sets against it a picture in striking contrast with the evils of the present. The section that follows ii. 6–21 has for its main theme Israel's Sin and the Day of Doom, and gives the prophet's conception of the Day of Yahweh (note especially chapter ii. 11–17 and the passage against idolatry v.18 *sqq.*). A section follows on Judah's impending ruin, completed by *c.* 735 B.C., contained in iii. 1–15 and this again by a powerful passage directed against the ladies of Jerusalem, iii. 16–iv.1. The whole section is completed by iv. 2–6, apocalyptic in character. Here *vv.* 5–6 may form a later addition. The general theme of the passage is the felicity of the redeemed community after it has been purged by judgment.

Chapter v. forms a section by itself and may be dated *c.* 735 B.C. The theme of the chapter is the parable of the vineyard and its application. The parable is contained in *vv.* 1–7 (*cf.* Matt. xxi. 32 *sqq.*); *vv.* 8–24 contain a denunciation in the form of six woes directed against the upper classes (*vv.* 25–30 should follow chapter x. 4). The whole composition is a very powerful piece of writing.

The second minor collection (Chapters vi.1 to ix.8) contains important material. Chapter vi. gives an account of Isaiah's inaugural vision, date about 738, and may have been composed to form an introduction to the group that follows which consists of (*a*) chapter vii. (prophecies of the period of the Syro-Ephraimitish war); (for the sign of Emmanuel, vii. 14–16, *see* article EMMANUEL); (*b*) viii. 1–4, *c.* 734 B.C., and *vv.* 5–10 and 11–15 all of the same period. An epilogue of uncertain date follows in *vv.* 16–18. This is an important section which seems to have been written down when the failure of the prophetic addresses contained in vii. 1–8, 15, had become evident. The Prophet now solemnly consigns "the testimony" to an inner circle of disciples.

The final section culminates in the description of the Messianic King (viii. 18–ix. 6). The text of the opening verses seems to have been much edited, in fact rewritten to form an introduction to what follows. The grand picture of the Messianic King given in ix. 1–6 is probably from Isaiah's hands, though some critics have denied this. The date of the Messianic passage is uncertain; perhaps it may be assigned to the youthful period of Isaiah's life, when he despaired of the Davidic House as represented by Ahaz (contrast xi. 1–9). The section that follows ix. 7–x. 4, to which should be attached v. 26–30 may be dated about 735 B.C. It is an artistically constructed poem with a refrain and may be entitled

"Yahweh's Outstretched Hand." It is mainly directed against north Israel and is a splendid example of Isaiah's poetical genius. A collection of oracles against Assyria with a Messianic appendix follows in Chapter x. 5–xi. 16. The Messianic section forms an appropriate conclusion. The Isaianic material here is fragmentary in character and has been edited to a certain extent by later hands. The general date of the fragments appears to be between 711 and 701 B.C. The date of the Messianic appendices xl. 1–9 and 10–16 is uncertain, but *vv.* 1–9 may be Isaianic while 10–16 probably belong to a later age; xl. 1–9 form perhaps the grandest of all the Messianic passages of the O.T. Its wonderful picture of the Golden Age marked by universal peace and its serene outlook on a transformed world are worthy of Isaiah. These features reflect the serenity of old age. Isaiah probably composed the passage towards the end of his life: notice the prophet's revived hope in the Davidic dynasty. Chapter xii. (probably post-exilic) forms the lyrical epilogue to the first complete Isaianic collection embodied in chapters ii.–xii. Chapter xii. is largely composed of reminiscences of the Psalter.

Book 2 forms an intermediate collection of oracles mainly concerning foreign nations, chapters xiii.–xxiii. The bulk of this section consists of ten "oracles" (burdens); and interspersed among these are four passages without titles which undoubtedly come from Isaiah's hand, viz. (*a*) xiv. 24–27 (*b*) xvii. 12–14 (*c*) Chapter xviii. and (*d*) Chapter xx. Of the ten oracles Chapter xvii. 1–6, 9–11, and xxii. 1–8, 12–14, may be assigned with confidence to Isaiah, while chapter xv. to xvi. 12 may be an older prophecy adopted by Isaiah and re-affirmed in a special postscript (Chapter xvi. 13–14). The only "oracles" which bear no relation to Isaiah or his age are Chapter xiii. 2–xiv. 23 against Babylon, which was probably composed during the Exile; chapter xix. against Egypt, Chapter xxi. and Chapter xxiii. Not improbably this collection in its original form, consisting of ten oracles had an independent existence. The editor of the complete Isaianic collection took over this book which contained a genuine Isaianic element by inserting the four passages mentioned above and then incorporated the whole into the collected form of Isaiah's prophecies. It should be noted that it occupies in the complete book a similar position to corresponding groups of oracles in Ezekiel (Chapters xxv.–xxxii.) and Jeremiah (according to the LXX arrangement). Probably this editor is responsible for the heading, chapter xiii. 1, or at least for the words *which Isaiah Ben Amoz saw.* The poem on the Fall of Babylon consists of (a) a prophecy directed against Babylon xiii. 2–22 and (b) a triumphal ode on the downfall of the oppressive power, xiv. (4b)–21. This latter is certainly one of the finest compositions in the O.T. The date of composition probably belongs to the latter years of the Exile and therefore is more or less contemporary with Deutero-Isaiah. Note the contrast in tone between this oracle and that of Chapter xxi. Chapter xvii. 1–11, containing an oracle about Ephraim and Syria, may be dated about 735 B.C. and the second of the appended Isaianic fragments, Chapter xvii. 12–14, about 702 B.C. This is a very fine piece of writing. The third of the appended fragments, containing an address to the Ethiopian Ambassadors, may be dated about the same time (Chapter xviii.). Chapter xix., an oracle about the fall of Egypt, seems to be of composite origin. *vv.* 1–15 perhaps may be dated between 528 and 485 B.C., while the remarkable verses, 16–25, forming an appendix, seem to belong to a later date still. Note the broad universalistic spirit of the passage which can hardly belong to an earlier time than the Greek period. Sellin, however, takes a different view. He dates *vv.* 1–17 prior to 663 B.C., and even *vv.* 18–25 he thinks are pre-Exilic. Chapter xx. contains the fourth of the appended Isaianic pieces. It may perhaps be dated about 711 B.C. in the reign of Sargon. The words translated Egypt (Miṣraim) and Ethiopia (Cush) may however be referred to a different provenance, if Winckler can be followed in assuming the existence of a Muṣri and Cush in north Arabia: it is possible that these terms have been confused with Egypt and Ethiopia in this chapter and occasionally elsewhere in the O.T. Chapter xxi. 1–10 containing a vision of the fall of Babylon may be dated about the end of the Exile. It is followed by two fragmentary oracles on Edom, and Kedar, and has appended to it an Isaianic fragment xxi. 16–17 which may be dated about 711 B.C. Chapter xxii. 1–14, an oracle on the Valley of Vision, may be dated about 701 B.C. Appended to this oracle is an interesting political invective directed against Shebna with a later appendix (Chapter xxii. 15 *sqq.*). The final chapter of this Section Chapter xxiii. deals in its present form with the Fall of Tyre and perhaps with the siege which the prophecy has in view is the one conducted by Nebuchadnezzar 585–573 B.C. (*vv.* 13 and 15–18 may be post Exilic additions). Duhm has proposed a brilliant solution by slightly altering the text in 8 and substituting Sidon for Tyre (Sidon is mentioned in *vv.* 2, 4 and 12). The reference will then be to the devastation of Sidon by Artaxerxes III. A later editor again altered it so as to make it refer to the siege of Tyre by Alexander the Great. Book iii. contains the third collection of Isaianic prophecies dealing mainly with the deliverance of Jerusalem, with an eschatological preface and appendix. The centre of this group of chapters is largely composed of material from Isaiah's hand dating apparently from the crisis of Sennacherib's invasion in 701 B.C. To the post-exilic editor who combined this collection with the two preceding books, the dominating interest was eschatological.

The invasion of Sennacherib was invested with an eschatological significance, and was "regarded as typical of the last great attempt to extinguish the people of Yahweh" at the end of the age. This editor will also have been responsible for prefixing the eschatological preface (chs. xxiv.–xxvii.) and affixing the eschatological appendix (chs. xxxiv.–xxxv.) to the central group.

The third collection thus falls into three main parts, viz., I. Eschatological Preface (Chs. xxiv.–xxvii.). II. Prophecies dealing mainly with the Deliverance of Jerusalem (Chs. xxviii.–xxxiii.). III. Eschatological Appendix (Chs. xxxiv.–xxxv.). Chapters xxiv.–xxvii. are characterized by certain remarkable features. When the lyrical passages or songs are taken away there emerges a uniform apocalypse. The songs in question are (*a*) xxv. 1–5 (commemorating the destruction of a strong city); (*b*) xxv. 9–11 (the taunt song on Moab); (*c*) xxvi. 1–19 (a poetical meditation); and (*d*) the song in xxvii. 2–5. The subject of the main apocalyptic section is a great catastrophe which convulses the entire world. A picture of world-wide desolation is drawn in vivid colours. This is followed by a description of the divine judgment on the evil powers (heavenly and earthly) and of Yahweh's enthronement on Mount Zion (Ch. xxiv.). Finally the "Coronation festival"—" a feast of fat things for all peoples"—is described (xxv. 6–8). The date of this section is hard to determine. The earliest assignable date is in the reign of Artaxerxes Ochus and probably the limits are 350–330 B.C. A number of distinguished scholars, however, date these compositions late in the Maccabean period, but on insecure grounds. The doctrinal importance of the chapters is considerable. Thus ch. xxvi. 19 contains perhaps the first clear allusion to the doctrine of the resurrection; *cf.* the oracles contained in chapters xxviii.–xxxiii. Doubts have been raised as to the Isaianic character of xxviii. 23–29, a little poem in the style of the Wisdom literature which may well be Isaiah's. Ch. xxix. 17–24 is almost certainly post-exilic (the *humble and needy* of *v.* 19 are the oppressed pious so often mentioned in the Psalms). Ch. xxx. 18–26 also post-exilic. Ch. xxx. 27–33 doubtfully Isaianic, perhaps post-exilic. Chapters xxxii.–xxxiii. contain a description of the renovated state in the Messianic age and form a contrast with preceding chapters especially as regards the upper classes. With the exception of *vv.* 6–8 Chapter xxxii. might have been written by Isaiah. If so, with chapter xxxiii., it must be a product of the prophet's old age. Though the subject of chapter xxxiii. is undoubtedly the deliverance of Jerusalem from Sennacherib it is highly improbable that the chapter is a composition by Isaiah. It seems rather to be a sort of liturgical meditation by a post-exilic poet on the deliverance of Jerusalem. It is in fact a composition parallel to xxvi. 1–19 (*cf.* xxxvii. 22–32, also post-exilic). Sellin, however, warmly defends the Isaianic character of the passage, as well as of the previous chapters xxxiv.–xxxv., probably written by the same hand to form the eschatological appendix to the preceding group. Edom figures prominently in xxxiv.; but the apocalyptic character of the pas-

sage is not modified by this fact—Edom in fact became a symbolical name for the oppressive world-power. The earliest possible date of composition would be about 400 B.C.

A further appendix to the Isaianic collection ending at Chapter xxxiii. is contained in Chapters xxxvi.–xxxix. These chapters which are mainly narrative in character have been excerpted from the Book of Kings. They correspond to 2 Kings xviii. 8–xx. 19. The only divergencies are (*a*) the omission in the Isaiah text of the section contained in 2 Kings xviii. 14–16 and (*b*) the insertion in the Isaiah text of Hezekiah's psalm of thanksgiving Is. xxxviii. 9–20, apparently a late post-exilic composition. *See.* further HEZEKIAH.

The Deutero-Isaiah.—With Chapter xl. a new section of the book of Isaiah begins. Here the background is entirely different from that of the earlier chapters contained in part I. The oppressive world-power is no longer Assyria but Babylon. The Exile is not so much predicted as pre-supposed. The chapters are the work of a great lyrical poet who sees everything through a sort of golden haze. Chapters xl.–xlviii., apart from some small interpolations, are the work of this writer who apparently composed them *c.* 538 B.C., *i.e.*, after Cyrus had appeared on the scene, but before his capture of Babylon. Theologically the chapters are of great importance, insisting as they do on the unique character of Yahweh who is the sole God—there is but one God Yahweh and Israel is his prophet. The chapters were apparently written in Babylonia. Chapters xlix.–lv., which by a majority of critics are ascribed to "Deutero-Isaiah" (style and phraseology are practically the same), are distinguished from the preceding chapters by the disappearance from them of the themes so prominent in the earlier chapters. Cyrus is no longer referred to. The Exodus from Babylon is no longer insisted upon. The future glory of Zion-Jerusalem is prominently dwelt upon, and the gathering in of the exiles scattered throughout the world is described. Possibly these chapters were composed, as Cornill suggests, "under the immediate impression produced by the issue of the edict in which Cyrus gave permission to the exiles to return home."

It is important to note Sellin's reminder that the whole work of Deutero-Isaiah is eschatological. "With the victory of Cyrus there dawns for him those last times which for centuries had been the object of a burning hope. By this everything is to be explained—the miraculous march through the wilderness, the picture of the New Jerusalem, the conversion of the heathen and the overthrow of the world-power" (*cf.* also xlix. 26: li. 6 *sqq.*). It has been commonly assumed that the prophecies of Deutero-Isaiah were circulated by this author in written form; but recently the view that the discourses were spoken orally at different times (perhaps in some place where the exiles met) has gained ground.

Trito-Isaiah.—With Ch. lvi. an entirely new section of the Book begins. Here everything breathes a different atmosphere. Zion's felicity—the day of longed-for salvation—has not yet dawned. But the obstacle is no longer Babylon, but godless members of the Jerusalem community and heretics. There is here no question of a Return—a new Exodus. The Jews are settled in the Holy Land; Jerusalem is no longer in ruins, but has a settled population; the Temple has been re-built. But matters are not well with the restored community. There are grave symptoms of internal weakness. Social conditions are unsatisfactory; the rich oppress the poor. The old Israelitish population of the land (in Judaea and Samaria) is unwilling to submit to the "yoke of the Law" and threatens to build a rival Temple. The chapters form a distinct group by themselves, though the various items are strung rather loosely together. They were evidently written at a critical time, when it was all-important to strengthen the faith of the strict, religious party by kindling hope among them in the coming salvation. The godless are to be brought into judgment, and redress is to come for the pious followed by the glorification of the Holy City.

Apart from some inconsiderable additions the, chapters are regarded by many modern scholars, including Duhm and Marti, as having emanated from one author, who is styled for the sake of convenience the "Trito-Isaiah." He wrote in the middle of the fifth century, apparently (*c.* 450 B.C.), a few years before the arrival of Nehemiah in Jerusalem.

There are certain difficulties about the hypothesis of Trito-Isaiah which have been well summarized by Sellin, who points out that the themes which are prominent in the time of Malachi and Nehemiah are absent from these chapters. Moreover, there are two, if not three, passages which imply that the Temple was not in existence at the time when the author wrote (*cf.* lxiii. 18; lxiv. 8 *sq.*; and lxvi. 1–5). Possibly the first two of these passages are late interpolations, while the third does not necessarily imply the non-existence of the Jerusalem Temple. If these chapters are not a literary unity the best alternative view as to their origin is perhaps the following: a post-Exilic editor taking a section of writing which belonged to Deutero-Isaiah, viz., Chapters lx.–lxii., combined this, "with the work of a Jerusalemite prophet of the period between 586 and 520" (Sellin) and enlarged it with additions of his own.

It is impossible here to do more than refer to the so-called "Servant Songs" about which a whole literature has grown up (xlii. 1–4; xlix. 1–6; l. 4–9; lii. 13–liii. 12). Is the servant here a collective term for the true Israel, or does it stand for an individual and if so for whom? The commonly accepted view has been some form or other of the first or collective interpretation (*see* J. Skinner, *The Cambridge Bible* ad loc.); but recently several scholars have adopted the individualistic interpretation; so especially Sellin who now identifies the servant with Moses, though he formerly thought of Jehoiachin. *See* further discussions by S. A. Cook, *Camb. Ancient History,* iii. 489 *sqq.*, and H. Wheeler Robinson, *The Cross and the Servant.*

The Origin of the Book of Isaiah.—It may be inferred from Ecclus. xlviii. 20–25 that the book as we have it was then already in existence *c.* 200–180 B.C.; further it seems probable that about 400 B.C. a Book of Isaiah was in existence which contained chapters i.–xxxv. of our present book, to which chapters xxxvi.–xxxix. were added later. Between 400 and 200 B.C. the work of Deutero- and Trito-Isaiah which at first circulated independently, were added to the Isaianic collection. Not improbably the juxtaposition may have been due to Deutero-Isaiah himself, for there are linguistic points of contact between the later chapters and the work of Isaiah of Jerusalem. The earlier history of the Isaianic collection is wrapped in obscurity. It is clear that the prophet himself was primarily a preacher and delivered his discourses orally; they were written down only at a later stage. (*Cf.* the analogous case of Jeremiah, Jer. xxxvi.) Fragments of the prophet's discourses were no doubt carefully treasured by his disciples (*cf.* Is. viii. 16; xxx. 8). Then collections were formed and later still further collections, the whole being brought up to date by eschatological additions.

The Life and Activity of Isaiah.—The prophet Isaiah, the son of a certain Amoz, was the father of two sons who bore highly symbolical names, viz., Shear-Jashub ("a remnant shall return") and Mahar-shalal-hash-baz ("swift spoil, speedy prey"). The prophet's family probably belonged to the aristocracy of Jerusalem and may have had connections with the royal house. At any rate the prophet seems to have been able to enter the presence of the king at will (*cf.* Chapter vii.). His active career extended from about 738 B.C. (*cf.* Is. vi. 1) to at least 701 B.C. and probably later 690 B.C. (?). He may have been martyred under Manasseh as Jewish legend attests. The prophet lived through a succession of political crises connected with the intervention of Assyria in Western Asia, viz.: the Syro-Ephraimitish War 734 B.C.; the fall of Samaria, 722 B.C.; the siege of Ashdod by Sargon, 711 B.C.; the death of Sargon, 705 B.C.; and the invasion of Sennacherib in 701 B.C. Isaiah has well been called "the prophet of Faith." He stands a sublime figure for faith in the supremacy of the spiritual over the earthly; for the potency of high ideas and ideals over brute force and power. To have combined such a lofty faith with practical statesmanship—for Isaiah was essentially a man of action—is an achievement worthy of the greatest men of any age.

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ISAIAH, ASCENSION OF, an interesting apocryphal book of the Old Testament. Its various constituents—the *Martyrdom of Isaiah,* the *Testament of Hezekiah* and the *Vision of Isaiah*—circulated independently as early as the 1st century. The first of these was of Jewish origin, and is of less interest than the other two, which were the work of Christian writers. The *Vision of Isaiah* is important for the knowledge it affords us of 1st century beliefs in certain circles as to the doctrines of the Trinity, the Incarnation, the Resurrection, the Seven Heavens, etc. The long lost *Testament of Hezekiah,* which is, in the opinion of Charles, to be identified with iii. 13b–iv. 18 of our present work, is unquestionably of great value owing to the insight it gives us into the history of the Christian Church at the close of the 1st century. Its descriptions of the worldliness and lawlessness which prevailed among the elders and pastors, *i.e.,* the bishops and priests, of the widespread covetousness and vainglory as well as the growing heresies among Christians generally, agree with similar accounts in 2 Peter, 2 Timothy and Clement of Rome.

Of the three original sources, (i.) The *Martyrdom of Isaiah* consists of i. 1, 2^a, 6^b–13^a, ii. 1–8, 10–iii. 12, v, 1^b–14, and is but an imperfect survival of the original work. (ii.) The *Testament of Hezekiah* is to be found in iii.13^b-iv.18, in a mutilated form, without beginning or end. (iii.) The *Vision of Isaiah* is vi.–xi. 1–40. Its archetype existed independently in Greek, and differs in many respects from the form in which it was republished by the editor of the entire work. This editor had the three documents mentioned at his disposal; the first was of Jewish, the others of Christian origin; he reduced or enlarged them as it suited his purpose, and put them together as they stand in our text. As regards the dates of the different elements, the *Martyrdom* belongs to the 1st century A.D., the *Testament of Hezekiah* to the period 88–100 A.D., the *Vision of Isaiah* to the close of the 1st century A.D., but the work as we now have it is probably not earlier than the latter half of the 2nd century.

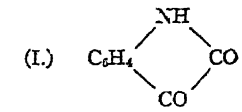
See R. H. Charles, *The Ascension of Isaiah* (1900), in *The Apocr. and Pseudepig. of the O.T.,* ii. 155–162 (1913), and in the S.P.C.K. "Translations of Early Documents" (1918). (W. O. E. O.)

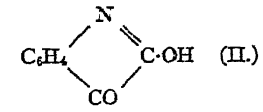
ISANDHLWANA, an isolated hill in Zululand, 8m. S.E. of Rorke's Drift across the Tugela river, and 105m. N. by W. of Durban. On Jan. 22, 1879, a British force encamped at the foot of the hill was attacked by about 10,000 Zulus, the flower of Cetewayo's army, and destroyed. Of eight hundred Europeans engaged about forty escaped (*see* ZULULAND: *History*).

ISANOMALOUS LINES. Lines connecting places of similar temperature and pressure, etc., to equal departures from the average values of the respective zones of latitude. *See* also ISABNORMAL LINES.

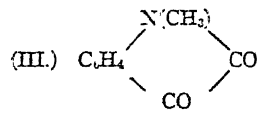
ISAR (identical with *Isère,* in Celtic "the rapid"), a river of Bavaria. It rises in the Tirolese Alps, at an altitude of 5,840 feet. It winds in deep, narrow gorges through the Alps, and at Tölz (2,100 ft.), enters the Bavarian plain, which it traverses in a generally north and north-east direction, and enters the Danube immediately below Deggendorf. It is 219 m. long with a drainage area of 38,200 sq.m. Below Munich the stream is 140 to 350 yd. wide, and is studded with islands. It is not navigable, except for rafts. The Isar is essentially the national stream of the Bavarians; it traverses the finest corn land in the kingdom. On its banks lie the cities of Munich and Landshut, and the venerable episcopal see of Freising. (*See* DANUBE.)

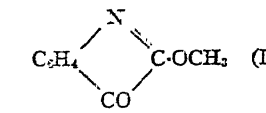
ISATIN, in chemistry, an oxygenated derivative of indole (*q.v.*) prepared by oxidizing indigo with nitric or chromic acid. It crystallizes in orange-red prisms melting at 200–201° C. Isatin, which furnishes indirubin, the red pigment of indigo, on condensation with indoxyl, is of practical importance in the manufacture of vat colours (*see* DYES, SYNTHETIC). For example, it yields Ciba red G (thioindigo scarlet G) by condensation with α-hydroxythio-naphthene and subsequent bromination of the condensation product. Isatin is also of outstanding scientific interest because it affords a noteworthy example of tautomerism (*see* ISOMERISM). It is a chemical individual with two personalities. Certain of its reactions suggest the lactam constitution (I.) whereas others indicate the lactim configuration (II.).





Although itself existing in only one form, isatin has two methyl ethers: pseudomethylisatin (III.) made from dibromomethyloxindole, and methylisatin (IV.) prepared by





the interaction of methyl iodide and silver isatin. The absorption curves of isatin and the pseudomethyl ether are practically identical and differ considerably from that of the methyl ether. Accordingly, isatin is regarded as having the lactam structure, although its silver derivative corresponds with the lactim formulation.

Isatin and its homologues are produced by condensing aniline and its homologues with hydroxylamine sulphate and chloral hydrate; an intermediate isatinimide is formed which on hydrolysis furnishes the corresponding isatin.

ISAURIA, a district in the interior of Asia Minor. The nucleus of it was that section of the Taurus which lies directly south of Iconium and Lystra. Lycaonia had all the Iconian plain; but Isauria began as soon as the foothills were reached. When the Romans first encountered the Isaurians (early in the 1st century B.C.), they regarded Cilicia Trachea as part of Isauria, which thus extended to the sea; the whole basin of the Calycadnus was reckoned Isaurian, and the cities in the valley of its southern branch formed what was known as the Isaurian Decapolis. Towards the end of the 3rd century A.D., however, all Cilicia was detached for administrative purposes from the northern slope of Taurus; Pisidia was also detached, and made to include Iconium. In compensation Isauria received the eastern part of Pamphylia. Restricted again in the 4th century, Isauria ended as the wild district about Isaura Palaea and the heads of the Calycadnus. During the war of the pirates against Rome, the Isaurians took so active a part that the proconsul P. Servilius followed them into their fastnesses, and reduced the whole people to submission. The Isaurians were afterwards placed under the rule of Amyntas, king of Galatia; but it is evident that they continued to retain their predatory habits and virtual independence. In the 4th century they are described by Ammianus Marcellinus as the scourge of the neighbouring provinces of Asia Minor; but they are said to have been effectually subdued in the reign of Justinian. Isauria passed into the hands of Turcomans and Yuruks with the Seljuk conquest.

This comparatively obscure people had the honour of producing two Byzantine emperors, Zeno, whose native name was Traskalisseus Rousoumbladeotes, and Leo III., who ascended the throne of Constantinople in A.D. 718, reigned till 741, and became the founder of a dynasty of three generations. The ruins of Isaura Palaea are mainly remarkable for their fine situation and their fortifications and tombs. Those of Isaura Nea have disappeared, but numerous inscriptions and many sculptured *stelae,* built into the houses of *Dorla,* prove the site. It was the latter, and not the former town, that Servilius reduced by cutting off the water-supply. The site was identified by W. M. Ramsay in 1901.

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ISCHAEMIC ANOXAEMIA: *see* SHOCK AND COLLAPSE.

ISCHIA (Gr. Πιθηκοῦσσα, "the apes' island," Lat. *Aenaria,* in poetry *Inarime*), an island off the coast of Campania, Italy, province of Naples, 16 m. S.W. of Naples and 7 m. S.W. of the Capo Miseno, the nearest point of the mainland. Pop. (1921) 27,631. It is situated at the west extremity of the gulf of Naples, and is the largest island near Naples, measuring about 19 m. in circumference and 26 sq.m. in area. It belongs to the same volcanic system as the mainland near it, and the Monte Epomeo (anc. Ἐπωπεύς, viewpoint), the highest point of the island (2,588 ft.),

lies on the N. edge of the principal crater, which is surrounded by twelve smaller cones. The island was occupied by Greek settlers but its Eretrian and Chalcidian inhabitants abandoned it about 500 B.C. owing to an eruption, and it is said to have been deserted almost at once by the greater part of the garrison which Hieron I. of Syracuse had placed there about 470 B.C., owing to the same cause. Later on it came into the possession of Naples, but passed into Roman hands in 326, when Naples herself lost her independence.

Several eruptions are recorded in Roman times. The last of which we have any knowledge occurred in 1301, but the island was visited by earthquakes in 1881 and 1883, 1,700 lives being lost in the latter year, when the town of Casamicciola on the north side of the island was almost entirely destroyed. The hot springs (147°), are alkaline and saline, and are much visited by bathers, especially in summer. They were known in Roman times, and many votive altars dedicated to Apollo and the nymphs have been found. The island is mountainous, beautiful and fertile. Wine, corn, oil and fruit are produced, especially the former, while the mountain slopes are clothed with woods. Tiles and pottery are made. Straw-plaiting is a considerable industry at Lacco; and a certain amount of fishing is also done. The potter's clay of Ischia served for the ancient potteries of Cumae and Puteoli.

The chief towns are Ischia on the E. coast, capital and seat of a bishop (pop. in 1921, town, 2,825; commune, 7,815), with a 15th century castle, to which Vittoria Colonna retired after the death of her husband in 1525; Casamicciola (pop. in 1921, town, 2,690; commune, 3,375) on the north, and Forìo on the west coast (pop. in 1921, town, 2,476; commune, 5,813). There is regular communication with Naples, both by steamer direct, and also by steamer to Torregaveta, 2 m. W.S.W. of Baiae and 12½ m. W.S.W. of Naples, and thence by rail. (T. A.)

ISCHL, spa and town in Upper Austria. Beautifully situated between the rivers Ischl and Traun on a peninsula at an altitude of 1,530 ft., it is one of the most fashionable watering-places in Europe, and is famous for its mild climate (mean annual temp. −49·4 F), its saline and sulphur drinking springs, mud, sulphur and brine baths. Much of its popularity has been due to the fact that it was from 1822 the summer residence of the Austrian imperial family. Ischl is a centre of the Austrian salt industry which has been carried on since the 12th century. Pop. (1923) 10,200.

ISEO, LAKE OF, a lake in Lombardy, north Italy (anc. *Lacus Sebinus*), at the southern foot of the Alps, between the provinces of Bergamo and Brescia. The Oglio enters the north end at Lovere and leaves the south end at Sarnico to join the Po. Area 24 sq.m., length 17½ m., greatest width 3 m., greatest depth 984 ft., height of surface above sea-level 607 ft. It contains the island of Siviano, culminating in Monte Isola (1,965 ft.) crowned by a chapel, while to the south is the islet of San Paolo, occupied by the buildings of a small disused Franciscan convent and to the north the equally tiny island of Loreto, with a ruined chapel containing frescoes. At the southern end of the lake are the small towns of Iseo (15 m. by rail from Brescia) and of Sarnico. From Paratico, opposite Sarnico, on the left bank of the Oglio, a railway runs in 6¼ m. to Palazzolo, on the main Brescia-Bergamo line. Towards the head of the lake, the deep wide valley of the Oglio is seen, dominated by the glittering snows of the Adamello (11,661 ft.). Along the east shore a fine carriage road as well as the railway runs from Iseo to the town of Pisogne (13½ m.), on the north-east side of the lake.

ISÈRE, a department of France, formed in 1790 out of the northern part of the old province of Dauphiné. Pop. (1926) 558,079. It is bounded north by the department of the Ain, east by Savoie, south by the Hautes Alpes and the Drôme and west by the Loire and the Rhône department. Area 3,178 sq.m. The department consists of most of the upper course of the Isère river (*q.v.*) and of the Drac, among the French Alps, and of the lower land towards the great bend of the Rhône at Lyons (Bas Dauphiné). At Vienne the average annual temperature is 5·3° above that of Paris, but winters are cold amongst the mountains, and rainfall increases there to nearly 80 in. The department is divided into three separate arrondissements (Grenoble, la Tour du Pin and Vienne), 45 cantons and 564 communes. It is in the region of the XIV. Army Corps (Lyons). Its capital is Grenoble which is the seat of a court of appeal, of an académie (educational division), and of a bishop now in the province of Lyons, but before the Revolution in that of Vienne: other important towns are Vienne, St. Marcellin and la Tour du Pin. It contains coal and iron mines, slate and stone quarries and several mineral springs. The forests cover much ground. Flourishing industries are those of cement, glove making, silk weaving and paper making, metal work of various kinds, etc. Wheat, oats, vines, mulberries, chestnuts, tobacco, etc. are grown. The pastures feed horses, mules and cattle, while sheep from Provence migrate into the department in summer. Crémieu is a hill town with ancient fortifications and market. La Grande Chartreuse is in the department.

ISÈRE (anc. ISARA), tributary of the Rhône, south-east France, 180 m. long, with a descent of 7,550 ft. and a drainage area of 4,275 square miles. It flows through the departments of Savoie, Isère and Drôme. It rises as a torrent in the Galise glaciers of the French Graian alps, and has successive sections of its course orientated south-east, north-west and north-east-south-west, crossing the geological outcrops for the most part obliquely, and receiving the Arly and Arc, among other streams. After traversing the northern part of the axis of the Belledonne chain, it enters the wider Graisivaudan valley, floored by Jurassic strata, which is parallel to the Belledonne and flows south-westward to its union with its southern feeder, the Drac, just below Grenoble; it becomes navigable at Montmélian.

ISERLOHN, a town in the Prussian province of Westphalia, on the Baar, 17 m. W. of Arnsberg, and 30 m. E.N.E. from Barmen by rail. Pop. (1925) 30,296. Iserlohn is a very old town, its gild of armourers being referred to as "ancient" in 1443. Both in the town and neighbourhood there are numerous foundries and works for iron, brass, steel and bronze goods, while other manufactures include wire, needles and pins, fish-hooks, machinery, umbrella-frames, thimbles, bits and furniture.

ISFAHAN (ēs-fah-hahn′) (the *Aspadana* of Ptolemy and *Spahan* of the Pehlevi texts), a Persian province and city. The province is bounded by the districts of Kashan and Gulpaigan on the north, Khuzistan on the west, Yazd on the east and Fars on the south. Data are insufficient on which to base any very accurate estimate of the total population, but it is doubtless well under 600,000. The amount of grain cultivation in some districts is very large and much is exported to other parts of Persia; but the cultivation of the poppy, cotton and tobacco constitutes the chief wealth of Isfahan province. The general elevation lies between 5,000 ft. in the east and 9,000 ft. in the west. The total revenue amounted to 8,007,433 krans (£ St.=45 krans) in 1926–27.

The City of Isfahan, formerly the capital of Persia, is now only the administrative headquarters of the province. Choosing Isfahan for his capital, Shah Abbas I. made it a large and imposing town, and it had a population of at least 600,000 in the 17th century, whence the Persian saying *Isfahán nisf-i-jahán* (Isfahan is half the world). The city lies in 32° 39′ N. and 51° 40′ E., at an elevation of 5,330 ft. along the north bank of the Zayinda Rud, which is crossed by three fine masonry bridges, one in the centre of the city, the Pul-i-Julfa because it leads to the suburb of Julfa on the south bank of the river, and two others at the extremity of the city. The Pul-i-Julfa or Allah Verdi Khan bridge, consists of 33 arches, is 388 yards in length with a paved roadway of 12 yards in breadth, and has galleried arcades on each side for foot passengers. The water supply of the city is principally from open canals led off from the river and from several streams and canals which come down from the hills in the north-west. The population (according to an estimate made in 1913) is 80,000 including that of the suburb of Julfa, but Lorini (1910) put it at 100,000 and Julfa 4,000. There is a small settlement of Jews, numbering some five thousand.

Viewed from the air, the city presents an immense expanse of mingled buildings and gardens, 30 m. in circuit; but, with the exception of the bazaars and other scattered agglomerations of houses, there is really no continuous inhabited area, except in the

centre. The city lies in a level tract of country which extends around it for miles, and a peculiar feature of the landscape is the large number of towers which dot the plain providing shelter for pigeons whose fertilizing manure forms a lucrative source of revenue.

THE MODERN CITY

Present-day Isfahan is largely a city of vanished glory. Many of its remarkable buildings having suffered from long neglect, an official was sent from Tehran in 1902 to inspect the crown buildings and to report on their condition. Pursuant to his report it was decided to repair and renovate some, while others were demolished and their timber, bricks and stone sold to local builders. Many of the gardens for which in the early days it was famous, became wildernesses. Of the many fine buildings constructed by the Safavis and during the Kajar dynasty very few remain.

The heart of the city and central point of interest at the present time is the Maidan-i-Shah, an immense and still imposing rectangular space, 560 yards from north to south, by 174 yards, bordered by brick buildings of two storeys of recessed arches or arcades, in front of which still survive a few stunted planes and sycamores. On the south side of the *maidan* is an arched portal leading to the famous Masjid-i-Shah, or royal mosque, completely covered with enamelled bricks of great brilliancy, which was built by Shah Abbas I. at the end of the 15th century and is even now one of the most beautiful buildings in the world. It is still in good repair. On the eastern side stands the blue-domed Masjid-i-Lutf Allah, and opposite, on the west side, is the Aali Kapu (highest gate or sublime porte), a lofty building in the form of an archway crowned in the fore part by an immense open balcony (which formerly served as an audience hall) supported by wooden columns commanding the square. This gateway leads into the gardens of the former royal palace, which covers a considerable area with its courts and pavilions, one of which, the Chihil Situn (hall of forty pillars), was famous as the verandah and throne-room of Shah Abbas. On the north side of the *maidan* is the gateway, covered with brick of faience, leading to the main bazaar.

From the precincts of the palace mentioned above runs the grand avenue or Chahar Bagh (four gardens), an avenue laid out by Shah Abbas I., nearly ¾ m. in length and two hundred feet broad, leading to the Julfa bridge. It was originally laid out with watercourses and fountains, and poplar and sycamore trees; most of the latter have disappeared, but the avenue, which has been sadly neglected, is now being restored. Between this avenue and the *maidan* is the Madrasseh-i-Shah Husain, built in 1710, designed as a college for the training of mullahs and dervishes, and described by Curzon in 1892 as "one of the stateliest ruins that he saw in Persia." The bazaars of Isfahan lie behind the northern and eastern sides of the *maidan*, and in them it is possible to walk for 3 miles or more under covered shade. They have all the characteristic features of other Asiatic marts and the trade carried on preserves for Isfahan some at least of the prestige which once belonged to the city. Brocaded cloths, felt goods, saddles, native weapons, lacquered ware, articles of silver filigree-work and of metal are among the characteristic merchandise. The confluence of people in the bazaars is very great and tends to give an exaggerated idea of the populousness of the city.

Julfa, across the Zayinda Rud, is the Armenian suburb of Isfahan. Here Shah Abbas, about 1603, transplanted several thousand families of Christian Armenians from Julfa on the Araxes and settled them on the outskirts of his capital. They are strictly orthodox and have a cathedral. The population of the suburb has tended to decline in recent years.

In Isfahan itself the Church Missionary Society has a church, medical mission, industrial home and schools and hostels both for boys and girls. Among these the Stuart Memorial college is the leading educational institution in this part of Persia. It has some 200 boys on its rolls, and maintains a staff of four or five Englishmen in addition to its Persian teachers.

From Isfahan there are several unconstructed roads, and one quite suitable for motor traffic to Tehran (240 m.). Roads to Shiraz (290 m.) and to Kirman (400 m.) via Yazd are also, amongst others, at any rate, passable by motor-cars. Isfahan is notably a centre of the metal-work industry, such as chiselled brass ware in bowls, vases, trays, painted pen cases, etc.; earthenware, pottery and tiles, reproducing old patterns; also printed calicoes of native design. A telephone service was installed in the city in 1911, and there is telephonic communication with Gulpaigan (100 m.) and with Dehkhurd (76 m.). The climate of Isfahan is damp and subject to extremes. The temperature varies from a maximum of 97·8° F in July to 23·8° in Jan. The relative humidity is 63 as compared with 54 at Tehran and 67 at Bushire. The average rainfall over a period of 17 years was 4·74 inches.

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HISTORY

The natural advantages of Isfahān—a genial climate, a fertile soil and abundance of water for irrigation—must have always made it a place of importance. In the most ancient cuneiform documents, referring to a period between 3000 and 2000 B.C., the province of *Anshan*, which certainly included Isfahān, was the limit of the geographical knowledge of the Babylonians, typifying the extreme east, as Syria (or *Martu-ki*) typified the west. The two provinces of *Anshan* and *Subarta*, by which we must understand the country from Isfahān to Shuster, were ruled in those remote ages by the same king, who undoubtedly belonged to the great Turanian family; and from this first notice of Anshan down to the 7th century B.C. the region seems to have remained more or less dependent on the paramount power of Susa. The Western Iranians, after separating from their eastern brethren on the Oxus as early perhaps as 3000 B.C., are believed to have bifurcated into two branches, westward into Media and southward towards Persia. The first substantial settlement of the southern branch would seem to have been at Isfahān, where *Jem*, the eponym of the Persian race, is said to have founded a famous castle, the remains of which were visible as late as the 10th century A.D. At the commencement of the 7th century B.C. Persia and Anshan are still found in the annals of Sennacherib amongst the tributaries of Elymais, confederated against Assyria; but shortly afterwards the great Susian monarchy, which had lasted for full 2,000 years, crumbled away under continued pressure from the west, and the Aryans of Anshan recovered their independence, founding for the first time a national dynasty, and establishing their seat of government at Gabae on the site of the modern city of Isfahān.

The royal city of Gabae was known as a foundation of the Achaemenidae as late as the time of Strabo, and the inscriptions show that Achaemenes and his successors did actually rule at Anshan until the great Cyrus set out on his career of western victory. The provincial name of Anshan or Assan seems after the age of Cyrus to have given place to Gabene or Gabiane, which alone appears in the Greek accounts of the wars of Alexander and his successors, and in the geographical descriptions of Strabo. Gabae or Gāvi became gradually corrupted to *Jaī* during the Sassanian period, and it was thus by the latter name that the old city of Isfahān was generally known at the time of the Arab invasion. Subsequently the title of Jaī became replaced by *Sheheristān* or *Medineh*, "the city" *par excellence*, while a suburb which took the name of *Yahudieh*, or the "Jews' town," gradually rose into notice and superseded the old capital.

Sheheristān and *Yahudieh* in the early ages of Islam are described as independent cities, each surrounded by a separate wall; but about the middle of the 10th century the famous Buyid king, known as the *Rukn-addaula* (*al-Dowleh*), united the two and many of the adjoining villages in one general enclosure which

was about 10m. in circumference. The city, which had now resumed its old name of Isfahān, continued to flourish till the time of Timur (A.D. 1387), who is said to have erected a *Kelleh Minār* or "skull tower" of 70,000 heads at the gate of the city, as a warning to deter other communities from resisting his arms. Isfahān, however, recovered and when the Safavid dynasty, who succeeded to power in the 16th century, transferred their place of residence to it from Kazvin, it rose rapidly in population and wealth. It was under Shah Abbas the first, the most illustrious sovereign of this house, that Isfahān attained its greatest prosperity. This monarch adopted every possible expedient, by stimulating commerce, and encouraging arts and manufactures, to attract visitors to his favourite capital. He built several magnificent palaces in the richest style of Oriental decoration, planted gardens and avenues, and distributed amongst them the waters of the Zendeh-rūd in an endless series of reservoirs, fountains and cascades. The baths, mosques, colleges, bazaars and caravanserais of the city received an equal share of his attention, and European artificers and merchants were encouraged to settle in his capital. Ambassadors visited his court from many of the first states of Europe, and factories were permanently established for the merchants of England, France, Holland, the Hanseatic towns, Spain, Portugal and Moscow. The celebrated traveller Chardin, who passed a great portion of his life at Isfahān in the latter half of the 17th century, has left a detailed and most interesting account of the statistics of the city at that period. He himself estimated the population at 600,000, though in popular belief the number exceeded a million. There were 1,500 flourishing villages in the immediate neighbourhood; the enceinte of the city and suburbs was reckoned at 24m. while the mud walls surrounding the city itself, probably nearly following the lines of the Buyid enclosure, measured 20,000 paces. In the interior were counted 162 mosques, 48 public colleges, 1,802 caravanserais, 273 baths and 12 cemeteries. The adjoining suburb of Julfa was also a most flourishing place. The first blow to the prosperity of modern Isfahān was given by the Afghan invasion at the beginning of the 18th century, since which date, although continuing till the end of the century to be the nominal head of the empire, the city has gradually dwindled in importance, and now only ranks as a second or third rate provincial capital.

For modern Isfahān *see* E. G. Browne, *A Year Amongst the Persians* (1926).

ISHII, KIKUJIRO, VISCOUNT (1866–), Japanese diplomatist, was born at Chiba, Japan. Like other members of his family, he was destined to enter official life. His intention was to become a lawyer, but his studies in international law gave him a deep interest in foreign affairs. His early days were full of incident: the Meiji reconstructions took place before his eyes, and the constant stream of foreign influences soon aroused in him a desire to see and understand other countries. Leaving the law faculty of the Imperial university in Tokyo in 1890, he was made attaché to the Japanese Legation in Paris. During his stay in Paris he applied himself to the study of European languages and became proficient in French and English. He was made third secretary in 1893, and about this time he devoted much attention to the problems of economics and international trade. He was distressed to observe that Japan did not hold such a position in the world's mart as in the opinion of most Japanese she deserved, and he set himself to find out the causes of the trouble. He endeavoured to form a Franco-Japanese mutual trade association, and although his efforts did not at first meet with the full success he desired, a certain stimulus was at once felt. Some part of the fruits of Ishii's labours were seen in the commercial mission which was sent from France to Japan in 1925.

In 1896 he was appointed Consul to Chemulpho (Jinsen) in Korea. After this he was made second secretary and later first secretary at the Japanese Legation in Peking. He was, therefore, in Peking in an official capacity during the Boxer rising. In 1900 he was appointed Secretary of the Head Office and chief of the telegraph section of the Home Office Department, which post he held until he became director of the Commerce Bureau in 1904. In 1907 he was sent to San Francisco and Vancouver in connection with the anti-Japanese riots there. His success in this matter was the direct cause of his appointment in the following year as Vice-Minister for Foreign Affairs. His love of France and understanding of French problems made him an easy favourite for the ambassadorship to Paris in 1912, and on his return he took over the portfolio for Foreign Affairs in the new Government. He was chief of the Foreign Office for the period 1915–16, and in the latter year he was created Viscount, having been made Baron in 1912. He played a great part in American-Japanese relations and was a special envoy to the United States in 1917. He was nominated a member of the House of Peers in 1916. In 1920 Viscount Ishii was for the third time officially delegated to Paris. In 1927 he became one of the Japanese delegates to the Naval Disarmament Conference at Geneva. He returned to Japan in the autumn of 1927, and retired from diplomatic service.

Perhaps Ishii's greatest claim on his country's gratitude was his work in connection with the so-called "Gentlemen's Agreement" made between Washington and Tokyo in 1907. Lansing was the United States representative in the negotiations, for which reason the arrangement is sometimes called the "Lansing-Ishii Pact." The western coast of the United States made representations to Congress deploring the increasing immigration of Asiatics, notably Chinese and Japanese. It was claimed that owing to the Asiatic standard of living being lower than that of Americans, there was a serious possibility of California becoming a Japanese colony, and the aid of legislation was invoked. The Lansing-Ishii pourparlers resulted in the postponement of suggested legislative measures, and a yearly maximum (tentatively fixed at 150) was proposed. Japan, through Ishii, agreed not to issue passports for more than this number annually to enter the United States as residents, and it was through Japan's alleged breach of faith in connection with this agreement that the Immigration Restriction Act was passed by Congress in 1924. In substance, this Act was one of the proposals originally shelved by the labours of Lansing and Ishii.

In Dec. 1920 Viscount Ishii became Japanese delegate to the 11th session of the Council of the League of Nations. In Aug. 1923 he became President of the Council of the League and in the following month was one of the Vice-Presidents of the Assembly. In Sept. 1925 he was again a Vice-President of the Assembly. In March 1926 he was President of the Council at its 39th session, and as such acted as President of the Assembly (March 1926) until the election of the new President. (A. N. J. W.)

ISHIM, a town in the Uralsk Area of the R.S.F.S.R. in 56° 10′ N. and 69° 18′ E., on the Ishim river, a left bank tributary of the Irtish. Average January temperature −3·8° F, average July 66·0° F, rainfall 17·5 in. per annum, half of which falls between June and August. Pop. (1926) 14,099. A railway from Sverdlovsk (Ekaterinburg) to Omsk, passes through the town. It is an agricultural centre, with fairs in December and May to which tallow, butter, skins, hides, cattle, horses, bristles, groceries and the products of local *kustar* (peasant) industries are sent.

ISHMAEL was the son of Abraham and his Egyptian concubine, Hagar. Through the jealousy of Sarah, mother and son were driven from the tribe, and saved from death by thirst through the miraculous discovery of a well (Gen. xxi. 8–20). Ishmael grows up an archer (Gen. xxi. 20) and a "wild ass of a man" (Gen. xvi. 12), living to the south and east of Palestine. He is the ancestor of twelve tribes of desert rangers (Gen. xxv. 12–18), of whom the most important seem to be Nebaioth (Assyrian Nabaitu and Pliny's Nabataei) and Kedar (Assyrian Kidru and Pliny's Cedrei). A third tribe, Dumah, may be the Domata of Pliny, and Jetur seems to be the eponymous ancestor of the Itureans.

"Ishmael," therefore, is used in a wide sense of the wilder, roving peoples encircling Canaan from the north-east to the south, related to but on a lower rank than the "sons" of Isaac. It is practically identical with the term "Arabia" as used by the Assyrians. Nothing certain is known of the history of these mixed populations. They are represented as warlike nomads and with a certain reputation for wisdom (Baruch iii. 23). Not improbably they spoke a dialect (or dialects) akin to Arabic or Aramaic. According to the Mohammedans, Ishmael, who is recognized as their

ancestor, lies buried with his mother in the Kaaba in Mecca. *See* T. Nöldeke, *Ency. Bib., s.v.*, and the articles EDOM, MIDIAN.

ISHPEMING, city, Marquette county, Michigan, U.S.A., in the northern part of the Upper Peninsula, 15m. from Lake Superior, at an altitude of 1,400 feet. It is on Federal highway 41, and is served by the Chicago and Northwestern, the Duluth, South Shore and Atlantic and the Lake Superior and Ishpeming railways. The population was 10,500 in 1920 (30·5% foreign-born white). It is in the heart of the Marquette Range iron district, and there are large mines within the city limits. The county in 1926 produced 3,940,581 gross tons of ore; gold, silver and marble also are found in the vicinity. The city has various manufacturing industries, with an aggregate output in 1925 valued at $1,844,629. Ishpeming was settled about 1854 and incorporated as a city in 1873. The name is an Ojibway word, meaning "high up."

ISHTAR or **IŠTAR,** the name of the chief goddess of Babylonia and Assyria, the counterpart of the Phoenician Astarte (*q.v.*). The earliest written form of the name is *Ash-dar*, an Accadian rendering of the older Sumerian Innīni, "Lady of Heaven." Ishtar was the Semitic deity identified with the Sumerian virgin mother-goddess, who was always associated with the planet Venus. For this reason Ashdar, Ishtar, is undoubtedly the same deity as the south Arabian Athtar, god of the planet Venus. At all events it is now generally recognized that the name is Semitic in its origin. Where the name originated is likewise uncertain, but the indications point to Erech, where we find the worship of a great Sumerian mother-goddess having no association with a male counterpart flourishing in the oldest period of Babylonian history. She appears under various names, among which are Nanā, Innanna, Ninā and Anunit. As early as the days of Khammurabi we find these various names which represented originally different goddesses, though all manifest as the chief trait the life-giving power united in Ishtar. Even when the older names are employed it is always the great mother-goddess who is meant. Ishtar is the one goddess in the pantheon who retains her independent position despite and throughout all changes that the Babylonian-Assyrian religion undergoes.

See S. Langdon, *Tammuz and Ishtar* (Oxford, 1914); Joseph Plessis, *Étude sur les textes concernant Ishtar–Astarte* (1921).

ISHTIB (Shtip), town, south Serbia, Yugoslavia. Pop. (1921) 11,191. There are several mosques, a bazaar and a number of fountains. Wheat and the poppy are cultivated and there is a vegetable oil factory in the town. During the World War Ishtīb was an important military centre, and a railway was constructed to Veles. There is lignite in the district, also some hot mineral springs.

ISIDORE OF ALEXANDRIA[1] (*fl. c.* A.D. 500), Greek Neoplatonist, head of the school in Athens in succession to Marinus who followed Proclus. He is known principally as the preceptor of Damascius who wrote a favourable *Life of Isidorus*. He was more of an enthusiast than a thinker, and inclined to theosophical speculation.

Damascius' *Life* is preserved by Photius in the *Bibliotheca*, and the fragments are printed in the Didot edition of Diogenes Laërtius. *See* Agathias, *Hist.* ii. 30; Photius, *Bibliotheca*, 181.

ISIDORE OF SEVILLE (ISIDORUS HISPALENSIS) (*c.* 570–636), Spanish encyclopaedist and historian, was born of a noble family from Cartagena. Distinguishing himself in controversies with the Arians, in 609 he was chosen to succeed his brother Leander as archbishop of Seville. In the provincial and national councils he played an important part, notably at Toledo in 610, at Seville in 619 and in 633 at Toledo, which profoundly modified the organization of the Church in Spain. His great work, however, was the preservation of the remnants of Greek and Roman culture against the barbarians. His chief writing, the *Originum sive etymologiarum libri* XX, written between 622 and 633 (last ed. by W. M. Lindsay, Oxford, 1911) condenses the fruit of his extensive reading in the seven liberal arts, the sciences, architecture, war, political theory, the nature of spiritual beings, etc. It was much cited by the Schoolmen, and though not original, is interesting for the history of thought.

Of the *Libri differentiarum sive de proprietate sermonum*, the first book is a collection of synonyms and the second of explanations of metaphysical and religious ideas. The *De scriptoribus ecclesiasticus* or *De viris illustribus*, was a continuation of the work of St. Jerome and of Gennadius. The *De natura rerum*, ed. G. Becker (Berlin, 1857), a treatise on astronomy and meteorology, contained the sum of physical philosophy during the early middle ages. His *Regula monachorum* was adopted by many of the monasteries in Spain during the seventh and eighth centuries. The *De Fide Catholica contra Iudaeos* was edited by K. Weinhold (Paderborn 1874). The collection of canons known as the *Isidoriana* or *Hispalensis* is not by him, and the following are also of doubtful authenticity: *De ortu ac obitu patrum qui in Scriptura laudibus efferuntur; Allegoriae scripturae sacrae et liber numerorum; De ordine creaturarum.*

Isidore's works were edited by F. Orevalo (Rome, 1797–1803, 7 vols.), and reproduced in Migne, *Patrol. Lat.* 81–84. Mommsen has edited the valuable historical works, *Chronica maiora* or *Chronicon de sex aetatibus* (from the creation to A.D. 615) and the "Historia Gothorum, Wandalorum, Sueborum" in the *Monum. Germ. hist., auctores antiquissimi; Chronica minora II. See* also C. Canal, *San Isidoro* (Seville, 1897); E. Brehaut, *An Encyclopaedist of the Dark Ages, Isidore of Seville* (New York, 1912); C. H. Beeson, *Isidor-Studien* (Munich, 1913); A. Schmekel, *I. von Sevilla* (Berlin, 1914) and Manitius, *Gesch. d. latein. Lit.* (1911).

ISIN (modern Ishan Bahriyat). The identification of the ancient Isin with this site, which lies 14 miles due south of Afaj, in 31° 51′ N. and 45° 17′ E., is due to Col. Stevenson. The city of Isin was of late foundation and does not appear in inscriptions until the last years of the Ur-Engur dynasty of Ur. After the final overthrow of the Sumerians of that city state the two dominant principalities in Babylonia were Larsa and Isin, which were of Semitic origin. From 2357 B.C. these two states had each a synchronous dynasty. In spite of various changes and the growth of the first dynasty of Babylon Isin managed to maintain itself, until in 2126 B.C. when it was conquered by the Elamites who had previously made themselves masters of Larsa. Finally both cities were united to the Babylonian empire under Hammurabi.

The site consists of a low mound of about 200 acres, extending from north-east to north-west. On the summit is a large building. Such scanty excavation as has been done by Langdon shows that the site was occupied in Neo-Babylonian times. There is a further mound which has not yet been explored.

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ISINGLASS, a pure form of commercial gelatin obtained from the swimming bladder or sound of several species of fish. The sturgeon is the most valuable, various species of which, especially *Acipenser stellatus* (the seuruga), *A. ruthenus* (the sterlet) and *A. güldenstädtii* (the ossétr), flourish in the Volga and other Russian rivers, in the Caspian and Black seas, and in the Arctic ocean, and yield the "Russian isinglass"; a large fish, *Silurus parkerii*, and probably some other fish, yield the "Brazilian isinglass"; other less definitely characterized fish yield the "Penang" product; while the common cod, the hake and other *Gadidae* also yield a variety of isinglass. The sounds, having been removed from the fish and cleansed, undergo no other preparation than desiccation or drying, an operation needing much care; but in this process they are subjected to several different treatments. If the sound be unopened the product appears in commerce as "pipe," "purse" or "lump isinglass"; if opened and unfolded, as "leaf" or "honeycomb"; if folded and dried as "book," and if rolled out, as "ribbon isinglass." Russian isinglass generally appears in commerce as leaf, book, and long and short staple; Brazilian isinglass, from Para and Maranham, as pipe, lump and honeycomb; the latter product, and also the isinglass of Hudson bay, Penang, Manila, etc. is darker in colour and less soluble than the Russian product.

The finest isinglass, which comes from the Russian ports of Astrakhan and Taganrog, is prepared by steeping the sounds in

[1] With Isidore of Alexandria has been confused an Isidore of Gaza, mentioned by Photius. The latter accompanied Damascius to the Persian court when Justinian closed the schools in Athens in 529. Suidas says that Hypatia was the wife of Isidore of Alexandria but this is chronologically impossible.

hot water in order to remove mucus, etc.; they are then cut open and the inner membrane exposed to the air; after drying, the outer membrane is removed by rubbing and beating. As imported, isinglass is usually too tough and hard to be directly used. To increase its availability, the raw material is sorted, soaked in water till it becomes flexible, and then trimmed; the trimmings are sold as a lower grade. The trimmed sheets are sometimes passed between steel rollers, which reduce them to the thickness of paper; it then appears as a transparent ribbon, "shot" like watered silk. This is dried, and, if necessary, cut into strips.

The principal use of isinglass is for clarifying wines, beers and other liquids. This property is the more remarkable since it is not possessed by ordinary gelatin; it has been ascribed to its fibrous structure, which forms a fine network in the liquid in which it is disseminated, and thereby mechanically carries down all the minute particles which occasion the turbidity. The cheaper varieties are generally used. Of secondary importance is its use for culinary and confectionery purposes, *e.g.*, in making jellies, stiffening jams, etc. Here it is often replaced by the so-called "patent isinglass," which is a very pure gelatin, and differs from natural isinglass by being useless for clarifying liquids. Mixed with gum, it is employed to give a lustre to ribbons and silk; incorporated with water, Spanish liquorice and lamp-black, it forms an Indian ink; a solution, mixed with a little tincture of benzoin, brushed over sarsenet and allowed to dry, forms the well-known "court plaster." Another plaster is obtained by adding acetic acid and a little otto of roses to a solution of fine glue. It also has valuable agglutinating properties; on being dissolved in two parts of pure alcohol, it forms a diamond cement, cooling to a white, opaque, hard solid; it also dissolves in strong acetic acid to form a powerful cement, which is especially useful for repairing glass, pottery, and like substances.

ISIS, the most famous of the Egyptian goddesses. She was of human form, in early times distinguished only by the hieroglyph of her name  upon her head. Later she commonly wore the horns of a cow, and the cow was sacred to her; it is doubtful, however, whether she had any animal representation in early times, nor had she possession of any considerable locality until a late period, when Philae, Behbēt and other large temples were dedicated to her worship. Yet she was of great importance in mythology, religion and magic, appearing constantly in the very ancient Pyramid texts as the devoted sister-wife of Osiris and mother of Horus. In the divine genealogies she is daughter of Keb and Nut (earth and sky). She was supreme in magical power, cunning and knowledge.

Isis was identified with Demeter by Herodotus, and described as the goddess who was held to be the greatest by the Egyptians; he states that she and Osiris, unlike other deities, were worshipped throughout the land. The importance of Isis had increased greatly since the end of the New Kingdom. The great temple of Philae was begun under the XXXth Dynasty; that of Behbēt seems to have been built by Ptolemy II. The cult of Isis spread into Greece with that of Serapis (*q.v.*), early in the 3rd century B.C. In Egypt itself Isea, or shrines of Isis, swarmed. At Coptos Isis became a leading divinity on a par with the early god Min. About 80 B.C. Sulla founded an Isiac college in Rome, but their altars within the city were overthrown by the consuls no less than four times in the decade from 58 to 48 B.C., and the worship of Isis at Rome continued to be limited or suppressed by a succession of enactments which were enforced until the reign of Caligula. At Philae the temple of Isis was frequented until the middle of the 6th century when the last remaining shrine of Isis was finally closed.

See G. Lafaye, art. "Isis" in Daremberg et Saglio, *Dictionnaire des antiquités* (1900); *id. Hist. du culte des divinités d'Alexandrie hors de l'Égypte* (1883); Meyer and Drexler, art. "Isis" in Röscher's *Lexicon der griech. und röm. Mythologie* (1891–92) (very elaborate); E. A. W. Budge, *Gods of the Egyptians,* vol. ii. ch. xiii.; Ad. Rusch, *De Serapide et Iside in Graecia cultis* (dissertation) (Berlin, 1906). (The author especially collects the evidence from Greek inscriptions earlier than the Roman conquest; he contends that the mysteries of Isis were not equated with the Eleusinian mysteries.)

ISKELIB, a town in Asia Minor, altitude 2,460 ft., near the left bank of the Kizil Irmak (anc. *Halys*), 100 m. in a straight line north-east of Angora and 60 S.E. of Kastamuni. Population (1927) 53,722. It lies several miles off the road, between Changri and Amasia in a picturesque *cul de sac* amongst wooded hills, at the foot of a limestone rock crowned by the ruins of an ancient fortress. To the south of the town are saline springs, from which salt is extracted.

ISLA, JOSÉ FRANCISCO DE (1703–1781), Spanish satirist and Jesuit, first showed his gifts in the *Triunfo del amor y de la lealtad: Dia Grande de Navarra,* a satirical description of the ceremonies at Pamplona in honour of Ferdinand VI.'s accession; its sly humour so far escaped the victims that they thanked the writer for his appreciation of their local efforts, but the true significance of the work was discovered shortly afterwards, and the protests were so violent that Isla was transferred by his superiors to another district. He gained a great reputation as an effective preacher, and his posthumous *Sermones morales* (1792–93) justify his fame in this respect. His position in the history of Spanish literature is due to his *Historia del famoso predicador fray Gerundio de Campazas, alias Zotes* (1758), a novel which wittily caricatures the bombastic eloquence of pulpit orators in Spain.

See B. Gaudeau, *Les Prêcheurs burlesques en Espagne au XVIIIe siècle* (1891); V. Cian, *L'Immigrazione dei Gesuiti spagnuoli letterati in Italia* (Torino, 1895).

ISLAM (Arabic, "submission" to the will of God) is the name which all Muhammadans give to their religion; it claims to be a divine revelation communicated to the world through Muḥammad, who was the last of a succession of inspired prophets, beginning with Adam. Its *doctrine* and *practice* are based upon (1) the Word of God, the Qur'ān (*see* KORAN); (2) the traditions (Ḥadīth), or rather the sayings and manner of life (*sunna*) of Muḥammad, as contained in the traditions.

Creed.—The Muslim creed is "There is no god but God (Allāh): Muḥammad is the apostle of God." The acceptance of this faith is held to imply belief in (i.) God, (ii.) the angels, (iii.) the inspired books, (iv.) the prophets, (v.) the day of judgment and (vi.) God's predestination of good and evil. In the Qur'ān the unity of God is emphasized as against the mistaken conception of the Christian Trinity, and the divine nature is expounded through an enumeration of His various qualities under the three categories of power, unity and goodness. Around the throne of God are the angels, pure, sexless beings, some of whom bear the throne, while others praise Him continually; they are also His messengers and are sent to help the faithful in their fight with unbelievers. Some are the guardian angels of men, others are the watchmen of hell.

Creation.—God created the world in six days, and set Adam in the garden of paradise, but, tempted by Satan, Adam fell. Intermediate between men and angels are the Jinn, male and female, created from fire; some are believers, others are infidels. The devil is sometimes described as one of the angels, sometimes as one of the Jinn; he was expelled from heaven because he refused to prostrate himself before Adam at his Lord's command.

Prophets.—God has revealed Himself to man through prophets, to some of whom he has given a book, *e.g.*, to Moses the Law (*taurāt*), to Jesus the Gospel (*injīl*), to Muḥammad the Qur'ān. A prophet has been sent by God to each people, but Muḥammad is "the seal of the prophets," *i.e.*, the last of the series. His mission at first was to warn men of imminent judgment, and in the earlier chapters of the Qur'ān descriptions of the resurrection, the last judgment, and paradise and hell frequently occur.

Practice.—The religious practices obligatory on the believer are (i.) the recital of the creed; (ii.) the performance of divine worship five times a day; (iii.) the fast in the month of Ramaḍān; (iv.) payment of the legal alms; (v.) the pilgrimage to Mecca.

Creed.—The creed must be recited at least once in a lifetime aloud, correctly, with full understanding of its meaning and with heartfelt belief in its truth.

Worship.—Every man who professes Islam is required in

ordinary life to worship God five times in each day. In the Qur'ān only four times are mentioned. "Wherefore glorify God, when the evening overtaketh you, and when ye rise in the morning, and unto Him be praise in Heaven and earth; and in the evening and when ye rest at noon" (xxx. 16–17), but commentators say the "evening" includes the sunset and after sunset. The five times therefore are: (1) Dawn or just before sunrise, (2) just after noon, (3) before sunset, (4) just after sunset and (5) just after the day has closed. Tradition decides within what limits the recitals may be delayed without impairing their validity. The service (*Ṣalāt*—incorrectly translated "prayer"—for which the word *duʿā* is used) is preceded by the lesser ablution (*wuḍū*) consisting in the washing of face, hands (to the elbows) and feet in prescribed manner. Complete washing of the body (*ghusl*) is required only after legal pollution. The worshipper faces the *qibla* (direction of prayer), which was at first Jerusalem, but was changed by the prophet to Mecca. In a mosque the *qibla* is indicated by a niche (*miḥrāb*) in one of the walls. The service consists of prescribed ejaculations, and the recital of parts of the Qur'ān, always including the first *sūra*, accompanied by prostrations of the body. (*See* Muḥammad Ali, *The Holy Qur'ān*, preface xviii.–xxv.) Detailed physical positions are prescribed for each part of the worship; these vary slightly in the four *sunnī* schools. On a journey, in time of war or in other special circumstances, the set form of worship may be modified in accordance with appointed rules. In place of (2) there is the prayer of the assembly, which is observed on a Friday (*yaum al-jamʿa*, "the day of assembly") in a mosque, and is usually accompanied by a bidding-prayer or declamation (*khutba*) delivered from a step of the pulpit (*minbar*). Special services are also prescribed for certain occasions, as on the eclipse of the sun or the moon, etc. Among the Sūfīs special attention is given to informal prayer, consisting chiefly in the continual repetition of the name of God (*dhikr*). (*See* Sufi'ism.) This is still a characteristic of some of the Dervish (*q.v.*) communities.

Fasting.—The command to fast begins with the words, "O ye who believe! There is prescribed for you the fast, as it was prescribed for those before you." The expression "those before you" has been taken to refer to the Jews, who fasted on the day of atonement, but more probably refers to the long fast of 36 days observed by the eastern Christians. In the passage of the Qur'ān referred to (ii. 179–181) Muslims are required to fast during the month of Ramaḍān, "wherein the Qur'ān was revealed," but if one is on a journey or sick he may fast "another number of days," and if he is able to fast and does not, "he may redeem it by feeding a poor man," but "if ye fast, it is better for you." This fast was probably instituted in the second year at Medina. At that time the corrected lunar year was in use, and Ramaḍān, the ninth month, was always in the winter. A few years later Muḥammad decreed the use of the uncorrected lunar year, which remains the standard of time for the Muslim world, so that the month of fasting now occurs at all seasons of the year in turn. The fast is severe, and means entire abstinence from food and drink from sunrise to sunset each day of the month. The fast is associated with the statement that in this month God sent down the Qur'ān from the seventh heaven to Gabriel in the lowest that it might be revealed to the Prophet.

Alms.—Alms are of two kinds: (1) the legal and determined (*zakāt*), and (2) voluntary (*sadaqāt*). The former were given in cattle, grain, fruit, merchandise and money once a year after a year's possession. For cattle a somewhat elaborate scale is adopted. Of grain and fruit a tenth is given if watered by rain, a twentieth if the result of irrigation. Of the value of merchandise and of money a fortieth is prescribed. In the early days of Islam the alms were collected by officials and used for the building of mosques and similar religious purposes. At the present time the carrying of these prescriptions is left to the conscience of the believers, who pay the alms to any needy fellow-Muslim.

Pilgrimage.—The fifth religious duty of the Muslim is the pilgrimage (*ḥajj*) to Mecca, which should be performed once by every Muslim "if he is able," that is, if he can provide or obtain the means to support himself on pilgrimage and his family during his absence, and if he is physically capable. The pilgrimage is made at one time of the Muslim year, namely, from the 7th to the 10th of the month Dhu'l-Ḥijja. For the arrangements for the journey from various countries to Mecca, *see* Caravan. When the pilgrim arrives within five or six miles of the holy city he puts off his ordinary dress after ablution and prayer, and puts on the two seamless wrappers which form the dress of the pilgrim (the iḥrām), who goes without head-covering or boots or shoes. He must not shave at all, or trim the nails or anoint the head during the ceremonial period. The chief parts of the ceremonial are the visit to the sacred mosque (*masjid al-ḥarām*), the kissing of the black stone, the compassing of the Kaʿba (the *Tawāf*) seven times, three times running, four times slowly, the visit to the Maqām Ibrahīm, the ascent of Mount Safā and running from it to Mount Marwa seven times, the visit to Mount Arafāt, hearing a sermon, and going to Muzdalifa, where he stays the night, the throwing of stones at the three pillars in Minā on the great feast day, and the offering of sacrifice there. (For the localities *see* Mecca.) After the accomplishment of these ceremonies the ordinary dress is resumed, the pilgrimage is finished, but the pilgrim usually remains another three days in Mecca, then visits Medina to pay his respects to the tomb of Muḥammad. Beside the *ḥajj* (great pilgrimage) Islam also recognizes the merit of the *ʿumra* (or lesser pilgrimage), *i.e.*, a religious visit to Mecca at any time accompanied by most of the ceremonies of the *ḥajj*.

The ceremonies of the *ḥajj* have been described by several European travellers who have witnessed them, such as J. L. Burckhardt in 1814, Sir Richard Burton in 1853. (*See* bibliography to Mecca.) A concise account of them is given in T. P. Hughes *Notes on Muhammadanism*, 3rd ed. (1894). Details in vol. i. of Bukhārī's traditions (Houdas and Marcais's French translation, i. 493–567).

The Development of Islam.—The battle of Siffīn (657) between ʿAlī and Muʿawiya was the occasion of the first breach in the unity of Islam, and the results remain to this day. The occasion was in the first case political in connection with the disputed succession to the Caliphate (*q.v.*). After the battle ʿAlī was compelled to submit his claims to arbitration, whereupon a number of his supporters (the Kharijites or Khawārij) broke away from him, saying that there should have been no appeal save to the Book of God.

The most important sectarian division in Islam—Sunnī, Shiah and Khawārij—have their origin in divergent theories on the office of the Caliph (Khalīfa), the head of the Muslim community as successor of the Prophet.

Sunnis.—The Sunnī (Sunnīte) form by far the larger number—at the present day about 150 millions out of a total of nearly 235 millions. They hold that the Caliphate is an elective office and must be occupied by a member of the tribe of the Quraysh. They derive their name from the *sunna*, or "path," *i.e.*, the traditional practice of Muḥammad, as set forth in the Hadīth (or Traditions); of these traditions six collections are regarded as authoritative by the Sunnīs, viz., (1.) the *Kitāb al-jāmiʿ aṣ-Ṣaḥīḥ* of Bukhārī (*q.v.*) (810–870). This is the most respected throughout the Muslim world and most carefully compiled (ed. L. Krehl and T. W. Juynboll, Leyden,—and frequently in the East; also with many commentaries. French translation by O. Houdas and W. Marcais, Paris, 1903 *sqq.*). (ii.) The *Ṣaḥīḥ* of Muslim (817–875) with an introduction on the science of tradition (ed. Calcutta, 1849, etc.). (iii.) The *Kitāb as-Sunan* of Abū Dā'ūd (817–888) (ed. Cairo, 1863, Lucknow, 1888, Delhi, 1890). (iv.) The *Jāmiʿ aṣ-Ṣaḥīḥ* of Tirmidhī (*q.v.*). (v.) The *Kitāb as-Sunan* of Nasā'ī (830–915) (ed. Cairo, 1894). (vi.) The *Kitāb as-Sunan* of Ibn Māja (824–866) (ed. Delhi, 1865–1889). (*See* A. Guillaume, *The Traditions of Islam*, 1924.) To the Qu'r'ān and the Ḥadīth, as authoritative sources of religious doctrine and practice, the Sunnīs add Ijmāʿ, the universal consent which is held to justify practices or beliefs, although they are not warranted by the Qur'ān or tradition, and may be inconsistent with the apparent teaching of one or both of these. These beliefs and practices, which had often come from the pre-Islamic customs of those who had become believers, seemed to have escaped notice

until the Abbasid period. They were too deeply rooted in the lives of men to be abolished. It became necessary either to find a tradition to abrogate the earlier forbidding one, or to acknowledge that ijmā' is higher than the tradition. The former expedient was resorted to by some later theologians (*e.g.*, Nawāwī) by a fiction that such a tradition existed though it was not found now in writing. But in earlier times some (as Ibn Qutayba) had adopted the latter alternative, saying that the truth can be derived much earlier from the *ijmā'* than from the tradition, because it is not open to the same chances of corruption in its transmission as the latter. Tradition itself was found to confirm this view, for the Prophet is related to have said, "My people does not agree to an error."

But *ijmā'* itself has been used in different senses: (i.) the *ijmā'* of Medina was used to indicate the authority coming from the practices of the people of Medina (*see* below). (ii.) The *ijmā'* of the whole community of Muslims is that most commonly recognized. It was used to support fealty to the Abbasid dynasty. By it the six books of tradition mentioned above are recognized as authoritative, and it is the justification of the conception of Muḥammad as superhuman. (iii.) Some of the more thoughtful theologians recognize only the *ijmā'* of the doctors or the teachers of Islam (the mujtahidūn), these being restricted by the orthodox to the first few generations after Muhammad, while the Shi'ites allow the existence of such up to the present time.

The fourth basis of Islam, according to the Sunnīs, is *qiyās, i.e.,* analogy. It is that process by which a belief or practice is justified on the ground of something similar but not identical in the Qur'ān, the tradition, or ijmā'. Originally it seems to have been instituted as a check upon the use of private opinion (*ra'y*) in the teaching of doctrine. The extent to which it may be used is a subject of much discussion among theologians. Some would apply it only to a "material similarity," others to similarity of motive or cause as well.

By the ninth century there were established in the Sunnī world the four schools of law, which exist to the present day—Hanafī, Mālikī, Shāfi'ī and Hanbalī—(for these and the wide extension of the concept of law in Islam, *see* Islamic Law). They assiduously cultivated the various branches of Muslim theology and law, and the students they trained became the *'ulamā* (or, learned), who have filled such an important place in the history of Sunnī countries. In former times the colleges of Damascus, Baghdad, Nishapur, Bukhara, Cairo, Qayrawan, Seville, Cordova, were thronged by thousands of students; and the Azhar university in Cairo still preserves some of the characteristics of these earlier seats of learning. From their ranks were chosen the *qāḍīs* (judges), the *muftīs* (the authoritative exponents of the sacred law), and in countries like Turkey, in which they enjoyed the confidence of the government, they occupied numerous other official positions, and acquired wealth and power. The 'ulamā have constituted the only equivalent in the Muslim world to the priesthood in Christendom, and have been active in the defence of orthodoxy and in resisting foreign influences. The Turkish republic has deprived them of most of their power, and in countries under European control their influence has greatly declined. Among the Sunnīs the various orders of Dervishes (*q.v.*) have achieved a vast expansion.

The foundations of Sunnī theology for succeeding generations were laid in the 10th century by Abu'l-Ḥasan al-Ash'arī (*see* Ash'ari); he was for 40 years a Mu'tazilite, then became orthodox, and at once applied rational methods for the support and interpretation of the orthodox faith. Before him, reason had not been allowed any scope in orthodox theology. He was not the first to use it; some teachers (as al-Junayd) had employed it in teaching, but only in secret and for the few. The methods of scholastic philosophy were now introduced into Muslim theology. The chief characteristic of his religious teaching was the adoption of the *via media* between materialistic grossness and the ideas of pure speculative philosophy. Thus he taught, as to the attributes of God, that they exist, but are not to be compared with human attributes; as to His visibility, that He can be seen but without the limitations of human sight. As to the great question of free will, he denied man's power but asserted his responsibility. So he passed in review the doctrines of God, faith, the Qur'ān, sin, intercession, etc., and for the first time in the history of Islam produced a systematic theology. The teaching of Ash'arī was taken up and propagated by the Buwayhids soon after his death, and was developed and perfected by Abū Bakr al-Bāqilānī, the Cadi, (*d.* 1012), but up to the middle of the 5th century of Islam (*c.* A.D. 1058) was suspected elsewhere and confounded with Mu'tazilism. The Ash'arīte al-Juwayni (known as Imām al-Ḥaramayn) was persecuted under Toghrul Beg (*c.* 1053) and exiled, but was restored under Alp Arslān by the vizier Nizām al-Mulk, who founded an Ash'arite college (the Nizāmiyya). In the West, Ibn Ḥazm (*q.v.*) fiercely opposed the system, but Ghazālī established its orthodoxy in the East, and it spread from Persia to Syria and Egypt under the Ayyūbids and Mamluks and thence to the Almohades in Africa under Ibn Tūmart (1130). It remains the predominating influence to the present day, its only serious rival being the theological system of al-Māturīdī, a Hanifite (*d.* 945), whose creed as represented in that of an-Nasafī is still used largely by the Turks. Since the 12th century no great theological movement has been made in Islam. The quiet of religious life has thrice been broken by Wahhābism (*q.v.*) in Arabia, by Bābism (*q.v.*) in Persia, and by the Aḥmadiyyah (*see* below) in India.

Shi'ites.—Historically the next most important group, but at the present time shrunk in numbers to about 12 millions only, is that of the Shi'ites (Shī'ah, *i.e.,* "the party of 'Alī"). They regard 'Alī and his descendants as the only rightful Caliphs. For them the Caliphate was a God-given office, and not one to be given by human appointment. Belief in this was an ordinance of God, an article of the faith. He who did not accept it as such was an unbeliever. Moreover, the party consisted largely of Persians who on their conversion to Islam brought with them many of the doctrines of their old faith, religious and political. Among these was the belief in the divinity of the sovereign and the duty of worshipping him. Gnostic elements, which may have come from the old religion of Babylonia, were also introduced. The idea of an absolute personal and hereditary monarchy was thus developed among the subjects of 'Alī. But in Islam there is no separation between politics and theology. The theological position of the Shi'ites was that the superhuman power of Muḥammad descended to the members of his house ('Alī and his children), so that they could interpret the will of God and tell future events.

The Shi'ites quite early broke up into a number of sects, several of which no longer exist. The most important at the present day is that of the Twelvers (the Ithnā'ashariyya) so called because they accept as Imāms twelve of the descendants of 'Alī. The 12th Imām, Muḥammad, is said to have disappeared about 874, but to be still living, and he will return in the last days to establish the Shiah faith in the world. This has been the official creed of Persia since the beginning of the 16th century, and that of most of the Shi'ites of India. The Ismā'īlīs or Severners are the followers of Ismā'īl, whom they regard as the 7th Imām, rather than his younger brother, Mūsā (797), who is accepted by the Twelvers. To the Ismā'īlīs belong the Carmathians (*q.v.*), the Fatimites (*q.v.*), the Assassins (*q.v.*) and the Druses (*q.v.*). The Zaydites are the followers of Zayd, a grandson of Ḥusayn, and are the most moderate of the Shi'ites, for though holding that the imamate belongs only to the descendants of 'Alī by Fātima, and that any of these might be Imām (even though two or three should be in existence at the same time), they allow that circumstances might justify the appointment of another caliph for the time. Thus they acknowledge the imamate of Abū Bakr, and 'Umar, though 'Alī was more entitled to the office. One branch of the Zaydites, arising in the Yemen about 893, has remained there until the present day.

The Shi'ites differ from the Sunnites not only in their political theory of the caliphate, but in matters of law and ceremonial. They reject all the Sunnite books of Hadīth or tradition, but have collections of traditions of their own, and claim to follow the Sunna, or way, of the Prophet, even as the Sunnīs do. An allegorical and mystical interpretation reconciles the words of the Qur'ān with the inordinate respect paid to 'Alī; the Sunnite doctrine of

the uncreated Qur'ān is denied. To the creed "There is no god but God; Muḥammad is the apostle of God" they add "and 'Alī is the vice-regent of God" (*walī*, properly "confidant"). There are some modifications in detail as to the four main religious duties of Islam—the prescriptions of ritual purity, in particular, being made the main duty of the faithful. The prayers are almost exactly the same, but to take part in public worship is not obligatory, as there is at present no legitimate imām whose authority can direct the prayer of the congregation. Pilgrimage to Mecca may be performed by a hired substitute, or its place can be taken by a visit to the tombs of Shi'ite saints, *e.g.*, that of 'Alī at Najaf, of Ḥusayn at Karbata, of Rizā at Mashhad, or of the "unstained Fātima" at Qum (daughter of Mūsā, the 7th Imām). The Shi'ites are much the most zealous of Muslims in the worship of saints (real or supposed descendants of 'Alī) and in pilgrimages to their graves, and they have a characteristic eagerness to be buried in those holy places. They celebrate many religious feasts. Of these the great sacrificial feast (*'īd-i-Qurbān;* Turkish *Qurbān Bairām*) is also Sunnite; the first ten days of the month Muḥarram are dedicated to the mourning for the death of Ḥusayn at Karbalā which is celebrated by passion-plays (*ta'zīya*), while the universal joy of the Nawrūz, or the new year of the old Persian calendar, receives a Muslim sanction by the tradition that on this day the prophet conferred the caliphate on 'Alī. Shi'ite law permits temporary marriages (mut'a), provided that a dower is specified, and that a period—a year, a month or a day—is fixed. Another special doctrine is that it is lawful for a man in case of danger or persecution to deny his faith (*taqiyya*, "caution"), and pass himself off as a Sunnī. The best accounts of Shi'ism are in E. G. Browne, *History of Persian Literature in Modern Times*, index *s.v.* Shī'a (1924), and I. Goldzīher, *Vorlesungen über den Islam*, 196 *sqq.* (1925).

The Khawarij, the third sect (originating like the other two in disputes over the caliphate), added to their political doctrine that this office was open to any believer whom the faithful might consider fitted for it, even though he be a black slave; certain theological doctrines on the subject of sin, *e.g.*, they regarded any one who had committed one of the greater sins as no longer a believer, and they rejected the doctrine of justification by faith without works. Under the Umayyads they were a source of trouble to the government through their constant risings, but under the Abbasīds they became restricted to Eastern Arabia, and only a few of them now survive there and in North Africa.

Apart from these three important groups which had their origin in primitive times and exist to the present day, there has been in Islam an immense activity in theological speculation, resulting in the formation of many sects, the majority of which have now ceased to exist. The first impulse to these speculations appears to have come from contact with Christian theologians in Damascus during the Umayyad Caliphate. Two sects arose under these influences—that of the Murjiites and that of the Qadarites. The Murjiites ("postponers") were so called because they postponed the judgment of human actions until the Day of Judgment. In politics they accepted the Umayyads as *de facto* rulers, since they were Muslims, and left the judgment of their actions to God. As theologians they taught that religion consists in belief (*īmān*) in the unity of God and in His apostle, and in that alone, consequently no one who held this faith would perish eternally, though he had been a sinner. This was opposed to the Khārijite doctrine that the unrepentant sinner would perish eternally, even though he had professed Islam.

The Qadarites were concerned with the doctrine of predestination and free-will. So long as Muslims were fighting the battles of Islam they naturally paid most attention to those revelations which laid stress on the absolute determination of a man's destiny by God. They fought with great bravery because they believed that God had fore-ordained their death or life and they could not escape His will. In the quieter realm of town and court life and in their disputations with Christians they were called upon to reconcile this belief with the appeals made in the Qur'ān to man's own self-determination to good, to courage, etc. The Qadarites declared that man had power over his own actions. But the teaching of predestination had gained too great a hold on Muslims to be thus displaced. The teaching of the Qadarites was held to be heresy, and one of its first professors, Ma'bad al-Juhānī, was put to death in 699.

Many of the Qadarites were also Mu'tazilites, whose founder was Wāsil ibn 'Atā, who separated himself (whence his followers were called Mu'tazilites, "Separatists") from his teacher Ḥasan al-Baṣrī, and founded a school which became numerous and influential. The Mu'tazilites objected to the attributes of God being considered in any way as entities beside God; they explained away the anthropomorphisms used in speaking of the Deity; they regarded the Qur'ān as created and as a product of Muḥammad writing under the divine influence. Briefly, they asserted the supremacy of reason (*'aql*) as distinct from faith received by tradition (*naql*). They also called themselves "the people of justice and unity" (*Ahl al-'adl wat-tauḥīd*). Such a faith as this naturally found favour rather with the thinking classes than with the uneducated multitude, and so went through many vicissitudes. At the time of its appearance and until the reign of Ma'mūn its adherents were persecuted as heretics. After discussions among the theologians Ma'mūn took the decided step of proclaiming that the Qur'ān was created, and that a belief in this dogma was necessary. Mu'tazilites were appointed to official posts, and an inquisition (*miḥna*) was appointed to enforce belief in their doctrine. This movement was strongly opposed by the orthodox and especially by Aḥmad ibn Ḥanbal (*q.v.*). By him the founding of theology on reason was rejected, and he suffered persecution for his faith. *See* W. N. Patton, *Ahmed ibn Hanbal and the Mihna*, (Leyden, 1897). Mu'tazilism retained its sway until 849, when the caliph Mutawakkil again declared the Qur'ān uncreate and restored orthodoxy.

According to an early tradition Muḥammad said that Islam would be divided into 73 sects, of which 72 would perish and one would be saved. The Arabic writers on the heretical sects of Islam feel compelled therefore to restrict their number to 72, but as they adopt diverse classifications the number of sects they describe amounts to some hundreds. The fullest accounts available in translation are given by Shāhrastānī, *Religionpartheien und Philosophenschulen*, übersetzt von Th. Haarbrucker (1851), and by 'Abd al-Qāhir al-Baghdādī, *Moslem Schisms and Sects*, trans. by K. C. Seelye (1920).

RECENT DEVELOPMENTS

In modern times the most important sectarian developments have been those of the Wahhābīs (*q.v.*), the Bābīs (*q.v.*), and the Aḥmadiyya. The last of these movements was started by Mīrzā Ghulām Aḥmad, who, in 1879, began to preach in the village of Qadian in the province of the Punjab, India. He claimed to be not only the promised Mahdi but also the promised Messiah—personages generally held to be distinct in ordinary Muslim theology. Another modification he introduced into Islamic doctrine had reference to the death of Jesus; the commonly-accepted belief maintains that Jesus was taken by God alive into heaven, while a phantom was crucified in his place; in opposition to this he declared that Jesus was actually crucified, but was taken down from the cross while still alive by his disciples, was healed of his wounds and afterwards made his way into Kashmir, where he finally died, his tomb being still in existence in the city of Srīnagar. Having thus removed the ground for any expectation of the second coming of Jesus from heaven to earth, he explained that he himself was the Messiah, not as being an incarnation of Jesus (for he rejected the doctrine of transmigration), but as having come in the likeness of Jesus—being Jesus for this generation just as John the Baptist was Elijah, because he came in the spirit and power of Elijah.

In proof that he had come in the spirit and power of Jesus, Mīrzā Ghulām Aḥmad adduced the likeness of his own character and personality to that of Jesus, his gentleness of spirit, the peaceful character of his teaching, his miracles and the appropriateness of his teaching to the need of the age. In harmony with this pacific claim, he expounded the doctrine of Jihād (usually interpreted as meaning war against unbelievers) as a striving after

righteousness. Mīrzā Ghulām Aḥmad died in 1908, and a few years after his death his followers split into two parties, one having its headquarters in Qadian and the other in Lahore. Both these sections of the community succeeded in enlisting the services of devoted, self-sacrificing men, who are unceasingly active as propagandists, controversialists and pamphleteers. They control an extensive missionary activity, not only in India, West Africa, Mauritius and Java (where their efforts are mainly directed towards persuading their co-religionists to join the Aḥmadiyya sect), but also in Berlin, Chicago and London. Their missionaries have devoted special efforts to winning European converts and have achieved a considerable measure of success. In their literature they give such a presentation of Islam as they consider calculated to attract persons who have received an education on modern lines, and thus not only attract non-Muslims, and rebut the attacks made on Islam by Christian controversialists, but win back to the faith Muslims who have come under agnostic or rationalist influences.

Apart from these organized movements, there has been considerable theological activity in the Muslim world in recent years. This has especially expressed itself in apologetic literature, which endeavours to present Islam in a form acceptable to the present generation and to discard those special features which have exposed it to hostile criticism; thus polygamy, slavery and intolerance are declared to receive no sanction from the Qur'ān, as rightly interpreted; in Islam the reconciliation of religion and science is effected, and the demands of the modern spirit of enlightenment are satisfied. Of such modernist literature there has been a considerable output, especially in Egypt and India; it naturally appeals most to those readers who have come under European influences, and excites considerable opposition among more conservative orthodox circles, who remain loyal to the traditional schools of thought (as enumerated above) and resent the rejection of traditional, mediaeval theology by the modern thinkers. The older sects continue to flourish, and the new thought has not yet attempted to organize itself on sectarian lines and has thus remained largely a matter of individual opinion.

This lack of sectarian development is possibly in great measure due to the absorbing attraction that political problems during recent years have exercised upon the Muhammadan world. Anxiety as to the fate of Turkey after the Armistice, the withdrawal of the Holy Cities from the control of the Caliph and the occupation of Jerusalem by unbelievers, the separation of the Sultanate from the Caliphate (in 1922), and the abolition of the Caliphate altogether (in 1924) were circumstances that profoundly stirred the minds of pious Muslims all the world over and did not create an atmosphere favourable to the calm consideration of purely dogmatic problems. Moreover, in many Muhammadan countries some form of nationalism obscured the larger vision of a united Islamic world; in Turkey it took the extreme form of Pan-Turanianism, or Pan-Turkism, which aimed at the union of all sections of the Turkish race in one vast confederacy and sought to purge the national life from all foreign admixture, in language, literature and political institutions; in India nationalist feeling prompted the Hindu-Muslim entente and gave birth to the oft-repeated sentiment, "I am an Indian first, and a Muslim afterwards"; among the Muhammadan populations of Russia the formation of Soviet Socialist republics has evoked nationalistic movements which have temporarily thrust purely religious interests into the background; Bolshevik propaganda has also met with a response among the Muslims of Java.

But Islam is so closely bound up with every aspect of the life of a Muslim people that even a purely nationalist political movement may react strongly on the religious life. This has been notably the case in Turkey, where the Government, besides abolishing the Caliphate, has confiscated the religious endowments and suppressed the religious orders; polygamy has practically been made illegal; the date of Ramaḍān has been fixed in accordance with astronomical science instead of being made dependent on reports that the moon has been seen (as has been the immemorial custom in the Islamic world); and the discontinuance of the wearing of the veil by women and the adoption of hats by men, are typical of a changed attitude towards the established usages of Muhammadan society. The breach with the past has been nowhere so violent as in Turkey, but throughout the whole Islamic world there are indications of a changed attitude towards religious questions. The old orthodoxy still holds the allegiance of the masses, as well as many of the educated, but others, especially those whose education has brought them under European influences, are seeking a re-statement of their religion, more in harmony with their general outlook upon life. To those that seek a solution in the realization of some nationalist ideal, there remains little save a sentimental attachment to Islam, while they deprive it of any control over law and social organization; the reformers, on the other hand, claim for the precepts of Islam control over all the relations of human life, but seek to restore it to its primitive simplicity, believing that thus it can be brought into harmony with modern thought and modern conditions.

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ISLAMABAD, a town of India in the state of Kashmir, on the north bank of the Jhelum. Pop. (1921) 9,464. It is the second town in the Kashmir valley, and was originally the capital of the valley, but is now decaying. It contains an old summer palace, overshadowed by plane trees, with numerous springs, and a fine mosque and shrine. Below the town is a reservoir containing a spring of clear water called the *Anant Nag,* slightly sulphurous, from which volumes of gas continually arise; the water swarms with sacred fish.

ISLAMIC INSTITUTIONS. Of all the institutions of Islam the caliphate is the oldest, the most fundamental, and in essence the most enduring. For its history *see* CALIPHATE; the present subject is its origin and nature. Muḥammad ruled over his people as a divinely inspired and guided prophet. He led the public prayers; he acted as judge; he controlled the army. On his death a leader was put in his place of similar authority, though without the divine prophetic guidance. He was called the "successor" (*khalīfah,* caliph) of the Prophet, later also the *amīr-al-mu'minīn,* commander of the faithful, and was elected by the Muslims, just as the Arab tribes had always elected their chiefs. He was thus an absolute ruler, but was democratically elected. For the Sunnites it has been a matter of agreement (*see* ISLAMIC LAW) from the earliest times that the Muslim community must appoint such a leader (*see* IMĀM). The Shī'ites, on the other hand, hold that the appointment lies with God, and that God always has appointed, though his appointment may not always have been known and accepted. Their position may be called a legitimist one. Some few heretical sects have held that the necessity of a leader was based on reason, not on the agreement of the community. But, for all, the rule of the leader thus appointed is absolute, and all authority is delegated from him and, in theory, can be resumed by him at any time.

But Abū Bakr, the first caliph, nominated his successor, 'Umar, and that nomination was accepted and confirmed by the people. So a second precedent was fixed, which was again carried a step farther, when Mu'āwiyah I., the first Umayyad caliph, nominated his son, Yazīd I., as his successor, and caused an oath of allegiance

to be taken to him. The hereditary principle was thus introduced, though some relics of the form of election persisted. The Ottoman claim was based on an asserted nomination by the last 'Abbāsid, who died in exile in Egypt in 1538, of the Ottoman sultan, Salīm I., as his successor. Such a nomination in itself was a perfectly legal act, but in this case had a fatal flaw. It was an absolute condition, laid down in tradition, that the caliph must be of the tribe of Quraish, that of the Prophet.

The duties of the caliph were to enforce legal decisions and maintain the divinely revealed ordinances; guard the frontiers and equip armies; receive the alms; put down highwaymen; maintain the Friday services and the festivals; decide disputes and receive evidence bearing on legal claims; marry minors, male and female, who have no guardians; divide booty. He had to be a free. male, adult Muslim; have administrative ability; be an effective governor and do justice to the wronged. So long as he fulfilled these conditions he was to be absolutely obeyed. The caliph, therefore, was the highest executive officer of a system assumed to be definite and fixed. To depose him a *fatwā* (*see* MUFTI) would be required—in Turkey from the Shaykh-ul-Islām—that he had violated some essential of the Muslim faith, and no longer fulfilled the conditions of a caliph.

The Diwans.—But it was impossible for the caliph personally to administer the affairs of the empire, and by degrees government bureaus (*dīwāns; see* DIVAN) were created to regulate and administer the system of taxation and the revenues of the state. The sources of revenue were (i.) the poor-rate (*zakāt*), a tithe paid by every Muslim; (ii.) the fifth of all booty; (iii.) the poll-tax (*jizya*) on non-Muslims; and (iv.) the land-tax (*kharāj*) also on non-Muslims. The non-Muslims must retain their lands, cultivate them and pay the land-tax and the poll-tax and give contributions in kind to support the local Muslim garrisons which were massed in great camp-cities at strategic points. The first patriarchal period of conquest, unearned wealth and the simple life passed rapidly into the genuinely Arab empire of the Umayyads, with whom came an immediate development of organization in the state. The seclusion of the caliph in Umayyad times increased still further when the administration of the state passed by delegation into other hands, and the caliph himself became a sacrosanct figurehead, as in the case of the later 'Abbāsids; when theories of semi-divine nature and of theocratic rule appeared, as in the case of the Fatimites; and finally when all the elaborate court ritual of Byzantium was inherited by the Ottoman sultans.

Under the 'Abbāsids the semi-independent provinces became fully independent, or at most acknowledged the caliph as a spiritual head and paid a nominal tribute. His name might stand on the coinage and prayers be offered for him in the Friday service, the two signs of sovereignty to this day in Islam. With this crumbling of the empire went a more elaborate organization; bureaus took the place of principles and of the energy of individual rulers.

The Vizierate.—Abu 'l-Abbās, the first 'Abbāsid caliph, was the first to appoint a vizier (*wazīr,* "helper," so Aaron is *wazīr* to Moses in the Qur'ān), a confidential minister to advise him and come between him and the people. The vizier sometimes became as important as the caliph, for with a weak ruler his vizier became absolute, with a strong ruler his vizier remained subordinate. Until the time of Rāḍī (934–940) the vizierate thus fluctuated in importance. In that caliphate the vizier lost all authority, and in his place came the *amīr al-umarā*—equivalent to the *major domus* of the Franks—the head of the Turkish bodyguard, in terror of whom the caliph now stood. When in 945 the Būyids captured Baghdad and the caliph became a purely spiritual sovereign, they took the title "vizier" for their own chief minister, and the caliphs retained only a secretary. Under the Seljuks, however, they regained their viziers and some real authority.

Under the early 'Abbāsids the four most important ministers were the chief cadi, the chief of police or head of the life guards, the minister of finance and the postmaster, who was the head of the system of information and espionage which covered the empire. But at different times the different bureaux varied greatly. Under Mutawakkil we find the bureau of taxes and finance; bureau of the crown estates; bureau of state book-keeping; bureau of war, *i.e.* of hired troops; bureau which kept reckoning and control of the pensions of the clients and slaves of the ruling family; bureau of the post system; bureau of expenditures.

As the chief of police, mentioned above, was rather the head of the caliph's bodyguard, there was also a police system after our ideas, but more thoroughgoing. The *muḥtasib* had charge in the broadest sense of public order and morals in the streets, and had oversight as to weights, measures and adulterations; but had no right to interfere privately or enter houses save in the clearest and most necessary cases. He had a summary jurisdiction in all minor cases where no trial was necessary; but where witnesses and oaths entered the case must go to the cadi. Slaves and beasts of burden were under his guardianship: he prevented public scandals, such as the sale of wine; he regulated the public conduct of Jews and Christians. In the interest of public morals he had to find suitable husbands for widows and see that they did not marry before the legal time; questions of paternity also he had to investigate.

It is impossible in Islam to separate logically from the mass of institutions those which we should call religious, as Islam on all sides is for the Muslim equally religious. But perhaps the following may practically be separated under that rubric. Islam, runs a tradition, is built on five things: testimony that there is no god save Allah, and that Muḥammad is the apostle of Allah; prayer; the poor-rate; pilgrimage; fasting. For these *see* ISLAM.

The law and usage of religious foundations in perpetuity (*waqf,* mortmain) became as important in Islam as monastic endowments in mediaeval Europe, and such foundations tended similarly to absorb the greater part of the national wealth. A pious foundation could be erected in such a way that either so much from its funds would be paid yearly in perpetuity to the descendants of the erector, or those descendants would be employed as officials of the foundation.

The Imam.—When it became impossible for the caliph to lead the people personally in prayer in the mosque, he delegated that part of his duties to another, hence called imām (*q.v.*). Naturally, then, the appointment of the imām would lie with the supreme ruler. This holds of the daily prayers in the principal mosque (*al-masjid al-jāmi'*) supported by the ruler where the Friday service is held, but in the separate smaller mosques built by each community the community chooses its own imām. The imām appoints the *muadhdhin,* the announcer of the hour of prayer from the minaret, and both have a claim on the state treasury.

Another office exercised when possible by the caliph, but very frequently delegated to some high dignitary, such as the heir to the caliphate or a prince, was the leadership of the pilgrimage caravan to Mecca and back. Sometimes this official, called *amīr-al-ḥajj,* was appointed imām as well. He then led all the pilgrimage ceremonies at Mecca.

The Cadi.—Islamic law (*q.v.*) is treated separately. Here, again, as judging is a duty of the caliph, a cadi is the delegate, or, when appointed by a vizier or governor, a delegate of his delegate. He examines into disputes brought before him and enforces his judgments, he names administrators of the estates of minors, the insane, etc.; he supervises the *waqf* property of mosques and schools in his district and inspects highways and public buildings; he watches over the execution of wills; he inflicts the due legal penalties for apostasy, neglect of religious duties, refusal to pay taxes, theft, adultery, outrages, murder; he can inflict the penalties of imprisonment, fine, corporal punishment, death; if there is no imām, he can perform his duty, as in fact can anyone who has the requisite knowledge.

The Army.—For the existence of an army in Islam, there are two grounds, the holy war (*jihād, q.v.*) against unbelievers without the state and the suppression of rebellion within. Under Umar, every able-bodied male Muslim was theoretically a fighting man, part of the national militia. This army was divided into corps situated in the conquered lands, as armies of occupation, where they eventually came to form military colonies in great camp-cities. The occupied countries had to support them, and they were bound to render military service at any time. But as the ideal of Umar broke down before facts the use of mercenary

and slave troops finally increased; although there has always continued in Muslim armies acting against unbelievers a proportion of volunteers not paid a fixed wage but subsidized by the state from the poor-rate and alms funds. The generals were appointed by the caliph, and had either unlimited authority to act as his representatives, concluding peace, acting as cadi and imām, distributing booty; or were restricted within limits, *e.g.* to simple leading of the troops and carrying on military operations. As war by a Muslim power is essentially sacred war, the regulations of *jihād* must be considered here. Unbelievers must first be invited to embrace Islam and, if they follow a sacred book and are not idol-worshippers, are given a choice between (*a*) becoming Muslims; or (*b*) submitting to the Muslims and entering on a treaty with them of protection and tribute; or (*c*) fighting. If they accept Islam, their lives, families and property are secure, and they form henceforth part of the Muslim community. If they submit and enter on treaty relations, they pay a poll-tax, for which their personal safety is assured, and assume a definitely inferior status, having no technical citizenship in the state, only the condition of protected clients (*dhimmīs*). If they elect to fight, the door of repentance is open, even when the armies are face to face. But after defeat their lives are forfeit, their families are liable to slavery, and all their goods to seizure. Apostates must be put to death. Four-fifths of the booty after a battle goes to the conquering army.

Education.—The glory of Muslim education was its university system, which fed the higher learning and did not serve every-day needs. Its primary system was very poor, almost non-existent; and technical education has never been recognized in Islam. Primary teachers were despised as ignorant and foolish. Their pupils were the young only; they taught the rudiments of reading, Qur'ān, catechism, prayer, writing and arithmetic, but very little of the latter. Technical education was given by the gilds through their apprentice system, teaching mechanical arts and crafts. All Muslim university education, like all Muslim science, revolved round theology. There were, apparently, only two outstanding exceptions to this rule, the academy of Ma'mūn (813–833) at Baghdad, and the hall of wisdom of the Fatimites at Cairo (1004–1171); both of these are explained by their environment. From the earliest times, independent scholars instructed classes in mosques —the common places of meeting for the community—and gave their pupils personal certificates. Their subjects were the reading and interpretation of the Qur'ān; the body of traditions from the Prophet; the thence deduced system of theology; the canon law. But the interpretation of the Qur'ān involved grammatical and lexicographical studies of early Arabic, and hence of the early Arabic literature. Theology came to involve metaphysical and logical studies. Canon law required arithmetic and mensuration, practical astronomy, etc. But these last were strictly ancillary; the object of the instruction was primarily to give knowledge of value for the life of the next world, and, secondarily, to turn out theologians and lawyers. Medicine was in Jewish and Christian hands; engineering, architecture, etc., with their mathematical bases, were crafts. Gradually, educational institutions came to be equipped with scholarships of money or in kind for the students. The first instance of this is generally ascribed to Nishapur (Naisābūr) in 1066; but it soon became general in the system and afforded a means of control and centralization. A final, and most important, characteristic was the wide journeying of the students "in search of knowledge." Scholars thus kept in touch with one another all over the Muslim world, and intellectual unity was maintained.

The Sayyids.—To the democratic equality of Islam, in which the slave of to-day may be the prime minister of to-morrow, there is one outstanding exception. The descendants of the Prophet and of his relatives (the family of Hāshim) formed and form a special class, held in social reverence, and guarded from contamination and injury. These are the *sayyids* (lords), and genealogical registers of them are carefully preserved. They are of all degrees of wealth and poverty, but are guarded legally from *mésalliances* with persons of ignoble origin or equivocal occupation. Their influence is very great, and in some parts of the Muslim world they enjoy the standing and reverence of saints.

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ISLAMIC LAW. Law (*Sharī'ah*) in Islam has a wider application than any western secular law, since it claims to regulate all the aspects of life—duty to God, to one's neighbour, to one's self. It is really a system of duties, ethical, legal, religious, and governs not only the private life of the pious Muslim, but also fixes the laws of marriage, divorce and inheritance, as well as the criminal law. Its historical development began with Muḥammad sitting as judge in Medina; his decisions followed, at one time, the usages of the Arab and Jewish tribes of Medina; at another, his own personal judgment. At his death he left behind the legislative enactments embodied in the Qur'ān, and the memory of his legal decisions. These were collected among the traditions (*ḥadīth*), which recorded his sayings and doings, manners and customs, and his answers to questions on religious life and faith, and his decisions in legal disputes.

The first collecting of traditions was for private purposes, and the first publication dealing with them was legal, viz. the *Muwaṭṭa'* of Malik ibn Anas (d. 795), a *corpus juris* based partly on traditions. Thereafter came collections of two different types, the earlier, arranged according to the companions of Muḥammad, on whose authority the traditions were transmitted, *e.g.*, the *Musnad* of Aḥmad ibn Ḥanbal; the other, called *Muṣannaf* (classified), containing traditions arranged in chapters according to their subject matter. That of Bukhārī is the most famous, and is arranged to give a traditional basis for a complete system of canon law; another is that of Muslim ibn al-Ḥajjāj, who paid less attention to legal aspects and more to minute accuracy.

Another element which came into the development was Roman law, which the Muslim jurist found at work in the conquered Roman provinces and in law courts. Many principles of Muslim law can be traced to the Roman codes, and it was plainly influenced by the liberty involved in the *Responsa prudentium* of Roman lawyers, and by the broad conception of the law of nature in the Edict of the Praetor.

During the Umayyad dynasty, the public life of the state was no longer so religious as it had been while Medina was still the capital, and though law was still needed, it had to be opportunist. Its development went on, but became speculative. The study of tradition was now private, and its students were more and more the personally pious, no longer living in contact with reality; they regarded any system of government which did not simply reproduce the patriarchal form of Medina, as a thing with which no religious man could have aught to do.

The rise of the 'Abbāsids brought a change, in that they had promised a return to the old religious attitudes. But in substance they were much as the Umayyads, and though the state was outwardly on a pious footing, and the religious sentiment of the people was respected, the old, absolute religious law was not restored. It was made possible for more theologians and lawyers to work with the state, but an irreconcilable party still remained, and the situation was fixed as it is to this day.

Yet the 'Abbāsids did, in their way, encourage legal studies, and under them processes and results, long pursued in private, became public. Almost within the first century of their dynasty the four legal schools, or rites, were formed and the principles established which survive to this day.

ISLAMIC LAW SCHOOLS

The first school to take definite form was the Hanifite, founded by Abū Ḥanīfa (d. 767), who left behind him a definite system. He used few traditions, and preferred to go back to the Qur'ān, and extract from it by reasoning the rulings which fitted his ideas. The 'Abbāsids adopted his school, and the Ottoman Turks also later, and it may be said to hold now a leadership among the four legal rites.

Mālik ibn Anas, the founder of the Mālikite school, used traditions much more generally than did Abū Ḥanīfa, but two of his principles marked a distinct advance and showed that he was no mere traditionalist. For one, he laid down the conception of public advantage (*istiṣlāḥ*); when a rule founded on even a valid analogy would work a general injury, it was to be set aside; justice must not be overcome by logic. And, for the other, he laid stress on the conception of the agreement (*ijmā'*), an idea which was to have indefinite importance in the future. When the surviving companions of the Prophet, after his death, agreed upon any point as belonging to their store of tradition and experience, their agreement was accepted as final.

The third school was founded by ash-Shāfi'ī (d. 820), who laid great stress on tradition, but gave to the principle of agreement (*ijmā'*) its full rights. The agreement of the Muslim peoples was to be the voice of God. "My people," said a tradition from Muḥammad, "will never agree in an error." So, over traditions and over the Qur'ān itself, the agreement tacitly or explicitly ruled and rules. It stamps as authoritative that which the other principles lay down. He also emphasized the principle of analogy (qiyās).

The four bases thus laid down by ash-Shāfi'ī—Qur'ān; traditions; analogy; agreement—have come to be accepted by all existing schools. This applies to all spheres of life, ethical, social, theological, legal, and it should never be forgotten that the Qur'ān is only one of the sources for Muslim faith and conduct.

The fourth, the Ḥanbalite school, was founded by the scholars of Aḥmad ibn Ḥanbal after his death in 885. It minimizes agreement and analogy, is literal in its interpretations, and is now by far the smallest of the four surviving schools.

All these schools of law administer a scheme of duties, law which for centuries has had only a partial connection with the real legal systems of the Muslim peoples. Among the Wahhābis and Ibāḍites alone is it the whole of law. Elsewhere, since the Umayyad period, its courts have been in great part pushed aside by others, and its scheme has come to be regarded as an expression of impossible theory, to be realized, at best, with the coming of the millennium.

For as Islam spread, it came to regions, climates, customs, where the Arabian usages no longer held. Not only were the prescripts of Medina ill adapted to the new conditions; the new people had legal usages of their own to which they clung and which nothing could make them abandon. So, as in religion the faiths of the conquered peoples were thinly veneered with Muslim phrases, in law there grew up a customary code (*'ādāt*) for each country, differing from every other, which often completely obscured and annulled the prescriptions of the *sharī'ah*. The one was an ideal system, studied and praised by the pious learned; the other was the actual working of law in the courts.

There also arose a new and specific statute law, emanating from the sovereign, and sometimes codified as in the Turkish statute law (*qawānīn*) derived from various European codes. Thus there has grown up in almost every Muslim country at least two systems of courts, the one administering the sharī'ah, and taking cognisance of private and family affairs, such as marriage, divorce, inheritance, its officials also giving rulings on purely personal religious questions, such as details of the ritual law, the law of oaths and vows, etc.; the other, the true law courts of the land, administering codes based on local custom and the decrees of the local rulers.

A rift almost as important entered the legal life of the Muslim lands on another side. Non-Muslim communities, settled in Muslim territory, have been uniformly permitted to administer and judge themselves according to their own customs and laws. Accordingly, to various ecclesiastical organizations, Christian and Jewish, was given over the administration of these non-Muslim sections of the community, their bishops and rabbis becoming their responsible heads and the links of contact with the Muslim rulers.

In accordance with the same principle, the European merchant, living and trading in the East, was put first by usage and finally by treaty under the jurisdiction and control of his own consul. Thus there grew up the extra-territorial law of the capitulations and conventions, by which the sanctity of the person and household of an ambassador is extended to every European.

There may be said, then, in short, to be three elements in the legal life of a Muslim state: the *sharī'ah*, the sacred and fixed law of Islam; the civil law, based on the usages of the different peoples, Muslim and non-Muslim, and on statutes going back to the will of rulers; the international law of the capitulations, with a contractual sanction of its own.

In modern times, frequent demands have been made by liberal Muslim thinkers that the principle of agreement (*ijmā'*) should be so extended as to render possible changes in the *sharī'ah*, so as to bring it into harmony with modern conditions; but the orthodox legists have steadily resisted any such change. In 1926, the Turkish Republic solved the problem by adopting the Swiss Civil Code and the Italian Penal Code, thereby abolishing the sacred law of Islam altogether.

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ISLAMISM: *see* PAN-ISLAMISM.

ISLAND, a piece of land surrounded by water (O.E. *ieg*=isle +land). The words "island," "isle" are sometimes used for a piece of land isolated during high tide or surrounded by marsh; *e.g.*, Hayling Island, Isle of Ely; the spelling "island," accepted before 1700, is due to a false connection with "isle" (Fr. *île*, Lat. *insula*). Islands are usually classified as continental or oceanic. The former may result from the submergence of coastal highlands of which the summits remain above water or by the sea cutting through the isthmus (*q.v.*) of a peninsula, or through some zone of weakness between a coastal headland and the mainland. In all cases their structure is essentially that of the mainland and they occur on the continental shelf (*q.v.*). Examples are provided by the smaller islands off the coasts of Britain and Ireland (while the larger islands are in their turn continental islands of Europe. Oceanic islands have various origins. The majority of the islands of the Malay Archipelago may be regarded either as continental or oceanic, but such a group as the Caroline islands in their vicinity are truly oceanic. The ocean floor has marked irregularities, and where any individual peak, structurally belonging to the ocean bed, rises above the surface, an oceanic island is produced. Its projection above sea-level may be consequent on submarine volcanic activity, or on the buckling of the ocean bed by earth movements. Coral islands (*see* ATOLL) are usually oceanic islands and are frequently clustered upon submarine plateaux in shallow water, but occasionally represent the crowns of isolated peaks rising from deep water.

Island life exhibits features of special interest. The sea is a barrier to some forms of life, but acts as a carrier to others which, once established in their new home, frequently develop new features in their isolated surroundings. A long-established sea-barrier results in a marked difference between the fauna and flora even of adjacent islands; and this difference can be made to indicate the origin of an island. Wallace noticed that to the west of a line running between Bali and Lombok, and between Borneo and Celebes, the islands were biologically Asiatic, but to the east of the line (Wallace's line), notwithstanding the narrow Bali strait, the flora and fauna were Australian. Any detailed map of the biological regions of the globe will illustrate the importance of islands in the determination of the boundaries of faunal and floral types. Oceanic islands are usually colonized by but few animal forms, chiefly sea-birds and insects, but they are often clothed with abundant vegetation, the seeds of which have been carried by air and water currents, birds, etc., but the variety of plants is by no means so great as on the mainland.

ISLAY, the southernmost island of the Inner Hebrides, Argyllshire, Scotland, 16 m. W. of Kintyre and ¾ m. S.W. of Jura, from which it is separated by the Sound of Islay. Pop. (1921) 6,496; maximum breadth 15 m. and maximum length 25 m. The sea-lochs Gruinart and Indaal cut into it so deeply as almost to convert the western portion into a separate island. It is rich and productive, and has been called the "Queen of the Hebrides."

The surface generally is regular, the highest summit being Ben Bheigeir (1,609 ft.), but the shore is rugged. There are several freshwater lakes and streams, which provide good fishing. Islay was the ancient seat of the "lord of the Isles," the first to adopt that title being John Macdonald of Isle of Islay, who died about 1386; but the Macdonalds were ultimately ousted by their rivals, the Campbells, about 1616. Islay house, the ancient seat of the Campbells of Islay, stands at the head of Loch Indaal. Considerable business is done in stock-raising, and oats, barley and various green crops are raised. The chief difficulty in the way of reclamation is the great area of peat (60 sq.m.). The island contains several distilleries, producing large quantities of whisky, slate and marble are quarried, and iron and lead are found. At Bowmore, the chief town, some shipping is carried on. Port Ellen, the principal village, is a golfing resort, with a quay and a fishery. Port Askaig is the ferry station for Feolin on Jura. Regular communication with Glasgow and W. Tarbert is maintained by steamers which call at Bowmore, Port Ellen, Askaig and Bruichladdich. There are 3 lighthouses on the island.

ISLES OF THE BLEST or **FORTUNATE ISLANDS** (Gr. *αἱ τῶν μακάρων νῆσοι*; Lat., *Fortunatae insulae*), placed in Greek mythology in the Western ocean, and peopled, not by the dead, but by mortals upon whom the gods had conferred immortality. Like the Phaeacian land in Homer (*Od.* viii.) or the Celtic Avalon and St. Brendan's island, the Isles of the Blest have perpetual summer and abundance. No reference is made to them by Homer, who speaks instead of the Elysian Plain (*Od.* iv. and ix.), but they are mentioned by Hesiod (*Works and Days*, 168) and Pindar (*Ol.* ii.). By mediaeval map-makers, Madeira and the Canaries are sometimes named *Fortunatae insulae*. (*See* ATLANTIS.)

ISLINGTON (in Domesday and later documents *Iseldon*, *Isendon* and in the 16th century *Hisselton*), a northern metropolitan borough of London, England, bounded east by Stoke Newington and Hackney, south by Shoreditch and Finsbury, and west by St. Pancras, and extending north to the boundary of the county of London. Pop. (1925) 330,737. The southern part includes Holloway, Highbury, part of Kingsland and Barnsbury and Canonbury. The districts included preserve the names of ancient manors, and in Canonbury, which belonged in the 13th century to the priory of St. Bartholomew, Smithfield, traces of the old manor house remain. The fields and places of entertainment in Islington were favourite places of resort for London citizens in the 17th century and later; sports were practised here and the popularity of the place was increased by the discovery of chalybeate wells. At Copenhagen Fields, now covered by the Caledonian cattle market, a great meeting of labourers was held in 1834. They were suspected of intending to impose their views on parliament by violence and a display of military force was made. The Agricultural Hall, used for cattle and horse shows and other exhibitions, Pentonville Prison and Holloway Prison are in the borough. Islington is a suffragan bishopric in the London diocese. Its population includes metal, textile and transport workers and printers.

ISLIP, a township of Suffolk county, New York, U.S.A., in the central part of the south side of Long Island. The township is 16m. long from E. to W., and 8m. wide in its widest part. It is bounded on the S. by the Atlantic ocean; between the ocean and the Great South bay, here 5–7m. wide, is a long narrow strip of beach, called Fire Island, at the west end of which is Fire Island Inlet. The "Island" beach and the Inlet, both very dangerous for shipping, are protected by the Fire Island Lighthouse, the Fire Island Lightship, and a life saving station near the Lighthouse and another at Point o' Woods. A short distance E. of the Lighthouse there is a State park. Along the "Island" beach there is excellent surf-bathing. The township is served by two parallel branches of the Long Island railroad about 4m. apart. On the main (northern) division are the villages of Brentwood (first settled as Modern Times, a quasi free-love community), which now has the Convent and School of St. Joseph; Central Islip, the seat of the Central Islip State Hospital for the Insane; and Ronkonkoma, on the edge of a lake of the same name. On the south division of the Long Island railroad are the villages of Bay Shore (to the west of which is West Islip); Oakdale; West Sayville, originally a Dutch settlement; Sayville and Bayport. These villages are famous for oyster and clam fisheries. About one-half of the present township was patented in 1684, 1686, 1688 and 1697 by William Nicolls (1657–1723), the son of Matthias Nicolls, who came from Islip in Oxfordshire, England; this large estate (on either side of the Connetquot or Great river) was kept intact until 1786; the west part of Islip was mostly included in the Moubray patent of 1708; and the township was incorporated in 1710.

See C. J. Werner, *Historical Miscellanies Pertaining to Long Island* (1917); B. F. Thompson, *History of Long Island* (1918); R. H. Gabriel, *The Evolution of Long Island* (New Haven, Conn., 1921); and H. J. Hazelton, *The Boroughs of Brooklyn and Queens, Counties of Nassau and Suffolk, Long Island, 1609–1924* (Chicago, 1925).

ISLY, the name of a small river on the Moroccan-Algerian frontier, a sub-tributary of the Tafna, famous as the scene of the greatest victory of the French army in the Algerian wars. The intervention of Morocco on the side of Abd-el-Kader led at once to the bombardment of Tangier by the French fleet under the prince de Joinville, and the advance of the French army of Gen. Bugeaud (1844). The enemy, 45,000 strong, was found to be encamped on the Isly river near Kudiat-el-Khodra. Bugeaud had a force of 6,500 infantry and 1,500 cavalry, with a few pieces of artillery. In his own words, the formation adopted was "a boar's head." On Aug. 14 the "boar's head" crossed the river about 9m. to the northwest of Kudiat and advanced upon the Moorish camp; it was immediately attacked on all sides by great masses of cavalry, but the volleys of the steady French infantry broke the force of every charge, and at an apt moment the French cavalry in two bodies, each of the strength of a brigade, broke out and charged. One brigade stormed the Moorish camp (near Kudiat) in the face of artillery fire, the other sustained a desperate conflict on the right wing with a large body of Moorish horse which had not charged, and only the arrival of infantry put an end to the resistance in this quarter. A general rally of the Moorish forces was followed by another action in which they endeavoured to retake the camp. Bugeaud's forces, which had originally faced south when crossing the river, had now changed direction until they faced almost west. Near Kudiat-el-Khodra the Moors had rallied in considerable force, and prepared to retake their camp. The French, however, continued to attack in perfect combination, and after a stubborn resistance the Moors once more gave way. For this great victory, which was quickly followed by proposals of peace, Bugeaud was made duc d'Isly.

ISMAIL (1830–1895), khedive of Egypt, was born at Cairo on Dec. 31, 1830, being the second of the three sons of Ibrahim and grandson of Mehemet Ali. After receiving a European education at Paris, where he attended the staff college, he returned home, and on the death of his elder brother became heir to his uncle, Said Mohammed, the Vali of Egypt. Said employed him on missions abroad, notably to the pope, the emperor Napoleon III. and the sultan of Turkey. In 1861 he was despatched at the head of an army of 14,000 to quell an insurrection in the Sudan. On the death of Said, on Jan. 18, 1863, Ismail was proclaimed viceroy without opposition. He found the Egyptian revenue vastly increased by the rise in the value of cotton which resulted from the American Civil War, the Egyptian crop being worth about £25,000,000 instead of £5,000,000. Ismail had discovered that the civilized nations of Europe made a free use of their credit for raising loans. He now proceeded to transfer his private debts to the state and to embark on a grand scale of expenditure.

During the sixties and seventies Egypt became the happy hunting-ground of financiers, to whose schemes Ismail fell an easy and a willing prey. In 1866–1867 he obtained from the sultan of Turkey, in exchange for an increase in the tribute, firmans giving him the title of khedive, and changing the law of succession to direct descent from father to son; and in 1873 he obtained a new firman making him to a large extent independent. He projected vast schemes of internal reform, remodelling the customs system and the post office, stimulating commercial

progress, creating a sugar industry, introducing European improvements into Cairo and Alexandria, building palaces, entertaining lavishly and maintaining an opera and a theatre. Of the total amount of debt incurred by Ismail for his projects, about 10% may have been sunk in works of permanent utility—always excluding the Suez canal. On his accession he refused to ratify the concessions to the canal company made by Said, and the question was referred in 1864 to the arbitration of Napoleon III., who awarded £3,800,000 to the company as compensation for the losses they would incur by the changes which Ismail insisted upon in the original grant.

In 1867 Ismail visited Paris and London, and in 1869 he again paid a visit to England. The opening of the canal in Nov. 1869 enabled him to claim to rank among European sovereigns, and to give and receive royal honours; this excited the jealousy of the sultan, but Ismail was clever enough to pacify his overlord. In 1876 the old system of consular jurisdiction for foreigners was modified, and the system of mixed courts introduced, by which European and native judges sat together to try all civil cases without respect of nationality.

In 1874 Ismail annexed Darfur, and was only prevented from extending his dominion into Abyssinia by the superior fighting power of the Abyssinians. But at length the inevitable financial crisis came. A national debt of over one hundred millions sterling (as opposed to three millions when he became viceroy) had been incurred by the khedive, whose fundamental idea of liquidating his borrowings was to borrow at increased interest. The bondholders became restive. Judgments were given against the khedive in the international tribunals. When he could raise no more loans he sold his Suez canal shares (in 1875) to Great Britain for £3,976,582. Foreign intervention followed. In Dec. 1875 Stephen Cave was sent out by the British Government to inquire into the finances of Egypt, and in April 1876 his report was published, advising that it was necessary for foreign Powers to interfere in order to restore credit. The result was the establishment of the Caisse de la Dette. In October Goschen and Joubert made a further investigation, which resulted in the establishment of Anglo-French control. A further commission of inquiry by Evelyn Baring (afterwards Lord Cromer) and others in 1878 made it necessary for Ismail to hand over his estates to the nation and accept the position of a constitutional sovereign, with Nubar as premier, Rivers Wilson as finance minister, and de Blignières as minister of public works.

The new régime lasted six months, and then Ismail dismissed his ministers, an occasion being deliberately prepared by his getting Arabi (*q.v.*) to foment a military *pronunciamento*. England and France insisted (May 1879) on the reinstatement of the British and French ministers. The tribunals were still giving judgments for debt against the government, and when Germany and Austria showed signs of intending to enforce execution, the governments of Great Britain and France determined to get rid of Ismail altogether. He was first advised to abdicate, and a few days afterwards (June 26), he received a telegram from the sultan, addressed to him as ex-khedive, and informing him that his son Tewfik was his successor. He left Egypt for Naples, but eventually retired to his palace of Emirghian on the Bosporus. There he died on March 21, 1895.

Beneath a veneer of French manners and education Ismail remained throughout a thorough Oriental. It was his early encouragement of Arabi, and his introduction of swarms of foreign concession-hunters, which precipitated the "national movement" that led to British occupation.

See Earl Cromer, *Modern Egypt* (1908); and Lord Milner, *England in Egypt* (1892, 12th edit. 1915).

ISMAIL HADJI MAULVI-MOHAMMED (1781–1831), a Muslim reformer, was born at Pholah near Delhi. In co-operation with Syed Ahmed he attempted to free Indian Mohammedanism from the influence of the native early Indian faiths. The two men travelled extensively for many years and visited Mecca. In the Wahhabite movement they found much that was akin to their own views, and on returning to India preached the new doctrine of a pure Islam. The official Mohammedan leaders objected, and the dispute led to the reformers being interdicted by the British government in 1827. The party then moved to Punjab where they made Peshawar the capital of the theocratic community which they wished to establish (1829). Ismail Hadji fell in battle against the Sikhs amid the Pakhli mountains (1831). Some of his adherents are still found in the mountains of the north-west frontier.

Ismail's book *Taqouaïyat el Imān* was published in Hindustani and translated in the *Journal of the Royal Asiatic Society*, xiii. 1852.

ISMAIL, a town of Bessarabia, Rumania, capital of the Department of Ismail, situated on the left bank of the Chilia branch of the Danube. Pop. (1928) 37,400, including, besides Rumanians, Russians, Ukrainians, Bulgars, Turks, Jews and Gypsies. There are flour mills and a trade in cereals, woods, tallow and hides. As a Turkish fort and capital of a Sanjak, Ismail long enjoyed peace and prosperity. It was occupied by Russia in 1770, 1790 and 1812; transferred to Rumania in 1856, to Russia in 1878, and to Rumania in 1918.

ISMAILIA, a town of Lower Egypt, on the north-west shore of Lake Timsah, a salt lagoon, about 50 m. from the Mediterranean and the Red Sea, and 93 m. N.E. of Cairo by rail. Population about 10,000. It was laid out in 1863, in connection with the construction of the canal, and is named after the khedive Ismail. Ismailia was the scene of the first scientific attack upon malaria, by the extinction of the *anopheles* mosquito. The town is well laid out. At the end of the quay are works supplying Port Said with water. On the other side of the lake are the so-called Quarries of the Hyenas, from which the building material for the town was obtained. It was an important headquarters for the Allied forces during 1916.

ISMAY, THOMAS HENRY (1837–1899), British shipowner, was born at Maryport, Cumberland, on Jan. 7, 1837. In 1867 he took over the White Star Line of Australian clippers, and in 1868, established, in conjunction with William Imrie, the Oceanic Steam Navigation company, which has since become famous as the White Star Line. While continuing the Australian service, the firm determined to engage in the American trade, and for this purpose ordered from Messrs. Harland & Wolff, of Belfast, the first "Oceanic" (3,807 tons). The launching of this vessel marks a turning-point in north Atlantic travel. To Ismay is mainly due the credit of the arrangement by which some of the fastest ships of the British mercantile marine are held at the disposal of the government in case of war. The origin of this plan dates from the Russo-Turkish War, when there seemed a likelihood of England being involved in hostilities with Russia, and when, therefore, Ismay offered the Admiralty the use of the White Star fleet. In 1892 he retired from partnership in the firm of Ismay, Imrie and Co., though he retained the chairmanship of the White Star company. He died at Birkenhead on Nov. 23, 1899.

ISMET PASHA (1884–), Turkish statesman, was born in Smyrna of a Turkish family of Malatia. He received his education in the military schools of Turkey, and in 1903 graduated as an artillery lieutenant. Three years later he became a captain on the General Staff. After the Young Turk revolution of 1908, he was sent several times on military expeditions to Yemen. During the World War he served on the Syrian front, and was in command of an army corps when peace was declared. At the time of the occupation of Constantinople by the Allies he escaped to Angora disguised as a common soldier and was appointed by the Great National Assembly to be chief-of-staff during the military operations of the Nationalists against the Caliphate army and Armenia. Later he became commander-in-chief of the Turkish western front, and in this capacity insisted on the formation of a regular army in place of the irregular Nationalist forces. In the meantime, the irregular forces were unwilling to submit, and the Greek Army had taken the offensive. At Ineunu, Ismet defeated the Greeks, checked their offensive, subdued the irregular forces, and succeeded in completing the organization of a regular army. He remained in command of the western front until after the battle of the Sakharia and the fall of Smyrna, in which events he was the right-hand man of Mustafa Kemal. In 1922 he signed the Armistice concluded at Mudania with the Allies, and secured

the evacuation of Eastern Thrace. In 1922–3, as minister of foreign affairs and senior Turkish delegate to the Lausanne Conference, he ably defended the interests of his country, and signed the Treaty of Lausanne.

During the autumn of 1923, at the time of the declaration of the republic, he became prime minister. After a short rest, due to failing health, he became prime minister a second time, towards the end of 1924, and shared in the suppression of the Sheikh Said revolt in Kurdistan. The abolition of the Caliphate, the closing of the medressehs (religious schools) and of the tekkes (monasteries), the abolition of the tithe, the adoption of the Swiss civil code, and the wearing of the hat are some of the momentous changes which were realized during Ismet's tenure of office. He again resigned office, according to constitutional procedure, in Nov. 1927, on the meeting of the third Great National Assembly, but was again invited to form a cabinet.

ISMID (IZMID, ISNIKMID) (anc. *Nicomedia*), a town of Asia Minor situated on rising ground near the head of the gulf of Ismid, Sea of Marmora. Pop. (1927) 55,790. It is an agricultural district, producing cocoons and tobacco, and there are large forests of oak, beech and fir. Near Yalova there are hot mineral springs, much frequented in summer. The town is connected by railway with Haidar Pasha, the western terminus, and with Angora, Konia and Smyrna. It contains a fine 16th-century mosque, built by the celebrated architect Sinan. As the seat of a Greek metropolitan and an Armenian archbishop, Ismid retains somewhat of its ancient dignity. The head of the gulf of Ismid is silting up and the port Darinje is almost 4 miles distant from Ismid. The vilayet of Ismid (Nodja-Eli) had a population of 286,670 in 1927.

ISNARD, MAXIMIN (1758–1825), French revolutionist, dealer in perfumery at Draguignan, was elected deputy (for the Var) to the Legislative Assembly, where he joined the Girondists. Attacking the court, and the "Austrian committee" in the Tuileries, he reproached Louis XVI. for infidelity to the constitution. But on June 20, 1792, when the crowd invaded the palace, he was one of the deputies who tried to protect the king. After Aug. 10, 1792 he was sent to the army of the North to justify the insurrection. Re-elected to the Convention, he voted the death of Louis XVI. and was a member of the Committee of General Defence organized on Jan. 4, 1793. On April 4, Isnard presented the report recommending a smaller committee of nine, which two days later was established as the Committee of Public Safety. On May 25, he was presiding at the Convention when a deputation of the commune of Paris came to demand the release of Hébert; Isnard made the famous reply: "If by these insurrections, continually renewed, it should happen that the principle of national representation should suffer, I declare to you in the name of France that soon people will search the banks of the Seine to see if Paris has ever existed." On June 2, 1793 he offered his resignation as representative of the people, but his arrest was not decreed until Oct. 3. He escaped, and on March 8, 1795 was recalled to the Convention, where he supported all the measures of reaction. He was elected deputy for the Var to the Council of Five Hundred. In 1797 he retired to Draguignan. In 1800 he published a pamphlet *De l'immortalité de l'âme,* in which he praised Catholicism; in 1804 *réflexions relatives au senatus-consulte du 28 floréal an XII.,* an enthusiastic apology for the Empire. Upon the restoration he professed royalist sentiments, and was not disturbed, in spite of the law of 1816 proscribing regicide ex-members of the Convention.

See F. A. Aulard, *Les Orateurs de la Législative et de la Convention* (2nd ed., 1906).

ISOBAR, a line upon a map or pressure chart connecting places having the same atmospheric pressure. The pressures can either be "reduced to sea-level" by means of a calculated factor, or can be in the form of unaltered barometer (*q.v.*) readings. A general pressure map is intended to indicate by isobars the "reduced" average pressure, for any selected period over large areas, while the daily weather charts for smaller regions show the presence of cyclonic, anti-cyclonic, or other such temporary systems. Isobars should be interpreted as the intersections of inclined isobaric surfaces with the surface of the earth.

ISOCHORE, in physics, a line on a thermodynamic diagram showing certain relations of pressure and temperature in a gas. If a gas is kept at a constant volume (*e.g.,* in a closed vessel) while the temperature to which it is subject is varied, the pressure exerted on the walls of the vessel by the gas alters in a definite manner. If, further, the way in which the temperature and pressure are thus related is indicated by a line on a graph, this line is known as an isochore (ἰσο, equal; χῶρος, space).

The term is often applied also to van't Hoff's "reaction isochore," which may be briefly described. If a reversible chemical reaction takes place at a constant volume, the equilibrium constant, which determines the extent to which the reaction proceeds (*see* CHEMICAL ACTION), varies with the temperature in a way which depends upon the heat evolved by the reaction, thus:

$$\frac{d\log K}{dT} = \frac{-Q}{2T^2}$$

Here K is the equilibrium constant, T the absolute temperature, and Q the heat (in calories) which would be evolved if 1 gram-equivalent of the initial substance was completely converted to the final product at the temperature T.

ISOCLINIC LINES, lines drawn on maps, connecting those parts of the earth's surface where the magnetic inclination is the same in amount. (*See* TERRESTRIAL MAGNETISM.)

ISOCRATES (436–338 B.C.), Attic orator, was the son of Theodorus of the deme of Erchia. He received the best education Athens provided, and Plato (*Phaedrus,* 278 E) makes Socrates prophesy a brilliant future for him, saying that he will leave the whole of his generation behind in oratory, and that even greater things may be hoped from him, as "a certain philosophy is inborn in him." The dramatic date of the dialogue is about 410. He took no part in public life, for which he was unfitted in physique as well as by temperament, and under the Thirty he withdrew to Chios. He had already started teaching rhetoric, having lost his inherited fortune in the tumult of the end of the Peloponnesian War. He returned about the time of the restoration of the Democracy in 403. For the next ten years he continued to write occasional speeches for the law courts, of which six are extant. He himself despised this branch of his work.

His real vocation was teaching; about 392 he founded his famous school near the Lyceum, where for the rest of his life he may be said to have had the Greek-speaking world from the Black sea to Sicily for his pupils. They include Ephorus, Theopompus and Androtion among historians, Isaeus, Lycurgus and Hypereides among orators. Forty-one names are still known. (*See* P. Sanneg, *De schola Isocratea,* Halle, 1867.) There is a tradition that at the panegyric contest on the death of Mausolus of Caria in 351 there was not a competitor who had not been trained by Isocrates. The instruction given, though based on rhetorical composition, was not confined to it. It seems to have been as much a system of general culture as Quintilian's *Institutio Oratoria.*

Meanwhile he was also active as a publicist. The dominant idea of his public writings was the policy of uniting Greece in a concerted attack on Asia. In Greece there was peace neither between the cities nor inside them; a panhellenic invasion of the Persian empire would obliterate political enmities; its success would contribute to the solution of the economic problem. The difficulty was to find a leader to direct the enterprise; in the *Panegyricus* (380) he looks to a coalition between Athens and Sparta, whose leadership Greece would be proud to follow now as before. When this failed him, he looked in turn to Dionysius I. of Syracuse, Agesilaus III., and finally to Philip of Macedon. His faith in Philip lasted down to Chaeronea (*Philippus,* 346 B.C.; *Epist.* ii., ? 342 B.C.); the question whether it survived that depends on the view taken of the authenticity of *Epist.* iii. There is nothing against it except the tradition that on hearing of Chaeronea Isocrates killed himself by voluntary starvation. On the whole it seems better to discard the tradition than the letter; it is easy to see how the legend could have grown supposing, as seems probable, that he died soon after the battle. He was then 98.

Isocrates amassed considerable wealth at his profession, and fulfilled the usual public services of the rich man at Athens. He

married Plathane, widow of the sophist Hippias of Elis, and adopted her son Aphareus. He had one lawsuit in 355, being challenged to undertake a trierarchy or exchange properties. (*See* the *Antidosis*.)

We have to estimate his position from the political and the literary points of view. In the first place, his political views were in tune with the prevailing tendency of Greek political thought at the time. Xenophon, Plato, Aristotle (in the *Politics*) all lean at times to the idea of a monarchy to rule a united Greece. The special bent given to this tendency by Isocrates is the prominence of the attack on Asia in his scheme. And here he was not far wrong; Alexander did not lead a panhellenic army into Asia; but the extended field brought under the influence of Greek civilization produced indirectly the results Isocrates desired. He deals in two speeches, *On the Peace* and the *Areopagiticus* (both 355 B.C.), with Athenian politics; in the first he advocates a policy of equality and alliance between Athens and the subject cities of the empire, in the second he appears as a Cato mourning the moral degeneracy of the republic. Whatever may be thought of his political tenets, there is no doubt of his place in the history of literature. He was regarded by the Greeks as representing the smooth or florid school of prose style (γλαφυρὰ, ἀνθηρὰ ἁρμονία), which phrase was designed to describe his periodic, antithetical style, in contrast to the "austerity" of Antiphon. His real eminence consists in the fact that by giving an artistic finish to the literary branch of rhetoric he set a standard in form and rhythm for prose style. This prose style of his creation, based on the periodic sentence, and subject to rules of rhythm comparable to those of verse, though of course less strict, is his legacy to Cicero, and through him to the literature of modern Europe.

Works.—The extant works of Isocrates consist of 21 speeches or discourses and nine letters. Among these the six forensic speeches represent the first period of his literary life—belonging to the years 403–393 B.C. These are Or. xvi.–xxi. Among the forensic speeches, we must, on the whole, give the palm to the *Aegineticus* (or xix.)—a graphic picture of ordinary Greek life in the islands of the Aegean. Here—especially in the narrative—Isocrates makes a near approach to the best manner of Lysias. The remaining 15 orations form two clearly separated groups—the scholastic and the political.

Under the head of scholastic writings we have, first, three letters or essays of a hortatory character. (1) The letter to the young Demonicus—once a favourite subject in the schools—contains a series of precepts neither below nor much above the average practical morality of Greece. (2) The letter to Nicocles—the young king of the Cyprian Salamis—sets forth the duty of a monarch to his subjects. (3) In the third piece, it is Nicocles who speaks, and impresses on the Salaminians their duty to their king—a piece remarkable as containing a popular plea for monarchy, composed by a citizen of Athens. These three letters may be referred to the years 374–372 B.C.

Next may be placed four pieces which are "displays" (ἐπιδείξεις) in the proper Greek sense. They are the *Busiris* (Or. xi., 391–390 B.C.), *Encomium on Helen* (Or. x., 370 B.C.), containing the celebrated passage on the power of beauty, *Evagoras* (Or. ix., 365 B.C.) and *Panathenaicus* (Or. xii., 339 B.C.), his last work.

The third subdivision of the scholastic writings is formed by two most interesting essays on education—that entitled *Against the Sophists* (Or. xiii., 390–391 B.C.), and the *Antidosis* (Or. xv., 353 B.C.). The first of these is a manifesto put forth by Isocrates at the outset of his professional career of teaching, in which he seeks to distinguish his aims from those of other "sophists." As this piece is the prelude to his career, its epilogue is the speech on the *Antidosis*—so called because it has the form of speech made in court in answer to a challenge to undertake the burden of the trierarchy, or else exchange properties with the challenger. The discourse *Against the Sophists* had stated what his art was *not;* this speech defines what it *is*. His own account of his φιλοσοφία "the discipline of discourse" (ἡ τῶν λόγων παιδεία) —has been embodied in the sketch of it given above.

His political writings, again, fall into two classes—those which concern (1) the relations of Greece with Persia, (2) the internal affairs of Greece. The first class consists of the *Panegyricus* (Or. iv., 380 B.C.) and the *Philippus* (Or. v., 346 B.C.). The *Panegyricus* urges that Athens and Sparta should unite in leading the Greeks against Persia. The *Philippus* is an appeal to the king of Macedon to assume that initiative in the war on Persia which Isocrates had ceased to expect from any Greek city. In the view of Demosthenes, Philip was the representative barbarian; in that of Isocrates, he is the first of Hellenes, and the natural champion of their cause.

Of those discourses which concern the internal affairs of Greece, two have already been noticed—that *On the Peace* (Or. viii.), and the *Areopagiticus* (Or. vii.)—both of 355 B.C.—as dealing respectively with the foreign and the home affairs of Athens. The *Plataicus* (Or. xiv.) is an appeal to Athens to restore Plataea, destroyed by Thebes. The *Archidamus* (Or. vi.) is a speech purporting to be delivered by Archidamus III., son of Agesilaus. in a debate at Sparta on conditions of peace offered by Thebes in 366 B.C. It was demanded that Sparta should recognize the independence of Messene, which had lately been restored by Epameinondas (370 B.C.). The oration gives brilliant expression to the feeling which such a demand was calculated to excite in Spartans who knew the history of their own city. Xenophon witnesses that the attitude of Sparta on this occasion was actually such as the *Archidamus* assumed (*Hellen*, vii. 4. 8–11).

Of his letters the first—to Dionysius I.—is fragmentary; but a passage in the *Philippus* leaves no doubt as to its object. Isocrates was anxious that the ruler of Syracuse should undertake the command of Greece against Persia. The date is probably 368 B.C. Next in chronological order stands the letter "to the Children of Jason" (vi.). Isocrates urges Thebe, the daughter of Jason, and her half-brothers to set up a popular government. The date is 359 B.C. (*See* R. C. Jebb in *Journal of Philology*, v. 266, 1874.) The letter to Archidamus III. urges him to execute the writer's favourite idea—"to deliver the Greeks from their feuds, and to crush barbarian insolence." It is remarkable for a vivid picture of the state of Greece; the date is about 356 B.C. The letter to Timotheus (vii., 345 B.C.), ruler of Heraclea on the Euxine, introduces an Athenian friend who is going thither, and at the same time offers some good counsels to the benevolent despot. The letter "to the Government of Mytilene" (viii., 350 B.C.) is a petition to a newly established oligarchy, begging them to permit the return of a democratic exile, a distinguished musician named Agenor. The first of the two letters to Philip of Macedon (ii.) remonstrates with him on the personal danger to which he has recklessly exposed himself, and alludes to his beneficent intervention in the affairs of Thessaly; the date is probably the end of 342 B.C. The letter to Alexander (v.), then a boy of 14, is a brief greeting sent along with the last. The letter to Antipater (iv.) introduces a friend who wished to enter the military service of Philip. The later of the two letters to Philip (iii.) appears to be written shortly after the battle of Chaeronea in 338 B.C.

BIBLIOGRAPHY.—With the exception of defects at the end of Or. xiii., at the beginning of Or. xvi., and probably at the end of Letters i., vi., ix., the existing text is free from serious mutilations. It is also unusually pure. The smooth and clear style of Isocrates gave few opportunities for the mistakes of copyists. On the other hand, he was a favourite author of the schools. Numerous glosses crept into his text through the comments or conjectures of rhetoricians. This was already the case before the 6th century, as is attested by the citations of Priscian and Stobaeus. Jerome Wolf and Koraes successfully accomplished much for the text. But a more decided advance was made by Immanuel Bekker. He used five mss., viz., (1) Codex Urbinus III., Γ (this, the best, was his principal guide); (2) Vaticanus 936, Δ; (3) Laurentanius 87, 14, Θ; (13th century); (4) Vaticanus 65, Λ; and (5) Marcianus 415, Ξ. The first three, of the same family, have Or. xv. entire; the last two are from the same original, and have Or. xv. incomplete.

J. G. Baiter and H. Sauppe in their edition (1850) follow Γ "even more constantly than Bekker." Their apparatus is enriched, however, by a ms. to which he had not access—Ambrosianus O. 144, E., which in some cases, as they recognize, has alone preserved the true reading. The readings of this ms. were given in full by G. E. Benseler in his second edition (1854–55). The distinctive characteristic of Benseler's textual criticism was a tendency to correct the text against even the

best ms., where the ms. conflicted with the usage of Isocrates as inferred from his recorded precepts or from the statements of ancient writers. Thus, on the strength of the rule ascribed to Isocrates—*φωνήεντα μὴ συμπίπτειν*—Benseler would remove from the text every example of hiatus (on the mss. of Isocrates, *see* H. Bürmann, *Die handschriftliche Überlieferung des Isocrates*, 1885–86, and E. Drerup, in *Leipziger Studien*, xvii., 1895.

Editions: in *Oratores Attici*, ed. Imm. Bekker (1823–28); W. S. Dobson (1828); J. G. Baiter and Hermann Sauppe (1850). Separately *Ausgewählte Reden, Panegyrikos und Areopagitikos*, by Rudolph Rauchenstein, 6th ed., Karl Münscher (1908); in Teubner's series, by G. E. Benseler (new ed., by F. Blass, 1886–95) and by E. Drerup (1906, etc.); *Ad Demonicum et Panegyricus*, ed. J. E. Sandys (1868); *Evagoras*, ed. H. Clarke (1885). Extracts from Orations iii., iv., vi., vii., viii., ix., xiii., xiv., xv., xix., and Letters iii., v., edited with revised text and commentary, in *Selections from the Attic Orators*, by R. C. Jebb (1880); vol. i. of an English prose translation, with introduction and notes by J. H. Freese, has been published in Bohn's *Classical Library* (1894). *See* generally Jebb's *Attic Orators* (where a list of authorities is given) and F. Blass, *Die attische Beredsamkeit* (2nd ed., 1887–98), and the latter's *Die Rhythmen der attischen Kunstprosa* (1901). There is a special lexicon by S. Preuss (1904). On the philosophy of Isocrates and his relation to the Socratic schools, *see* Thompson's ed. of Plato's *Phaedrus, Appendix* 2. (R. C. J.; X.)

ISODYNAMIC LINES, lines drawn on maps, connecting those parts of the earth's surface where the magnetic force has the same intensity (*see* TERRESTRIAL MAGNETISM).

ISOGAMY, term applied in biology to conditions in which the sexual cells (gametes, *q.v.*) are alike, in contradistinction to heterogamy or anisogamy, where the gametes are differentiated into male elements (spermatozoa or spermatozoids) and female elements (ova). Isogamy occurs in some of the lower Algae and certain Protozoa, but it would seem that in most cases, if not in all, the gametes do not behave alike, so that they are functionally anisogamous. (*See* FERTILIZATION, PROTOZOA, ALGAE, REPRODUCTION.)

ISOGONIC LINES, lines drawn on maps, connecting those parts of the earth's surface where the magnetic declination is the same in amount (*see* TERRESTRIAL MAGNETISM).

ISOLA DEL LIRI, a town of Lazio, province of Frosinone, Italy, 15 m. by rail N.N.W. of Roccasecca, which is on the main line from Rome to Naples, 10 m. N.W. of Cassino. Pop. (1921), town 3,139; commune, 8,931. The town, as its name implies, is situated between two arms of the Liri. The many waterfalls of this river and of the Fibreno afford motive power for several important paper-mills; felt and blankets are also made. About 1 m. to the north is the church of San Domenico, erected in the 12th century, which probably marks the site of the villa of Cicero (*see* ARPINO).

ISOMERISM. In the period when chemical analysis was first introduced, the belief was generally held that the properties of every substance depended solely upon its chemical composition. Two substances which had the same properties were therefore supposed to be identical in composition; and, conversely, if a difference could be detected in the properties of two samples of a substance under the same conditions, it was held to be due to some difference in chemical composition.

The fundamental postulate that the properties of a substance are determined uniquely by its chemical composition is subject to certain well-defined types of exception. The general term "isomerism" which is sometimes assigned to these can be classified more accurately under three headings as, (i.) *polymorphism*, where a difference of properties is caused by a different arrangement of identical molecules in a crystal; (ii.) *polymerism*, where the molecules are of identical composition, but of different size; and (iii.) *isomerism*, where the molecules are of identical composition and size, but of different structure.

Polymorphism.—The fundamental postulate set out above was expressed in a precise form in 1801 by the Abbé Haüy, who made it the basis of his classification of minerals. "His guiding principle was this: that every difference in the fundamental form of a crystal implied a difference in its chemical composition" (Armitage, *A History of Chemistry*, 1906, p. 104). Thus, although the two minerals calcite, or Iceland spar, and aragonite appear to be merely two crystalline modifications of ordinary chalk (calcium carbonate) (*see* fig. 1), it is often possible to detect the presence of iron (as ferrous carbonate) in calcite, and of strontia (as strontium carbonate) in aragonite. The two different methods of crystallization of calcium carbonate in calcite and in aragonite could therefore be attributed to the determining action of these impurities, since ferrous carbonate does in fact form crystals of the same general type as calcite, while crystals of strontium carbonate have the same general form as aragonite. Since, however, these impurities are not essential to the production of either mineral, Haüy's postulate has long since been abandoned. It is, for instance, obviously untenable in the case of sulphur, where the type of crystallization depends on the temperature, and not on the composition of the sample, since the same sample of sulphur can be made to change from one crystalline form to the other without any change of composition merely by heating and cooling above and below 96° C. This is the phenomenon described as polymorphism, and affords a simple example of those variations of properties which lie outside the scope of chemical analysis, and which form the main subject of this article. Further examples of this phenomenon are described in the article ALLOTROPY.

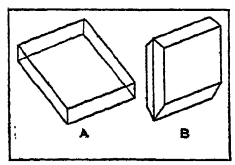


FIG. 1.—A, CALCITE. B, ARAGONITE
These two minerals have the same chemical composition, but differ widely in the form of the crystals

Structural Isomerism.—The type of isomerism which depends on a dissimilar arrangement of equal numbers of atoms in the molecules of an element or compound is known as structural isomerism. It is therefore a mere truism to assert that it can only exist in polyatomic molecules. Thus among elements, since the majority of them contain only one atom in the molecule, polymerism (which depends on the formation of polyatomic molecules of two different sizes) is rare, although polymorphism is relatively common and isomerism (which depends on the formation of polyatomic molecules of equal size but different structure) is so scarce that soluble and insoluble sulphur (*q.v.*) still stand alone as the only case in which the existence of two forms of equal molecular weight has been clearly established. Since, however, carbon is unique in the readiness with which complex structures can be built up from the elementary atoms, it is not surprising that differences of properties depending on differences of molecular structure, in compounds of identical composition, should have been discovered amongst organic compounds at a very early period—antedating by nearly a century the discovery of the same phenomenon in elementary sulphur.

The first example of a pair of organic compounds of identical percentage composition, but having totally different properties, was recorded in 1820 by Dalton, who, by the distillation of fatty oils, prepared a gas which resembled olefiant gas (*see* ETHYLENE) in combining with chlorine, but appeared to contain twice as much carbon and hydrogen in a given volume. When, therefore, W. Henry in 1821 discovered a similar constituent in coal gas,

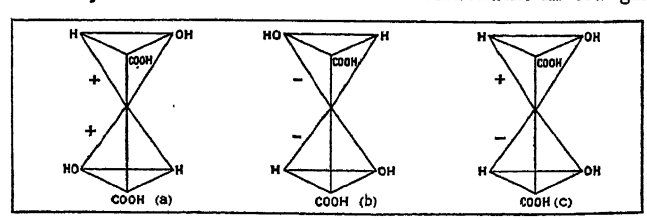


FIG. 2.—ISOMERISM
Molecular structure of (a) dextro-tartaric acid, (b) laevo-tartaric acid, (c) mesotartaric acid. Note the change in position of the hydrogen (H), hydroxyl (OH) and carboxyl (COOH) groups, accounting on different behaviour towards polarized light

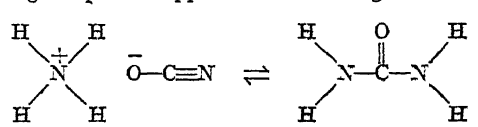
Dalton was able to suggest that "almost probably the atoms [molecules] of the new gas consist of two of olefiant gas." This conclusion was subsequently confirmed by Faraday, who separated the same compound by condensation from oil-gas at 0° F, and showed that it contained carbon and hydrogen in the same proportion as olefiant gas, but had twice the density. Faraday cited this case as evidence of "the existence of bodies composed of the same elements and in the same proportion but differing in their qualities," and ventured to predict that "now we are taught to look for them they will probably multiply on us." This pre-

diction was abundantly fufilled; but in the case cited by Faraday the two bodies (now known as ethylene, C_2H_4, and butylene, C_4H_8) differ in the number of atoms in the molecule; they are therefore polymeric and not isomeric in the strict usage of the word. These two phenomena give rise, however, to such similar changes of properties that it is often difficult to distinguish between them, unless the molecular weights of the two forms can be determined with ease and certainty, as in the case of ethylene and butylene, where they can be deduced at once from the densities of the two gases (*see* STOICHIOMETRY).

In the second case cited by Faraday, the fulminates prepared and analyzed by Liebig (1823) and Gay Lussac (1824) have the same composition as the cyanates prepared and analyzed by Wöhler (1824), although these compounds have nothing in common but their composition. Whilst, however, the percentage composition of both silver salts can be represented by the formula AgCNO, it is not easy to prove whether these salts are isomeric or polymeric, since the ordinary methods of determining molecular weights are not applicable to salts such as these. An undoubted example of true isomerism was disclosed, however, when Wöhler in 1828 converted ammonium cyanate into urea, since these two compounds are identical in molecular weight as well as in their percentage composition. Both compounds can, in fact, be represented by the formula CON_2H_4, but whereas ammonium cyanate is regarded as an aggregate of ammonium and cyanate ions, NH_4 and CNO, urea is formulated as a compound in which two amino-groups, NH_2, are united by a carbonyl group, CO, thus:

Ammonium cyanate, $(NH_4)CNO$; Urea (or carbamide), $CO(NH_2)_2$.

The structural isomerism of these two substances can therefore be summarized by saying that in one compound (ammonium cyanate) all four atoms of hydrogen are attached to one atom of nitrogen to form an ammonium radical, NH_4, whereas in the other compound (carbamide) each atom of nitrogen carries two atoms of hydrogen. This contrast is shown more clearly in the following structural formulae, where the links or "bonds" between the atoms are represented by straight lines, and the plus and minus signs represent opposite electric charges:



Ammonium cyanate Urea

The double barbs pointing in opposite directions are used to indicate the fact (discovered at a much later date) that the conversion of one isomeride into the other can take place in either direction, *i.e.*, that the process is *reversible* (Walker and Hambly, 1895). Wöhler's discovery not only provided one of the first authentic cases of isomerism, but was hailed as the first example of the synthesis of an organic compound from inorganic materials by ordinary laboratory processes and without the intervention of any vital force. Since the urea which he had prepared from ammonium cyanate proved to be identical in every respect with that which is found in urine, Wöhler announced his discovery to Berzelius in the following terms: "I must tell you that I can prepare urea without requiring a kidney or an animal, either man or dog."

Metameric Substances.—Wöhler's synthesis, as affording the first recorded example of *isomeric change, i.e.*, of the conversion of one isomer into another, is second in importance only to the fact of isomerism itself, and Berzelius therefore introduced a special term to describe it. Thus in 1831 he introduced the term *isomeric* (ἰσομερής, composed of equal parts) to describe bodies composed of an equal number of atoms of the same elements but arranged in an unlike manner, and therefore possessing different chemical properties and crystalline forms, and the term *polymeric* (πολύς, several) to describe those cases in which, although the relative number of the atoms is the same, the absolute is not. In the following year he introduced the further term *metameric* (Gr. μετα, change) to describe those isomeric substances which change easily into one another. Kekulé, however, confused this simple nomenclature by using the term isomeric to describe all compounds which have the same percentage composition but different properties; these compounds were then classed, on the one hand as polymeric when they had the same composition but differed in molecular weight, and on the other hand as metameric when the molecular weight was the same but the structure of the molecules was different; Kekulé therefore applied the term "metameric" to ordinary cases of structural isomerism. The terms isomeric and polymeric have fortunately survived in the sense of Berzelius' original definitions: but the term metameric, which was rendered ambiguous by Kekulé's attempt to make it mean something quite different, has been generally abandoned.

Examples of Structural Isomerism.—When structural chemistry came into existence about 1858, large numbers of isomeric compounds were prepared by deliberate synthesis. For instance, the following series of alcohols and acids can be regarded as fundamental units for the preparation of more complex carbon-compounds:

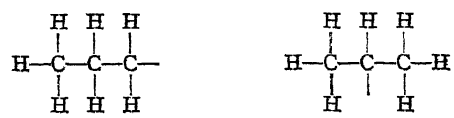
Methyl alcohol,	$CH_3{\cdot}OH$	Formic acid,	$H{\cdot}CO{\cdot}OH$
Ethyl alcohol,	$C_2H_5{\cdot}OH$	Acetic acid,	$CH_3{\cdot}CO{\cdot}OH$
Propyl alcohol,	$C_3H_7{\cdot}OH$	Propionic acid,	$C_2H_7{\cdot}CO{\cdot}OH$
Butyl alcohol,	$C_4H_9{\cdot}OH$	Butyric acid,	$C_3H_7{\cdot}CO{\cdot}OH$
Amyl alcohol,	$C_5H_{11}{\cdot}OH$	Valeric acid,	$C_4H_9{\cdot}CO{\cdot}OH$

In these abbreviated structural formulae, it will be seen that the alcohols contain an alkyl group or alkyl "radical," consisting of carbon and hydrogen in the ratio C_nH_{2n+1}, linked to the characteristic *hydroxyl* group, OH, of the alcohols; while the acids contain the same alkyl groups linked to the characteristic *carboxyl* group, CO·OH, of the acids. By eliminating a molecule of water from an alcohol and an acid, it is possible to produce a member of the series of esters (*q.v.*), which afford innumerable examples of structural isomerism. Thus the three compounds:

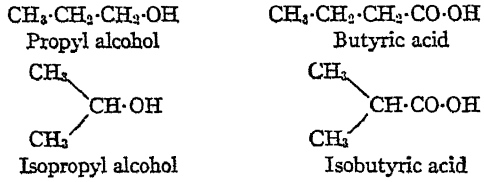
Ethyl formate, $H{\cdot}CO{\cdot}O{\cdot}C_2H_5$, Methyl acetate, $CH_3{\cdot}CO{\cdot}O{\cdot}CH_3$, Propionic acid, $C_2H_5{\cdot}CO{\cdot}OH$,

are obviously isomeric, since they all have the formula $C_3H_6O_2$; but, as they cannot be converted into one another by any simple process, they are not metameric in the sense of Berzelius' definition (although Kekulé cited the fatty acids and their esters as examples of his proposed use of this term).

Closer inspection shows, however, that isomerism can also occur in the alcohols and acids themselves, except in the simplest members of the two homologous series set out above. Thus we find that two different models of the propyl group, C_3H_7, can be constructed as follows:



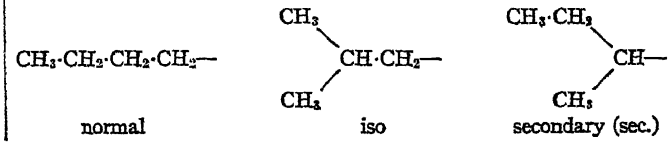
the spare bond by which the group is attached to hydroxyl or to carboxyl being at the end or at the centre of the chain of carbon atoms. We can therefore write the formulae of propyl alcohol, $C_3H_7{\cdot}OH$, and of butyric acid, $C_3H_7{\cdot}CO{\cdot}OH$, each in two ways:



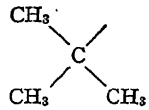
Propyl alcohol Butyric acid

Isopropyl alcohol Isobutyric acid

Similarly, the higher members of this series of alcohols and acids give rise to increasing numbers of isomers. Thus the butyl radical, C_4H_9, can exist in four forms,

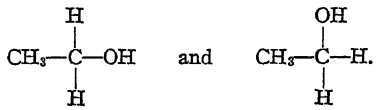


normal iso secondary (sec.)

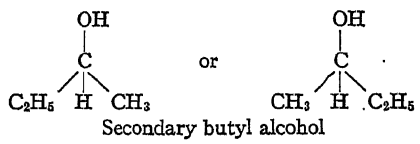

tertiary (tert.)

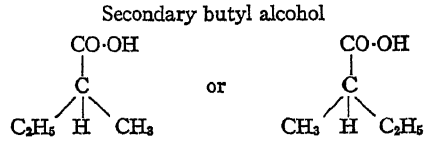
and there are, therefore, four isomeric butyl alcohols and four isomeric valeric acids. Only a few further steps in the series are necessary in order to reach compounds of which hundreds of isomers are theoretically possible. There is therefore no limit to the extent to which structural isomers could be multiplied in organic chemistry if necessary.

Optical Isomerism.—If the two-dimensional formulae which have been used in the preceding paragraphs were correct, it would be possible to construct two alternative models to represent the molecule of ethyl alcohol, thus



In one model, which we may call the *trans*-form, the two hydrogen atoms are at opposite corners of the cross, whilst in the other, the *cis*-form, the two hydrogen atoms are adjacent. Since ethyl alcohol is known only in one form, we conclude that these planar formulae are incorrect. We therefore follow Pasteur in supposing that the atoms are arranged in three dimensions in space, and conclude that the conventional formulae in two dimensions are misleading. Isomerism in compounds of this type then becomes possible for the first time when an *asymmetric carbon atom, i.e.*, a carbon atom linked to four different radicals, is present in the molecule. Two isomers are then possible, as in the formulae:

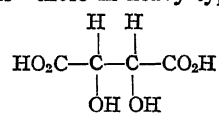

Secondary butyl alcohol


Isovaleric acid

Each of these models is supposed to stand like a tripod on a triangular base, with H at the back and the CH_3 and C_2H_5 groups in front. Since these models differ in the same way as a right hand differs from a left hand they are often described as right-handed and left-handed. It will also be seen that, whichever of the four radicals occupies the vertical position the remaining three radicals are arranged in an opposite sequence, and that the two models are never superposable. If, however, one of the models is looked at in a mirror, the image of one will correspond with the object of the other. These two models are therefore also described as *mirror-images* of one another, or in more technical language they are said to be enantiomorphous, *i.e.*, one is the opposite form of the other.

Two isomers which only differ in this subtle way must obviously resemble one another very closely. They can, however, be detected by the fact that the crystals like the molecules are *dissymmetric, i.e.*, yield an opposite figure when reflected in a mirror, and also by the power (which is generally possessed by solutions of the two isomers, as well as by the crystals) of twisting the plane of vibration of polarized light (*q.v.*) to the right or to the left. For this reason, this type of isomerism is often described as optical isomerism, and the optical isomers are distinguished as *dextro-rotatory* and *laevo-rotatory* according as the twist is to the right or to the left.

Even before Wöhler's discovery of the conversion of ammonium cyanate into urea, a genuine example of isomerism had been found in a pair of compounds of this type. Thus tartaric acid and racemic acid were shown to be identical in composition. This anomalous result was confirmed by Berzelius, who therefore cited the two acids in 1831 as illustrations of the phenomenon which he proposed to describe as isomerism. In 1849 Pasteur made a crystallographic study of the salts of the two acids, the results of which are described in the article STEREOCHEMISTRY, since the phenomena are instances of stereoisomerism. As a result of these researches, and of the later theories of von 't Hoff and Le Bel (1874), it became possible to attribute the optical activity to the presence of an asymmetric carbon atom whose four different groups were situated at the corners of a tetrahedron, the carbon atom being at the centre. Since tartaric acid has two such asymmetric carbon atoms—those in heavy type in the formula

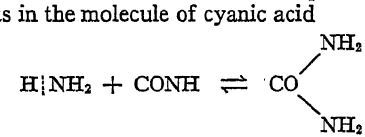


it was possible to assign to the dextro and laevo varieties the space formulae (a) and (b) (fig. 2), in which (b) is the mirror-image of (a), since the two are identical in properties except for their equal and opposite effects on polarized light and for their mirror-image crystalline forms. It followed therefore that racemic acid was a crystal mixture of equal amounts of the *d*- and *l*-acids, but that the *meso*-acid, which was optically inactive like racemic acid, owed its inactivity to "internal compensation" (fig. 2 c).

Static and Dynamic Isomerism.—Although structural isomers cannot usually be converted directly into one another, a large number of examples are now known in which conditions are present which enable isomeric change to take place. Thus the conversion of ammonium cyanate into urea probably depends on the fact that ammonia and cyanic acid can combine in two ways. In the one process, the cyanic acid is broken up by the familiar process of neutralization:

$$NH_3 + H|CNO \rightleftharpoons (NH_4)CNO;$$

in the other process the ammonia is broken up and attached to two different points in the molecule of cyanic acid



If both processes are reversible, it is easy to see how one isomer can be converted into the other.

Another type of isomeric change is very common amongst the derivatives of benzene, where the displacement of an atom of hydrogen by some other atom or radical often leads to a relatively unstable product, which then changes to a more stable isomer by a process of exchange. A good example is afforded by acetanilide, which can be derived from aniline and acetic acid by eliminating a molecule of water:

$$\underset{\text{Aniline}}{C_6H_5\cdot NH_2} + \underset{\text{Acetic acid}}{HO\cdot CO\cdot CH_3} \rightleftharpoons \underset{\text{Acetanilide}}{C_6H_5\cdot NH\cdot CO\cdot CH_3} + \underset{\text{Water}}{H_2O}$$

This compound contains hydrogen, (i.) in the acetyl radical, $-CO\cdot CH_3$, (ii.) in the "imino-group," –NH–, (iii.) in the phenyl radical, C_6H_5–. When attacked by bleaching powder the central atom of hydrogen is replaced by chlorine; but by the further action of hydrochloric acid an isomeric change is induced in which the chlorine changes places with an atom of hydrogen in the phenyl group, thus:

$$C_6H_5\cdot NCl\cdot CO\cdot CH_3 \rightarrow ClC_6H_4\cdot NH\cdot CO\cdot CH_3.$$

This particular isomeric change has been shown to be due to a reversible chlorination, *i.e.*, the hydrochloric acid interacts with the first product, setting free a molecule of chlorine, which then attacks a phenyl group and replaces an atom of hydrogen there,

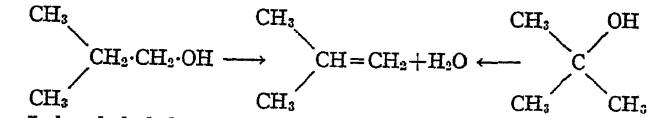
$$C_6H_5\cdot NCl\cdot CO\cdot CH_3 + HCl \rightleftharpoons C_6H_5\cdot NH\cdot CO\cdot CH_3 + Cl_2$$
$$Cl_2 + C_6H_5\cdot NH\cdot CO\cdot CH_3 \rightleftharpoons ClC_6H_4\cdot NH\cdot CO\cdot CH_3 + HCl.$$

Another interesting change of the same character is made use of in the manufacture of benzidine, with a view to preparing an important series of dye-stuffs:

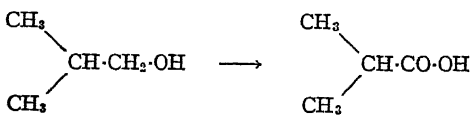
$$\underset{\text{Hydrazobenzene}}{C_6H_5\cdot NH\cdot NH\cdot C_6H_5} \longrightarrow \underset{\text{Benzidine}}{NH_2\cdot C_6H_4\cdot C_6H_4\cdot NH_2}.$$

In this isomeric change two molecules of aniline, which are joined together by the reactive "heads" of the molecule, undergo an isomeric change which leaves them united "tail to tail," so that the two heads are again available for further reactions. Under the conditions usually employed these isomeric changes appear to be completely non-reversible, since it has not been found possible to make a substituent in the phenyl group change places with a hydrogen atom in a radical attached to it.

Reversible Isomeric Change.—Although ethyl ether cannot be converted directly into any of the four butyl alcohols, it is quite easy to convert iso- and tertiary-butyl alcohol into one another; and this change can be carried out under conditions in which the isomeric change is shown to be reversible. Thus, if we remove a molecule of water from either of these alcohols, the product in each case is the hydrocarbon isobutylene,[1] thus:

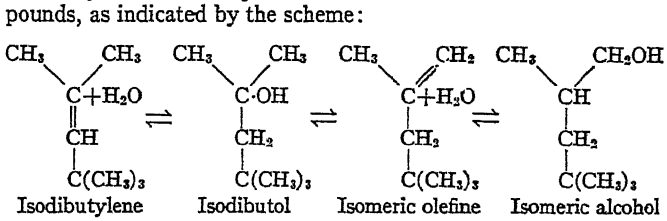


If, therefore, this process of dehydration could be reversed, we should expect isobutylene to give rise simultaneously to iso- and tertiary butyl alcohol. This hydration of the hydrocarbon can be effected by dissolving gaseous isobutylene in sulphuric acid of moderate strength. A reversible process of hydration and dehydration then takes place, of which the main product is tertiary butyl alcohol, which can be separated and identified easily, since it is a solid, whereas isobutyl alcohol is liquid at ordinary temperatures. When, however, pure crystalline tertiary butyl alcohol is dissolved in sulphuric acid and oxidized by means of chromic acid, the main product of oxidation is isobutyric acid, which must have been formed by the oxidation of isobutyl alcohol:



A solution in sulphuric acid must therefore contain isobutyl alcohol as well as tertiary butyl alcohol. Whilst, therefore, iso- and tertiary butyl alcohols are perfectly stable in the free state, it is clear that in presence of sulphuric acid they are readily converted into one another, so that the isomerism is no longer fixed or *static,* but mobile or *dynamic.* Moreover, the mechanism by which the static isomerism of the alcohols has been rendered mobile or dynamic is also clear, since this phenomenon is seen to depend on a reversible process of hydration and dehydration.

The preceding experiments on the inverconversion of butylene and the butyl alcohols were carried out by Bütlerow from 1867 to 1873. They were followed by the publication in 1877 of a paper of far-reaching importance under the prosaic title "On Isodibutylene." The hydrocarbon isodibutylene, C_8H_{16}, is a polymer of isobutylene, C_4H_8, and is formed as a by-product when isobutylene is prepared from tertiary butyl alcohol by the action of 50% sulphuric acid. When, however, this polymer was oxidized by a mixture of chromic and sulphuric acids, oxidation products were obtained which showed the presence in the solution of two isomeric hydrocarbons and two isomeric alcohols. The equilibrium established by means of sulphuric acid therefore includes four compounds, as indicated by the scheme:



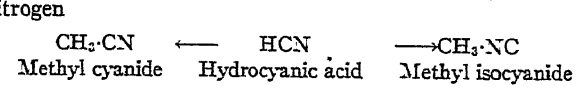
[1]This is an isomer of the hydrocarbon butylene, C_4H_8, which has been cited above as a polymer of ethylene, C_2H_4.

At low temperatures the proportion of hydrocarbon is small; the principal equilibrium is then a dynamic isomerism of two alcohols, proceeding through the formation of a small quantity of an intermediate hydrocarbon, as indicated by the last three formulae of the above scheme. At high temperatures on the other hand the proportion of hydrocarbon is large; the main equilibrium is then a dynamic isomerism of two hydrocarbons, proceeding through the formation of a small quantity of an intermediate alcohol, as indicated in the first three formulae of the above scheme.

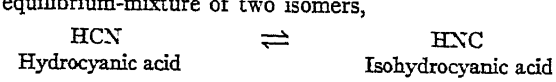
Bütlerow did not propose any new name for the condition of dynamic equilibrium between isomers which he had discovered in isodibutylene, but the term *dynamic isomerism* was introduced in 1899 by Lowry as a convenient abbreviation. Under this heading all cases of isomeric change should be included, in view of the possibility that they are all reversible to a larger or smaller extent; and the important question of the chemical and physical conditions under which a particular isomeric change takes place must also be regarded as subsidiary to the fact that an isomerism, which under other conditions may be merely static, has actually become dynamic.

Tautomerism.—The static isomerism of iso- and tertiary butyl alcohol, or of the two isodibutylenes, becomes dynamic only in presence of sulphuric acid of moderate strength, *i.e.,* when a reversible process of hydration and dehydration is set up. The isomerism of these compounds could therefore be rendered static at any moment by diluting the acid with water, when the isomers could be separated from one another in the ordinary way by fractional distillation, crystallization, etc. Bütlerow, however, also considered the possibility of reversible isomeric change proceeding without the addition of sulphuric acid, or of any similar "catalyst" to initiate the change: "In such cases, all attempts to establish a definite chemical structure for the substance would be useless, since molecules of the two or more isomeric varieties would always be present. It is clear that the chemical metamorphoses of such a substance must proceed sometimes in the sense of one chemical grouping, and sometimes in the sense of the other, according to the nature of the reagent and the conditions of the experiment."

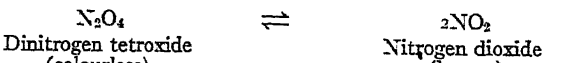
He therefore put forward his discovery of dynamic equilibrium between isomers as a solution of the problem of the *dual reactivity* of hydrocyanic acid, HCN, and of cyanic acid, HCNO. Each of these acids is known only in a single form (although cyanic acid, HOCN, yields a polymer, cyanuric acid, to which the formula $H_3O_3C_3N_3$ is assigned); but each acid yields two series of methyl derivatives. Thus hydrocyanic acid gives, (i.) methyl cyanide, in which the methyl group CH_3 is attached to the carbon of the acid, and (ii.) methyl isocyanide, in which the methyl group is attached to nitrogen



In order to explain the dual reactivity of hydrocyanic acid, Bütlerow suggested that liquid prussic acid (as it is commonly called) is an equilibrium-mixture of two isomers,



just as gaseous nitrogen peroxide is an equilibrium-mixture of two polymers



This analogy suggests of course that, since the brown vapours of nitrogen dioxide are converted wholly into colourless crystals of the tetroxide by freezing (*see* NITROGEN), the crystals of solid prussic acid would consist of one pure isomer; but this deduction was beyond the scope of Bütlerow's discussion.

The dual reactivity of a chemical compound, such as prussic acid, which behaves towards some reagents as if it had one structural formula, and towards other reagents as if it had another structural formula, is now generally called "tautomerism." Thus the Oxford Dictionary defines tautomerism as follows: "This

term is applied to the property exhibited by certain compounds of behaving in different reactions as if they possessed two or more different constitutions, that is, as if the atoms of the same compound or group were arranged in two or more different ways, expressible by different structural formulae." This definition may now be regarded as an agreed definition of a term to which several different meanings had been assigned previously.

In many cases, tautomerism is due to the existence of two isomers in dynamic equilibrium with one another; but there is no reason to suppose that this is always the case. Thus, if we attribute to silver cyanide the formula AgNC, we should expect it to yield methyl isocyanide, $CH_3{\cdot}NC$, by the direct replacement of silver by methyl,

$$CH_3I + AgNC \longrightarrow CH_3{\cdot}NC + AgI;$$

but it could also yield methyl cyanide, $CH_3{\cdot}CN$, through the intermediate formation of an addition-compound, thus:

$$AgNC + CH_3I \longrightarrow AgNC\begin{matrix}\diagup CH_3\\ \diagdown I\end{matrix} \longrightarrow CH_3{\cdot}CN + AgI.$$

It is therefore important to distinguish clearly between the purely chemical phenomenon of tautomerism, which implies the existence of *isomeric derivatives* of the parent-compound, and the physico-chemical phenomenon of dynamic isomerism which postulates the real existence of *isomeric forms of the parent-compound itself.*

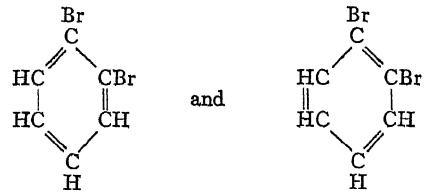
The term tautomerism was introduced in 1885 by Laar in a paper "On the possibility of several structural formulae for the same chemical compound." This possibility was used to explain an observation of Zincke (1884), who had obtained identical, instead of isomeric, products by the action of phenylhydrazine on naphthaquinone and of diazobenzene on α-naphthol, and was unable to determine whether the product should be formulated as a hydrazone or as an azo-compound:

$C_6H_5{\cdot}NH{\cdot}N{:}C_{10}H_6{:}O$	$C_6H_5{\cdot}N{:}N{\cdot}C_{10}H_6{\cdot}OH$
Hydrazone	Azo-compound

since one method of preparation pointed to the first of these structural formulae, and the other method to the second. In order to explain this and a number of similar cases, in which a single compound seemed to stand for more than one structural formulae, Laar put forward his hypothesis of tautomerism, of which a definition has virtually been given in the title of his paper. A more precise definition was put forward, however, in a paper published in the following year in which Laar stated that the various structural formulae that can be assigned to a tautomeric compound represent *"not isomeric but identical substances."*

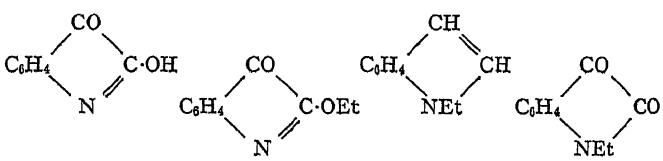
This more precise definition was introduced in order to show that his hypothesis of tautomerism was quite distinct from the explanation of the dual reactivity of prussic acid which Bütlerow had given 8 years previously, but under a title that was so obscure that Laar was probably ignorant of the contents of the paper when his own first paper was written. The fundamental difference between the two explanations arises from the fact that, according to Laar, structural isomerides can never be isolated from a tautomeric substance, because they have no real existence, whereas in order to separate a mixture of dynamic isomerides it is usually only necessary to secure the proper experimental conditions, purity, dryness, low temperature, etc. In this way Laar's theory of tautomerism was soon shown to be incorrect in the main group of cases to which he applied it. The name which he introduced has, however, remained in use, but with a wide variety of meanings as alternatives to his original definition of the term, of which the one cited above is perhaps the most authoritative expression of the current and future usage of the word.

Laar's hypothesis, that several formulae may be required to represent the successive phases in the life history of a single substance, had already been used by Kekulé in 1872 in order to account for the non-existence of certain isomeric derivatives of benzene which would otherwise have appeared to be theoretically possible. Thus, theory would predict the existence of the two isomers represented by the formulae



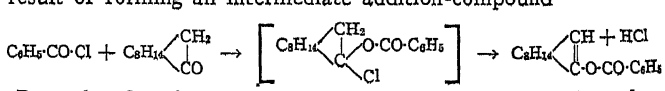
where the carbon atoms which carry the two atoms of bromine are united in the former case by a single bond, and in the latter case by a double bond. Since no such isomerism could be detected in practice, Kekulé suggested that the alternation of single and double bonds was mobile, in the sense that the first formula was a correct record of one phase in the life history of the molecule, but that this was followed by a phase of which the second formula was the record. This hypothesis is by no means improbable, but it was only rendered necessary by Kekulé's strict adherence to the view that every atom of carbon must carry four bonds. It is therefore noteworthy that, in their less formal writings, organic chemists habitually "cut the Gordian knot" by ignoring the double bonds of Kekulé's formula for benzene, and represent the hydrocarbon by a simple hexagon, in which the atoms of carbon are shown with an effective valency of 3 instead of 4. The many formulae that have been assigned to benzene, in order to account for the various chemical properties of the hydrocarbon, afford, however, an ideal example of Laar's hypothesis of tautomerism, since all these formulae are intended to represent the same hydrocarbon, *i.e.*, they represent identical and not isomeric substances.

Pseudomerism.—An alternative explanation of Zincke's observation (which he rejected) was described by Laar as pseudomerism in order to describe a discovery which von Baeyer had made in 1883, that a compound to which a definite structural formula can be assigned may nevertheless yield (or be prepared from) derivatives having a totally different structure. Thus Baeyer's observations showed that, although isatin yields an *O*-ethylisatin (a) by direct ethylation, an isomeric *N*-ethylisatin (b) can be prepared indirectly from ethylindole by oxidation, although the pseudo-isatin (ψ-isatin) from which it is derived is altogether unknown:



Isatin — Ethylisatin — Ethylindol — Ethyl-ψ-isatin

A similar possibility has already been discussed in connection with silver cyanide, but many other illustrations might be cited. Thus, ordinary camphor, when boiled with benzoyl chloride, $C_6H_5{\cdot}CO{\cdot}Cl$, yields the benzoate of an isomeric alcohol (or enol), perhaps as a result of forming an intermediate addition-compound



Benzoyl chloride — Camphor — Intermediate addition-compound — Benzoylcamphor

This hypothesis was contrasted by Laar with his own hypothesis of tautomerism; but it should be noticed that the Oxford definition of tautomerism would include, instead of excluding, every case in which the occurrence of pseudomerism could be established, since it lays stress only on the fact of dual reactivity, and wisely ignores the various explanations that can be given of that fact.

Desmotropy and Prototropy.—The two structural isomerides which Zincke attempted, but failed, to prepare, differ from one another (apart from a rearrangement of the single and double bonds between the atoms) only in the position occupied by a single atom of hydrogen, which is attached to nitrogen in the hydrazone and to oxygen in the isomeric azo-compound. Most of the other cases cited by Laar were of the same type. When therefore his

theory of tautomerism became untenable, it was natural that this feature of his work should have tended to survive. Many writers have, in fact, adopted a definition which limits the phenomenon of tautomerism to cases of this type. Thus Kurt Meyer (1913) suggests that: "Substances are tautomeric if they form two series of derivatives which are deduced from two isomeric formulae; these formulae differ from one another in the position of a hydrogen atom, and of one or more double bonds." In the same way Schmidt, *Text-book of Organic Chemistry* (English trans., 1926), says: "A substance is tautomeric when it forms two series of derivatives. These are derived from two parent structures which differ only in the position of a hydrogen atom and of one or more double bonds."

This limitation is out of harmony with the definition of tautomerism cited above, and has the disadvantage of excluding the most characteristic of all cases of tautomerism, namely, that of the hydrocarbon benzene; it is therefore out of place in a modern definition of the term. On the other hand, this particular group of isomeric changes is so important that some special term is needed to describe it. The term *desmotropy*, or bond-shifting, was therefore put forward for this purpose by Jacobsen in 1887, to describe "a rearrangement of bonds consequent upon the displacement of a hydrogen atom," in the following note: "The word 'tautomerism' is based on Laar's view, which (I believe) is not shared by most chemists, that the molecules of compounds whose chemical behaviour is represented by two structural formulae differing in the point of attachment of a hydrogen atom never assume a definite constitution, but exist in a constant state of oscillatory change. The majority of chemists would explain the observations in question in this way, that the known form of such compounds are to be represented by a definite grouping of atoms which in certain reactions passes over into an isomeric grouping by a rearrangement of bonds consequent upon the displacement of a hydrogen atom" (*Ber.*, 1887, 20, p. 1,732, footnote).

A serious blunder was made, however, when Hantzsch and Hermann (1887) attempted to make this term mean something different by limiting it to those cases of supposed tautomerism to which Laar's term could no longer be applied, because pairs of isomers had actually been isolated from the substance in question. In this way a word which might have been a valuable addition in chemical nomenclature was rendered ambiguous and therefore useless. Until recently, therefore, there was no term available to describe specifically the important group of isomeric changes which Jacobsen sought to differentiate. This gap has now been filled by the introduction of the word *prototropy* (Lowry, *Trans. Chem. Soc.*, 1923, 123, p. 828) to describe those isomeric changes which depend only on the displacement of a hydrogen atom, or proton, accompanied by a rearrangement of bonds, as postulated in Jacobsen's definition. By way of contrast isomeric changes which involve only a displacement of bonds or valency electrons without any accompanying displacement of atoms has been described as *electrotropy* (*cf.* H. S. Fry, *Electronic Conception of Valence*, p. 11), whilst those isomeric changes which involve the displacement of radicals or ions other than hydrogen have been described by the term *ionotropy* (Lowry, "Le Mécanisme de la Transformation Chimique," Second Report of the *Institut International de Chimie Solvay*, 1925, p. 150).

Examples of Prototropic Change.—(a) Ethyl acetoacetate. The classical example of prototropy is found in ethyl acetoacetate, which was cited in Laar's first paper as an example of tautomerism, since it gives with almost equal readiness derivatives of the two structural isomers formulated below:

$CH_3{\cdot}CO{\cdot}CH_2{\cdot}CO{\cdot}O{\cdot}C_2H_5$ — Ketonic form

$CH_3{\cdot}C(OH){:}CH{\cdot}CO{\cdot}O{\cdot}C_2H_5$ — Enolic form

The first structure is described as the *ketonic* form, since it contains the characteristic group $>C{\cdot}CO{\cdot}C<$ of the ketones; the second structure contains a double bond ("en") and an alcohol-radical ("ol") and is therefore described as *enolic*. By working at low temperatures Knorr (1911) was able to separate the two isomers, to determine the proportions in which they are present in the liquid ester at atmospheric temperatures, and to prove that they behave differently towards ferric chloride. Later on Kurt Meyer, who had devised a method for estimating the enolic form by its easy bromination, showed that the two isomers could be separated by "aseptic distillation," *i.e.*, by fractional distillation in vessels of silica glass, in order to avoid the catalytic action of the alkali in ordinary glass. The isomerism of both the *ketonic* and the *enolic* forms of the ester has thus been studied with marked success.

(b) Nitrocamphor and the sugars. The migration of a hydrogen atom in nitrocamphor, giving rise to a salt-forming isomeride, is accompanied by changes of optical rotatory power or *mutarotation* (Lowry, *Trans. Chem. Soc.*, 1899, 75, p. 211), and can therefore be studied very easily with the help of a polarimeter to measure their rotary power.

$C_8H_{14}{<}^{CH{\cdot}NO_2}_{CO}$ $\rightleftharpoons$ $C_8H_{14}{<}^{C{:}NO{\cdot}OH}_{CO}$

Nitrocamphor — pseudo-Nitrocamphor

As long ago as 1899 therefore the study of this compound led to the discovery that even this very facile type of isomeric change does not take place spontaneously, since solutions of nitrocamphor in chloroform could sometimes be kept for many days before they began to change, apparently as the result of the introduction of some catalytically active impurity.

Changes of mutarotation, resulting from analogous changes of structure, were discovered as long ago as 1846 by Dubrunfaut in freshly-prepared solutions of glucose, and subsequently by other workers in solutions of many other sugars, from several of which the two isomeric forms have been separated, just as in the case of ethyl acetoacetate. By making use of methylated sugars, which are soluble in inert organic solvents as well as in water, it has been possible to arrest the mutarotation of these compounds in just the same way as in the case of nitrocamphor (Lowry and Richards, 1925) and therefore to determine what conditions are needed in order to initiate the isomeric change. Experiments in non-aqueous solvents then showed that this can only be effected by *amphoteric solvents*, *i.e.*, solvents such as water or a mixture of pyridine and cresol which possess both acid and basic properties (Lowry and Faulkner, 1925). These solvents are able to bring about the migration of a hydrogen atom, since on the one hand the basic components can take away a proton (or hydrogen atom) from the sugar, whilst on the other hand the acid components can supply a proton to the sugar at the new point of attachment. The isomeric change can therefore be attributed to an electrolysis (*q.v.*) of the sugar, as represented by schemes such as

$$\overset{-}{HO} + HG + \overset{+}{H} \longrightarrow H_2O + GH + \overset{-}{Ac}$$

or $$H_2O + HG + H_2O \longrightarrow \overset{+}{H_3O} + GH + \overset{-}{HO}$$

where the two forms of the sugar are represented by the formula HG and GH, with the base or proton-acceptor on the left and the acid or proton-donator on the right.

Polymorphism and Isomerism of Prototropic Compounds.—The ease with which prototropic compounds can change into one another leads one to suspect that many of the cases which have been described as polymorphism really depend on differences of molecular structure, since, if the changes of structure are rapid, it may be quite impracticable to detect them. Thus in the case of π-bromonitrocamphor, two types of crystals had been submitted to crystallographic measurement and drawings published (Lapworth and Kipping, 1896) before they were shown to be isomerides of widely-different rotatory power. It therefore appears certain that when compounds of this type are reported to exist in polymorphic forms which differ in colour but yield identical solutions, the two series of crystals must be built up from molecules which differ in structure but are readily interconvertible in solution. It is, in fact, impossible to draw a sharp boundary between the two phenomena, and whilst the existence of isomerism can often be established, it is impossible to assert with confidence in any but the simplest cases that polymorphic crystals are built up from identical and not from isomeric molecules. (T. M. L.)

ISOMORPHISM, in crystallography and mineralogy (*qq.v.*), the similarity of crystalline form in substances which are chemically related. Isomorphism is also used in mathematics as applied to groups to denote the correspondence between their operations (*see* GROUPS, THEORY OF).

ISONZO, a river in Italy which played a very important part in the World War on the Italian front, no less than twelve battles being named after it. It rises in the Val Trenta, northwest of Monte Tricorno, flows through the Plezzo basin in a southerly direction, past Caporetto and Tolmino, through the Canale gorge, between the hills E. of Gorizia and the Podgora-Sabotino group opposite, debouches in the plain of Eastern Friuli, until not far from its mouth it divides into two branches, the Sdobba and the Isonzato, both of which flow into the sea in the gulf of Trieste. Before the war the whole of its course was in Austrian territory, but on the outbreak of hostilities the Italian troops crossed it both in the gorge of Plava north of Gorizia, where they established a small bridgehead, and on its lower reaches south of Gradisca. There was very heavy fighting along its banks before the capture of Gorizia and during the operations leading to that capture (August 1916). Between Plava and Salcano and north of Plava the Italians remained on the right bank of the river, until the 10th battle of the Isonzo in May 1917, when an attack from Plava resulted in the Italian capture of Hill 383, Monte Kuk and Monte Vodice on the left bank. In the 11th battle (August 17–Sept. 12, 1917) the river was crossed by the Italians north of Plava between Dobar and Anhovo, and Auzza and the Jelenik were conquered, and immediately after the whole of the Bainsizza plateau, some 500 m. above sea level north-east of Gorizia. Higher up the left bank was again in Italian hands, except in the Tolmino sector which it proved impossible to capture in spite of repeated offensives. In October 1917 General Cadorna decided to withdraw all his artillery on the right bank, in view of the coming enemy offensive, but his orders to that effect were not completely carried out. The Austro-Germans delivered their attack on October 24, 1917 and broke through the Italian lines first in the Plezzo basin between Sleme and the Mrzli, and crossed the river at Idersko and Caporetto. This breach determined the fall of the positions further south and consequently of the whole Isonzo front, forcing the Italians to fall back on the Piave. The battle positions were reoccupied after the Italian victory of Vittorio in October-November 1918.

ISOPERIMETRY, a word originally used in geometry to refer to figures of equal perimeter; *e.g.*, a circle and an ellipse may have equal perimeters (circumferences) although not equal areas. One of the simplest of the problems arising in the study is to determine, from all plane figures having the same perimeter, the one that shall have the greatest area. This figure is the circle. Considered more generally, given any number of geometric figures, all defined in the same way, determine the form of the one possessing a maximum (or minimum) amount of a certain property; *e.g.*, of all the triangles having a given area (figures defined as plane, three-sided, and of a given area), the one having the least perimeter is equilateral. For the general definition and treatment consult works on the calculus of variations (*q.v.*), where the theory is extended to include solid as well as plane figures.

ISOPRENE, a mobile volatile liquid, C_5H_8 (sp. gr. 0·69; b.p. 34° C) which is of interest chiefly because it polymerizes readily to form rubber-like substances (*see* TERPENES and POLYMERIZATION).

ISOPTERA, an order of insects (*q.v.*), comprising the termites (*q.v.*) or so-called "white ants" of the tropics. (*See* also SOCIAL INSECTS.)

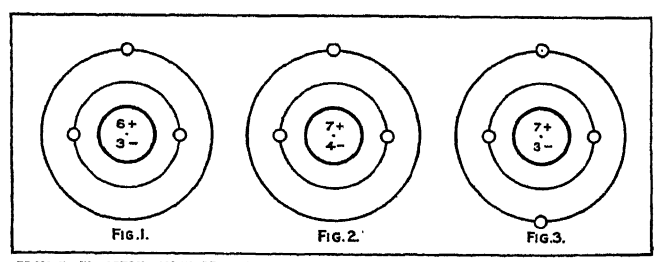
ISOSTASY: *see* GEODESY.

ISOTHERM, a line upon a map connecting places having the same temperature at any particular instant or for any selected period of time. Alexander von Humboldt (1769–1859) first employed them in a discussion of the temperatures occurring in the Northern Hemisphere. (*See* MATHEMATICAL MODELS.)

ISOTOPES is the term first applied by F. Soddy in 1913 to substances which, though they had different atomic weights, yet had identical chemical properties and occupied the same place in the periodic table of the elements. Over a century earlier Dalton had postulated that atoms of the same element are similar to one another and equal in weight. A little later Prout suggested that the atoms of all elements were composed of atoms of a primordial substance which he endeavoured to identify with hydrogen.

If both these theories were right, the atomic weights of all elements would be comparable with each other as whole numbers. This the chemists soon showed was quite incompatible with experimental evidence. It is true that many were very nearly whole numbers, far too many for the effect to be pure chance, but others, like chlorine, were hopelessly fractional. Of the two alternatives Dalton's is much the simpler from the chemical point of view and was therefore quite rightly chosen as a working hypothesis. From this in course of time it developed into an article of scientific faith, and, despite the complete absence of positive evidence in its support, no serious questions as to its validity were raised until late in the 19th century. Of such speculations those of Crookes were founded on unsound evidence and were soon discredited. The question could not be settled by ordinary chemical methods, which employ countless myriads of atoms and could therefore only give a mean result, and it was only by the discovery of radioactivity and the development of accurate methods of weighing individual atoms that the existence of isotopes was disclosed. The two advances were nearly contemporaneous but the first definite convincing proof of isotopy was found among the radioactive elements and their products.

The Radioactive Isotopes.—In 1906 Boltwood discovered ionium and found that it had similar chemical properties to thorium. Further research using the most delicate radioactive methods failed to indicate the slightest chemical separation of these two elements once they had been mixed, and even more surprising their spectra appeared to be identical. Other pairs of elements in the radioactive group showed corresponding identities and later investigations on the chemistry of the products of radioactive disintegrations enabled the chemical law of radioactive change to be formulated (*see* RADIOACTIVITY). This stated that a radioactive element when it loses an alpha particle goes back two places in the periodic table; when it loses a beta particle it goes forward one place. An alpha particle is a helium nucleus of weight 4, whereas a beta particle is an electron of negligible weight. It follows that if a body loses one alpha and two beta particles it will be back again in the same place in the periodic table although it will have lost a mass equal to four units of atomic weight.



FROM F. W. ASTON, "ISOTOPES" (EDWARD ARNOLD)

Fig. 1. represents an atom with a nucleus made up of 6 protons and 3 electrons, surrounded by 3 planetary electrons, whose energy levels are represented by the small circles. Fig. 2. One proton and one electron have been added to the nucleus. The atomic number remains 3; therefore, Figs. 1 and 2 are isotopes. Fig. 3. The proton has been added to the nucleus and the electron to the planetary system, so that the atomic number becomes 4. Figs. 2 and 3 are therefore isobares

Isotopic Bodies Predicted.—Supported by this law, which he was the first to state in its most general form, Soddy boldly claimed that these "isotopic" bodies would be both chemically and spectroscopically indistinguishable. He also predicted that the lead produced by the disintegration of uranium would have an atomic weight 206, while that of the lead produced from thorium would be 208, and that consequently the atomic weight of the lead found in uranium minerals should be less than that of ordinary lead (207·2) while that of lead from thorium minerals should be greater. These predictions were amply vindicated by

the work of experts on atomic weights (Richards, Hönigschmid and others), and it was shown beyond all dispute that the isotopic leads, though they differed by the predicted amount in properties such as atomic weight, density, and solubility which depend directly on the weight of their atoms, in all others, which do not—atomic volume, boiling-point, melting-point, refractive index and spectrum—were quite indistinguishable.

Practical Utilization of Indicators.—The impossibility of separating isotopes has been utilized in ingenious manner by Hevesy and Paneth. By the addition of a small quantity of a radioactive isotope to an ordinary inactive element, the latter is, so to speak, indelibly labelled and can be followed by the methods of radioactivity, which are incomparably more delicate than those of chemistry. In this way the solubility of very insoluble salts can be readily determined. By the addition of a little thorium B, an isotope of lead, valuable information has been obtained on the assimilation of the salts of the latter element by living plants. The use of such radioactive indicators affords a direct proof of the ionic dissociation theory; it has led to the discovery of certain metallic hydrides and to the determination of the velocity of diffusion of molecules among themselves, an otherwise insoluble problem.

The reasoning which led to the discovery of isotopes among the products of radioactive disintegration could not, however, be applied to the vast majority of elements which are not radioactive. For these there is only one direct method of testing Dalton's postulate, namely, that of weighing their individual atoms. This can be done by the analysis of positive rays (*see* POSITIVE RAYS). The fact that when subjected to Sir J. J. Thomson's method of positive ray analysis certain elements gave definite sharp parabolas, and not mere blurs, constituted the first direct proof that atoms of the same element were, even approximately, of equal mass. For some time the results of the application of this method of analysis appeared to support the hypothesis of Dalton, as the elements introduced into the discharge tube gave single, or apparently single, parabolas in the positions expected from their chemical atomic weights (*see* CONDUCTION OF ELECTRICITY: *Gases*).

Examination of Neon.—But when, in 1912, neon was examined, the trace obtained was definitely double. The brighter curve corresponded roughly to an atomic weight of 20, the fainter companion to one of 22, the atomic weight of neon being 20·20. The line 22 could only be explained as due to a hitherto unknown elementary constituent of neon. This agreed well with the new idea of isotopic elements which was just then emerging from the investigations on radioactivity, so that it was of importance to investigate the point as fully as possible. The first line of attack was an attempt at separation by fractional distillation, but the result was entirely negative. The second method employed was that of fractional diffusion through pipe-clay which gave a small, but definite, positive indication of separation. It therefore seemed probable that neon was a mixture of isotopes.

The Mass-Spectrograph.—By the time that research on the subject was resumed at the Cavendish laboratory in 1919, the existence of isotopes among the products of radioactivity had been proved beyond all reasonable doubt by the work on the atomic weight of lead. This fact automatically increased the value of the evidence of the complex nature of neon and the urgency of its definite confirmation. It was realized that separation could only be very partial at the best, and that the most satisfactory proof would be afforded by measurements of atomic weight by the methods of positive ray analysis. These would have to be so accurate as to prove beyond dispute that the accepted atomic weight lay between the real atomic weights of the two constituents, but corresponded with neither of them. The parabola method was not equal to this, but the required accuracy was achieved by means of the mass-spectrograph, an instrument capable of analysing positive rays (*q.v.*) into a spectrum of focussed lines, a mass spectrum. The first mass-spectrograph built in 1919 compared masses with an accuracy of about 1 in 1,000.

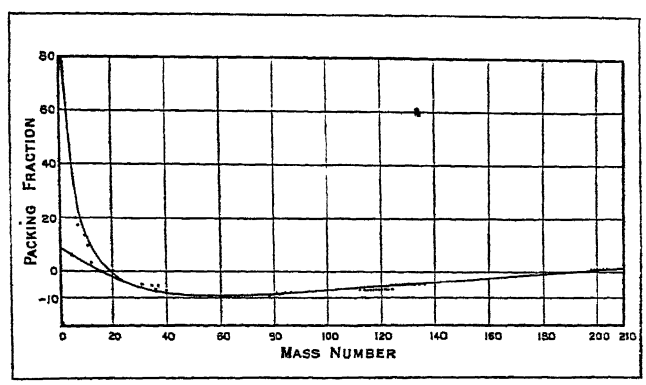
When neon was introduced into this apparatus, four new lines made their appearance at 10, 11, 20 and 22. The first pair are second order lines. All four are well placed for direct comparison with standard lines, and a series of consistent measurements showed that to within about one part in a thousand, the atomic weights of the isotopes composing neon are 20 and 22 respectively. Ten per cent of the latter would bring the mean atomic weight to the accepted value 20·20, and the relative intensity of the lines agrees well with this proportion. The isotopic nature of neon was therefore settled beyond doubt. *See* Plate in POSITIVE RAYS for the first order lines of neon and some of the reference lines with which they were compared.

Analysis of Chlorine.—The element chlorine was naturally the next to be analysed, and the explanation of its fractional atomic weight (35·46) was obvious at once. Its mass-spectrum is characterized by four strong lines 35, 36, 37, 38. The simplest explanation of the group is to suppose that the lines 35 and 37 are due to the isotopic chlorines, and the lines 36 and 38 to their corresponding hydrochloric acids. The elementary nature of 35 and 37 is indicated by their second order lines at 17·5 and 18·5, and also when phosgene was used, by the occurrence of lines at 63 and 65 due to $COCl^{35}$ and $COCl^{37}$.

Later it was found possible to obtain the spectrum of the negatively charged atoms of chlorine. This showed only two lines 35 and 37, so that the lines 36 and 38 cannot be due to isotopes of the element. These results show that chlorine is a complex element, and that its isotopes are of atomic weight 35 and 37. Spectra II., III. and IV. show the results with chlorine taken with different field strengths.

Other Elements.—As the work progressed with other elements further interesting results were obtained. Some elements, such as carbon and oxygen, were found to be "simple"; that is, not mixtures of isotopes. This was to be expected from their whole-number atomic weights. The large majority proved "complex," the number of isotopes tending to be greater in elements of high atomic weight. Tin has no less than 11 isotopes.

Mass rays of the metallic elements, which are in the majority, cannot in general be produced in the ordinary vacuum discharge but they can be investigated by means of anode rays. Thus the constitution of the alkali metals was first discovered by the use of an anode consisting of a platinum strip coated with salts of the metals and heated electrically. Dempster, at Chicago, produced mass rays of metals by heating the element in a furnace and



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FIG. 4.—PACKING FRACTION CURVE. BEGINNING AT MERCURY, AT RIGHT, IT DESCENDS TO MINUS 10 IN THE IRON-NICKEL REGION AND THEN ASCENDS IN A ROUGHLY HYPERBOLIC MANNER TO HYDROGEN, +77.8, ON THE LEFT

ionizing the vapour produced by electron impact. By this means he made the first analyses of magnesium calcium and zinc, and also confirmed the results already obtained for the lighter alkali metals.

More recently a large number of elements, including some of the rare earths, have been successfully attacked by means of the special method of "accelerated anode rays" (*see* POSITIVE RAYS) and in all 57 out of the 80 known non-radioactive elements have been analysed into their constituent isotopes or shown to be simple.

Table of Elements and Isotopes.

Element.	Atomic number.	Atomic weight.	Minimum number of isotopes.	Mass numbers of isotopes in order of intensity.
H	1	1·008	1	1
He	2	4·00	1	4
Li	3	6·94	2	7, 6
Be	4	9·02	1	9
B	5	10·82	2	11, 10
C	6	12·00	1	12
N	7	14·01	1	14
O	8	16·00	1	16
F	9	19·00	1	19
Ne	10	20·20	2	20, 22
Na	11	23·00	1	23
Mg	12	24·32	3	24, 25, 26
Al	13	26·96	1	27
Si	14	28·06	3	28, 29, 30
P	15	31·02	1	31
S	16	32·06	1	32, 33, 34
Cl	17	35·46	2	35, 37
A	18	39·88	2	40, 36
K	19	39·10	2	39, 41
Ca	20	40·07	2	40, 44
Sc	21	45·1	1	45
Ti	22	48·1	1	48
V	23	51·0	1	51
Cr	24	52·0	1	52
Mn	25	54·93	1	55
Fe	26	55.84	2	56, 54
Co	27	58.97	1	59
Ni	28	58·68	2	58, 60
Cu	29	63·57	2	63, 65
Zn	30	65·38	4	64, 66, 68, 70
Ga	31	69·72	2	69, 71
Ge	32	72·38	3	74, 72, 70
As	33	74·96	1	75
Se	34	79·2	6	80, 78, 76, 82, 77, 74
Br	35	79·92	2	79, 81
Kr	36	82·92	6	84, 86, 82, 83, 80, 78
Rb	37	85·44	2	85, 87
Sr	38	87·63	2	88, 86
Y	39	88·9	1	89
Zr	40	(91)	3 (4)	90, 94, 92, (96)
Ag	47	107·88	2	107, 109
Cd	48	112·41	6	114, 112, 110, 113, 111, 116
In	49	114·8	1	115
Sn	50	118·70	11	120, 118, 116, 124, 119, 117, 122, 121, 112, 114, 115
Sb	51	121·77	2	121, 123
Te	52	127·5	3	128, 130, 126
I	53	126·92	1	127
X	54	130·2	9	129, 132, 131, 134, 136, 128, 130, 126, 124
Cs	55	132·81	1	133
Ba	56	137·37	(1)	138
La	57	138·91	1	139
Ce	58	140·25	2	140, 142
Pr	59	140·92	1	141
Nd	60	144·27	3 (4)	142, 144, 146, (145)
Hg	80	200·6	6	202, 200, 199, 198, 201, 204
Bi	83	209·00	1	209
Pb	82	207·2	3	208, 206, 207

The Whole-Number Rule.—By far the most important general result of these investigations is that, with the exception of hydrogen, the weights of the atoms of all the elements measured, and therefore almost certainly of all elements, are whole numbers to about one part in a thousand. Of course, the error expressed in fractions of a unit increases with the mass measured, but with the lighter elements the divergence from the whole-number rule is extremely small. This enables sweeping simplifications to be made in our ideas of mass.

The original hypothesis of Prout can now be restated with the modification that the primordial atoms are of two kinds: protons and electrons, the atoms of positive and negative electricity. According to the modern theory of the nucleus atom (*see* ATOM; MATTER) all the protons and about half of the electrons are packed very close together to form a central, positively charged nucleus, round which the remaining electrons circulate, somewhat like the planets round the sun. All the spectroscopic and chemical properties of the atom depend on the net positive charge on the nucleus, which is the excess of protons over nuclear electrons. This is also clearly the number of planetary electrons in the neutral atom; it is called the "atomic number" and is actually the number of the element in the periodic classification: 1 for H, 2 for He, 3 for Li, and so on.

The whole-number weight of the atom, on the other hand, will be the total number of neutral pairs of protons and electrons it contains. This is also the number of protons in its nucleus, and is called the "mass-number" of the atom: 1 for H, 4 for He, 6 and 7 for the isotopes of Li, and so on. For the purpose of distinguishing isotopes it is customary at present to use the chemical symbol of the complex element with an index corresponding to the mass-number of the particular isotope, *e.g.*, Ne^{22}, Rb^{87}.

Isotopes and Isobares.—Fig. 1 represents an atom with a nucleus made up of 6 protons and 3 electrons, surrounded by 3 planetary electrons. It must be borne in mind that the circles represent the energy levels of the latter, not their actual orbits. If we add 1 proton and 1 electron to the nucleus we shall get the atom represented in fig. 2. Here the atomic number remains 3 as before, the planetary electrons are unaffected and the chemical and spectroscopic properties unaltered but the weight of the atom will be increased by one unit. Figs. 1 and 2 are therefore atoms of different weight but identical chemical properties, *i.e.*, isotopes. They are in fact the isotopes of lithium Li^6 and Li^7.

If on the other hand the proton is added to the nucleus and the electron introduced into the planetary system we obtain fig. 3. Here the weight is increased by 1 as before but the atomic number is now 4, the planetary system altered and the chemical properties changed. Figs. 2 and 3 therefore represent atoms having the same weight but different properties; such substances are called isobares. Many pairs of isobares are known, the most striking being the most abundant constituents of argon and calcium having the same mass number 40. It is difficult to imagine bodies more completely different in all outward properties yet no difference whatever has yet been detected between the weights of their atoms.

Packing Fraction.—If the additive law of mass were as true when an atomic nucleus is built of protons plus electrons as when a neutral atom is built of nucleus plus electrons, or a molecule of atoms plus atoms, the divergences from the whole-number rule would be too small to be significant, and, since a neutral hydrogen atom is 1 proton plus 1 electron, the masses of all atoms would be whole numbers on the scale H=1. The measurements made with the first mass-spectrograph were sufficiently accurate to show that this was not true. The theoretical reason adduced for this failure of the additive law is that, inside the nucleus, the protons and electrons are packed so closely together that their electro-magnetic fields interfere and a certain fraction of the combined mass is destroyed, whereas outside the nucleus the distances between the charges are too great for this to happen. The mass destroyed corresponds to energy released, analogous to the heat of formation of a chemical compound, the greater this is the more tightly are the component charges bound together and the more stable is the nucleus formed. It is for this reason that measurements of this loss of mass are of such fundamental importance, for by them we may learn something of the actual structure of the nucleus, the atomic number and the mass number being only concerned with the numbers of protons and electrons employed in its formation.

The most convenient and informative expression for the divergences of an atom from the whole-number rule is the actual divergence divided by its mass number. This is the mean gain or loss of mass per proton when the nuclear packing is changed from that of oxygen to that of the atom in question. It is called the "packing fraction" of the atom and expressed in parts per 10,000. Put in another way, if we suppose the whole numbers and the masses of the atoms to be plotted on a uniform logarithmic scale such that every decimetre equals a change of 1%,

then the packing fractions are the distances, expressed in millimetres, between the masses and the whole numbers.

The original mass-spectrograph was not sufficiently accurate to detect the divergences from the whole-number rule except in the case of hydrogen. The atom of hydrogen weighs about 1·008 on the oxygen scale and its abnormal weight is clearly attributable to the fact that its nucleus consists of a single proton the mass of which will not be reduced by the packing effect described. In order to measure the packing fractions of other elements it has been necessary to build a special mass-spectrograph (*see* POSITIVE RAYS) with an accuracy of 1 in 10,000. The results obtained with this instrument are tabulated below. The table includes results for the lithium isotopes calculated from measurements made by Costa with an accuracy of 1 in 3,000.

Atom.	Packing fraction $\times 10^4$.	Mass O=16.	Atom.	Packing fraction $\times 10^4$.	Mass O=16.
H	77·8±1·5	1·00778	Cl^{35}	−4·8±1·5	34·983
He	5·4±1	4·00216	A^{36}	−6·6±1·5	35·976
Li^6	20·0±3	6·012	Cl^{37}	−5·0±1·5	36·980
Li^7	17·0±3	7·012	A^{40}	−7·2±1	39·971
B^{10}	13·5±1·5	10·0135	As	−8·8±1·5	74·934
B^{11}	10·0±1·5	11·0110	Kr^{78}	−9·4±2	77·926
C	3·0±1	12·0036	Br^{79}	−9·0±1·5	78·929
N	5·7±2	14·008	Kr^{80}	−9·1±2	79·926
O	0·0	16·0000	Br^{81}	−8·6±1·5	80·926
F	0·0±1	19·0000	Kr^{82}	−8·8±1·5	81·927
Ne^{20}	0·2±1	20·0004	Kr^{83}	−8·7±1·5	82·927
Ne^{22}	(2·2 ?	22·0048)	Kr^{84}	−8·5±1·5	83·928
P	−5·6±1·5	30·9825	Kr^{86}	−8·2±1·5	85·929
			I	−5·3±2	126·932
Tin (eleven isotopes)			Sn^{120}	−7·3±2	119·912
Xenon (nine isotopes)			Xe^{134}	−5·3±2	133·929
Mercury (six isotopes)			Hg^{200}	+0·8±2	200·016
Lead (three isotopes)			Pb^{207}	+0·8±2	206·016

It will be seen that in addition to the first two fundamental constants of an atom, atomic number and mass number which settle the numbers of protons and electrons contained in its nucleus, we now have a third, the packing fraction, which gives entirely new information on the nucleus, for it is a measure of the forces binding those protons and electrons together. The discriminating value of this information is clear at once, *e.g.*, had the packing fraction of the helium atom not been greater than that of the oxygen atom it would have ruled out the possibility that the nucleus of the latter was simply built of four unchanged helium nuclei or alpha particles, for there would have been no loss of energy, that is mass defect, in the latter to represent the binding forces holding the four particles together. High packing fractions indicate looseness of packing, and therefore low nuclear stability; low packing fractions the reverse. When the packing fractions of the atoms are plotted against their mass-numbers, it is found that for all atoms above mass-number 20 these lie roughly on a single curve. (Fig. 4.)

From mercury, whose packing fraction is hardly distinguishable from that of oxygen, the curve descends and reaches a minimum of about −10 in the iron nickel region. It then ascends and in the case of atoms of odd atomic number continues to do so, in a roughly hyperbolic manner, right up to hydrogen +77·8. The light atoms of even atomic number have packing fractions well below this curve and approximate to a branch rising much less steeply to helium +5·4. This suggests that the light elements of odd atomic number have a common loosely packed, and therefore heavy, outside structure, which is not present in the closer packed and more stable nuclei of helium, carbon and oxygen.

Isotopes and Atomic Weights.—The theoretical importance of chemical atomic weight has been somewhat reduced by the discovery that for so large a number of elements it merely represents a statistical mean. Its position as a natural numerical constant associated with an element has now been taken by the atomic number, which indeed defines the element, though from the point of view of chemical analysis, the mean atomic weight is as important as ever. The anomalies shown by those elements which, by their atomic weights, appear out of their right order in the periodic table, are now open to the simplest explanation. Thus argon, in which the heavier of two isotopes predominates, has a greater mean weight than potassium, in which the reverse is the case. The same explanation applies to cobalt, nickel, tellurium and iodine.

Since the atomic number only depends on the *net* positive charge on the nucleus, arithmetically any element can possess an indefinite number of isotopes. The table herewith shows that those present in detectable quantity are restricted both in number and range of weight, though the causes of these restrictions are at present unknown. No element of odd atomic number has more than two isotopes and, above atomic number 9, the mass-numbers of the isotopes always differ by 2, and the lighter is the more abundant constituent. The number of nuclear electrons tends to be even. That is, in the great majority of cases even atomic number is associated with even mass-number, and odd with odd. Beryllium and nitrogen are the only elements consisting entirely of atoms whose nuclei contain an odd number of electrons.

If the mass-numbers of the various species of atoms are plotted against their relative abundance in the earth's crust, a strong preponderance of those of type 4n may be seen. There is an extreme difference of range between the abundance of isotopes in an element and elements in nature. In the case of elements of an odd atomic number this cannot be ascribed merely to lack of delicacy in the means of detection of their isotopes. Thus while there are only about three Cl^{35} atoms to one Cl^{37} and about two Ga^{69} atoms to one Ga^{71}, yet there are a thousand million more atoms of chlorine than of gallium. This suggests that isotopes have some relation in common more fundamental than that of identity of nuclear charge, an idea which is supported by other independent lines of reasoning.

Spectra of Isotopes.—As regards their series spectra, in which, on Bohr's theory, the two bodies concerned are an electron and an enormously more massive atomic nucleus, the prediction that isotopes should be indistinguishable is satisfied to a high degree of precision. So far the only effect detected is a minute difference of wave-length between the lines of Carnotite lead (206) and ordinary lead (207·2). The most accurate measurements by Merton indicate that this has a maximum value of 0·011 Å for the line λ=4058. Smaller shifts are detectable in a few other lines, the wave-length for the lighter atom being the greater in all cases. In band spectra, where two nuclei are concerned, the isotope effects are much larger and in excellent agreement with theory. In the case of HCl bands in the infrared region the duplicate peaks are as much as 14 Å apart, and in position and relative intensity, correspond exactly with the results expected from the presence of HCl^{35} and HCl^{37}.

More recently by investigation of band spectra produced in the visible region by boron oxide and silicon nitride, Mulliken has shown that separate band heads appear corresponding to the 2 isotopes of boron, in the one case, and to 3 isotopes of silicon in the other. These results constitute valuable independent confirmation of the results of the mass-spectrograph.

Separation of Isotopes.—It is perhaps a fortunate thing for the simplicity of chemical arithmetic that the artificial separation of isotopes is excessively difficult, while at the same time no process tending to that end in nature appears to exist at all. Of the artificial methods the only one giving complete separation is the actual analysis of the mass-rays, during which the isotopic atoms strike the plate at different points and therefore, if collected, would yield pure specimens. The quantities so produced would, with the means at present available, be far too minute to be of any practical value.

A large number of methods for partial separation have been suggested and tried. The first successfully used, which is only applicable to gases, is that of free diffusion through pipe-clay or other suitable porous material. The diffusion rates are inversely proportional to the square roots of the masses concerned. It follows that if a large volume V of a mixture of isotopes is

allowed to diffuse, leaving a small residue v, the latter will be richer in the heavier constituent than was the original gas. The actual numerical value of this enrichment, under ideal conditions, with isotopes, such as those of neon, which differ by 10%, is only $(V/v)^{1/20}$, so that only by the use of very large volumes, or laborious repetitions, can any measurable change be achieved. The original experiments with neon gave a shift of atomic weight of rather more than 0·1 of a unit. Harkins, at Chicago, by the use of 19,000 litres of HCl, was able to obtain considerable samples in which the atomic weight of chlorine differed by 0·055 unit.

Another method, following much the same numerical laws, is that of Bronsted and Hevesey, which consists of free evaporation from a liquid surface at very low pressure. They obtained two samples of above 0·2 cc. of mercury differing in density by 5 parts in 10,000, or 0·1 of a unit. The atomic weights showed a corresponding difference, but the electrical conductivity of the two samples was indistinguishable to one part in a million.

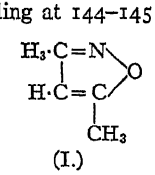
Other methods of separation such as chemical action, centrifuging, ionic migration and thermal diffusion have only yielded meagre or entirely negative results. A very large number of attempts have been made in recent years to discover any variation in the chemical atomic weight of elements known to be complex, which would indicate a change in the proportions of the isotopes present. Boron, silicon, chlorine, iron and nickel have all received attention, but in no case with any certain positive result. From their experiments on silicon from no less than 12 different terrestrial and meteoric sources, Jaeger and Dijkstra concluded that their products differed in density not more than 0·00004%.

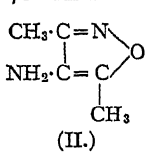
The accumulation of negative evidence of this kind is very impressive, and supports the idea that the evolution of the elements, apart from those produced by radioactive disintegration, must have been such as to lead to a proportionality of isotopes which was constant from the start, and, since we know of no natural process of separation, has remained constant ever since.

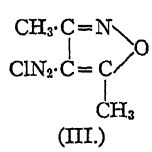
See F. W. Aston, *Isotopes* (2nd ed., 1924); K. Fajans, *Radioactivity* (trans. from the 4th German ed. by T. S. Wheeler and W. G. King, 1923); E. N. da C. Andrade, *The Structure of the Atom* (1927).

(F. W. A.)

ISOXAZOLES, in chemistry, cyclic compounds containing a five-membered ring of three carbon atoms, one nitrogen atom, and one oxygen atom, the last two being adjacent to each other (*see* CHEMISTRY: *Organic*: *Heterocyclic Division*). They are prepared by eliminating water from the monoximes of β-diketones, β-ketone aldehydes, or hydroxymethylene ketones (L. Claisen, 1891). Dimethylisoxazole (*see* I.), thus obtained from acetylacetone and hydroxylamine, is a colourless pungent liquid boiling at 144–145° C at 760 mm.


(I.)


(II.)


(III.)

This isoxazole can be nitrated by replacement of the hydrogen in position 4, and this nitro-compound reduced with amalgamated aluminium and moist ether yields 4-amino-3:5-dimethylisoxazole (II.), a base which resembles the aromatic primary amines in that its hydrochloride and other salts are diazotizable (G. T. Morgan and H. Burgess, 1921). Its diazonium chloride is represented by (III.). These results indicate that the isoxazole ring has certain properties in common with the aromatic nuclei of benzene and its homologues.

ISRAEL, the national designation of the Jews. The Hebrew name means "Gbd strives" or "rules" (*see* Gen. xxxii. 28; and the allusion in Hosea xii. 4). It was borne by their ancestor, Jacob, the father of the 12 tribes. For some centuries the term was applied to the northern kingdom, as distinct from Judah, although the feeling of national unity extended it so as to include both.

See JACOB, HEBREW LANGUAGE, HEBREW RELIGION; JEWS: *History;* and PALESTINE.

ISRAELI, ISAAC BEN SALOMON (*c.* 845–*c.* 940), Jewish physician and philosopher, was born in Egypt, and became court physician at Kairawan. Constantine the African translated into Latin his medical works, including the popular treatise on *Fevers,* while Gerard of Cremona translated his *Elements,* an exposition of Aristotle's *Physics,* and his *Book of Definitions* explaining philosophical terms. In philosophy, Israeli had a preference for the Neoplatonism of Proclus and the *Liber de Causis* rather than for Aristotle, and a conspicuous absence of any avowed attitude to Jewish dogma and the Scriptures. Through the labours of Gundissalinus he became very popular with the 13th century Scholastics who took from his *Definitions* the famous definition, *veritas est adaequatio rei et intellectus.* His *Opera Omnia* were published at Lyons in 1515.

See J. Guttmann, *Die phil. Lehren des Isaak ben Salomon Israeli* (Munster, 1911) and I. Husik, *Hist. of Mediaeval Jewish Philosophy* (New York, 1916).

ISRAËLS, JOSEF (1824–1911), Dutch painter, was born at Groningen, of Hebrew parents, on Jan. 27, 1824. His father intended him to be a rabbi and the study of the Talmud in his youth influenced his outlook in later life. However, the attempts he made under the guidance of two painters in his native town—Buÿs and van Wicheren—led to his being sent to Amsterdam, where he became a pupil of Jan Kruseman, of Jan Willem Pienemaun at the academy and of the sculptor Royer. He then spent two years in Paris, working in Picot's studio and at the Acad. des B. Arts under Pradier, H. Vernet and Delaroche; and returned to Amsterdam in 1847. There he remained till 1870, when he moved to The Hague for good. Israëls was one of the greatest Dutch painters of the 19th century. He has often been compared to J. F. Millet. They both saw in the life of the poor and humble a motive for expressing with peculiar intensity their wide human sympathy; but Millet was the peasant poet of rural life, while Israëls is a painter of the soul.

He began with historical and dramatic subjects in the romantic style of the day. In 1855, after an illness, he went to recruit his strength to the fishing-town of Zandvoort near Haarlem, and there he was struck by the daily tragedy of life. Thenceforth he was possessed by a new vein of artistic expression, sincerely realistic, full of emotion. Among his more important subsequent works are "The Zandvoort Fisherman" (Amsterdam gallery), "The Silent House" (gold medal at the Brussels Salon, 1858) and "Village Poor" (a prize at Manchester). In 1862 he achieved great success in London with his "Shipwrecked," and "The Cradle." We may mention among his maturer works "The Widower" (Mesdag collection), "When we grow Old" and "Alone in the World" (Amsterdam gallery), "An Interior" (Dordrecht gallery), "A Frugal Meal" (Glasgow museum), "Toilers of the Sea," "A Speechless Dialogue," "Between the Fields and the Seashore," "The Bric-à-brac Seller" (medals of honour at the great Paris Exhibition of 1900). In "David Singing before Saul" (Stedelijk museum, Amsterdam) and other pictures painted in his old age he attained a powerful style of expression by which he approached the later works of Rembrandt. As a water-colour painter and etcher he produced a vast number of works, full of deep feeling, generally treated in broad masses of light and shade, which give prominence to the principal subject. He died at The Hague on Aug. 12, 1911. His art created but few followers. Vincent van Gogh speaks of it with great admiration in his famous letters; and in so far as the expression of feeling was the subject matter of his pictures Israëls may be regarded as a precursor of the expressionists. His works are very numerous. The Rijksmuseum, Amsterdam, has 30 paintings and water-colours. He is represented in many public collections in Europe and America, and many works are in private ownership.

See Jan Veth, *J. Israëls en zÿn Kunst* (Arnheim, 1904); F. Stahl, *J. Israëls* (1903); C. L. Dake, *J. Israëls* (1911); M. Liebermann, *J. Israëls* (4th ed., 1911); J. E. Phythian, *J. Israëls* (1912); A. Plaschaert, *J. Israëls* (1924); M. Eisler, *J. Israëls* (Studio Special Spring Number 1924). Pr. Zilcken, *J. Israëls* in *Peintres holland. modernes* contains a catalogue of his etchings (1899 2nd ed.). *See* also *J. Israëls. Spain; the Story of a Journey* (1900) with illustrations by the author.

ISSACHAR, Jacob's ninth son, his fifth by Leah, is the eponymous ancestor of one of the northern tribes of Israel,

occupying territory which included the Plain of Esdraelon, having affinities with the northern group of tribes rather than with the Joseph clans on their southern border. Issachar played but an insignificant part in Israelite history. The name hardly occurs in later times, and the references to the premonarchic period suggest an attitude of submissiveness to their Canaanite neighbours (*cf.* Gen. xlix. 14 *seq.*, and the fact that the Canaanite cities of the plain of Esdraelon retained their independence comparatively late), though Issachar is mentioned in Jud. v. 15 as taking a part in the war against Sisera.

ISSEDONES, name of an ancient people of Central Asia at the end of the trade-route leading north-east from Scythia (*q.v.*), described by Herodotus (iv. 26). The position of their country is fixed as the Tarim basin by the more precise indications of Ptolemy, who tells how a Syrian merchant penetrated as far as Issedon. They had their wives in common and were accustomed to slay the old people, eat their flesh and make cups of their skulls. Such usages survived among Tibetan tribes and make it likely that the Issedones were of Tibetan race.

ISSERLEIN, ISRAEL (d. 1460), German Talmudist. His fame attracted many students to Neustadt, and his profound learning did much to revive the study of the original Rabbinic authorities. After the publication of the Code of Joseph Qaro (*q.v.*) the decisions of Isserlein in legal matters were added in notes to that code by Moses Isserles. His chief works were *Terumath ha-Deshēn* (354 decisions) and *Peasqim u-kethahim* (267 decisions) largely on points of the marriage law.

ISSERLES, MOSES BEN ISRAEL (*c.* 1520–1572), known as REMĀ, was born at Cracow and died there in 1572. He wrote commentaries on the *Zohar*, the "Bible of the Kabbalists," but is best known as the critic and expander of the *Shulhan Aruch* of Joseph Qaro (Caro) (*q.v.*). His chief halakhic (legal) works were *Darke Moshē* and *Mappāh*. Qaro, a Sephardic (Spanish) Jew, in his Code neglected Ashkenazic (German) customs. These deficiencies Isserles supplied, and the notes of Remā are now included in all editions of Qaro's Code.

ISSOIRE, a town of central France, capital of an arrondissement in the department of Puy-de-Dôme, on the Couze, near its junction with the Allier, in the fertile plain of Limagne, 22 m. S.S.E. of Clermont-Ferrand on the P.L.M. railway to Nîmes. Pop. (1926) 5,205. Issoire (*Iciodurum*), probably founded by the Arverni, was in Roman times famed for its schools. The Christian community established by Stremonius in the 3rd century was overthrown by the Vandals in the 5th. During the religious wars of the Reformation, Issoire suffered severely from the Protestants in 1574, from the Roman Catholics in 1577 and in the contest between the Leaguers and Henry IV. The old part of the town is distinct from the new part, which has fine promenades. The church of St. Paul or St. Austremoine on the site of an older chapel over the tomb of St. Austremoine (Stremonius) is an excellent example of the Auvergne Romanesque. Issoire is the seat of a sub-prefect, and of tribunals of first instance and of commerce. Straw hats, linen goods and *galoches* are made. Trade is in corn, fruit and wine.

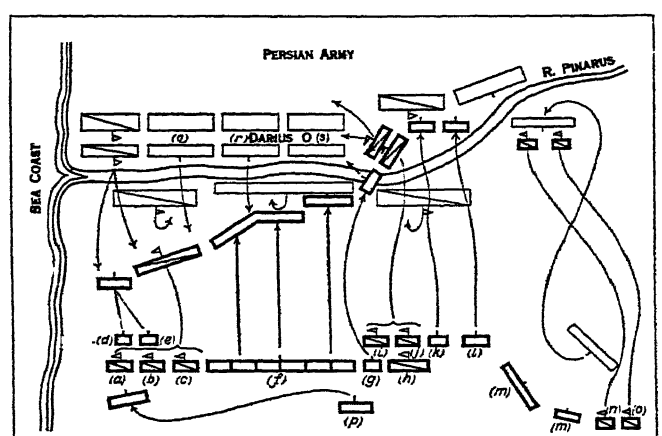
ISSOUDUN, a town of central France, capital of an arrondissement in the department of Indre, on the right bank of the Théols, 17 m. N.E. of Châteauroux by rail. Pop. (1926) 10,415. Issoudun, in Latin *Exoldunum* or *Uxellodunum*, existed in and before Roman times. Louis XIV. rewarded its fidelity during the Fronde by the grant of several privileges. The church of St. Cyr has a fine east window, and the chapel of the Hôtel Dieu is 16th century. Of the fortifications a town-gate (16th century) and the White Tower (12th century) survive. Issoudun is the seat of a sub-prefecture, and has tribunals of first instance and of commerce and a chamber of arts and manufactures. The industries, of which the most important is leather-dressing, also include malting and brewing and the manufacture of bristles for brushes and parchment. Trade is in wood, grain, live-stock and wine.

ISSUE PRICE, the price at which an investment banking house or a syndicate offers an issue of securities for sale to the public. This is to be distinguished from the "underwriting price" at which the issuing corporation disposes of the issue to the underwriter, and also from the "syndicate price" at which participants in the selling syndicate can purchase the securities from the syndicate manager.

ISSUS, BATTLE OF (October, 333 B.C.). Topographically, the region in which the battle of Issus was fought is an interesting one. The field itself lies a few miles north of Myriandrus, at, or near Alexandria (Alexandretta). It is surrounded by mountainous country, and is approached by three passes: north-west of Issus the Cilician Gates over the Taurus range; north-east, the Amanic Gates leading to the Euphrates, and south the Syrian Gates leading into Syria and towards Sochi where Darius had assembled his army. Towards this last-mentioned pass Alexander marched, and either the Amanic Gates were unknown to him, or what is more probable he never expected that Darius, whose main strength lay in cavalry, would desert the plains. The unexpected, however, happened, and Darius, rejecting the advice of his generals, marched on the Amanic Gates which lay to the rear of Alexander. If tactically this was a bad move, strategically it was a sound one, for by advancing through this pass Darius compelled Alexander to relinquish the initiative and fight a battle to regain command of his communications. On hearing what Darius had done, Alexander at once assembled his generals pointing out to them the danger they were in, and then counter-marched to meet the Persians.

As the Greeks debouched on to the coastal plain Alexander deployed his army, the right wing resting on the foot-hills, and the left on the sea shore; the front of the army was about one mile and a half from flank to flank. The Persians, who considerably outnumbered Alexander, were drawn up on both banks of the river Pinarus (Deli), their main force of cavalry being on their right. Alexander, noticing this, reinforced his left wing with the Thessalian cavalry and secured his right by a *crochet* of light infantry. In front of his left wing he placed the Cretan archers and the Thracians; the Greek mercenaries he held in reserve.

The Battle.—The battle opened by a skirmish on the right flank, the Persians on the foot-hills being driven back. This done,



THE BATTLE OF ISSUS, 333 B.C., WHEN, BY OUTFLANKING ITS LEFT CENTRE, ALEXANDER BROKE THE FRONT OF THE PERSIAN ARMY

Alexander first rested his men, then led them forward at a slow pace, and on nearing the Pinarus advanced his right wing at a run in order to close, and so lessen the time taken in crossing the arrow-zone. Darius had established his headquarters in the centre of his line of battle, and towards him Alexander charged throwing the Persians back in confusion. Then the unexpected happened. The phalanx, disordered whilst crossing the Pinarus, fell back, whereupon Alexander wheeled his right wing round to the left, and

charged in flank the Greek mercenaries who were driving back the phalanx. Once he had extricated his centre the pursuit of the defeated Persians was taken up. The traditional losses given by Diodorus and Plutarch are 110,000 Persians killed and 450 Macedonians.

Tactics.—The main tactical interest in this battle is that though Alexander developed his attack from his normal order of battle he was in no way tied down by it, but adapted it to the ground and the probable actions of the enemy. He did not advance to the attack until he had secured both his flanks, neither did he direct his decisive attack against the Persian cavalry, the most formidable troops confronting him, but against the enemy's command, that is against Darius himself. Thus, he first decided on his objective, secondly he secured his advance, and thirdly, only then did he launch his attack which was carried out at top speed, and so simultaneously developed security and offensive power. The blow was an overwhelming one, yet in the elation of success Alexander did not lose his head, for directly he saw that his phalanx was in danger he wheeled his cavalry round to assist his infantry. By so doing he abandoned his goal in order to secure his base of action which was vital to him.

Lessons.—The main lessons of this battle are: correct distribution of troops to ground; concentration against the decisive point, and the maintenance of tactical direction. If the phalanx had been destroyed whilst Alexander was pursuing Darius, the whole of the Macedonian army would in all probability have been overwhelmed by the Persian right wing.

Bibliography.—Same as for Granicus, Battle of the.

(J. F. C. F.)

ISSYK-KUL, also called Tuz-kul or salt lake, owing to its brackish waters, and by the Kalmucks Temurtu-nor (iron lake), a lake in the Kirghiz A.S.S.R. (*q.v.*) lying in a deep basin, apparently of tectonic origin, 5,400 ft. above sea-level. It extends from 76° 10′ E. to 78° 2′ E., and has a length of 115 m. from W.S.W. to E.N.E., and a breadth of 38 m.; its area is estimated at 2,230 sq.m. The name is Kirghiz for "warm lake" in reference to the fact that though ice may form occasionally, the surface of the lake is never completely frozen over. Issyk-kul lies between two westward running spurs of the Tian Shan mountains, the Kunghei Ala-tau range to the north, which rises on an average 8,000 ft. above the level of the lake, with peaks reaching 13,000 ft., and the snow clad Terskei Ala-tau range which skirts the south of the lake at a distance of 5 to 13 m. and rises 6,000 to 9,000 ft. above its level, with peaks reaching 15 to 18,000 ft. The passes over the Terskei lie at great altitudes, the Barskoun (12,000 ft.), the Suka or Sauka (11,650 ft.) and the Jauku (14,000 ft.). The Sauka, linking northwards with Karakol, the eastern stage for steamer communication with the west of the lake, from which a comparatively easy route leads to the railhead at Tokmak, is most used, since it links south with the Ak-su oasis by the Akbel pass (12,000 ft.) and the Bedel pass (12,400 ft.). Another route, involving a steep climb of 12,000 ft. over the Muzart Pass on the east of Khan-tengri, leads to the Tekes river.

The narrow plain which fringes the lake extends inland for 46 m. to the east and then rises to the Santash range, 5,970 ft. above the level of the lake, which forms a link between the Terskei Ala-tau and the Kunghei Ala-tau. A route from the east of the lake crosses this ridge, goes along the valley of the Tegen river, and crosses the Temur-lik-tau range to Kulja in Chinese Turkestan. There is an abundance of blossom, especially at the eastern end of the lake where bee-keeping is profitable, over 800 tons of honey being exported per annum. There are few trees, except in the valleys of the streams entering the lakes. Numerous small streams reach the lake from the mountain slopes, the two chief being the Tyub and Dzhargalan from the east. The Chu river rises in several streams to the west of the lake and approaches the western extremity very closely in a curve which it takes before flowing north-west to lose itself in the desert; it is incorrectly shown on some maps as draining from Lake Issyk-kul. A marsh extends between the bend of the Chu and the lake, and a tiny stream drains from this marsh into Issyk-kul. Issyk-kul probably at one time drained through the Baum gorge at the north-west extremity of the lake, through which the route now goes to Tokmak and the Russian settlements on the fertile loess strip extending to Frunze. The present level of the lake is lower than in former times, and sandy marshes overgrown with reeds, the haunts of the wild boar and the tiger, have spread on the sites formerly occupied by the lake. Fish, especially carp, abound in the lake; its waters are too salt to provide drinking water. The soils on the shore of the lake are sandy, but in a few places there are fertile clayey patches. The nomad herdsmen pasture their flocks in the Issyk-kul valley in winter and on the high alpine meadows in summer.

Along the narrow route by the southern shores of the lake, passed the tribes driven westward by the Huns, notably the Indo-Scythian Yue-chi (*q.v.*), and the blue-eyed and fair-haired Uzuns or Ussuns from Central Asia at the end of the 2nd century B.C. The former passed further west, but the latter settled in the valley and built the town of Chi-gu near the Tyub river, which still existed in the 5th century. The rude stone images of the Uzuns are sometimes washed up from the lake and are of a type distinct from those of the Kalmucks or Kirghiz; a huge copper cauldron of the Uzuns was washed ashore in 1842. The Uzuns disappear from history after the 5th century, but the fair-haired, blue-eyed, straight-nosed element sometimes met with among the Kirghiz of the Issyk-kul region indicates that they were probably absorbed by these tribes. The valley is at present occupied by the On, (right or east) section of the Kara-Kirghiz, with Russian settlements at the eastern end of the lake. Hsuän-tsang (*q.v.*) the Chinese Buddhist pilgrim passed south of Issyk-kul in the seventh century and has left a description of the region. In the early 14th century Nestorian Christians founded a monastery on the northern shores of the lake, indicated on the Catalan map of 1374. The famous Russian explorer Nikolai Przhevalsky (*q.v.*) died at Karakol in 1889, and for a time the town bore his name. The region was annexed to Russia in 1864.

ISTHMUS, a narrow land connection between two larger portions that are otherwise separated by the sea. (Gr. *ἰσθμός*, neck.)

ISTRIA, formerly a margravate and crownland of Austria, now the Italian province of Pola, in the region of Venezia Giulia; area 1,908 sq.m. It comprises the peninsula of the same name (area 1,545 sq.m.), which stretches into the Adriatic Sea between the Gulf of Trieste and the Gulf of Quarnero, and the islands of Cherso, Lussino and others. The coast line extends for 267 m., and is indented on the west by the bays of Muggia, Capodistria, Pirano, Porto Quieto and Pola, and on the east by those of Medolino, Arsa, Fianona and Volosca. A great portion belongs to the Carsic region, and is occupied by the so-called Istrian plateau, flanked north and east by mountains (Monte Maggiore 4,573 ft.). It slopes down south and west in undulating terraces towards the Adriatic. The Quieto in the west and the Arsa in the east, neither navigable, are the principal streams. The climate is on the whole warm and dry. The coasts are exposed to the *Sirocco* from the south-south-east, and the *Bora* from the north-east. Wheat, maize, rye, oats, olives, figs and melons are grown. Viticulture is well developed, and the best sorts of wine are produced near Capodistria, Muggia, Isola, Parenzo and Dignano, while well-known red wines are made near Refosco and Terrano. The oil of Istria was already famous in Roman times. Cattle are bred and lumbering gives beech and oak timber (good for shipbuilding), gall-nuts, oak-bark and cork. The bauxite mines produced 195,000 tons in 1925, and further mining has been prohibited for fear of exhausting the supply. Fishing, recovery of salt from the sea-water, and shipbuilding are other occupations. Istria had in 1921 a population of 299,295.

Istria was the ancient Istria or Histria, known to Rome as the abode of fierce Illyrian pirates. It owed its name to an old belief that the Danube (Ister, in Greek) discharged some of its water by an arm entering the Adriatic in that region. The Istrians, protected by the difficult navigation of their rocky coasts, were only subdued by Rome in 177 B.C. after two wars. Under Augustus the greater part of the peninsula was added to Italy, and the later removal of the capital to Ravenna advantaged Istria. After

the fall of the Western empire it was pillaged by Longobardi and Goths; it was annexed to the Frankish kingdom by Pepin in 789; and about the middle of the 10th century it fell to the dukes of Carinthia, then successively to the dukes of Meran, the duke of Bavaria and the patriarch of Aquileia, and the republic of Venice. Under this rule it remained until 1797, when Austria added it to the north-eastern part which had fallen to her share so early as 1374. By the peace of Pressburg, Austria was in 1805 compelled to cede Istria to France, and the department of Istria was formed, but in 1813 Austria again seized it, and retained it until 1918.

See T. G. Jackson, *Dalmatia, the Quarnero and Istria* (Oxford, 1887); A. A. Bernardy, *L'Istria e la Dolmazia* (Bergamo, Arti Grafiche u. d.) well illustrated.

ISYLLUS, a Greek poet, whose name was discovered on an inscription in the temple of Asclepius in Epidaurus. The inscription consists of a dedication in prose, giving the author's name, and 72 lines of Doric verse in various metres, recording a procession in honour of Asclepius and Apollo, and containing a paean and a poem of thanks to Asclepius for aid against Philip. The date assigned to the poem depends on whether this Philip is Philip II., who invaded Sparta after Chaeronea in 338, or Philip III., who did the same in 218.

Wilamowitz-Möllendorff, who characterizes Isyllus as a "poetaster without talent and a farcical politician," has written a treatise on him (Kiessling and Möllendorff, *Philosophische Untersuchungen,* Heft 9, 1886), containing the text with notes, and essays. The inscription was first edited by P. Kavvadias (1885), and by J. F. Baunack in *Studien auf dem Gebiete der griechischen und der arischen Sprachen* (1886).

ITACOLUMITE, a variety of porous yellow sandstone or quartzose schist occurring at Itacolumi, in the southern portion of Minas Geraes, Brazil. The rock is of interest for two reasons; it is believed to be the source of the abundant diamonds of the district, and it is the best known example of a flexible sandstone. If a piece 1ft. in length and about ½in. thick be supported at its ends it will gradually bend under its own weight; if it then be turned over it will bend in the opposite direction. The cause of the flexibility is ascribed to the porous character of the rock and the interlocking of the sand-grains. (P. G. H. B.)

ITAGAKI, TAISUKE, COUNT (1837–1919), Japanese statesman, was born in Tosa in 1837. He distinguished himself originally as one of the soldier politicians who contributed so much to the overthrow of feudalism and the restoration of the administrative power to the throne. After taking a prominent part in subduing the resistance offered by a section of the *shogun's* feudatories to those changes, he received cabinet rank in the newly organized system. But in 1873 he resigned his portfolio as a protest against the ministry's resolve to refrain from warlike action against Korea. Itagaki feared that the country was about to pass under the yoke of a bureaucratic government. He became thenceforth a warm advocate of constitutional systems, though at the outset he does not seem to have contemplated anything like a popular assembly in the English sense of the term, his ideas being limited to the enfranchisement of the *samurai* class. Failing to obtain currency for his radical propaganda, he retired to his native province, and there established a school (the *Risshi-sha*) for teaching the principles of government by the people, thus earning for himself the epithet of "the Rousseau of Japan." His example found imitators. Not only did pupils flock to Tosa from many quarters, attracted alike by the novelty of Itagaki's doctrines, by his eloquence and by his transparent sincerity, but similar schools sprang up among the former vassals of other fiefs, who saw themselves excluded from the government. In 1875 no less than seven of these schools sent deputies to hold a convention in Osaka, and for a moment an appeal to force seemed possible.

But the statesmen in power were not less favourable to constitutional institutions than the members of the *Aikoku Kō-tō* (public party of patriots), as Itagaki and his followers called themselves. A conference attended by Kido, Okubo, Inouye, Ito, Itagaki and others entered into an agreement by which they pledged themselves to the principle of a constitutional monarchy and a legislative assembly. Itagaki now accepted office once more. Finding, however, that his colleagues in the administration favoured a much more leisurely rate of progress than he himself advocated, he once more retired into private life (1876) and renewed his liberal propagandism. It is in the nature of such movements to develop violent phases, and the leaders of the *Aikoku-sha* (patriotic association), as the agitators now called themselves, not infrequently showed disregard for the preservation of peace and order. Itagaki made the mistake of memorializing the government at the moment when its very existence was imperilled by the Satsuma rebellion (1877), and this evident disposition to take advantage of a great public peril went far to alienate the sympathies of the cabinet. Recourse was had to legislation in restraint of free speech and public meeting. But repression served only to provoke opposition.

Throughout 1879 and 1880 Itagaki's followers evinced no little skill in employing the weapons of local association, public meetings and platform tours, and in Nov. 1881 the first genuine political party was formed in Japan under the name of *Jiyū-tō*, with Itagaki for declared leader. A year later the emperor announced that a parliamentary system should be inaugurated in 1891, and Itagaki's task might be said to have been accomplished. Thenceforth he devoted himself to consolidating his party. In the spring of 1882, he was stabbed by a fanatic during the reception given in the public park at Gifu. The words he addressed to his would-be assassin were: "Itagaki may perish, but liberty will survive." Once afterwards (1898) he held office as minister of home affairs, and in 1900 he stepped down from the leadership of the *Jiyū-tō* in order that the latter might form the nucleus of the *Seiyū-kai* organized by Count Ito. Itagaki was raised to the nobility with the title of "count" in 1887. From the year 1900 he retired into private life, devoting himself to the solution of socialistic problems. His countrymen justly ascribe to him the fame of having been the first to organize and lead a political party in Japan. He died in 1919. True to his liberal principles, he forbade his son to apply for the succession of his title and it lapsed.

ITALIAN CLOTH. "Italians" and "Italian linings" are two optional trade terms denoting an important class of fabric comprising various qualities and employed in the dress goods trade chiefly for coat and dress linings, aprons and ladies' overalls. These fabrics are characterized by a smooth and glossy surface resulting chiefly from their construction on the simple five-end weft satin weave structure (with the weft only displayed on the surface) as well as from the finishing and calendering which imparts to the fabric a very lustrous and glossy surface.

A typical example of the true Italian cloth of good quality is produced from a warp with 100 threads per inch of 2/66's fast black cotton, and 160 picks per inch of botany worsted weft, piece-dyed black and highly calendered; while a good quality of all-cotton Italian lining contains 72 ends per inch of 36's cotton yarn, and 120 picks per inch of 40's super quality weft.

ITALIAN CODES. The principal are the civil and the penal codes. The Italian civil code was promulgated on June 25, 1865, and came into force on Jan. 1, 1866. It was promulgated on Nov. 27, 1870, in the province of Rome and on June 25, 1871, in the provinces of Mantua and Venice. The States into which Italy was divided before unification, except the Papal State and Tuscany, had their own codes of civil laws. The first idea was to extend the "Codice Albertino," duly revised, throughout the kingdom. But the need soon became apparent for a new code more in accordance with the basic principles of the new constitution. Pisanelli understood this need and it rested with him to carry out his scheme. Several weighty voices were raised against the codification, wishing to return to the common law or *ius receptum*. The historian Cantù and D'Ondes Reggio maintained in the Italian chamber that codes were not necessary. Ninchi boldy stated: "You do not perceive that under the new code the State binds and shackles you from the hour of your birth to that of your death; that the code leads, hinders and encircles you in all the activities of your life; under this code you will not be free." But Pisanelli who, in point of codification was a follower of Savigny and not of Thibaut, successfully contended that it was undesirable to destroy all existent Italian codes, thus

"submerging the whole of Italy in the uncertainty of customs, judgments and common law, and to restore that *jus vagum*—the miserable condition in which people exist at the beginning of their civilization."

The Civil Code.—The Italian civil code was moulded on the Code Napoléon. One of the principal criticisms, especially in Italy, is that the Italian code has a foreign origin. Indeed, when one sees that its framework is almost entirely that of the Code Napoléon, which in its turn followed the division of the *Institutes* of Gaius, and that there are several articles in the Italian code which are simply a literal translation of the Code Napoléon, one cannot help thinking this criticism is well founded. Yet the Italian civil code is essentially national. The fact that before the unification of the kingdom all the Italian codes (with the exception of the Austrian which was in force in Lombardy and Venetia) had taken the Code Napoléon as a model does not mean that such a code was accepted in Italy as "a system of laws which was imposed," but that the Code Napoléon was a system of laws in harmony with Italian sentiments, customs and needs, of which the principal contents were, to quote Pisanelli again, "our legacy, fruit of the ancient Italian *sapientia.*" So it was that doctrines in the Code Napoléon which were not in accordance with Italian traditions, such as, for instance, divorce, the system of community of property as between husband and wife, the distinction between "inheritance" and "universal legacy," were not accepted by the Italian code, whereas Roman doctrines, suitable to Italian customs and traditions, which were lacking in the Code Napoléon were restored in the Italian code; *e.g.*, the equality as between the universal successor under testacy and the universal successor under intestacy, who is in both cases "heir." The Italian code has, as it were, Romanized the German "saisine héréditaire."

Foundations of Civil Code.—The Italian civil code is founded upon: (a) Roman law such as was commonly accepted at the time in Italy (hence the name of "common law"); (b) the Code Napoléon, especially for the laws relating to the registration of births, deaths and marriages, to the doctrine of absence and to the civil form of marriage; (c) the civil codes which from 1816 to 1865 were in force in the different Italian States (*e.g.*, the laws regarding the easements created by the law were derived from the Parmensis code); (d) canon law, from which some rules relating to marriage and legitimation were drawn; (e) text writers and the decisions of the courts. The rules relating to private international law were derived from this source. The Italian code was the first which contained rules with reference to the conflict of laws.

Two general principles of private international law different from those recognized by English courts were adopted by the Italian code. The first is, that a person's civil status and family relations depend not on his domicile but on his nationality. The second is, that in the main, the law of the country to which the deceased belonged by nationality governs the beneficial succession to his immovables and movables, and this without regard to the situation of the property at the time of his death. The Italian code has not accepted the old maxim: *quot sunt bona diversis territoriis obnoxia, totidem patrimonia* (*tot legibus obnoxia*) *intelliguntur.*

From the Italian rules of private international law it is apparent that the term "national law" or "law of the nation" means the *local* or *territorial* law, and does not extend to the whole law of a foreign country including the rules of private international law. The Italian code refers to a foreign law for the solution of the substance of a question and not for the determination of the rules of private international law to be applied to a given case. How could the Italian legislature, which was the first to enact rules relating to the conflict of laws, accept the doctrine of the *renvoi*, which at the time was quite unknown?

The Italian code was the first to lay down the liberal principle that an alien is admitted to enjoy the same civil rights as those of nationals even if not resident in the kingdom, and this without any regard to reciprocity.

Revisions of Civil Code.—The Italian civil code has always been considered as an intangible body of laws, not easily admitting of additions lest the structure should lose its harmony. For its omissions, especially as regards social and economic problems which either did not exist or were still latent at the time of its compilation, it was thought preferable to enact special laws. As regards the amendments which had to be made to satisfy the wants of a rapidly developing community, up to the present day there have been very few alterations of a fundamental kind. Suffice it to remember (a) the law of Dec. 6, 1877, which abolished the penalty of imprisonment for civil and commercial debtors; (b) the law of Dec. 9, 1877, which removed the incompetence of women to act as witnesses to private and public documents; (c) the Italian Nationality law, 1912, which repealed articles 4 to 15; (d) the law of Nov. 9, 1916, which made the so-called "transcription" of immovables obligatory; (e) the Decree law, Nov. 16, 1916, whereby if a person dies intestate leaving no surviving next of kin within the sixth degree, the estate goes to the Crown; (f) the Married Women's Status law, 1919, which introduced the greatest change in the law relating to married women. The code used to subject a married woman to a variety of disabilities; *e.g.*, a married woman was incompetent, without her husband's consent, to make a donation, to alienate or mortgage her real property, to make a contract of loan, to assign or collect moneys, to be a guarantor, to compromise or to sue or be sued in respect of these matters, to act as an agent. But now by the Married Women's Status law, 1919, all these and other disabilities have disappeared.

After the World War, the provisions of the civil code were gradually extended to the annexed provinces. The Fascist Government soon awakened to the necessity for the revision of the civil code, and by the law of Dec. 30, 1923, the Government was empowered to alter the code where it deals with absence, illegitimate children, nullity of marriage, adoption, paternal authority, guardianship, transcription and prescription, and to amend those articles which give rise to traditional disputes or which are recognized as imperfect in form. By the law of Dec. 24, 1925, the Government was also empowered to introduce other alterations and additions to the code, keeping intact fundamental principles. A preliminary project of the new rules relating to obligations and contracts is now ready and it has been submitted to the courts, universities, etc., for their advice and suggestions.

The Penal Code.—The Italian penal code in force in 1928 was the Zanardelli code. Zanardelli availed himself of the several projects prepared by his predecessors, beginning with that of 1862 by Miglietti who intended to extend the Sardinian penal code of 1859 with alterations and additions to the whole kingdom. The Zanardelli code was promulgated on June 30, 1889, and came into force on Jan. 1, 1890. Following the Tuscan code of 1853, it divides offences into crimes (*delitti*) and contraventions (*contravvenzioni*). A contravention is an act which, although it may be innocuous *per se*, yet is a danger to the public tranquillity and other people's rights; such as exceeding the speed limit without injuring anyone.

The Zanardelli code will soon be superseded by a new one which will bring penal law more in accordance with the fundamental rights and interests of the new society which has sprung out of the Fascist revolution. The new code, which has been well received in Italy, has been prepared by Rocco, and will be the first of the Mussolini codes.

Scope of New Code.—The preliminary project comprises 751 articles. It is divided into three books. The first book deals with offences generally, the second with crimes, the third with contraventions. The code embodies some of the special laws which have been promulgated since the Fascist revolution, such as the Defence of the State law, the law relating to the press, and the Public Safety law. The new code keeps faith with the fundamental principles of the traditional Italian school; nevertheless it accepts many practical reforms advocated by the Italian "Positive school," showing an unmistakable breadth of view. It is imbued with much greater severity against the individual and rigidly safeguards the whole "majesty of the law" in accordance with the Fascist principle of the supremacy of the authority of

the State.

Extending the doctrine of the so-called "juridical territoriality," the new code deals with offences of an international nature. Thus whosoever shall offend the Italian State is punished according to Italian law, whether he be a citizen or a foreigner, and whether he be in the kingdom or abroad. In the case of extradition the code provides for the surrender of nationals and of political offenders.

Dealing with the defence of the State, the new code introduces capital punishment for any person who endeavours:—to submit the State or a part thereof to a foreign Sovereign; to weaken its independence or dissolve its unity; to detach a colony from the mother country; to make an attempt on the life, integrity or personal liberty of the king, the queen, the crown prince or the head of the Government; to reveal political or military secrets; to incite to insurrection or civil war. The death penalty is inflicted also on the citizen in a high military command who takes arms against the State or serves a foreign country at war with Italy. Apart from war time, the citizen who shall spread abroad false or injurious news concerning the internal condition of the State is punishable by five years' imprisonment. Whoever in the State organizes associations calculated to establish by violence the dictatorship of a social class or to suppress by violence either the economical and social order of the State or its political and juridical order is also liable to imprisonment. The refusal to obey an official is now treated as a crime punishable with imprisonment.

The code contains further and more stringent provisions for the protection of family life. Besides increasing punishment for adultery and concubinage, punishing bigamy even if the first marriage be void, and considering incest as a crime even if it does not give rise to public scandal, the code provides that whoever makes propaganda in favour of birth control is punishable with imprisonment, and that a married man who seduces a girl is liable to imprisonment from six months to three years.

The new code contains rules aimed at strengthening the protection of cults and religious sentiments and especially the Catholic religion. Economic and political strikes, boycotts and lockouts are considered as crimes. The crime of usury is created. Whoever fails to pay a debt incurred with the intention of not paying is punishable with imprisonment. The crime of exceeding the speed limit is established and is punishable with imprisonment.

(G. M. P.)

ITALIAN FRONT, IN THE WORLD WAR, 1914–1918. On the outbreak of the World War the Austro-Italian frontier, as delimited after the war of 1866, was about 600 km. in length, four-fifths of it in the mountain zone and a considerable part in the high Alps. To some extent it corresponded with the crest of the mountains, but in several areas it was well to the S. or W. of it, and almost everywhere the summits and the most favourable positions were held by Austria. Commencing at the top of the Stelvio pass, it followed the Alpine ridge to the Tonale, deflected S. to the Adamello group and the lake of Idro, turned E. across the Lago di Garda, S. of Riva, ascended the M. Altissimo of the Baldo group, crossed the Adige S. of Borghetto, turned N.E. along the outer edge of the Asiago plateau, E. along the Cime Portule, Dodici, Undici, crossed the Brenta below Grigno, kept along the ridge of the Cadore mountains, crossed the Cordevole S. of Livinallongo, passed S. of Cortina d'Ampezzo, reaching the Carnia Alps at M. Popera, keeping due E. along the crest to the source of the Pontebba stream, turned S. along Morlasio, M. Canin, M. Maggiore and M. Kolovrat, W. of the Isonzo, followed the Judrio, crossed the Torre below its confluence with the Natisone, passed E. of Palmanova, and reached the sea between the lagoons of Murano and Grado. It formed two salients—that of the Trentino, driven like a wedge into the heart of the Venetian plain, with a dozen military roads spreading fan-like from it in all directions, and that of the Friuli extending towards the Isonzo; the former was much more favourable to Austria than the latter was to Italy.

On the Italian side there was a main line of railway from Milan to the Austrian frontier at S. Giorgio di Nogaro, with a line pushing N. from Verona to the Austrian frontier at Borghetto, and another from Mestre N.E. to the frontier at Pontebba, a line parallel to the E. frontier from Udine to Palmanova, and a number of branch lines. On the Austrian side there were the main lines from the Brenner to the frontier, from Leoben to Pontebba and from Graz to Trieste and San Giorgio di Nogaro, an intermediate line along the Pusterthal, another from Kalgenfurt to Gorizia and Monfalcone and various branch lines.

As soon as Italy intervened in the war the Italian troops effected a forward push and succeeded in some sectors in securing more favourable positions—the Tonale, M. Baldo, Col Santo, Pasubio, Vallarsa and Valsugana sectors of the Alpine front (*see* TRENTINO), and crossed the upper Isonzo at Caporetto, occupying the Monte Nero and Plezzo areas. On the middle and lower Isonzo the advance was held up by the defences of Gorizia (*see* ISONZO and GORIZIA) and the Carso (*q.v.*), although the river was eventually crossed at Pieris and other points and Monfalcone occupied. Subsequently, after heavy fighting, the enemy having been able to strengthen the naturally strong Carso positions, the Isonzo line was pushed forward until in Aug. 1916 Gorizia was captured, with a wide area on the Carso to the S. of the town. Further progress on the Carso and at various points E. of the Isonzo was effected in the autumn of 1916 and the first months of 1917, the Bainsizza plateau N.E. of Gorizia being occupied after hard fighting in August.

On the Trentino front the Austrian offensive of May 1916 resulted in the loss by the Italians of several sectors on the Asiago (*q.v.*) plateau; but the last mountainous diaphragm was held as well as the Pasubio, and an Italian counter-offensive recaptured most of the lost ground. On the other sectors there were few changes. When the Austrians broke through at Caporetto (*q.v.*) in October 1917 the II. and III. armies fell back on the Piave, the Carnia and Cadore sectors were evacuated and some important positions on the Asiago plateau were also lost. The new front was 200 km. shorter than the old. From the Stelvio to Asiago it was unchanged; in the latter sector it was well to the S. of the old line, and further E. it ran along M. Asolon, M. Grappa (*q.v.*), Col dell'Orso to the Piave S. of Valdobbiadene, and then followed the Piave (*q.v.*) to its mouth. Only slight changes were effected, except in the Grappa and Asiago areas where, after desperate fighting in November and December, the Italians fell back still further, until by the end of the year the new line was definitely stabilized. At the battle of the Piave some positions in the Asiago area were lost and the Austrians crossed the Piave at two points, but the Italians counter-attacked and regained all the lost ground. There were no further changes until the Italian victory of Vittorio Veneto (*q.v.*), which ended the war on this front (Oct. 23–Nov. 3, 1918).

The strategic outline of the campaign on the Italian front is given *s.v.* WORLD WAR; *see* also the references to separate articles above.

(L. V.)

ITALIAN LANGUAGE, MODERN. Spoken Latin must necessarily have varied in the successive centuries and according to the speech of the peoples which adopted it. When the centripetal force of Rome was relaxed, these differences were emphasized and by degrees the Romance languages (*q.v.*) developed. To speak however of the language of Italy, Spain or France is an abstraction, if we understand by language the vernacular actually used by the inhabitants of a whole country: for each hamlet and even each family and social group possessed, as it now possesses, certain peculiarities of vocabulary and pronunciation. So that there existed throughout the Roman Empire, and in particular throughout the Italian peninsula, a variety of vernaculars, each almost undistinguishable from its immediate neighbours, and each gradually better differentiated from others that are and were spoken at increasingly greater distances whether actual or virtual. When we speak therefore of the Italian language and of its dialects we are using inaccurate expressions. There existed, from the days of Republican Rome and before (*cf.* Latin language), local vernaculars which became gradually modified by usage, scholastic influence, accession of peoples of different ethnical stocks, contact with other peoples, etc.; and these vernaculars

became more strongly differentiated during the earlier middle ages when, owing to the breaking up of the political organization, public education was impaired and communications were rendered difficult and slow. It is possible to group the local vernaculars on the basis of certain common features of pronunciation and morphology mostly, but by no means necessarily coinciding with geographical subdivisions of the land; and these groups we call dialects. What is generally understood by the words "Italian Language" will be considered after the dialects have been surveyed.

Dialects.—In the upper valleys of the Adige and the Piave and in some neighbouring districts, in the land east of the Tagliamento (Friùli) and in some neighbouring parts dialects are spoken belonging to the Ladin (Raetian) group (Trentino, Cadorino, Friulano, Goriziano, etc.), which is not to be considered as belonging to the Italian family, but as a Romance vernacular kindred to the language of south-eastern Switzerland. Along the Italian coast from Istria (and also from Dalmatia) as far as the mouth of the Po and in the islands of the upper Adriatic, varieties of the Venetian dialect are spoken. Venetian is to be considered the whole region from the Tagliamento to the left bank of the Mincio, with considerably diversified vernaculars (of Venice, proper, of Chioggia, Treviso, Padua, Vicenza, Verona). Part of this territory was originally inhabited by Ladin people as is shown by the persistence of final *-s* in the 2nd pers. sing. of the Present indicative of interrogatives: *vas-tu?* (*cf.* Ascoli, "Arch. glott." 1, 411 ss.) Common features of the dialects of Venetia are the simplification of Latin *-ct-* to *-t-*, Latin *cl-* to palatal *c-* and the diphthongation of short stressed *e* and *o*. West of the Adige we meet with the Lombard dialects (in Brescia, Bergamo, Milan, Pavia, Lodi, Como, Valtellina and Canton Ticino) having in common like the dialects of Piedmont, the sounds of *ü* and *ö* (French *u* and *eu*), the lack of double consonants, the loss of final vowels and the frequent nasalisation of *n* and *m*. Connected with Lombard are the dialects of Liguria, Emilia and Romagna, all possessing the *ö* sound (*ü* only in Liguria), and all tending to the palatalization of Latin *-ct-*. Piedmontese dialects (Vercelli, Turin, Alessandria, Saluzzo, Monferrato, Asti, Aosta, etc.) are spoken west of the Ticino and the Trebbia as far as the Apennines and the Alps and are closer to French; while Ligurian vernaculars spoken all along the Riviera, at San Remo, Savona, Genoa, Spezia, Sarzana, have some points of contact with Provençal. On the other hand the dialects of Emilia (south of the Po; east of the Trebbia, north of the Apennines and the Reno, spoken at Piacenza, Parma, Reggio, Modena, Ferrara and Bologna), and those of Romagna (east of the Apennines, between the Reno, and the Marecchia) spoken at Ravenna, Imola and Forlí, respond to central Italian tendencies. In central Italy we find the dialects of the Marches between the Marecchia and the Tronto on the Adriatic coast (Pesaro, Ancona, Urbino, Macerata, Ascoli), of Umbria (upper valley of the Tevere and neighbouring districts (Perugia, Foligno, Spoleto, Terni), of Tuscany (upper valley of the Arno to the sea as far as Grosseto (Pistoia, Pisa, Lucca Livorno, Firenze, Arezzo, Siena), of Latium (west of the Apennines from Grosseto to Terracina approximately) and of Corsica. The Tuscan dialects are closest to Latin, but in some parts of the region we meet with cases of rhotacism (*obbrigo* for *obbligo, tumuro* for *tumulo*), with voiced for voiceless gutturals, (*siguro* for *sicuro*) and with *s* for *z* (*speransa* for *speranza*). Characteristic of the dialects of the Marches are the cases of umlaut whereby changes in the internal vowels are caused by certain terminal vowels due to the accidence (*castiello* next to *castella, muorto* next to *morta,* etc.). Corsican dialects are kindred to Tuscan, but southern Corsican is closely connected with Sardinian. In southern Italy we meet with dialectal groups which do not correspond to territorial divisions, in the northern section we find the dialects of Abruzzi (on the Adriatic side, south of the Tronto and the upper valley of the Pescara (Teramo, Aquila, Chieti, Sulmona), of Apulia (Puglia) and Basilicata spoken at Campobasso, Foggia, Barletta, Bari, Brindisi, Potenza; of Campania comprising Gaeta, Caserta, Avellino, Naples and Salerno. The southern section contains the dialects of the territories of Lecce, Otranto, Taranto, southern Calabria and Sicily. Peculiar features of the Southern dialects in general are the preservation of intervocalic voiceless consonants which in other regions are substituted by voiced consonants (Ital. *cittadino* is at Naples *cetatino*), the assimilation of *-nd-* to *-nn-* (*scendere* is *scénnere* at Naples); peculiar to the southern section and particularly to Sicily is the change of stressed and final *-e* to *-i* (*aviri* for *avere*) and *e, o* to *i, u* respectively in stressed syllables (*amuri* for *amore*). The vernaculars of Sardinia are no longer considered Italian dialects but rather as Romance vernaculars. There are of course others besides the phonetic differences between the various dialects. Thus all the northern dialects have lost the perfect and use instead the compound past or preterit (*ho cantato* for *cantai*); the southern dialects have kept the perfect. The archaic conditional *fora<fueram* occurs in older dialectal texts; in the south there occurs a present conditional *cantaria* from *cantare habebam* that by way of ancient Tuscan poems has found a place in the poetical language for the usual *canterei*. In Trieste and a few other places there occurs an exchange between the conditional and the subjunctive (*mi cantassi se podria* for *canterei se potessi*) (*cf.* G. Bertoni, *Italia dialettale,* Hoepli; Meyer-Luebcke, *Ital. Grammatik,* 1890; Guarnerio, *Fonologia romanza,* Hoepli).

The vocabulary of the several dialects varies owing to the different ethnical substrata and the peculiar conditions of the population. Words of Celtic origin being more frequent, if ever rare, where the pre-Roman population was Celtic; Germanic words having survived where the Teutonic occupation was longest (in the North) and Greek words occurring more frequently where the ethnic substratum was Greek or the Byzantine rule persisted through the earlier middle ages. Thus at Genoa "bran" is called *brénu* and at Como *bren* (Celtic); apart from a certain number of Germanic words that have been accepted by the literary language (*guerra, elmo, rocca, guancia, onta,* etc.) we find ven. *barba* for uncle, and *biet, biot* from old high-Germ. *blaut,* naked, in Lombardy. Of Greek origin are the Sicilian *melana,* ink, *centra,* nail, etc. On the contrary French words are quite as frequent in the literary language as in the dialects for, particularly during the 13th century, French and Provençal works were often read in Italy, and since then the literary relations between the two countries have been continuous and at times intimate, so that from *cavaliere,* for *cavallaro* to *vegliare* for *vegghiare* and to *saggio* for *savio* instances of French influence are very frequently discernible (*cf.* Bertoni, *L'elemento germanico nella lingua ital.,* 1914; G. Rohlfs, *Griechen u. Romanen in Unteritalien,* 1924; R. R. Bezzola, *Abbozzo di una storia dei gallicismi italiani,* 1925).

The Literary Language.—During the middle ages only Latin was taught in the schools; consequently all who ventured to write in their local vernacular would tend to regularize or to latinize the more definitely dialectal features of their daily speech and thus roughly to approximate it to Tuscan and particularly to Florentine which, of all the Italian vernaculars, was closest to Latin. The country lacked political unity and thus had no political centre which might become linguistically pre-eminent. The earliest literary work in Italian as distinct from isolated sentences is the "cantilena" of a Tuscan jongleur (forty lines of eight syllables) which must be ascribed to the neighbourhood of Pisa and dated about 1150. (Since Mazzoni's article in "Studi medievali," II. (1928) pp. 247 ss., the date of the poem is certain and its meaning no longer so obscure as it was previously held.) During the 13th century there were written poems and prose works in practically every dialect of Italy. Such an output was in many departments more plentiful in Tuscany than elsewhere (except perhaps for lyrical poetry at the court of Frederick II.), and as it was more plentiful it soon excelled also for intrinsic merit. Despite this Dante when he had already composed most of his lyrics and the *Vita Nuova* did not yet realize that the literary language of Italy must be based on the vernacular of Florence, and suggested an artificial selection of the best elements from each dialect. In practice, however, he departed from his own theory, for his language is nothing but Florentine. Dante's influence was as great as his success, and

unintentional writings in other dialects disappeared after the beginning of the 14th century. Petrarch who was born in Tuscany if he seldom lived there, had no hesitation as to which dialect to prefer. Boccaccio grew up in Florence. Collectively their example contributed to the inevitable triumph of Florentine. The Renaissance brought about a recrudescence in the use of Latin: for a time every man making any claim to literary distinction either exclusively or in preference wrote Latin; and it was no longer mediaeval Latin, but a language as pure in vocabulary and style as the increasing familiarity with classical masterpieces could well bring about. Works in Italian were thus either popular in character, affecting and exaggerating popular traits, or were written in an unpleasant jargon constituted by the admixture of purely Latin words to, and the superimposition of Latin constructions on, an Italian basis (e.g., *Hypnerotomachia Poliphili*, by F. Colonna). During the earliest period when the writers were struggling to build up an Italian tradition, they had naturally turned either to Latin or to French for their models. Ultimately Latin prevailed, but the general result was that an Italian literary language was developed which differed to a certain extent in vocabulary and to a greater extent in phrasing from the cultured speech of Florence; authors who did not hail from Tuscany were apt to allow dialectal features and local idioms to creep into their works, and when the Latin fashion somewhat abated at the beginning of the 16th cent. and the literary output in Italian was proportionately increased, despite the existence by then of a *κοινὴ διάλεκτος*, it was ardently debated whether the Florentine usage, the language of the princely courts or the works of Dante, Petrarch and Boccaccio should be taken as standards. Machiavelli championed the first, Castiglione the second and Cardinal Bembo the third solution. In theory, if not always in practice, Bembo triumphed, and his triumph implied the rigid conformance to models of the past precisely as was done in writing Latin or Greek. And thus during the later 16th, the 17th and the early 18th centuries the remoteness of prose style from everyday speech became accentuated in all except scientific works. At the same time there was an orgy of concepts and a considerable, if short-lived, influx of Spanish words and idioms. The so-called polite form of address in the third person is one of the few Spanish mannerisms that became established. In order to free themselves from the tyranny of the past, some 18th century authors (Verri, Beccaria) urged and practised a supine imitation of French, thus provoking a reaction and a return to the classics. Both these movements fostered the development of a more modern language; but it was only during the 19th century that the question was finally settled. A. Manzoni, a Milanese, steadily maintained that the vernacular of Florence must be the source and the touchstone of literary Italian. By then the Italian Kingdom was formed and Italy had acquired a political centre; the capital being established at Florence in 1864 and transferred to Rome in 1871 (*cf.* L. Morandi, *Origini della lingua italiana*, 7th ed., 1897; P. Rajna in D'Ancona e Bacci, *Manuale*, I., 1903; V. Crescini, *Origine della lingua ital.*, 1909; C. H. Grandgent, *From Latin to Italian*, 1927; T. Labande-Jeanroy, *La question de la langue en Italie*, 1925).

Contemporary Language.—Even cultured Italians, however, when in their native districts still spoke the local dialects; when writing therefore they made use of a medium that was to a certain extent foreign, being unable to employ their normal idioms unless they happened to be Tuscans. As a consequence throughout the 19th century prose style was often over elaborated, stiff, clumsy or excessively dialectal. And it was only during the present century that the Italian language ceased to labour under the severe handicap that had thwarted so long its natural development. The results of this soon became apparent for, except among the Tuscan writers of the earliest period, the literary language has never been so closely connected as it now is, with the spoken language. This change is perhaps greater than contemporaries are able to evaluate, though it implies no alteration in phonetic and morphology. Apart from a few orthographical changes and the obsolescence of words indicating things that are no longer in use, present day Italian is still Dante's Italian; such sound changes as are noticeable in English. German and French are completely unknown to Italian. Of course the dialects, lacking the restraining influence of an acknowledged literary usage and of the schools, alter more rapidly and profoundly. Despite this a comparison of the sentences in the documents of Capua (A.D. 960) with some modern variety of the Neapolitan dialect would show that no fundamental change has occurred. And a similar result would be reached if 13th century Northern or Southern texts were compared to modern parallels, provided it was borne in mind that ancient writers endeavoured to normalise the dialectal forms and did not propose faithfully to reproduce the forms and pronunciation of local usage. Owing to the strong traditions of regional life, dialects survive in conversation, are constantly employed in popular songs and occasionally in drama. Dialectal drama has, during the last thirty years, met with much favour even when acted far from its original centres: and of late there has been an extraordinary revival in the folk songs and music. Dialects, however, increasingly feel the effect of the pre-eminence of Italian, the language of the schools, of the courts, of the newspapers and books, but there is no sign of the disappearance of the dialects themselves with their very attractive element of local colour.

The local vernacular of Florence is itself a dialect, and educated Florentines, and Italians in general, do not turn the guttural stops into aspirates (It. *casa*—Flor. *hasa*), do not exaggerate the softening of palatal *c* and *g* (It. *cacio*—Flor. *hascio*), and the Florentine habit of avoiding the diphthongation of short *e* and *o* under stress is not accepted by standard Italian (*buono* and not *bono, tiene* and not *tene*). On the other hand, standard Italian is necessarily streaked with dialectal pronunciations and mannerisms whether Tuscan or of other regions. Northern Italians *e.g.*, find it difficult to discriminate between open and closed *e* and *o* in stressed syllables (the first *e* of *bene* is open, not closed as the Milanese pronounce it); the stressed *e* of *caramente* is close not open as it sounds at Turin. On the contrary in the South the tendency is to pronounce all these vowels close. Northern Italians tend to voiced and Southerners to voiceless *s;* Tuscans distinguish between them, though they are not consistent for there are instances of voiced *s* that have become voiceless in the course of years and vice versa. As a quite recent development accents have been exceptionally marked on all stressed vowels, unless they are in penultimate syllables, but this example was not followed. It has become customary to differentiate between acute and grave accents when they are marked, the former indicating a closed and the latter an open sound. Such a tendency, which is a consequence of the union of Italy and of a desire towards a greater uniformity of pronunciation, is welcome in itself, and may point to such developments in the use of accents as have become established in France and in Spain. (G. Malagoli, *Ortoepia e ortografia italiana moderna*, Hoepli manual.)

(C. F.)

ITALIAN LITERATURE. One characteristic fact distinguishes the Italy of the middle ages with regard to its intellectual conditions—the tenacity with which the Latin tradition clung to life (*see* LATIN). At the end of the 5th century the northern conquerors invaded Italy. The political structure of Rome crumbled to pieces; Goths, Greeks, Lombards and Franks were in turn pre-eminent in Italy. Theoderic the Great, however, who considered himself a lieutenant of the Byzantine emperor, was not averse to learning, and even the Lombard kings, who belonged to a truly barbaric stock, seem to have been compelled by the force of local habits to countenance the existence of lay and ecclesiastical schools. The persistence of lay schools throughout the middle ages is an Italian characteristic. Ecclesiastical schools were founded as a matter of routine; when the Benedictine institutions underwent a period of decadence, Irish monks settled in Italy and helped in reviving religious zeal and interest in learning. If the original output of Italian scholars during the earlier middle ages was comparatively small, there were nevertheless men of outstanding merit practically in every century. Peter of Pisa was at Charlemagne's court together with Paul the Deacon who hailed from Montecassino; Gunzo of Novara migrated to

the court of the Saxon emperors; later Lanfranc of Pavia and Anselm of Aosta rose to important positions in France and in England. No doubt the persistence of the classical tradition in the native population was rendered possible by the relatively small number of barbaric settlers and helped by the sight of countless monuments of Roman greatness; this same persistence greatly hindered that peculiar re-elaboration of classical tradition and barbaric legends which gave rise in France to a new literature. Italians were late in the field and they preferred to import French works dealing with the Romans (*Faits des Romains*), Alexander the Great (*Roman d'Alixandre*) and Trojan legends (*Roman de Troie*). Likewise the Italians, whose vernacular dialects must have taken shape very early (there are records of dialectal sentences as early as the 9th century at Verona and in the south), were slow to realize that Latin, the language they were taught at school (*grammatica*), was no longer their real language; they were shy to break away from tradition: Gunzo of Novara (10th century) justified a grammatical slip he had made in a Latin speech by his habit of speaking the Italian vernacular which was similar to Latin, and yet until the 13th century no Italian dialect seems to have been used in writing, with the exception of some verses in a poem by the Provençal R. de Vaqueiras, an inscription at Ferrara and the song of a Tuscan jongleur (*Salva lo vescovo senato*).

The Fashion of French and Provençal.—By the end of the 12th and the beginning of the 13th centuries Latin had become unsuitable to the expression of everyday feelings, and the courtly society of feudal castles, as well as the people loitering in the squares, wished for some kind of literary entertainment. In many a castle of northern and central Italy Provençal troubadours were welcome guests; their poems were transcribed in manuscripts which are still extant, and there were many Italians who wrote Provençal poems, such as the Marchese Alberto Malaspina (12th century), Maestro Ferrari of Ferrara, Cigala of Genoa, Zorzi of Venice, Sordello of Mantua, Buvarello of Bologna, Nicoletto of Turin and others. The same courtly circles that appreciated Provençal lyrics greedily read Arthurian romances, at first in French and later in Italian translations. Carolingian poems found favour instead with the less educated people for whose benefit they were recited in the thoroughfares at first by French jongleurs, who must have endeavoured to make themselves more easily understood by italianizing their pronunciation, and later by Italian imitators. As a result there came into being numbers of works written by Italians in imperfect French during the 13th century. Such were the "Chansons de Geste," *Macaire,* the *Entrée en Espagne* written by Nicola of Verona, the *Prise de Pampelune* and some others. Many such works have been lost, among them those which were later rendered into Tuscan *cantari* dealing with epic subjects, but a good number are still extant in prose as well as in verse, such as *Le régime du corps* by Aldobrandino of Florence or Siena, a chronicle of Venice written in 1267 by Martino da Canale, a treatise on Falconry translated by Daniele of Cremona (1251), the travels of Marco Polo written down, possibly from dictation, by Rustichello of Pisa (1298), who had previously lived at the court of Edward I. and composed many Arthurian romances; the encyclopaedic work *Lis livres dou tresor* of Brunetto Latini (just after 1260). Several authors—Canale, Ennachet, Latini (who wrote in France)—were at pains to state that they were using the French language because it was more pleasant than others and more widely understood. But so artificial an attempt must soon have proved a failure, for while it was in progress, there had begun an active effort at translating from Latin and French into the Italian vernaculars and also at writing original works in Tuscan and other Italian dialects.

It was in the course of the 13th century, and especially from 1250 onwards, that the new literature largely unfolded and developed itself. This development was simultaneous in the whole peninsula, only there was a difference in the subject-matter of the art. In the north, the poems of Giacomino of Verona and Bonvecino of Riva were specially didactic and religious, and were intended to be recited to the people. Uguccione of Lodi, Bonvecino, Giacomino, Girardo Patecchio and the others no doubt wrote in their local dialects, occasionally adopting words and forms from other dialects with the intention of thus attaining a higher literary standard; and their genuine forms may at times have been further modified by enterprising copyists who spoke different if neighbouring vernaculars. Some of these religious works may possibly have been connected with the heretical movements in Lombardy at the period.

The Sicilian School.—In the south of Italy French lyrics of the *langue d'oil* and particularly of the *langue d'oc* enjoyed favour in courtly circles. One of the most ancient poems of the Sicilian School, a name by which the poets of the court of Frederick II. are indicated whether they hail from Sicily or not, is ascribed to King John of Brienne, and the emperor Frederick, perhaps himself a poet, certainly encouraged his friends to cultivate the vernacular muse. Modern critics have pointed out French influences in many of these lyrics, and it may be that the famous and much discussed *contrasto* of Cielo Dalcamo, a poet who had probably studied at Salerno, was an attempt at imitating local and French popular or pseudo-popular poems. Despite some vigour, zest and coarseness it cannot rank with real popular poetry. The Provençals, however, had provided models which, being the product of social refinement in a feudal environment, must have proved more congenial to Frederick and his courtiers; and the lyrics of the Troubadours were often sheepishly imitated by Pier della Vigna, Enzo, Frederick's son, Jacopo Mostacci, Giacomo da Lentino and the others; among them Giacomino Pugliese and Rinaldo of Aquino occasionally gave signs of genuine feeling, and may have drawn inspiration from popular poetry. As has been noted, several of the poets of the Sicilian School were not Sicilians, but hailed from southern Italy, as Pier della Vigna and Rinaldo, from Tuscany, as Arrigo Testa, or from Genoa, as Percivalle Doria. Moreover Frederick and his courtiers were ever moving up and down Italy as the political situation required; and all of them endeavoured, when writing, to ennoble the language they used by discarding purely local forms and thus unconsciously worked towards a standard literary language. Later scribes may have emphasized such a tendency by altering Sicilian to Tuscan forms. Followers of the Provençals have been traced in Naples and Rome; and farther north, in central Italy, there were other forces at work besides the influence of the Troubadours.

Religious Poetry of the 13th Century.—The religious revival of the 13th century is connected in central Italy with St. Francis of Assisi (1182–1226). Around him a legend has grown up and from some points in it we seem to be able to infer that its hero had a strong feeling for nature, and a heart open to the most lively impressions. There is clear evidence of such gifts in his famous *Cantico del Sole,* which despite rhythmical irregularities is considered the finest religious hymn of early Italian literature. The Franciscan movement inspired the composition of many religious lyrics; and when after the saint's death the Order was split by dissensions, one of the upholders of strict adherence to the original rule, Jacopo dei Benedetti of Todi (d. 1306), wrote poems of outstanding merit. He was a lawyer and had probably tried his hand at poetry before his conversion. A vehement passion must have stirred his heart and maintained a despotic hold over him, the passion of divine love. Under its influence he went on subjecting himself to the severest sufferings, and giving vent to his religious intoxication in his poems. There is little art in him, and there is no indication of deliberate effort; there is only feeling, a feeling that absorbed him, fascinated him, penetrated him through and through. He was put in prison and laden with chains, but his spirit lifted itself up to God, and that was enough for him. The same feeling that prompted him to pour out in song ecstasies of divine love and to despise and trample on himself, moved him to reprove those who forsook the heavenly road, whether they were popes, prelates or monks.

To the religious movement in Umbria is also traceable the origin of the religious drama. In 1258 an old hermit, Raniero Fasani, leaving the cavern in which he had lived for many years, suddenly appeared at Perugia. These were difficult times in Italy. The breaking up of the feudal system, the incidence of economic forces connected with the rise of capitalism, the struggles between

popes and emperors kept the people in constant agitation, and spread abroad paralysing fears. Fasani represented himself as sent by God to disclose mysterious visions, and to announce terrible visitations to the world. Under the influence of fear there were formed "Compagnie di Disciplinanti," who, for a penance, scourged themselves till they drew blood, and sang "Laudi" in dialogue in their confraternities. These "Laudi," closely connected with the liturgy, were among the first examples of the drama in the vulgar tongue of Italy. Their development, however, was rapid. As early as the end of the same (13th) century we have the *Devozioni del Giovedì e Venerdì Santo*, which have some dramatic elements in them, though they are still connected with the liturgical office. Then we have the representation *di un Monaco che andò al servizio di Dio* ("of a monk who entered the service of God"), in which there is already an approach to the definite form which this kind of literary work assumed in the following centuries.

THE TUSCAN DIALECT

Tuscan Poetry.—In the 13th century Tuscany was peculiarly circumstanced both as regards its literary condition and its political life. The Tuscans spoke a dialect which most closely resembled the mother-tongue, Latin—one which afterwards became almost exclusively the language of literature, and which was already regarded at the end of the 13th century as surpassing the others; "Lingua Tusca magis apta est ad literam sive literaturam": thus writes Antonio da Tempo of Padua, born about 1275. Among the other cities Florence owing to geographical and economic causes acquired a pre-eminent position. From 1266, when the Hohenstaufens were defeated at Benevento, she was in a position to begin that movement of political reform which in 1282 resulted in the appointment of the Priori delle Arti. This was afterwards copied by Siena, by Lucca, by Pistoia, and by other Guelph cities in Tuscany with similar popular institutions. Economic prosperity found expression in the erection of churches and town halls and in their artistic decoration. It was no wonder that literature also rose to unlooked-for perfection. In Tuscany, too, there was some popular love poetry; there were imitators of the Troubadours and the Sicilians, such as Guittone del Viva of Arezzo and Dante of Majano; but literary originality took another line—that of humorous and satirical poetry. Folgore of San Gimignano laughs when in his sonnets he tells a party of Sienese youths what are the occupations of every month in the year, or when he teaches a party of Florentine lads the pleasures of every day in the week. Cene della Chitarra laughs when he parodies Folgore's sonnets. The sonnets of Rustico di Filippo are half fun and half satire; laughing and crying, joking and satire, are all to be found in Cecco Angiolieri of Siena. But another kind of poetry also began in Tuscany. Guittone d'Arezzo, besides imitating the love songs of the Provençals, attempted political poetry, and thus struck an original note. A more fruitful development occurred at Bologna, the seat of an already famous university. The poets of Provence had paid the same kind of homage to their ladies that the noblemen owed to their feudal overlords; at Bologna, where the new tendencies of the Schoolmen's philosophy were much discussed, a poet was born, Guido Guinicelli di Magnano (1230–75?), who followed at first the lead of Guittone but soon struck out on an original path, ascribing to his lady the power of calling into activity all the good qualities which were dormant in him, and as he was gifted with an extraordinary power of dramatic imagination and real feeling, he succeeded despite some philosophical subtleties in composing lyrics of striking beauty which brought about a revolution in Italian poetry and strongly influenced Cavalcanti and Dante.

But before we come to Dante, certain other facts, not, however, unconnected with his history, must be noticed. Didactic poetry, which was direct in northern Italy, adopted the allegorical device in Tuscany. Thus Brunetto Latini, whom Dante looked upon with filial affection, wrote the *Tesoretto*, in which the author professes to be lost in a wilderness and to meet with a lady, who is Nature, from whom he receives much instruction. Francesco da Barberino, a learned lawyer, wrote two little allegorical poems—the *Documenti d' amore* and *Del reggimento e dei costumi delle donne*. A fourth allegorical work was the *Intelligenza*, attributed to Dino Compagni.

Prose in the 13th Century.—While the production of Italian poetry in the 13th century was abundant and varied, that of prose was scanty. The oldest specimen dates from 1211, and consists of short notices of entries and expenses by Florentine bankers from Siena. In 1253 and 1260 there are some commercial letters. Next in order to the original compositions in the *langue d'oil* come the translations or adaptations from the same. There are translations and adaptations from French originals:—some moral narratives taken from religious legends; a romance of Julius Caesar; some short histories of ancient knights; the *Tavola rotonda*, translations of the *Milione* of Marco Polo and of the *Tesoro* of Latini. At the same time there appeared translations from Latin of moral and ascetic works, of histories and of treatises on rhetoric and oratory, several of which were due to Bono Giamboni. Among the oldest prose writing is a scientific book—the *Composizione del mondo* by Ristoro d'Arezzo, who lived about the middle of the 13th century. This work is a copious treatise on astronomy and geography. Ristoro seems to have been a careful observer of natural phenomena, and consequently many of the things he relates were the result of his personal investigations. There is also another short treatise, *De regimine rectoris*, by Fra Paolino, a Minorite friar of Venice, who was probably bishop of Pozzuoli, and who also wrote a Latin chronicle.

The 13th century was very rich in tales. There is a collection called the *Cento novelle antiche*, which contains stories drawn from Oriental, Greek and Trojan traditions, from ancient and mediaeval history, from the legends of Brittany, Provence and Italy, and from the Bible, from the local tradition of Italy as well as from bestiaries and ancient mythology. There were other prose tales inserted by Francesco da Barberino in his work *Del reggimento e dei costumi delle donne*, but they are of much less importance than the others. Some attention should be paid to the *Lettere* of Fra Guittone d'Arezzo, who wrote many poems and also some letters in prose, the subjects of which are moral, religious and political. During the later middle ages it had become the fashion to ornament Latin orations and letters with all sorts of rhetorical devices, among them rhythmic *clausulae* (*cursus*), and such a practice, which was enforced by a number of rhetorical treatises (*artes dictandi*), Guittone followed when writing Italian, with results that are often extravagant.

New Tuscan School of Lyric Poetry.—At the end of the 13th century in Tuscany, lyric poetry, almost of a sudden, reached a high standard of perfection. It depended to some extent on Guittone's and much more on Guinicelli's models, but its achievements were principally due to Cavalcanti. Guido Orlandi, Lapo Gianni, Dino Frescobaldi, Dante, Cino da Pistoia and a few others must all be grouped around him. The secret of their success was a fresh and sincere inspiration; as Dante expresses it—

> Quando
> Amore spira, noto, ed a quel modo
> Ch' ei ditta dentro, vo significando—

that is to say, the expression of the feelings in the way in which love inspires them, in an appropriate and graceful manner, fitting form to matter, and by art fusing one with the other. In Lapo Gianni the new style is not free from some admixture of the old associations of the Siculo-Provençal school. Sometimes, however, he draws freely from his own heart, and then the subtleties and obscurities disappear, and his verse becomes clear, flowing and elegant.

Guido Cavalcanti was a learned man with a high conception of his art. He felt the value of it, and adapted his learning to it. His poems may be divided into two classes—those which portray the philosopher, "il sottilissimo dialettico," as Lorenzo the Magnificent called him, and those which are more directly the product of his poetic nature imbued with mysticism and metaphysics. To the first set belongs the famous poem—*Donna mi prega*, which in fact is a treatise on the nature of love, and was annotated later in a learned way by Marsilio Ficino and others. But there are many of his poems, the *ballate* particularly, in which the truth of the images and the elegance and simplicity of style are admirable,

and make us feel that we are in quite a new period of art.

Among the followers of the new school was also Cino da Pistoia, of the family of the Sigisbuldi. His love poems are so sweet, so mellow and so musical that they are only surpassed by Dante's. The pains of love are described by him with vigorous touches. It is easy to see that they are not feigned but real. The psychology of love and of sorrow nearly reaches perfection.

DANTE, PETRARCH AND BOCCACCIO

Dante (1265–1321).—As the author of the *Vita nuova,* the greatest of all Italian poets, Dante, also belongs to the same lyric school and partly shares Guinicelli's and Cavalcanti's conception of love. In the lyrics of the *Vita nuova* there is a high idealization of love. It seems as if there were in it nothing earthly or human, and that the poet had his eyes constantly fixed on heaven while singing of his lady. Several of the lyrics (*Rime*) not included in the *Vita nuova* or the *Convivio* deal with the theme of the "new life"; but all the love poems do not refer to Beatrice, while other pieces are philosophical and bridge over to the *Convivio* (*c.* 1307), an unfinished philosophic treatise in which are to be read some of the finest passages of early Italian prose. About the literary language of Italy Dante expressed original views in another unfinished work in Latin (*De vulgari eloquentia, c.* 1305); just as later, in 1313, he expounded his political system in the Latin *Monarchia* and in some letters. Towards the end of his life he composed a short treatise *De aqua et terra* and two Latin eclogues of great interest. But the work which made him immortal is of course the *Divina Commedia* which was probably written between 1307 and 1321. In 100 cantos Dante describes a vision, during which he visited Hell, Purgatory and Paradise under the guidance of Virgil, symbolizing human reason, and later of Beatrice (human reason illumined by Revelation). Many incidents in this pilgrimage, as well as the pilgrimage itself, have an allegorical meaning, and Dante succeeded in expressing his opinion upon all the subjects that principally interested him in the course of an anticipated Last Judgment to which he dared to summon some men of past ages and many of those who had lived or were living in his own time. It was so clear to him that he had a mission to fulfill and a message to deliver, that he felt inspired to greater effort by the very daring of his undertaking. And though as a pilgrim through the after-world he described himself as having risen from human to celestial heights, as a poet he kept faith to the same moral and political ideals for which he had fought and suffered. Even those readers who may be unequal to the effort of making out the grand lines of his majestic structure, cannot fail to see and to remember the ineffable charm of some particular passages tender or ghastly, stern or moving.

Dante is often said to have summed up the middle ages for the men who came after him; it should not be overlooked, however, that there is much in his work that seems to herald the age which was to follow. He claimed to have learned his literary style from the classics and from Virgil in particular; and if his was not yet a scholarly return to the classics, the angle from which he looked upon them was no longer completely mediaeval.

Petrarch (1304–1374).—The next step was to be taken by Petrarch, and it will be easier to grasp its significance if one bears in mind that his principal aim was a rebellion against the philosophy of the Schoolmen and against the deductive method in science and philosophy by which every truth could only be derived from what Aristotle and his commentators had said. This rebellion he fostered by holding up Plato, whose works and ideas were only indirectly known to him, in opposition to Aristotle, and by summoning to his aid the results of his own introspection. The data of introspection he compared with the records which great writers of antiquity had set down of their own experiences. It was in order to render the study of such ancient records possible and fruitful that it became necessary to know exactly what the ancients had written, and therefore to discover and to collate as many of the manuscripts of their works as were still traceable. Scholarship and antiquarianism were means to an end, and not ends in themselves for Petrarch. He was the first humanist, and at the same time the first lyric poet of the modern school. His career was long and tempestuous. He lived for many years at Avignon, cursing the corruption of the papal court; he travelled through nearly the whole of Europe; he corresponded with emperors and popes; he was considered the first man of letters of his time; he had honours and moderate riches; and he always bore about within him discontent, melancholy and incapacity for satisfaction—three characteristics of the modern man. He loved Laura, whoever the lady was, and Laura may have for a time countenanced his courtship, but ever remained out of his reach. His life was passed in pining for her, admiring her beauty, sorrowing for her coldness and also in rebelling against love; for love of woman and desire for worldly fame hindered, in his view, the spiritual freedom of man and his striving toward Christian perfection. These perpetual alternations of his moods he embroidered upon with faultless technique, whether or not he happened to be prompted by feeling and strong inspiration, throughout the *Rime sparse,* as he seems to have called his Italian lyrics when, long after Laura's death (1348), he revised and collected them, including also a few political and occasional poems. A clearer but far less successful expression of his views is to be found in the vision that he called *I trionfi,* clearly imitated from Dante's *Commedia;* but no one could hope to penetrate the world of Petrarch's thought who did not read his *Secretum,* a dialogue between St. Augustine and himself, the treatise *De vita solitaria,* the great body of his Latin epistles, and last but not least his epic poem *Africa* by which he sometimes expected to be remembered by posterity.

Boccaccio (1313–1375).—Boccaccio had the same enthusiastic love of antiquity and the same worship for the new Italian literature as Petrarch. He supervised the work of Leon Pilatus, a Greek born in Calabria, who put together a Latin translation of the *Iliad* and the *Odyssey.* Boccaccio's vast classical learning was shown specially in the work *De genealogia deorum,* in which he enumerates the gods according to genealogical trees constructed on the authority of the various authors who wrote about the pagan divinities. Boccaccio was also the first historian of women in his *De claris mulieribus,* and the first to undertake to tell the story of the great unfortunate in his *De casibus virorum illustrium.* He continued and perfected former geographical investigations in his interesting book *De montibus, silvis, fontibus, lacubus, fluminibus, stagnis, et paludibus, et de nominibus maris,* for which he made use of Vibius Sequester, but which contains also many new and valuable observations. Of his Italian works his lyrics do not approach the perfection of Petrarch's. His narrative poetry is better. He was the first to use *ottava rima* in a work of some length and written with artistic skill, such as is his *Teseide,* the oldest Italian romantic poem. The *Filostrato* relates the loves of Troiolo and Griseida (Troilus and Cressida). The *Ninfale fiesolano* tells the love story of the nymph Mesola and the shepherd Africo. The *Amorosa Visione,* a poem in *terza rima,* doubtless owed its origin to the *Divina Commedia.* The *Ameto* is a mixture of prose and poetry, and is the first Italian pastoral romance.

The *Filocolo* takes the earliest place among prose romances. In it Boccaccio tells in a laborious style, and in the most prolix way, the loves of Florio and Biancafiore. The *Fiammetta* is another romance, about the loves of Boccaccio and Maria d'Aquino, a supposed natural daughter of King Robert, whom he always called by this name of Fiammetta.

The Italian work which principally made Boccaccio famous was the *Decameron,* a collection of 100 novels, related by a party of men and women, who had retired to a villa near Florence to escape from the plague in 1348. Novel-writing, so abundant in the preceding centuries, especially in France, now for the first time assumed an artistic shape. The rudeness of the old *fabliaux* gives place to the careful and conscientious work of a mind that has a feeling for what is beautiful, that has studied the classic authors, and that strives to imitate them as much as possible. Over and above this, in the *Decameron* Boccaccio is a delineator of character and an observer of passions. In this lies his novelty. Much has been written about the sources of the novels of the *Decameron.* Probably Boccaccio made use both of written and of oral sources.

Unlike Petrarch, Boccaccio felt for Dante something more than

love—enthusiasm. He wrote a biography of him, of which the accuracy has been unsuccessfully challenged in the past, and he gave public lectures on the poem in Santa Maria del Fiore at Florence.

IMITATORS OF DANTE AND BOCCACCIO

Dante and Boccaccio were not without their imitators. Fazio degli Uberti and Federigo Frezzi imitated the *Divina Commedia*, but only in its external form. The former wrote the *Dittamondo*, a long poem, in which the author supposes that he was taken by the geographer Solinus into different parts of the world, and that his guide related the history of them. Frezzi, bishop of his native town, Foligno, wrote the *Quadriregio*, a poem of the four kingdoms—Love, Satan, the Vices and the Virtues. The poet has Pallas for a companion.

Ser Giovanni Fiorentino wrote, under the title of *Pecorone*, a collection of tales, which are supposed to have been related by a monk and a nun in the parlour of the monastery of Forlì. He closely imitated Boccaccio, and drew on Villani's chronicle for his historical tales. Franco Sacchetti wrote tales too, for the most part on subjects taken from Florentine history. His book gives a life-like picture of Florentine society at the end of the 14th century. A third novelist was Giovanni Sercambi of Lucca, who after 1374 wrote a book, in imitation of Boccaccio, about a party of people who were supposed to fly from a plague and to go travelling about in different Italian cities, stopping here and there telling stories. Later, but important, names are those of Masuccio Salernitano (Tommaso Guardato), who wrote the *Novellino*, and Antonio Cornazzano whose *Proverbii* became extremely popular.

Chroniclers and Ascetic Writers.—At the end of the 13th century we find a *chronicle* by Dino Compagni. Little is known about the life of Compagni. Noble by birth, he was democratic in feeling, and was a supporter of the new ordinances of Giano della Bella. As prior and gonfalonier of justice he always had the public welfare at heart. He belonged to the party of the Bianchi and opposed the claims which Boniface VIII. made on Florence. His chronicle relates the events that came under his own notice from 1280 to 1312. It bears the stamp of a strong subjectivity. The narrative is constantly personal. It often rises to the finest dramatic style. He is one of the most important authorities for that period of Florentine history, notwithstanding the not insignificant mistakes in fact which are to be found in his writings. On the contrary, Giovanni Villani, born *c.* 1276, was more of a chronicler than an historian. He relates the events up to 1347. The journeys that he made in Italy and France, and the information thus acquired, account for the fact that his chronicle, called by him *Istorie fiorentine*, comprises events that occurred all over Europe. What specially distinguishes the work of Villani is that he speaks at length, not only of events in politics and war, but also of the stipends of public officials, of the sums of money used for paying soldiers and for public festivals, and of many other things of which the knowledge is very valuable. Matteo, the brother of Giovanni Villani, continued the chronicle up to 1363. It was again continued by Filippo Villani. Gino Capponi, author of the *Commentari dell' acquisto di Pisa* and of the narration of the *Tumulto dei ciompi*, belonged to both the 14th and the 15th centuries.

Neither Petrarch nor Dante could be classified among the pure ascetics of their time. But many other writers come under this head. St. Catherine of Siena's mysticism was political. She was a really extraordinary woman, who aspired to bring back the Church of Rome to evangelical virtue, and who has left a collection of letters written in a high and lofty tone to all kinds of people, including popes. She joins hands on the one side with Jacopone of Todi, on the other with Savonarola. Hers is the strongest, clearest, most exalted religious utterance that made itself heard in Italy in the 14th century.

Another Sienese, Giovanni Colombini, founder of the order of Jesuati, preached poverty by precept and example, going back to the religious idea of St. Francis of Assisi. His letters are among the most remarkable in the category of ascetic works in the 14th century. Passavanti, in his *Specchio della vera penitenza*, attached instruction to narrative. Cavalca translated from the Latin the *Vite dei santi padri*.

Poetry in the 14th Century.—In direct antithesis to this is a kind of literature which has a strong popular element. Humorous poetry, the poetry of laughter and jest, which as we saw was largely developed in the 13th century, was carried on in the 14th by Bindo Bonichi, Arrigo di Castruccio, Cecco Nuccoli, Andrea Orgagna, Filippo de' Bardi, Adriano de' Rossi, Antonio Pucci and other lesser writers. Antonio Pucci was superior to all of them for the variety of his production. He put into *terza rima* the chronicle of Giovanni Villani (*Centiloquio*), and wrote many historical poems called *Serventesi*, many comic poems, and not a few epico-popular compositions on various subjects. A little poem of his in seven cantos treats of the war between the Florentines and the Pisans from 1362 to 1365.

Many poets of the 14th century have left us political works. Of these Fazio degli Uberti, the author of *Dittamondo*, who wrote a *serventese* to the lords and people of Italy, a poem on Rome, a fierce invective against Charles IV. of Luxemburg, deserves notice, and Francesco di Vannozzo, Frate Stoppa and Matteo Frescobaldi. From this period also dates that literary phenomenon known under the name of Petrarchism. The Petrarchists, or those who sang of love, imitating Petrarch's manner, were found already in the 14th century. But others treated the same subject with more originality, in a manner that might be called semi-popular. Such were the *ballate* of Ser Giovanni Fiorentino, of Franco Sacchetti, of Niccolò Soldanieri, of Guido and Bindo Donati.

There cannot have been an entire absence of dramatic literature in Italy in the 14th century, but traces of it are scarce, although we find them again in great abundance in the 15th century. The 14th century had, however, one drama unique of its kind, the *Ecerinis* written by Albertino Mussato of Padua in 1315. Mussato, a political man and the historian of Henry VII., aimed at strengthening the antagonism against Cangrande della Scala by describing the evils of the tyrannical government of Ezzelino da Romano in a Senecan style.

The revival of learning which Petrarch had fostered as a means to a philosophical, moral and political revolution so fascinated many of his admirers that it became for them an end in itself. Petrarch had affected to look upon his works in Italian as trifles: he called them *nugellae vulgares;* the scholars who took over the literary leadership after him, Coluccio Salutati and partly Luigi Marsili, still admired Dante, Petrarch and Boccaccio's Italian works, but always wrote in Latin themselves, and for many decades Latin triumphantly rivalled Italian.

THE RENAISSANCE

In the 15th century a number of men arose, all learned, laborious, indefatigable, and all intent on one great work. Such were Niccolò Niccoli, Giannozzo Manetti, Palla Strozzi, Leonardo Bruni (L. Aretino), Francesco Filelfo, Poggio Bracciolini, Lorenzo Valla. Manetti spent his time in translating from Greek, studying Hebrew, and commenting on Aristotle. Palla Strozzi sent into Greece at his own expense to search for ancient books, and had Plutarch and Plato brought for him. Poggio Bracciolini went to the Council of Constance, and found in a monastery in the dust-hole Cicero's *Orations*. He copied Quintilian with his own hand, discovered Lucretius, Plautus, Pliny and many other Latin authors. Guarino went through the East in search of codices. Giovanni Aurispa returned to Venice with many hundreds of manuscripts. What was the passion that excited all these men? What did they search after? These Italians were but handing on the solemn tradition which, although partly latent, was the informing principle of Italian mediaeval history, and now at length came out triumphant. This tradition was that same tenacious and sacred memory of Rome, that same worship of its language and institutions, which at one time had retarded the development of Italian literature, and now grafted the old Latin branch of ancient classicism on the flourishing stock of Italian literature. Men came to have a more just idea of nature: the world was no longer cursed or despised as in the middle ages; man was born again; and human reason resumed its rights. Everything, the individual and society, were changed under the influence of new facts.

First of all there was formed a human individuality, which was

wanting in the middle ages. As J. Burckhardt has said, the man was changed into the individual. He began to feel and assert his own personality, which was constantly attaining a fuller realization. As a consequence of this, the idea of fame and the desire for it arose. The mediaeval idea of existence was turned upside down; men who had hitherto turned their thoughts exclusively to heavenly things, and believed exclusively in the divine right, now began to think of beautifying their earthly existence, of making it happy and gay, and returned to a belief in their human rights. This was a great advance, but one which carried with it the seeds of many dangers. The conception of morality became gradually weaker. The "fay ce que vouldras" of Rabelais became the first principle of life. Religious feeling was blunted. Besides this, a great literary danger was hanging over Italy. Humanism threatened to submerge her youthful national literature. There were authors who labored hard to give Latin forms to Italian. Provincial dialects tried to reassert themselves in literature. The great authors of the 14th century were by many people of the cultured class forgotten or despised.

It was Florence that saved literature by reconciling the classical models to modern feeling. At Florence celebrated humanists wrote also in the vulgar tongue, and commented on Dante and Petrarch, and defended them from their enemies. Leon Battista Alberti, the learned Greek and Latin scholar, wrote in the vernacular, and Vespasiano da Bisticci, whilst he was constantly absorbed in Greek and Latin manuscripts, wrote the *Vite di uomini illustri,* rivalling the best works of the 14th century in their candour and simplicity. Andrea da Barberino wrote the beautiful prose of the *Reali di Francia.* Belcari and Benivieni carry us back to the mystic idealism of earlier times.

Lorenzo de' Medici.—But it is in Lorenzo de' Medici that the influence of Florence on the Renaissance is particularly seen. His mind was formed by the ancients: he attended the class of the Greek Argyropulos, sat at Platonic banquets, took pains to collect codices, sculptures, vases, pictures, gems and drawings to ornament the gardens of San Marco and to form the library afterwards called by his name. In the saloons of his Florentine palace, in his villas at Careggi, Fiesole and Ambra, stood the wonderful chests painted by Dello with stories from Ovid, the Hercules of Pollajuolo, the Pallas of Botticelli, the works of Filippino and Verrocchio. And yet if we read Lorenzo's poems we only see the man of his time, the admirer of Dante and of the old Tuscan poets, who takes inspiration from the popular muse, and who endeavours to give to his poetry the colours of the most pronounced realism as well as of the loftiest idealism, who passes from the Platonic sonnet to the impassioned triplets of the *Amori di Venere,* from the grandiosity of the *Selve* to *Nencia* and to *Beoni,* from the *Canto carnascialesco* to the *Lauda.*

Next to Lorenzo comes Politian (Angelo Ambrogini), who also united, and with greater art, the ancient and the modern, the popular and classical styles. In his *Rispetti* and in his *Ballate* the freshness of imagery and the plasticity of form are inimitable. He, a great Greek scholar, a forerunner of scientific methods in textual criticism, wrote Italian verses with polished simplicity and refinement; the purest elegance of the Greek sources pervaded his art in all its varieties, in the *Orfeo* as well as the *Stanze per la giostra.*

As a consequence of the intellectual movement towards the Renaissance, there arose in Italy in the 15th century three academies, those of Florence, of Naples and of Rome. The Florentine academy was founded by Cosimo I. de' Medici. Having heard the praises of Platonic philosophy sung by Gemistus Pletho, who in 1439 was at the council of Florence, he took such a liking for those opinions that he soon made a plan for a literary congress which was especially to discuss them. Marsilio Ficino has described the occupations and the entertainments of these academicians. Here, he said, the young men learnt, by way of pastime, precepts of conduct and the practice of eloquence; here grown-up men studied the government of the republic and the family; here the aged consoled themselves with the belief in a future world. Among the members of the academy were besides the Medicis such men as Pico della Mirandola, Politian, L. B. Alberti. The Roman academy was founded by Giulio Pomponio Leto, with the object of promoting the discovery and the investigation of ancient monuments and books. It was a sort of religion of classicism, mixed with learning and philosophy. Platina, the celebrated author of the lives of the first hundred popes, belonged to it. At Naples, the academy known as the Pontaniana was instituted. The founder of it was Antonio Beccadelli, surnamed Il Panormita, and after his death the head was Il Pontano, who gave his name to it, and whose mind animated it.

Romantic Poetry.—Italy never had any true epic poetry in its period of literary birth. Still less could it have any in the Renaissance. It had, however, many poems, called *Cantari* because they contained stories that were sung to the people dealing with the heroes of Charlemagne and King Arthur. But the first to introduce elegance and a new life into this style was Luigi Pulci, who grew up in the house of the Medici, and who wrote the *Morgante Maggiore* at the request of Lucrezia Tornabuoni, mother of Lorenzo the Magnificent. The material of the *Morgante* is almost completely taken from an obscure chivalrous poem of the 15th century later discovered by Prof. Pio Rajna. On this foundation Pulci erected a structure of his own, often turning the subject into ridicule, burlesquing the characters, introducing many digressions, now capricious, now scientific, now theological. With a more serious intention Matteo Maria Boiardo, count of Scandiano, wrote his *Orlando innamorato,* in which he seems to have aspired to embrace the whole range of Carlovingian legends; but he did not complete his task. We find here too a large vein of humour and burlesque. Still the Ferrarese poet is drawn to the world of romance by a profound sympathy for chivalrous manners and feelings—that is to say, for love, courtesy, valour and generosity. A third romantic poem of the 15th century was the *Mambriano* by Francesco Bello (Cieco of Ferrara). He showed the influence of Boiardo, especially in something of the fantastic which he introduced into his work.

As the work of Boiardo originated from the popular *cantari,* the *Sacra Rappresentazione* developed from the mediaeval *Mistero* ("mystery-play"). Although it belonged to popular poetry, some of its authors were celebrated men of letters. It is enough to notice Lorenzo de' Medici, who wrote *San Giovanni e Paolo,* and Feo Belcari, author of the *San Panunzio,* the *Abramo ed Isac,* etc. From the 15th century, some comic and profane elements found their way into the *Sacra Rappresentazione.* From its biblical and legendary conventionalism Politian emancipated himself in his *Orfeo,* which, although in its exterior form belonging to the sacred representations, yet substantially detaches itself from them in its contents and in the artistic element introduced.

The eclogues of Virgil, Nemesianus and others had enjoyed great favour during the middle ages particularly during the so-called Carolingian Renaissance. Dante imitated Virgil when composing his eclogues to Giovanni del Virgilio, Mussato followed in his steps, so did Petrarch and Boccaccio, who also wrote a pastoral novel, the *Ameto.* This artificial conception of a pastoral world, so far removed from rural and real life, pleased the Italians no less than it had pleased other Romance peoples. Winsome and gentle shepherdesses appear in the poems of Cavalcanti, Sacchetti and many other poets in Tuscan and other dialects down to Lorenzo de' Medici who also attempted a more definitely rural form with his *Nencia da Barberino* which was imitated by Luigi Pulci (*Beca da Dicomano*). Boiardo composed eclogues in Italian, but it was left to Jacopo Sannazaro, the author of some piscatory eclogues in Latin, finally to fix the characteristics of pastoral poetry in his immensely popular *Arcadia* (1504). It is a partly allegorical story of prose mingled with verse, forming in all sections a mosaic of classical reminiscences and ever tinged with a melancholy charm. With Sannazaro the realm of shepherds and nymphs finally became something akin to the Golden Age, a dream-world whither men would fly seeking refuge from the dismal realities of an age in which the collapse of political independence, wars and violence caused more suffering than men of letters cared to describe realistically.

Lorenzo in his livelier mood had favoured masquerades and festivals for which he and his friends had composed poems such

as the *trionfi* and the *canti carnascialeschi.* The moral laxity and the heathen ideals that such poems expressed, the Dominican, Girolamo Savonarola of Ferrara, set himself to reform from the first day of his arrival in Florence (1489). He directed his attack against Lorenzo, the promoter of classical studies, the patron of pagan literature, rather than against the political tyrant. Animated by mystic zeal, he took the line of a prophet, preaching against the reading of voluptuous works, against the tyranny of the Medici, and calling for popular government. His attempt to put himself in opposition to his time, to arrest the course of events, to bring the people back to the faith of the past, the belief that all the social evils came from a Medici and a Borgia, his not seeing the historical reality as it was, his aspiring to found a republic with Jesus Christ for its king—all these things show that Savonarola was more of a fanatic than a thinker. Nor has he any great merit as a writer. He wrote Italian sermons, hymns (laudi), ascetic and political treatises, but they are roughly executed, and only important as throwing light on the history of his ideas. The religious poems of Girolamo Benivieni are better than his, and are drawn from the same inspirations. In these lyrics, sometimes sweet, always warm with religious feeling, Benivieni and with him Feo Belcari carry us back to the literature of the 14th century.

HISTORY IN THE RENAISSANCE

The Italian historians of the 15th century mostly wrote in Latin and were often readier to consider "eloquence" of style and the interests of their patrons than truthfulness; notable exceptions were Lorenzo Bruni, who made good use of the documents to which he had access in his history of Florence, and Lorenzo Valla of Forlì, who gave evidence of his pugnacious temperament in some historical tracts, among which that one disproving the legend about the donation of Constantine is the most famous. Pontano wrote the history of Naples in elegant Latin, B. Corio that of Milan in far less admirable Italian.

Leonardo da Vinci wrote a treatise on painting, Leon Battista Alberti one on sculpture and architecture. But the names of these two men are important, not so much as authors of these treatises, but as being embodiments of a characteristic of the age of the Renaissance—versatility of genius, power of application along many and varied lines, and of being excellent in all.

The fundamental characteristic of the later Renaissance is that it perfected itself in every kind of art, in particular uniting the essentially Italian character of its language with classicism of style. This period lasted from about 1494 to about 1560.

Niccolò Machiavelli and Francesco Guicciardini were the chief originators of the science of history. Machiavelli's principal works are the *Istorie fiorentine,* the *Discorsi sulla prima deca di Tito Livio,* the *Arte della guerra* and the *Principe.* The peculiarity of Machiavelli's genius lay in his artistic feeling for the treatment and discussion of politics in and for themselves, without regard to an immediate end—in his power of abstracting himself from the partial appearances of the transitory present, in order more thoroughly to possess himself of the eternal and inborn kingdom, and to bring it into subjection to himself. He was the creator of the experimental science of politics.

Next to Machiavelli both as an historian and a statesman comes Francesco Guicciardini. Guicciardini was very observant, and endeavoured to reduce his observations to a science. His *Storia d'Italia,* which extends from the death of Lorenzo de' Medici to 1534, is full of political wisdom, is skilfully arranged in its parts, gives a lively if rather cynical picture of the character of the persons it treats of, and is written in a grand style. He shows a profound knowledge of the human heart, and depicts with truth the temperaments, the capabilities and the habits of the different European nations.

Other historians were Jacopo Nardi, Benedetto Varchi, Giambattista Adriani, Bernardo Segni; and, outside Tuscany, Camillo Porzio, who related the *Congiura de' baroni* and the history of Italy from 1547 to 1552, Angelo di Costanzo, Pietro Bembo, Paolo Paruta and others.

Ariosto (1474–1533).—It was Boiardo's success that encouraged Ariosto to write his *Orlando furioso.* The world of chivalry interested him mainly as a canvas on which to embroider his beautiful patterns. Under the influence of classicism he rendered the structure of his poem more compact and harmonious, and if his characters lack some of the vigour with which Boiardo had endowed them, they are given a perfection of poise and of artistic delineation such as only a master craftsman could create. He worked for many years with unflagging enthusiasm at the revision of his poem, being fully aware that no poet could ever treat the octave stanza with the same easy grace and dazzling perfection.

Meanwhile there was an attempt at the historical epic. Gian Giorgio Trissino of Vicenza composed a poem called *Italia liberata dai Goti,* in which he forced himself to observe all the rules of Aristotle; Trissino's work is poor in invention and without any poetical colouring.

Originality was entirely wanting in lyrical poetry, since it seemed as if nothing better could be done than copy Petrarch. Still, even in this style there were some vigorous poets. Monsignore Giovanni Guidiccioni of Lucca (1500–41) showed that he had a generous heart. Giovanni della Casa (1503–56) and Pietro Bembo (1470–1547) were technically refined. Even Michelangelo Buonarroti was at times a Petrarchist, but his poems bear the stamp of his original genius. And a good many ladies are to be mentioned with these poets, such as Vittoria Colonna (Michelangelo's friend), Veronica Gambara, Gaspara Stampa and Giulia Gonzaga, who could hold their own with some of the men.

The first to occupy the tragic stage during the 16th century was Trissino with his *Sofonisba,* following the "rules" of the art most scrupulously. The *Oreste* and the *Rosmunda* of Giovanni Rucellai were no better, nor Luigi Alamanni's *Antigone.* Sperone Speroni in his *Canace* and Giraldi Cintio in his *Orbecche* tried to ensure success by barren innovations of technique. Superior to these was the *Torrismondo* of Torquato Tasso.

The Italian comedy of the 16th century was almost entirely modelled on the Latin comedy. There appear to be only two writers who should be distinguished among the many who wrote comedies—Machiavelli and Ariosto. In his *Mandragora* Machiavelli, unlike all the others, composed a comedy of character, creating types which seem living even now. Ariosto was far less original. The notorious Pietro Aretino might also be included in the list of the best writers of comedy.

The 15th century was not without humorous poetry; Antonio Cammelli, surnamed Pistoia, is specially deserving of notice. But it was Francesco Berni who carried this kind of literature to perfection in the 16th century. From him the style has been called "bernesque" poetry. It was art for art's sake that inspired and moved Berni to write, as well as Anton Francesco Grazzini, called Il Lasca, and other lesser writers. Bernesque poetry is the clearest reflection of that religious and moral scepticism which was one of the characteristics of Italian social life in the 16th century, and which showed itself more or less in all the works of that period. The Berneschi, and especially Berni himself, sometimes assumed a satirical tone. But theirs could not be called true satire. Pure satirists, on the other hand, were Antonio Vinciguerra, a Venetian, and Lodovico Alamanni. Ariosto's *Satire* read as chapters of a humourous autobiography.

In the 16th century there were not a few didactic works; such are the *Api* of Giovanni Rucellai and Baldassare Castiglione's *Cortegiano,* in which the author imagines a discussion in the palace of the dukes of Urbino between knights and ladies as to what are the gifts required in a perfect courtier. This book is valuable as an illustration of the intellectual and moral state of the highest Italian society in the first half of the 16th century.

Of the novelists of the 16th century, the two most important were Anton Francesco Grazzini and Matteo Bandello—the former as playful and bizarre as the latter is ponderous and solemn. During the 16th century much attention was paid to translating Latin and Greek authors. Among the very numerous translations of the time those of the *Aeneid* and of the *Pastorals* of Longus the Sophist by Annibal Caro are still famous; as are also the translations of Ovid's *Metamorphoses* by Giovanni Andrea dell' Anguillara, of Apuleius's *Golden Ass* by Firenzuola, and of Plutarch's *Lives* and *Moralia* by Marcello Adriani.

Tasso (1544–1595).—In the middle of the 16th century two events exercised a considerable influence upon Italian thought and consequently upon literature and art:—the Council of Trent and the rediscovery of Aristotle's *Poetics*. The Council of Trent having failed to find a compromise with the northern Reformers set itself to restore discipline within the ranks of the Roman Church by a strict enforcement of authority. It was then realized that the assimilation of classical ideas, symbolized by such popes as Nicholas V., Pius II. and Leo X., had imperilled the very existence of the church by its consequent laxity of morals. The Jesuit Order and the Index of forbidden books were the more conspicuous organs by which a deadening discipline was brought to bear on the men of the later Renaissance. At the same time the *Poetics* were re-discovered and commented on, and the principle of authority which prevailed in politics and religion was thus introduced in literature as well: only such literary forms were considered legitimate, as could be supposed to have Aristotle's support. Tasso, who was perpetually obsessed by religious scruples and critical uncertainties, well symbolizes that period. He was only 18 years old when, in 1562, he tried to reconcile the Aristotelian rules with the variety of Ariosto in his *Rinaldo*. He afterwards wrote the *Aminta*, a pastoral drama of exquisite grace. But the work to which he had long turned his thoughts was an heroic poem, and that absorbed all his powers. He himself explains what his intention was in the three *Discorsi* written whilst he was composing the *Gerusalemme:* he would choose a great and wonderful subject, not so ancient as to have lost all interest, nor so recent as to prevent the poet from embellishing it with invented circumstances; he meant to treat it rigorously according to the rules of the unity of action observed in Greek and Latin poems, but with a far greater variety and splendour of episodes, so that in this point it should not fall short of the romantic poem; and finally, he would write it in a lofty and ornate style. This is what Tasso has done in the *Gerusalemme liberata*, the subject of which is the liberation of the sepulchre of Jesus Christ in the 11th century by Godfrey of Bouillon. Tasso possessed an unparalleled gift for melodious verse; power he lacked, and occasionally, in order to bring in the element of surprise so persistently advocated by the commentators of the *Poetics*, he had recourse to tiresome antitheses and exaggerated metaphors.

THE SECENTISMO

Spanish oppression and the tyranny of the Counter-Reformation seem to have exhausted Italian creative power which was already worn out by the great output of the Renaissance. From about 1559 began a period of decadence in Italian literature. The suspicious rulers fettered all freedom of thought and word; they tortured Campanella, burned Bruno, made every effort to extinguish all freedom of thought. This period is known in the history of Italian literature as the Secentismo. Its writers, devoid of sentiment, resorted to exaggeration; the utter poverty of the matter tried to cloak itself under exuberance of forms.

Marini.—At the head of the school of the "Secentisti" comes Giovan Battista Marini of Naples, born in 1569, especially known by a poem called *L'Adone*. His aim was to excite wonder by novelties; hence the most extravagant metaphors, the most forced antitheses, the most far-fetched conceits, are to be found in his book. Achillini of Bologna followed in Marini's steps. In general, we may say that all the poets of the 17th century were more or less infected with "Marinism." Thus Alessandro Guidi, although he does not attain to the exaggeration of his master, is emptily bombastic, inflated, turgid, while Fulvio Testi is artificial and affected. Yet Guidi as well as Testi felt the influence of another poet, Gabriello Chiabrera, born at Savona in 1552. In him the Secentismo took another character. Enamoured as he said he was of the Greeks, he made new metres, especially in imitation of Pindar, treating of religious, moral, historical and amatory subjects. Chiabrera, though elegant in form, proves empty of matter, and, in his vain attempt to dissemble this vacuity, has recourse to poetical ornaments of every kind.

Filicaja, the Florentine, has a certain lyric *élan*, particularly in the songs about Vienna besieged by the Turks; but even in him we see clearly the rhetorical artifice and the falseness of the conceits. In consequence of all this Italian literature fell into disrepute in other countries and was severely criticised in Italy herself.

The Arcadia.—The belief then arose that it would be sufficient to change the form in order to restore literature. Weary of the bombastic style men said—let us follow an entirely different line, let us fight the turgid style with simplicity. In 1690 the "Academy of Arcadia" was instituted. Its founders were Giovan Maria Crescimbeni and Gian Vincenzo Gravina. The Arcadia was so called because its chief aim and intention were to imitate in literature the simplicity of the ancient shepherds, who were fabulously supposed to have lived in Arcadia in the golden age. This was obviously nothing else than the substitution of a new artifice for the old one; and they fell from bombast into effeminacy, from the turgid into the over-refined. The poems of the "Arcadians" fill many volumes, and are made up of sonnets, madrigals, canzonets and blank verse. The one who most distinguished himself among the sonneteers was Felice Zappi. Among the authors of songs Paolo Rolli was illustrious. Innocenzo Frugoni was more famous than all the others.

Scientific Prose and Satire.—Neither "secentismo" nor Arcadianism pervaded the whole field of thought. There were some strong and independent thinkers, such as Bernardino Telesio, Giordano Bruno, Tommaso Campanella, Lucilio Vanini, who turned philosophical inquiry into fresh channels, and opened the way for the scientific conquests of Galileo Galilei. Galileo was not only a great man of science, but also occupied a conspicuous place in the history of letters. His prose is in perfect antithesis to the poetry of his time; it is clear, goes straight to the point, is without rhetorical ornaments and without vulgar slips, artistic without appearing to be so.

Another symptom of revival, a sign of rebellion against the prevailing conditions, is given us in satire and in particular in that of Salvator Rosa and Alessandro Tassoni. Salvator Rosa, born in 1615, near Naples, was a painter, a musician and a poet. His exhortation to Italian poets to turn their thoughts to the miseries of their country as a subject for their song and certain passages where he deplores the effeminacy of Italian habits, make Salvator Rosa a forerunner of the 18th century. Tassoni was superior to Rosa. He showed independent judgment, and his *Secchia Rapita* proved that he was an eminent writer. This is a mock-heroic poem, which is at the same time an epic and a personal satire. He was bold enough to attack the Spaniards in his *Filippiche*, in which he urged his patron, Carlo Emanuele of Savoy, to persist in the war against them. The work of Traiano Boccalini was also of great significance.

THE 18TH CENTURY

Having for the most part freed itself from the Spanish dominion in the 18th century, the political condition of Italy began to improve. Promoters of this improvement, which was shown in many civil reforms, were Joseph II., Leopold I. and Charles I.

Giambattista Vico was a token of the awakening of historical consciousness in Italy. In his *Scienza nuova* he applied himself to the investigation of the laws governing the progress of the human race, and according to which events are developed. From the psychological study of man he endeavoured to infer the "comune natura delle nazioni," *i.e.*, the universal laws of history, or the laws by which civilizations rise, flourish and fall.

From the same scientific spirit which animated the philosophical investigation of Vico, there was born a different kind of investigation, that of the sources of Italian civil and literary history. Lodovico Antonio Muratori, after having collected in one entire body (*Rerum Italicarum scriptores*) the chronicles, the biographies, the letters and the diaries of Italian history from 500 to 1500, after having discussed the most obscure historical questions in the *Antiquitates Italicae medii aevi*, wrote the *Annali d' Italia*, minutely narrating facts derived from authentic sources. Muratori's associates in his historical researches were Scipione Maffei of Verona and Apostolo Zeno of Venice. In his *Verona illustrata* the former left, not only a treasure of learning, but an excellent specimen of historical monograph. The latter added much to the

erudition of literary history, both in his *Dissertazioni Vossiane* and in his notes to the *Biblioteca dell' eloquenza italiana* of Monsignore Giusto Fontanini. Girolamo Tiraboschi and Count Giovanni Maria Mazzuchelli of Brescia devoted themselves to literary history. Literary criticism also attracted great attention: Muratori, Vico, Gravina, Maffei and several others, while advocating the imitation of the classics as a cure of literary decadence, well realized that such imitation must needs be cautious, and thus forecast critical standpoints that were later to come into favour during the age of Romanticism.

The new spirit of the times also led men to inquire into the mechanism of economical and social laws. Francesco Galiani wrote on currency; Gaetano Filangieri wrote a *Scienza della legislazione*. Cesare Beccaria, in his treatise *Dei delitti e delle pene*, made a contribution to the reform of the penal system and promoted the abolition of torture.

Parini.—Giuseppe Parini, born in a Lombard village in 1729 and educated at Milan, seems to embody the literary revival of the 18th century. In a collection of poems that he published at 23 years of age, under the Arcadian name of Ripano Eupilino, there are some pastoral sonnets not devoid of realistic touches, and also some satirical pieces in which he exhibits a spirit of somewhat rude opposition to his own times. This, however, was only the beginning of the battle. In Parini's days the nobles and the rich consumed their lives in ridiculous trifles or in shameless self-indulgence, wasting themselves on immoral "Cicisbeismo." It was against this social condition that Parini's muse was directed. In the *Odi* the satirical note is already heard. But it came out more strongly in the poem *Il giorno*, in which he imagines himself to be teaching a young Milanese patrician all the habits and ways of gallant life; he shows up all its ridiculous frivolities, and with delicate irony unmasks the futilities of aristocratic habits. Dividing the day into four parts, the *Mattino*, the *Mezzogiorno*, the *Vespero*, the *Notte*, by means of each of these he describes the trifles of which they were made up, and the book thus assumes a social and historical value of the highest importance. As a work of art, the *Giorno* is notable for the skill with which that delicate irony is constantly kept up by which he seems to praise what he effectually blames. The verse has new harmonies; sometimes it is a little hard and broken, not by accident, but as a protest against the Arcadian monotony.

Gasparo Gozzi's satire was less elevated, but directed towards the same end as Parini's. In his *Osservatore*, something like Addison's *Spectator*, in his *Gazzetta veneta*, in the *Mondo morale*, by means of allegories and novelets he hit the vices with a delicate touch, and inculcated a practical moral with much good sense. Gozzi's prose is very graceful and lively. Another satirical writer of the first half of the 18th century was Giuseppe Baretti of Turin. In a journal called the *Frusta letteraria* he took to lashing without mercy the works which were then being published in Italy. He had learnt much by travelling; and especially his long stay in England and the friendship of Dr. Johnson had contributed to give independence to his criticism.

Also the drama felt the influence of the times. Apostolo Zeno and Metastasio (the Arcadian name for Pietro Trapassi, a native of Rome) had endeavoured to make "melodrama and reason compatible." The latter in particular succeeded in giving fresh expression to the affections, a natural turn to the dialogue and some interest to the plot. Comedy was reformed by Carlo Goldoni, a Venetian, who created the comedy of character. No doubt Molière's example helped him in this. Goldoni's characters are always true, but often a little superficial. He studied nature, but he did not plunge into psychological depths. In most of his creations, the external rather than the internal part is depicted. Goldoni wrote much (more than 150 comedies), and had no time to correct, to polish, to perfect his works, which are all rough cast. A good many of his comedies were written in Venetian dialect, and these are perhaps the best.

Return to Classicism.—The ideas that were making their way into French society in the 18th century, and afterwards brought about the Revolution of 1789, gave a special direction to Italian literature of the second half of the 18th century. Love of ideal liberty, desire for equality, hatred of tyranny, created in Italy a literature which aimed at national objects, seeking to improve the condition of the country by freeing it from the double yoke of political and religious despotism. But all this was associated with another tendency. The Italians who aspired to a political redemption believed that it was inseparable from an intellectual revival, and it seemed to them that this could only be effected by a reunion with ancient classicism—in other words, by putting themselves in more direct communication with ancient Greek and Latin writers.

Patriotism and classicism then were the two principles that inspired the literature which began with Alfieri (1749–1803). He worshipped the Greek and Roman idea of popular liberty in arms against the tyrant. He took the subjects of his tragedies almost invariably from the history of these nations, made continual apostrophes against the despots, made his ancient characters talk like revolutionists of his time; he did not trouble himself with, nor think about, the truth of the characters; it was enough for him that his hero was Roman in name, that there was a tyrant to be killed, that liberty should triumph in the end. But even this did not satisfy Alfieri. Before his time and all about him there was the Arcadian school. It was necessary to arm the patriotic muse also against this. If the Arcadians, not excluding Metastasio, diluted their poetry with languishing tenderness, if they poured themselves out in so many words, it behoved the others to do just the contrary—to be brief, concise, strong, bitter, to aim at the sublime as opposed to the lowly and pastoral. The stern example set by Parini and Alfieri's grand manner exercised a potent influence.

Ugo Foscolo was an eager patriot, who carried into life the heat of the most unbridled passion, and into his art an occasionally rhetorical manner, but always one inspired by classical models. The *Lettere di Jacopo Ortis* is a love story containing a violent protest against the treaty of Campoformio. Foscolo's passions were sudden and violent; they came to an end as abruptly as they began. To one of these passions *Ortis* owed its origin. The style is somewhat strained owing to an excessive sentimental tension. It is truly eloquent, on the contrary, in the lectures *Dell' origine e dell' ufficio della letteratura*, in which Foscolo for the first time gave evidence of his profound critical insight, and in which he may be said to have pointed the way to modern Italian criticism. His poem *I sepolcri* had a great and well deserved success. In less than 300 lines Foscolo succeeded in giving lyrical expression to a fundamental trait of Italian history which he probably learned indirectly from Vico, for the Italians have ever sought inspiration in their past, and in this poem past glories are extolled as incentives to, and good omens of, a great future. Among his prose works a high place belongs to his translation of the *Sentimental Journey* of Sterne, a writer by whom one can easily understand how Foscolo should have been deeply affected. He went as an exile to England, and died there. He wrote for English readers some *Essays* on Petrarch and on the texts of the *Decamerone* and of Dante, which are truly remarkable pieces of constructive criticism.

If in Foscolo patriotism and classicism were united, and formed almost one passion, as much cannot be said of Vincenzo Monti, in whom the artist was absolutely predominant. Yet Monti was a patriot too, but in his own way. He had no one deep feeling that ruled him, or rather the mobility of his feelings is his characteristic; but each of these was a new form of patriotism, that took the place of an old one. He saw danger to his country in the French Revolution, and wrote the *Pellegrino apostolico*, the *Bassvilliana* and the *Feroniade;* Napoleon's victories caused him to write the *Prometeo* and the *Musagonia;* in his *Fanatismo* and his *Superstizione* he attacked the papacy; afterwards he sang the praises of the Austrians. Thus every great event made him change his mind, with a readiness which was due to his absorption in art and literature. It would be unjust to accuse Monti of baseness. If we say that nature in giving him only one faculty had made the poet rich and the man poor, we shall speak the truth. Knowing little Greek, he succeeded in making a translation of the *Iliad* which is remarkable for its Homeric feeling.

Monti was born in 1754, Foscolo in 1778. Four years later still was born another poet of the same school, Giambattista Niccolini. In literature he was a classicist and in politics a staunch supporter of the monarchical idea. In his tragedies he set himself free from the excessive rigidity of Alfieri, and partly approached the English and German tragic authors. He nearly always chose political subjects, striving to keep alive the love of liberty in his compatriots. Such are *Nabucco, Antonio Foscarini, Giovanni da Procida, Lodovico il Moro,* etc. He assailed papal Rome in *Arnaldo da Brescia,* a long tragic piece, not suited for acting, and lyric rather than dramatic.

The prevailing political preoccupations were not without effect on historical studies; one passed from the purely documentary researches of the previous century to the interpretation of past ages from a modern angle. One of the most interesting historians of the earlier part of the 19th century was the Neapolitan, Carlo Troya, who investigated the events of mediaeval Italy with a view to encouraging his contemporaries by the account of the deeds of their forefathers. His *Storia d' Italia nel medio evo* (1839) expressed a new conception of life. The Piedmontese, Carlo Botta, also was prompted to write history by political considerations, but his work was notable for rhetorical eloquence of exposition, not, like Troya's, for penetration and originality. Botta wrote a *History of Italy from 1789 to 1814;* later on he continued Guicciardini's *History* up to 1789, and wrote *Guerra dell' indipendenza americana.*

Close to Botta comes Pietro Colletta, a Neapolitan, born nine years after him. He also in his *Storia del reame di Napoli dal 1734 al 1825* had the idea of defending the independence and liberty of Italy in a style borrowed from Tacitus. He has a rapid, brief, nervous style, which makes his book attractive reading.

The Purists.—It need not strike one as strange that precisely when so great a political agitation prevailed the question of the Italian language should be heatedly discussed, for it had raged during the 16th century already, when Bembo, Machiavelli and Castiglione, among others, had discussed it, and it was to be finally settled a little later by Manzoni and his friends. For the time being it took the form of a pedantic classicism in the choice of words and expressions as a reaction against the excessive Gallicism which had been favoured in theory and in practice by some of the 18th century innovators, such as Verri and Beccaria. "Purismo," as this tendency was called, appeared to its supporters to be a manner of patriotism. Among them may be mentioned Antonio Cesari of Verona, who republished ancient authors, and brought out a new edition, with additions, of the *Vocabolario della Crusca.* He wrote a dissertation *Sopra lo stato presente della lingua italiana,* and endeavoured to establish the supremacy of Tuscan and of the three great writers Dante, Petrarch, Boccaccio. But patriotism in Italy has always had something municipal in it; so to this Tuscan supremacy there was opposed a Lombard school, which would not admit the supremacy of Tuscan. At the head of the Lombard school were Monti and his son-in-law Count Giulio Perticari. This gave Monti an occasion to write *Proposta di alcune correzioni ed aggiunte al vocabolario della Crusca,* in which he attacked the Tuscanism of the *Crusca.* The dispute about language took its place beside literary and political disputes, and all Italy took part in it—Basilio Puoti at Naples, Paolo Costa in the Romagna, Marc' Antonio Parenti at Modena, Salvatore Betti at Rome, Giovanni Gherardini in Lombardy, Luigi Fornaciari at Lucca, Vincenzo Nannucci at Florence.

A patriot, a classicist and a purist all at once was Pietro Giordani, born in 1774; he was almost a compendium of the literary movement of the time. His works were few and comparatively unimportant but his position among his contemporaries was such as to single him out as the last great exponent of "Purism."

THE 19TH CENTURY

The French domination in Italy had a twofold effect—it caused people to realize that the ancient and often purely sentimental aspirations towards political unity and independence were within the range of possibilities, for all divisions and little tyrants had been swept away by Napoleon, and it convinced Italians that no reliance could be placed on foreign help if such an aim was to be attained, for the French themselves, who had entered Italy as liberators, had proved oppressive masters. With the Napoleonic pre-eminence there was associated an artificial form of classicism, so that when Napoleon fell, there were released forces antagonistic to classicism. The 18th century critics had long since denounced some of the exaggerations of the classicists; literary romanticism had won favour in France, and French romanticists, if erroneously, considered their tendencies akin to those of the German romanticists. Between 1816 and 1818 a battle was fought for romanticism particularly at Milan where a romanticist periodical, *Il Conciliatore,* was published. G. Berchet, S. Pellico, L. di Breme, Giovita Scalvini, E. Visconti were among its principal contributors; their polemical efforts were silenced when several of their group were arrested by the Austrian police (1820) on account of their liberal opinions; among the accused was Pellico, who was later to write a famous account of his experiences (*Le mie prigioni,* 1832). It appears from the articles in the *Conciliatore* and from other essays that the new school, though advocating the study of modern works in different languages, a certain independence from classical imitation and the discarding of classical conventions, was on the whole consistent with the Italian tradition, a point that was made even clearer by the works of Manzoni, who was hailed as the chief exponent of this school. Manzoni's ideal was "a true subject, a moral purpose and a pleasing form as a means of attraction." And it is precisely realism in art that characterizes Italian literature from Manzoni onwards. The *Promessi Sposi* is the work that has made him immortal. No doubt the idea of the historical novel came to him from Sir Walter Scott, but he produced something more than an historical novel in the narrow meaning of that word; he created an eminently realistic work of art. The attention is entirely fixed on the powerful objective creation of the characters. From the greatest to the least they have a wonderful verisimilitude; they are living persons standing before us, not with the qualities of one time more than another, but with the human qualities of all time. Manzoni is able to unfold a character in all particulars, to display it in all its aspects, to follow it through its different phases. As a poet too he had gleams of genius, especially in the Napoleonic ode, *Il Cinque Maggio,* and where he describes human affections, as in some stanzas of the *Inni* and in the chorus of the *Adelchi.*

Leopardi (1798–1837).—The great poet of the age was Leopardi, born 13 years after Manzoni at Recanati, of a patrician family, bigoted and avaricious. He became so familiar with Greek authors that he used afterwards to say that the Greek mode of thought was more clear and living to his mind than the Latin or even the Italian. Solitude, sickness, domestic tyranny, prepared him for profound melancholy. From this he passed into complete religious scepticism, from which he sought rest in art. Everything is terrible and grand in his poems, which are the most agonizing cry in modern literature, uttered with a solemn quietness that at once elevates and terrifies us. But besides being the greatest poet of nature and of sorrow, he was also an admirable prose writer. In his *Operette morali*—dialogues and discourses marked by a cold and bitter smile at human destinies which freezes the reader—the clearness of style, the simplicity of language and the depth of conception are such that perhaps he is not only the greatest lyrical poet since Dante, but also one of the most perfect writers of prose that Italian literature has had.

As realism in art gained ground, the positive method in criticism kept pace with it. From the manner of Botta and Colletta history returned to its spirit of learned research, as is shown in such works as the *Archivio storico italiano,* established at Florence by Giampietro Vieusseux, the *Storia d'Italia nel medio evo* by Carlo Troya, a remarkable treatise by Manzoni himself, *Sopra alcuni punti della storia longobardica in Italia,* and the very fine history of the *Vespro siciliano* by Michele Amari. But alongside of the great artists Leopardi and Manzoni, alongside of the learned scholars, there was also in the first half of the 19th century a patriotic literature. To a close observer it will appear that historical learning itself was inspired by the love of Italy. Giampietro Vieusseux had a distinct political object when in 1820 he estab-

lished the monthly review *Antologia*. And it is equally well known that his *Archivio storico italiano* (1842) was, under a different form, a continuation of the *Antologia*, which was suppressed in 1833 owing to the action of the Russian Government. Florence was in those days the asylum of all the Italian exiles, and these exiles met and shook hands in Vieusseux's rooms, where there was more literary than political talk, but where one thought and one only animated all minds, the thought of Italy. (A. Ba.; C. F.)

THE RISORGIMENTO

Since 1821 the literature of Italy has been mainly concerned with political events. The names of romanticists and classicists survived, but the representatives of either school were actuated by patriotism. Pellico's *Mie Prigioni* and Niccolini's *Arnaldo* have been mentioned; Leopardi and Manzoni themselves had given expression to patriotic sentiments in their poems. Both of them had produced works too masterly to allow of successful imitations. Despite this Manzoni's novel created so deep an impression that several writers of little merit followed in his tracks. The novels of Varese, Rosini, Sacchi and many others are scarcely deserving of record; but there were also written works that cannot so lightly be dismissed. T. Grossi (1790–1853), Manzoni's friend, composed a historical novel, *Marco Visconti*, lacking in vigour of characterization and conventional in its description of the middle ages, which enjoyed, however, a large measure of popularity. Massimo Tapparelli d'Azeglio (1798–1866), a painter and a statesman as well as an author, had a political object in view in writing his *Ettore Fieramosca* on a heroic episode of the Renaissance, and his *Niccolò de' Lapi* on the private life of a Florentine family of the middle classes during the siege of 1530. Though it is overcrowded with incidents, the first of these two novels is full of zest. Later D'Azeglio became a political man and was several times prime minister; during a period of leisure he composed an excellent book of memoirs, *I miei ricordi*. D'Azeglio was a Piedmontese and a monarchist. Yet another author of historical novels, F. D. Guerrazzi (1804–73), was born at Leghorn and was a republican and a follower of Mazzini. With him writing was a means of fighting against oppression; he led the Tuscan revolution of 1848 and in the intervals of political activity he brought out several novels of which the *Assedio di Firenze* is the most notable. His style is frankly rhetorical and his historical accuracy is open to criticism, nevertheless there was such vigour and conviction in his writing as strongly to impress his readers. Garibaldi knew Foscolo's *Sepolcri* by heart and his followers called each other by the names of Guerrazzi's characters. It is among Garibaldians that one finds the last historical novelists. G. C. Abba, the historian of the Thousand, wrote *Sulle rive della Bormida* on an episode of the French domination in Piedmont; and the Friulian Ippolito Nievo, who also was one of the Thousand, wrote besides several volumes of poems and tales, *Le memorie di un ottuagenario*, a cyclic novel that just falls short of being a masterpiece through lack of revision, Nievo having been drowned in 1861 in his 29th year.

The pressure of political events caused many works to be written, most of which were of course of ephemeral value, though not a few are of notable importance. G. Mazzini wrote profusely on art, literature and music; at first he championed romanticism, later he opposed it as laying too great a stress on the individual, but at all periods his style was as vigorous as his convictions were sincere; among his political works may be mentioned *Fede ed avvenire* (1835), *Doveri degli uomini* (1844) and *Ai giovani d' Italia* (1860). Balbo, the historian, should also be recorded here as the author of the essay *Le speranze d'Italia*, but more important was V. Gioberti (1801–52), a Piedmontese priest who left his country and the clergy owing to his love of liberty, a philosopher and a man of wide vision. In 1843 he published his *Primato morale e civile degli Italiani* in which he urged the moral and historical right of the Italians to independence, and the creation of an Italian confederation under the presidency of the pope. This book formed the basis of the political creed of the Italians, other than the followers of Mazzini, who took part in the events of 1848–49. The failure of the revolution caused him to revise his opinions and to advocate the institution of a monarchy under the house of Savoy in his *Rinnovamento civile d'Italia* (1851).

In view of the object of their works it is not inappropriate to mention some poets among the political writers. The lyrics of Poerio, Mercantini and Mameli, who died at the age of 21 fighting at Rome in 1849, are little better than impromptu poems, but particularly those of Mameli are so sincere and vigorous as to have survived the generation for which they were composed. G. Giusti's (1809–49) poems have greater literary merit. His satires, not unlike Béranger's, were greedily read, but he seldom gave the full measure of his capabilities as in the lyric *Sant' Ambrogio*. Dall' Ongaro, Aleardi and G. Prati were sentimental romanticists and patriots, but there was little beyond melody and sentimentality in their poems. They and the mediocre imitators of Manzoni brought romanticism into disrepute and prepared the way for Carducci's reaction. In other departments of literature there was no outstanding figure. P. Cossa was a successful playwright who composed tragedies on Roman subjects; P. Ferrari of Modena (1822–89) transformed the romantic comedy of Gherardi del Testa into modern drama either illustrating a historical period or stating a social problem.

Carducci (1835–1907).—The great figure of the age was Giosuè Carducci. He lived through the feverish period of 1859–60 and his patriotic enthusiasm was changed to disillusionment by the difficulties in which the new kingdom was involved and the manner in which they were faced by the politicians. He looked to history for inspiration, to the classics as models; and he believed his literary gifts to invest him with a political mission. As poet-seer endowed with a forceful personality, much learning and uncompromising sincerity he exercised a kind of literary dictatorship. His poems dating from 1861 to 1900 and published under various titles are collected in his *Poesie*. He was also a polished writer of prose and a scholarly historian of literature; a constructive critic he was not, and philosophical criticism such as that of De Sanctis was distasteful to him. F. de Sanctis (1818–83), who was exiled by the Bourbons of Naples, considered literature the expression of social and moral conditions, and on the basis of a sound philosophical training on the works of Vico and Hegel he inaugurated aesthetic criticism. His *Saggi critici* and particularly his masterly *Storia della letteratura italiana* were not fully or generally appreciated in his days, but have since received recognition and formed the starting point of the philosophical revival of the later 19th century.

In creative literature his generation turned for inspiration to foreign realism. The forceful style and rugged personality of A. Oriani (d. 1909), a novelist, essayist and historian (*La lotta politica in Italia*), passed almost unnoticed and has only received due attention in recent years. Minor if popular novelists were S. Farina and G. Rovetta; G. Verga's success was not immediate but proved lasting (1840–1922). He was a realist, and his two best novels (*I Malavoglia; Mastro don Gesualdo*) describe with great power the dismal conditions prevailing in Sicily during the first part of the century. A friend and a follower of his was L. Capuana, and the much younger F. de Roberto (d. 1927), who wrote a masterly novel (*I Vicerè*), must be considered as belonging to the same group. In order to secure a realistic reproduction of life all these writers kept to local subjects, as if feeling the appeal of regional life, and the same may be said of the Neapolitan Matilde Serao and the Sardinian Grazia Deledda. To some extent it could be said of A. Fogazzaro of Vicenza (1842–1911) although his characters move in a wider circle. He was a deeply religious man and was much influenced by Manzoni and the German romanticists. Among his novels *Daniele Cortis* and particularly *Piccolo mondo antico* are the finest, while *Il Santo* is better known outside Italy owing to the criticism which it called forth from the ecclesiastical authorities. Together with these "regionalist" novelists may be mentioned dialectal playwrights of whom there were many and of great merit. The Venetian Giacinto Gallina and the Neapolitan S. di Giacomo (b. 1860) wrote plays of great emotional power. Di Giacomo is also an inspired poet and with him may be mentioned C. Pascarella, some of whose poems in Roman dialect are extraordinarily incisive.

While Carducci was still active G. Pascoli (1855–1912) acquired a great reputation and succeeded him in the chair at Bologna. His art was impressionistic and fragmentary, and his language occasionally childish and laborious; despite this there are passages of great beauty in some of his poems, particularly in *Myricae,* so that he shared popular favour with G. d'Annunzio (b. 1863). D'Annunzio is so exceptional a writer as to be difficult to classify; as a novelist and tragedian he has echoed in turn Verga, Dostoievsky, Tolstoi and Nietzsche. He attained a large measure of success, but such success as he achieved was due to the glittering wealth of his elaborate style rather than to any intrinsic merit. His genius is essentially lyrical, and it is in some sections of his long poem *Laudes creaturarum* that he has shown himself at his best. Beside men of such stature, lesser men, however deserving of notice, almost pale into insignificance—poets as honest and highminded as G. Giacosa of Turin, novelists as thoughtful as E. de Marchi and E. A. Butti, poets as gifted as A. Graf, G. Marradi and M. Rapisardi.

The political reorganization following upon the establishment of the kingdom offered opportunities to scholars, and, during the second part of the 19th century, under the inspiration of such teachers as A. d'Ancona, A. Bartoli, C. de Leva, P. Villari and other professors, a great amount of scholarly research was carried out and expounded in learned monographs. Facts were ascertained and obscure points were cleared up in political and literary history. The historical method prevailed. It was due to B. Croce (b. 1864), a follower of De Sanctis, that aesthetic criticism won recognition. By his *Estetica* and his many critical essays Croce changed the whole outlook of the younger generation on literary matters. Though his evaluation of individual authors is occasionally at fault, his influence has been most beneficial. Such praise he must share with another philosopher, G. Gentile, whose works on literary criticism are models of penetration. He is an active teacher and has among the young men of the day a larger and more enthusiastic following than Croce. (H. O.; C. F.)

CONTEMPORARY LITERATURE

The works produced during the present century are characterized by a spirit of daring, restlessness and youth; by intellectual curiosity, love of novel experiments and experiences, and above all by self-analysis. Writers aimed at the discovery of new forms of expression to supersede the old; thus, the Futurists were of service to the new literature, if only by reason of their attempt to break down inherited and stereotyped traditions in prose and verse. Prose underwent a remarkable change. It became crisper and at the same time more flexible, while language attained the unity long since advocated by Manzoni.

Fresh interest was awakened in the most varied forms of criticism, in history, culture and philosophy of all times and in all countries. In this eclectic tendency Renato Serra, a young and promising critic who was killed in the War, saw the beginnings of a new form of classicism. Interest in foreign literatures, including those of the East as well as of the West, produced a vast library of translations varying in quality, but on the whole showing a marked tendency towards treating translation as an art.

Fiction.—Although strictly belonging to the preceding generation, Carlo Dossi (1847–1910) did not receive due recognition until after his death. By his harsh and elliptical style and his original and vivid treatment of his subject matter, he opened out new paths to his successors. Of an entirely different character is the work of Alfredo Panzini (b. 1863) one of Carducci's best pupils. Possessing a quiet sense of humour tinged with irony, his attitude towards life is detached but not aloof. In what are generally considered to be his masterpieces *Le Fiabe della Virtù* (1905), *La Lanterna di Diogene* (1909), Panzini is acutely sensitive to all forms of beauty and to the conflict between them and the evils and uglinesses of the world. It is worthy of notice that most of the novelists, dramatists and critics of to-day—men and women—have tried their hand at the short story of the magazine type. Of these A. Albertazzi (b. 1865), Luciano Zuccoli (b. 1870), Virgilio Brocchi (b. 1876), Antonio Beltramelli (b. 1880), Guido da Verona (b. 1881) and Ugo Ojetti (b. 1871) who is also a very highly esteemed art critic and a polished essayist (*Cose viste*), and among the women writers Clarice Tartufari (b. 1868), Sibilla Aleramo (b. 1879), Neera (1846–1916), Amalia Guglielminetti (b. 1885) and Carola Prosperi (b. 1883) are the most popular.

Recent Developments.—A rebellious and combative group of young men showed their activity, during the first years of the 20th century, mainly by uncompromising attacks on all established reputations. This group is known as "Gruppo della Voce," from the periodical of that name founded by Giovanni Papini and Giuseppe Prezzolini about 1909, itself the offspring of an earlier review—*La Leonardo* (1903–07), which gave a great impulse to philosophical studies. Not all of the contributors were of equal merit, but they showed the presence of a new spirit and vitality much needed, and exerted an influence as far-reaching as it was important and often superior to their individual achievements. Papini (b. 1881), however, is the only one who is at all known outside Italy mainly on account of the much-advertised *Storia di Cristo* (1921), a work which has added little to a reputation really founded upon his autobiography, *Un uomo finito* (1912), *Cento pagine di Poesia* (1915), and the brilliant, provocative, and at times superficial critical essays *Stroncature* (1916). Giuseppe Prezzolini also wrote some excellent critical essays, mostly on his contemporaries, but later abandoned literature and philosophy for politics. Of the other principal contributors to *La Voce,* Scipio Slataper (1888–1915), a Triestino killed in the War, is best known for his noteworthy lyrical autobiography in prose, *Il mio Carso* (1912) and a suggestive study on Ibsen published posthumously (1916).

Ardengo Soffici's (b. 1879) best writings are a fragment of a novel, *Lemmonio Boreo* (1912), two autobiographical journals, *Giornale di Bordo* (1915) and *Kobilek* (1918), and the art criticism in *Il caso Medardo Rosso e l'Impressionismo* (1909) and *Scoperte e massacri* (1919). Soffici as a writer is both thoughtful and forceful and uses language impressionistically, frequently introducing exact and unexpected similes. Serra was one of the most promising of the younger writers, and is best known for his remarkable psychological document, the *Esame di coscienza di un letterato* (1916), in which he examines the attitude of an artist and an intellectual towards the War with great acuteness. Several other writers, such as Federigo Tozzi (1883–1920), Ferdinando Paolieri (b. 1878), Bruno Cicognani (b. 1879) and Piero Jahier (b. 1884), also have points of contact, in spirit and in style, with the Florence group. And other journalistic and literary coteries, in Rome and elsewhere, brought into notice essayists, such as E. Cecchi (b. 1884), one of the most polished writers of the day, A. Baldini (b. 1889) and R. Bacchelli (b. 1891) who was to make his mark as a novelist.

Other and more extreme innovators were led by F. T. Marinetti (b. 1878) and called themselves Futurists. In the first Futurist manifesto published in 1909 Marinetti announced the new aesthetic of the machine, considered as symbol, source and teacher of a new artistic sensibility, and preached the beauty of speed. Apart from its sensationalism and self-advertisement and its principles of destructiveness, Futurism none the less acted as an irritant and forced writers, and particularly poets, to react against stagnation and to define poetry anew and the difference between it and prose. With the possible exception of some of Marinetti's and L. Folgore's (b. 1888) works, and Palazzeschi's (b. 1885) booklet of free verse *L'incendiario,* their literary contributions were of scant significance.

Poets and Playwrights.—The poetic output was not very plentiful or attractive. Besides belated imitators of Carducci and D'Annunzio, there were poets such as M. Moretti (b. 1885), Enrico Pea (b. 1881), Amalia Giuglielminetti (b. 1889), who gave evidence at first of technical skill and lyrical vein which has since degenerated into affectation and mannerisms. The Piedmontese G. Gozzano (1883–1916) and the Neopolitan F. Gaeta (d. 1927) came nearest to the expression of contemporary feeling in a style free from all conventionalities.

There have been since D'Annunzio some successful attempts at poetic drama such as Benelli's historical tragedies *Maschera di Bruto* (1909) and *Cena delle Beffe* (1909), written in effective

blank verse. Some of the other playwrights like Dario Nicodemi have portrayed society life, according to the formula derived from the French dramatists. Others have written light comedies or dramas in dialect. Many of these are very charming and well constructed, especially the Florentine ones, *L'acqua cheta* (1908) by Augusto Novelli and *I'Pateracchio* (1910) by F. Paolieri. Some notable plays of the grand-guignol type have been written in Neapolitan dialect by Salvatore di Giacomo (*Assunta Spina* and *O' Mese Mariano*, 1910), Ernesto Murolo and Roberto Bracco, and, in Sicilian, by Pirandello (*Liolà*, 1917). The fame of Roberto Bracco as a dramatist rests, however, on *Piccola Fonte* (1905) and *Piccolo Santo* (1912). Most of his plays present psychological and spiritual tragedies with hardly any external action, and are pronouncedly feminist in sympathies.

The essential difference between Bracco and Pirandello is that one is intellectual, the other cerebral. In Pirandello (*q.v.*) the dramatic form is a natural step from the novel and the short stories, in which the characters are *dramatis personae* always talking among themselves but unable to make each understood to the other, until they begin to doubt whether they really exist and are not shadowy forms conjured up by the imagination of those among whom they live and by which they are bound. The dramatic situations arise out of the contrast between what the individual is, what he conceives himself to be and what others think him.

Next to Pirandello, Rosso di San Secondo (b. 1887), a Sicilian known also for his short stories, and Federico Valerio Ratti, author of a remarkable tragedy on Judas Iscariot, are the most promising dramatists. Luigi Chiarelli's play, *La Maschera e il Volto* (1917), presents in light comedy form many of Pirandello's ideas.

Criticism and History.—Among the older idealist—though not Crocean—critics, Arturo Farinelli, author of *Il Romanticismo in Germania* (1911), *Il Romanticismo nel mondo latino* (1927), and several other valuable works; C. de Lollis, and A. Galletti, who succeeded Pascoli in the chair of Italian literature at the University of Bologna and to whom he has devoted a brilliant critical study, are the most important. To these three university professors should be added the name of a younger man—G. Toffanin—who has already given several proofs of originality and scholarship of a high order. The work of the militant critics is represented by Thovez's essays *Il pastore il gregge e la zampogna* (1910) and *Mimi del Moderno* (1919); by Renato Serra's *Scritti critici* (1910), and *Le Lettere* (1914), a brilliant survey of contemporary literature and its characteristics, as well as by the critical writings of Papini and G. A. Borgese (b. 1882) who, besides the *Storia della critica romantica in Italia* (1903) has also written *Rubé* (1921) an interesting autobiographical novel. Borgese is a regular contributor to the daily press, for which write also R. Simoni, a playwright, A. Tilgher, a philosopher, F. Palazzi and G. Zucca, novelists.

Historians no less than critics have felt the Crocean influence. Croce has himself written many historical works, including the *Storia di Napoli* (1926) and the *Storia d'Italia dal 1870 al 1915* (1928); and the modern tendencies in historical studies are well represented in the works of R. Caggese, G. Volpe and a few others.

A general improvement in prose style has been one of the most striking features of the 20th century literature; there are now numbers of young men who write with an easy grace that was uncommon if not inexistent in earlier days. A lively controversy has recently begun. Massimo Bontempelli presided over a group of writers, among whom were O. Vergani and A. Campanile, who called themselves "novecentisti" and wished to give Italian literature a fanciful and cosmopolitan tone; against them a twofold reaction is taking place led by the "strapaesisti" who wish for a simple and direct form of art, and the traditionalists who advocate a return to Italian classicism. Among these opponents of "novecentismo" are C. Malaparte, G. B. Angioletti and R. Bacchelli, who has written a remarkable novel, *Il diavolo al Pontelungo* (1927). (A. DEL R.; C. F.)

BIBLIOGRAPHY.—The history of Italian literature written by F. de Sanctis in 1870 and several times reprinted is still the best aesthetic account of the subject. English readers are referred to J. A. Symonds's *Renaissance in Italy*, especially but not exclusively vols. iv. and v. German works of note are Gaspary's history of Italian literature up to the 14th century (1884–89; Eng. trans., only to the death of Dante, 1901), and Casini's contribution in Groeber's *Grundr. d. rom. Philologie* (Strasbourg, 1896–99). A useful summary is Hauvette's *Histoire de la lit. ital.* (1913). Of fundamental importance are the two elaborate series:—*Storia della letteratura italiana scritta da una società di professori* (Milan, 1900 *sqq.*, 11 vols., each with a complete bibliography), and *Storia dei generi letterari* (Milan, 1902 *sqq.*), of which only ten volumes have been published so far. Excellent bibliographical notes are to be read in D'Ancona e Bacci, *Manuale della letteratura italiana* (Florence, new ed., 1920, 6 vols.). For the later period see B. Croce, *La letteratura della nuova Italia* (Bari, 1914) and the series of *Guide bibliografiche* published by the Istituto Leonardo (Rome, 1919 *sqq.*), of which 30 numbers have so far appeared. A select bibliography also appears in C. Foligno, *Italian Literature* 1923).

ITALIAN WARS. The war which broke out in 1548 had for its theatre the northern provinces of Italy and was due to the inhabitants endeavouring to gain their national unity. To expel the Austrians who were in possession of Lombardy and Venetia was the principal aim of the inhabitants. The Austrians had for a long time made themselves odious by their continued repressive measures, especially during the last 20 years. The Austrian statesmen in Vienna, though receiving warnings from their representatives, appeared unable to comprehend the gravity of the situation. Grave disorders which had to be put down by the military, occurred in 1846 on the elevation of pope Pius IX. to the chair. At that period he was known for his liberal tendencies, and the populace placed their hopes on his influence to shake off the Austrian domination. If the Austrian authorities in Vienna failed to grasp the danger that was threatening their power in Lombardy and Venetia, the same cannot be said of Count Radetsky, the veteran commander-in-chief, one of the ablest leaders of the 19th century. Though his reports failed to rouse the Government to the imminent danger, he had carefully trained his troops in Italy and had supervised the erection of fortifications on the Mincio and Adige. It was mainly due to him that Austria was able to retain her Italian provinces.

THE FIRST WAR

March 1848.—News of the outbreak of the Revolution in Vienna in March 1848 together with the revolt of the Hungarians, was the signal for the Italian patriots to rise in Milan four days later (March 17) against the Austrians. Radetsky, the military governor, disposing of but 10,000 men, constituting the Milan garrison, decided after severe street fighting to retire into the citadel. Seeing that his force was too small to cope with the rising, he evacuated the citadel, taking with him the troops in the district. On the 23rd he was already at Lodi. Here news was brought to him of the intended march of the Sardinians on Milan and of the fact that Venice had fallen. The Austrian position was grave, and the only available reinforcements, those in Tirol, were being hurried to Italy.

King Charles Albert, who assumed command of the Sardinians, did not favour a revolutionary war, but he was forced on March 23 to accede to the popular clamour. Ascertaining that Radetsky had evacuated Milan, he crossed the Ticino at Pavia and Buffalora intending to pursue the enemy, thought to be in flight. By the first week in April, he was at Cremona with 70,000 men. It was hoped by the Sardinians that in three months their forces would be doubled. Charles Albert wished to capture Mantua but, giving up the idea, he marched to Pastrengo intending to bar Radetsky's retreat to Tirol. After the action at Goito, April 8, the king crossed the Mincio, while Radetsky retreated to a position west of Verona. The Sardinian attack failed on May 6 at St. Lucia, but Radetsky refrained from following the enemy till reinforcements arrived. He was prepared even to sacrifice Peschiera which was invested by the enemy. Nugent with part of the expected reinforcements, 15,000 strong, moved from Gorizia to Verona, harassed by the inhabitants. Evading battle with the Papal forces under Durando and Ferrari, 25,000 strong, he joined Radetsky on May 23.

The Austrian leader assumed the offensive threatening the Sar-

dinian right and rear and intending to relieve Peschiera. He entered Mantua on May 28. Encountering strong resistance, after the fall of Peschiera, Radetsky attacked Durando with 30,000 men, and forced him to surrender with 18,000 men on June 11. Restoring order in the Brenta Valley, Radetsky, reinforced, returned to Verona with 60,000. Charles Albert with 75,000 men occupied the hilly country around Custozza and the Rivoli plateau. After four days fighting the Sardinians were driven across the Mincio and in full retreat. Charles Albert tried in vain to obtain an armistice. Radetsky, moving by parallel roads, defeated the hostile right at Crema and Lodi and reoccupied Milan on August 4. The Sardinians having crossed the Ticino, an armistice was concluded on August 9.

The Second Campaign.—By the beginning of 1849, the civil war raging throughout Austria and Hungary inspired Italian patriots to make a new bid for independence. Charles Albert was again forced to take up arms in March, entrusting command to Chrzanowski a former Polish general. His forces amounted to 80,000 men divided into seven divisions, three being thrown forward to the Ticino at Galiate, Tregate and Vigevano, with two others at Novara and Ollegio, while another stood under Ramorino south of the Po opposite Pavia instead of occupying Cava to threaten a possible hostile advance. Chrzanowski's mistaken objective was to occupy Milan instead of advancing against the main enemy's force. He hoped thereby to force the Austrians to retire to the Quadrilateral. Radetsky, disposing of 75,000 men, not including detached posts, intended to concentrate at Pavia, interposing between the two Sardinian forces north and south of the Po, and then to march against the principal force. He evacuated Milan on March 17 feigning to retire towards Piacenza. Two days later he wheeled to his right and made for Pavia so as to cross the frontier as soon as the armistice expired, seven days being given by the Sardinians. Firmly believing the Austrians were retreating Chrzanowski gave orders to cross the Ticino at Magenta on March 20.

Radetsky crossed the Ticino and destroyed the bridge at Mezzano Corte, whereby Ramorino was cut off from Chrzanowski's main army. Two divisions of the latter crossed the river, the remaining three stood at Vigevano and Novara. Hearing of Radetsky's advance, Charles Albert decided to meet him at Vigevano with three corps, calling the other two from Magenta. Radetsky sent three corps to Mortara, outflanking the enemy's right with one and with another guarding his own right flank at Vigevano. Mortara fell, the Sardinians hardly pressed retreating to Novara. Next day, Radetsky advanced towards Vespolate, with an outflanking detachment on Robbio. The five Sardinian divisions were drawn up at Novara, ready to receive battle that day. Owing to a false report, Radetsky believing he was faced by a rearguard, changed his plan of a massed advance on Novara, to a left wheel towards Vercelli with but one corps going to Novara.

The following morning the Austrian II. corps encountered the whole hostile army at Novara and for hours was in the greatest danger. The III. corps coming up saved the situation in the afternoon and was, in its turn, followed by IV., which threatened the enemy's right. The Reserve Corps arriving, Radetsky ordered a general advance, the Sardinians falling back in disorder on Novara. An armistice was arranged that night, Charles Albert abdicating in favour of his son, Victor Emmanuel, and Radetsky giving up the advance on Turin. Thus terminated a campaign which will ever rank as a model—rapidity and secrecy, two leading military principles, being realized by Radetsky most brilliantly.

Sardinia.—The unfortunate campaign of 1848–49 could not dispel the hopes of the Italian patriots to liberate their country eventually from the foreign dominion. Their one idea was to unify all the provinces under the sceptre of the king of Sardinia, but they felt that their forces were hardly adequate to cope with such a formidable power as the empire of the Habsburgs. The victory of Austria in 1849 only postponed hostilities to a more favourable moment. At the time of the Crimean War Sardinia had joined the Allies, despatching a force of 15,000 men to aid them in Jan. 1855. At the close of hostilities Sardinia took her place at the peace conference in Paris among the great European powers, and all the minor Italian states now considered her as their leader.

The clever policy of Cavour, her foreign minister, consolidated her position in the years following the war. He had paid many visits to Paris and tried his utmost to persuade the emperor Napoleon III. to help Italy to liberate the country from the Austrians. In the middle of July, 1858, the emperor was finally convinced by Cavour that it was for the interest of France to join Sardinia in a war against Austria. These conversations were held between him and Cavour at Plombières, when it was decided in principle that should hostilities break out between Sardinia and Austria, France would send two army corps, gradually increasing the number to 200,000 men. No plan of campaign was drawn up, but a French officer was to be despatched to Turin to discuss technical matters with the leading Sardinian generals on the spot.

By Dec. 1858 events began to move more rapidly. Napoleon at the annual New Year reception of the Diplomatic corps openly declared to Baron Hubner, the Austrian ambassador, that the relations between France and Austria were not as good as heretofore, though his friendship to the emperor Francis Joseph remained unchanged. From that moment it became evident that hostilities were not far distant.

France.—Early in the year France promised to support Sardinia with 200,000 men in case of a conflict with Austria and began discussing projects, which continually fluctuated, Napoleon being uncertain what plan to adopt. Spurred on by Cavour, Sardinia, since the Crimean War had reorganized her army, which now numbered 50,000 men, increased to 60,000 in April. It consisted of three divisions and was concentrated at Alessandria acting as an advance guard to the French.

Both France and Austria reinforced their forces by slow degrees the result being to hamper military operations. In Austria's case it was dictated by policy as every effort was used to persuade Prussia to join her in the conflict with France. Should this be possible the principal blow would be struck by the united forces from southern Germany, the Austrians in Lombardy remaining on the defensive. By the middle of April it became evident that Austria could not hope for this assistance, but valuable time was lost in assembling sufficient forces to crush the Sardinians prior to the arrival of the French. Austria mustered 150,000 men in five Army Corps: II., III., V., VII. and VIII., commanded by Gyulai. His plan was to fall back on Verona and await there reinforcements, but Kuhn his chief of staff suggested a march against the Sardinians, thereby forcing Prussia to a decision.

France, fearing Prussia's attitude, on her part was obliged to retain considerable forces by the Rhine, yet this was no excuse for her vacillation during the first period of the campaign. Having had three clear months she began hostilities ill prepared; these would have ended in disaster if she had been faced by an energetic opponent. No definite plan of action was decided upon before actual fighting began, though Jomini, on Napoleon's request to give a suggestion, advised a flank attack by way of Magenta against the Austrian right. The Sardinians meanwhile were massed between Casale-Alessandria covering Turin and Genoa.

THE SECOND WAR

Austria's Ultimatum.—War began on April 26. Sardinia had rejected the Austrian ultimatum to disarm, despatched on the 19th, and Gyulai ordered the frontier to be crossed the following day. Having crossed the Ticino at Pavia and Bereguardo, Gyulai reached Valenza on May 3 when a report coming from Vienna stating the French were already in Turin in great strength stopped his advance. He now decided to move on Turin and attack the French columns debouching from Suza. On May 8 the Austrians reached the Sesia at Vercelli, but reports announcing the advance of strong hostile forces on Piacenza forced Gyulai to retire to the Lomellino, with his headquarters at Mortara. A bridge was constructed at the confluence of the Po and Ticino to facilitate a retirement to the south if necessary. The French were already on Sardinian soil and were rapidly joining their allies. Some had come across the Alps by Mont Cenis and Mont Genevre, while the rest had arrived by sea, disembarking at

in the kingdom. Foreseeing that the Schleswig-Holstein disputes between Austria and Prussia would certainly end in hostilities, Italy signed a treaty of alliance with Prussia on April 8, 1866. It was stipulated that they were to demand Venetia from Austria, support by force of arms the reforms for a German confederation, and not to sign peace separately.

Austria was forced by her political circumstances to assemble two armies, one on her northern frontiers, against Prussia, and a much smaller one against Italy. She relied, to make up for her numerical inferiority, on her small but highly-trained forces, and on her strong defensive position in the Quadrilateral. The Italians now numbered 250,000 infantry and 13,000 cavalry, with 480 guns. By an agreement with Prussia, Italy was to invade Venetia, mobilizing her forces, for that purpose, in the middle of April, 1866, and concentrate them in two groups: Three army corps 110,000 strong at Lodi, Cremona and Piacenza under King Victor Emmanuel, La Marmora acting as Chief of Staff. Cialdini with eight divisions was on the south bank of the Po with headquarters at Bologna, and had 70,000 men. A volunteer force under Garibaldi guarded the extreme left flank and was to invade Tirol. The Italians, knowing the Austrians were weak in numbers, believed they would await them around Verona. They would cross the Mincio, advancing on Custozza and hold the Austrians, while Cialdini passing over the Po would invade Venetia in the rear of the enemy.

The Austrians under the Archduke Albert, with General John as Chief of Staff, disposed of but 75,000 well trained troops. He took up a central position between Montagnana and Lonino within reach of either Rovigo or Verona, as he learned the enemy would advance in two separate armies from two directions: one from the Mincio, the other from south of the Po. On June 20 orders were issued to advance to Verona, the Archduke intending to attack the Italian king; hostile cavalry was known to be along the Mincio and Po, and Garibaldi was advancing into Tirol. On the 23rd the Archduke having completed his concentration between Verona-Pastrengo sent his troops into the hills, his plan being to take the offensive the next day, striking the Italians when they would be advancing towards the Adige. The Italians not expecting serious resistance, advanced with little precaution.

When at Villafranca the Italians were checked by artillery and cavalry, and 20,000 remained inactive all day. Meanwhile they fell in with the main hostile forces on the heights of Peschiera-Custozza. The Austrians in their turn began the attack along the whole line. Battle raged all day with varying success till about 5 P.M. when the Italians were forced to retire to the Mincio. A fortnight later the Archduke and the bulk of the army were transported to defend Vienna against the Prussians and when hostilities closed in Austria the Archduke was sent with 155,000 men to Isonzo. No further fighting took place, however, and peace was signed October 3, Austria losing Venetia, though the Italian navy sustained a crushing defeat at Lissa on July 20 when attacked by Tegetthof. Only in 1870 however did Rome once again become the capital of Italy the French being obliged to withdraw their garrison from the Eternal City after the French Empire had fallen. (A. SMI.)

ITALIC, *i.e.,* Italian, in Roman archaeology, history and law, a term used of that which relates to the non-Roman parts of Italy (*see* ITALY: *Ancient Languages and Peoples*). In architecture the Italic order means the Composite order (*see* ORDER). The term was applied to the Pythagorean school of philosophy in Magna Graecia, and to an early, pre-Vulgate, Latin version of the Bible, known also as *Itala.* Its technical use is of a form of type, in which the letters slope to the right, now used, in printing, chiefly to emphasize, to indicate a foreign language, or to mark titles of books, etc. It was introduced by the Aldine Press (*see* MANUTIUS and TYPOGRAPHY).

ITALIC LANGUAGES. The Italic group of languages comprises Latin, Oscan and Umbrian (*qq.v.*). There were certainly other, perhaps many other, dialects, which by political conditions were prevented from spreading or attaining any importance.

ITALO-CELTIC. In many important respects the Celtic languages (*q.v.*) resemble the Italic languages (*q.v.*) so closely that it has been proposed to group them together as a unit group of the Indo-European family. When historical evidence became available, differentiation had progressed so far that, while an earlier unity is permissible, they should be kept separate. Ligurian and Sicilian were certainly spoken Greek or Latin. There are affinities with Venetic.

See Walde, *Über Älteste Sprächliche Beziehungen zwischen Kelten und Italienern* (1917).

ITALO-TURKISH WAR. Following the diplomatic discussions which took place between Rome and Constantinople during the summer of 1911, an ultimatum from Italy was delivered to the Porte on Sept. 28, demanding Turkey's consent to a military occupation of Tripolitania and Cyrenaica. A period of 24 hours was set by the ultimatum, and as the Turkish reply did not meet the Italian demands a state of war was declared as from 2.30 P.M. on Sept. 29.

Italian Naval Activity.—Military action was slow to succeed the formal declaration of war, and it was not till Oct. 11 that the first transports reached Tripoli. Meanwhile the Italian navy had been busy. On Sept. 28 a squadron appeared off Tripoli, and notice was given that if the town were not surrendered it would be bombarded. The obsolete fortifications were bombarded for two hours on Oct. 3, after the Turkish authorities had declined to surrender the town. By next day, the Turkish garrison, acting upon order received from Constantinople, had retired into the sandy plains, and on Oct. 5, a force of 1,600 sailors was disembarked. Meanwhile hostilities had been begun elsewhere. On Sept. 29 and 30 Italian destroyers under the command of the duke of the Abruzzi sank the Turkish torpedo-boats off Prevesa in Epirus and on Oct. 1 Admiral Aubry left Augusta to go in search of the Turkish fleet, which the declaration of war had found at Beirut. But the orders given him were suddenly countermanded, and instead of steaming to the Aegean in order to intercept the Turks, he was sent to Tobruk, which was occupied by a detachment of sailors on Oct. 4. The renunciation of the attempt to cut off the Turkish fleet was inspired by political reasons.

Italian Expeditionary Force.—A week elapsed between the landing of the sailors at Tripoli and the arrival of the expeditionary force, and it was not till Oct. 20 that all the equipment had been put on shore. The force consisted of some 9,000 rifles with a few field and mountain batteries and two squadrons of cavalry. There was very little transport, for it had not been anticipated that the Turks would retreat towards the interior and receive support from the native tribesmen. That Neshat Bey, the Turkish commander in Tripoli, did receive this support was largely due to two men—Ferhat Bey, deputy for Tripoli, and Suleiman el Baruni, a Berber from Fessato, who was deputy for the Jebel region. Meanwhile Homs, Derna and Benghazi had been occupied. There was some resistance at each place, especially at Benghazi, but the first fighting of any importance was a sudden attack on Oct. 23 upon the Italian lines at Shara Shat in the Tripoli oasis, backed by a rising behind the lines. Two companies of Bersaglieri were cut to pieces, and the rest of the regiment were hard put to it to hold their own. Further attacks led to a withdrawal of the line, and to the clearing of the oasis behind the trenches. Large reinforcements were sent from Italy, and by the fourth week in November General Caneva, who was in command of the expedition, had about 25,000 rifles and 16 batteries. He took the offensive, and in two actions cleared the oasis and sent the Turks and their tribesmen allies packing. Turkish headquarters were established at Aziziya, some 30m. south of Tripoli.

Political Aspect.—At the beginning of November the Italian Government had considered the possibility of extending the theatre of war, on the sea at least, hoping to induce Turkey to give up the struggle. Austro-Hungary intervened, backed by Germany, invoking Article VII. of the Triple Alliance. Italy's action being limited in this way, it was necessary to solve the problem directly, but the task was more difficult than it need have been owing to the limitations laid upon General Caneva by the Italian Government. General Caneva's orders appear to have

been that he must not risk reverses or suffer heavy loss. In the circumstances, an expedition in pursuit of the Turks, and their mobile allies seemed hardly practical. In any event, months went by without any action of importance in Tripolitania. In Cyrenaica there was one fight near Benghazi, when a force of Arabs who had come near the town were attacked and severely punished. Derna was closely beset throughout the winter, and Enver Bey, who had succeeded in reaching Cyrenaica towards the end of the year, organized a formidable resistance, securing relative unity among the tribesmen, and a willingness to co-operate with the Turks, which had never before existed.

Italian Offensive Renewed.—In April, the long spell of inaction in the western province came to an end, and from that time onward the resistance of the Turks and Arabs was gradually broken by a series of operations at various points. In April Italian warships appeared off the entrance to the Dardanelles. They were fired on by the Turkish forts and their answer drew a fresh and very energetic protest from Vienna. The northern Aegean was left alone by the Italians henceforth, but in May the island of Rhodes and 12 small islands of the Sporades (subsequently famous as the Dodecanese) were occupied by Italy. During the summer there were a number of successful actions in Tripolitania, and peace negotiations were begun at Ouchy in August. Progress was very slow, and it was not until Oct. 15, when two important victories had been won by the Italians, at Derna and Sidi Bilal (near Zanzur) that the Treaty of Ouchy was signed.

Conclusions.—The conduct of the Tripoli campaign was prejudiced, first, by the failure of the Italian Government to judge the situation correctly, and secondly, by the limitations which were laid upon the military command. It was not possible at once to launch a desert expedition, and the difficulties of an advance to the Jebel, through country largely waterless, may be said to justify the adoption of a less ambitious plan. What is difficult to understand is the practical veto upon action of any kind, which immobilized large forces from December till April and delayed the carrying out of the policy which eventually put an end to hostilities, the policy of extending the area of operations and striking blow whenever the chance offered.

The operations of the summer changed the situation, but Italian prestige was not wholly restored by the later successes, or by the subsequent actions against the tribesmen who did not lay down their arms when the treaty was signed. The policy of the Government bore heavily upon the army, which came in for much unfair criticism and increased the difficulties of those who undertook the administration of the country after the peace. The troubles which were to come with the outbreak of the World War may be traced in part at least to the hesitations and uncertainties of the first months following the landing.

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ITALY (*Italia*), the name applied both in ancient and in modern times to the great peninsula that projects from the mass of central Europe far to the south into the Mediterranean sea, where the island of Sicily may be considered as a continuation of the continental promontory. The portion of the Mediterranean commonly termed the Tyrrhenian sea forms its limit on the west and south, and the Adriatic on the east; while to the north, where it joins the main continent of Europe, it is separated from the adjacent regions by the mighty barrier of the Alps, which sweeps round in a vast semicircle from the head of the Adriatic to the shores of Nice and Monaco.

TOPOGRAPHY

The land thus circumscribed extends between the parallels of 36° 40′ and 36° 38′ N., and between 6° 30′ and 18° 30′ E. Its greatest length in a straight line along the mainland is from north-west to south-east, in which direction it measures 708 m. in a direct line from the frontier near Courmayeur to Cape Santa Maria di Leuca, south of Otranto, but the great mountain peninsula of Calabria extends about 2° farther S. to Cape Spartivento in lat. 37° 55′. Its breadth is, owing to its configuration, very irregular. The northern portion, measured from the Alps at the Monte Viso to the mouth of the Po, has a breadth of about 270 m., while the maximum breadth, from the Mont Cenis to Fiume, is far greater. The peninsula of Italy, which forms the largest portion of the country, nowhere exceeds 150 m. in breadth and does not generally measure more than 100 m. across. Its southern extremity, Calabria, forms a complete peninsula, being united to the mass of Lucania or the Basilicata by an isthmus only 35 m. in width, while that between the gulfs of Sta Eufemia and Squillace, which connects the two portions of the region, does not exceed 20 miles. The area of the kingdom of Italy is 120,956 sq.m., or, excluding Sicily and Sardinia, 101,575. Though the Alps form throughout the northern boundary of Italy, the exact limits at the extremities of the Alpine chain are not clearly marked. Ancient geographers appear to have generally regarded the remarkable headland which descends from the Maritime Alps to the sea between Nice and Monaco as the limit of Italy in that direction, and in a purely geographical point of view it is probably the best point that could be selected. But Augustus, who was the first to give to Italy a definite political organization, carried the frontier to the river Varus or Var, a few miles west of Nice, and this river continued in modern times to be generally recognized as the boundary between France and Italy. But in 1860 the annexation of Nice and the adjoining territory to France brought the political frontier farther east, to a point between Mentone and Ventimiglia which constitutes no natural limit.

Towards the north-east, Augustus carried the frontier far enough to include Tergeste (Trieste), and the little river Formio (Risano) was in the first instance chosen as the limit, but this was subsequently transferred to the river Arsia (the Arsa), which flows into the Gulf of Quarnero, so as to include almost all Istria; and the circumstance that the coast of Istria was throughout the middle ages held by the republic of Venice tended to perpetuate this arrangement, so that Istria was generally regarded as belonging to Italy, as it now does.

To the north the frontier is now fixed at the Brenner pass, at the head of the valley of the Adige. Here the main chain of the Alps (as marked by the watershed) recedes much farther to the north. In ancient times the upper valleys of the Adige and its tributaries were inhabited by Raetian tribes and included in the province of Raetia; and the line of demarcation between that province and Italy was purely arbitrary, as it was until after the war. Tridentum (Trento) was in the time of Pliny included in the tenth region of Italy or Venetia, but he tells us that the Tridentini were a Raetian tribe. Until 1919 the frontier between Austria and the kingdom of Italy crossed the Adige about 30 m. below Trento (*q.v.*).

While the Alps thus constitute the northern boundary of Italy, its configuration and internal geography are determined almost entirely by the great chain of the Apennines, which branches off from the Maritime alps between Nice and Genoa, and, after stretching in an unbroken line from the Gulf of Genoa to the Adriatic, turns more to the south, and is continued throughout central and southern Italy, of which it forms as it were the backbone, until it ends in the southernmost extremity of Calabria at Cape Spartivento. The great spur or promontory projecting towards the east to Brindisi and Otranto has no direct connection with the central chain.

One chief result of the manner in which the Apennines traverse Italy from the Mediterranean to the Adriatic is the marked division between northern Italy, including the region north of the Apennines and extending thence to the foot of the Alps, and the central and more southerly portions of the peninsula. No such line of separation exists farther south, and the terms central and southern Italy, though in general use among geographers do not correspond to any natural divisions.

Northern Italy.—By far the larger portion of northern Italy is occupied by the basin of the Po, which comprises the whole of the broad plain extending from the foot of the Apennines to that of the Alps, together with the valleys and slopes on both sides of it. From its source in Monte Viso to its outflow into the Adriatic—a distance of more than 280 m. in a direct line—the Po receives all the waters that flow from the Apennines north-

wards, and all those that descend from the Alps towards the south, Mincio (the outlet of the Lake of Garda) inclusive. The next river to the east is the Adige, which, after pursuing a parallel course with the Po for a considerable distance, enters the Adriatic by a separate mouth. Farther to the north and north-east the various rivers of Venetia fall directly into the Gulf of Venice.

The geography of northern Italy will be best described by following the course of the Po. That river has its origin as a mountain torrent descending from the north flank of Monte Viso, at more than 6,000 ft. above the sea; and after less than 20 m. it enters the plain at Saluzzo, between which and Turin (30 m.) it receives three considerable tributaries—the Chisone on its left bank, and the Varaita and Maira on the south. A few miles below Valenza it is joined by the Tanaro, which brings the waters of several minor rivers.

More important are the rivers that descend from the main chain of the Graian and Pennine alps and join the Po on its left bank. Of these the Dora (called for distinction's sake Dora Riparia), which unites with the greater river just below Turin, has its source in the Mont Genèvre, and flows past Susa at the foot of the Mont Cenis. Next comes the Stura, which rises in the glaciers of the Roche Melon; then the Orca, flowing through the Val di Locana; and then the Dora Baltea, which has its source in the glaciers of Mont Blanc, and thence descends through the Val d'Aosta for about 70 m. till it enters the plain at Ivrea, and, after 20 m more joins the Po below Chivasso. (*See* SAINT BERNARD PASSES.) About 25 m. further on, the Po receives the Sesia, which rises at the southern foot of Monte Rosa, and falls into the Po 14 m. below Vercelli. A little above this confluence, at Casale Monferrato, the navigable portion of the river begins (337 m. to the mouth, minimum width 656 ft., minimum depth 7 ft. with many shallows and sandbanks. About 16 m. E. of Vercelli it is joined by the Ticino, a large and rapid river, which brings the outflow of Lago Maggiore (*q.v.*). The next great affluent, the Adda, flows out of the lake of Como at Lecco, and thence traverses the plain for 70 m. till it enters the Po between Piacenza and Cremona. It receives the waters of the Brembo, descending from the Val Brembana, and the Serio from the Val Seriana above Bergamo. The Oglio rises in the Monte Tonale above Edolo, and descends through the Val Camonica to Lovere, where it expands into the Lago d'Iseo (*q.v.*). From its south-west extremity, the Oglio has a long and winding course through the plain reaching the Po above Borgoforte. In this lower part it receives the smaller streams of the Mella, which flows by Brescia, and the Chiese, from the small Lago d'Idro, between the Lago d'Iseo and that of Garda.

The last great tributary of the Po is the Mincio, which flows from the Lago di Garda (*q.v.*) and has a course of about 40 m. from Peschiera, at its south-eastern angle, till it joins the Po. About 12 m. above the confluence it passes under the walls of Mantua (*q.v.*) and expands into a broad lake-like reach so as entirely to encircle that city.

The Adige, joined by the Isarco below Bolzano descends as far as Verona, where it enters the great plain, with a course from north to south nearly parallel to the rivers last described, but below Legnago it turns eastward and runs parallel to the Po for about 40 m., entering the Adriatic by an independent mouth about 8 m. from the northern outlet of the greater stream. The two rivers have, however, been joined by artificial cuts and canals, thus permitting free circulation between them.

The Po itself, which is here a very large stream, with an average width of 400 to 600 yd., parts into two arms, known as the Po della Maestra and Po di Goro, at S. Maria di Ariano, and these again are subdivided into several other branches, forming a delta above 20 m. in width from N. to S. The point of bifurcation, at present about 25 m. from the sea, was formerly much farther inland, more than 10 m. W. of Ferrara, where a small arm of the river, still called the Po di Ferrara, branches from the main stream. Previous to the year 1154 this channel was the main stream, and the two small branches into which it subdivides, called the Po di Volano and Po di Primaro, were in early times the two main outlets of the river. The southernmost of these, the Po di Primaro, enters the Adriatic about 12 m. N. of Ravenna, so that if these two arms be included, the delta of the Po extends about 36 m. from S. to N. The whole course of the river, including its windings, is estimated at 417 m.

In the first 21 m. of its course, down to Revello (west of Saluzzo), the Po descends no less than 5,250 ft., a fall of 47·3:1,000. From the confluence of the Ticino its fall is about 0·3:1,000; from the beginning of the delta below Ferrara, 0·08:1,000. At Turin it has an average width of 400 to 415 ft., a mean depth of 3½ to 5½ ft., and a velocity of 1 to 3 ft. in the second. The mean depth from the confluence of the Ticino (altitude 217 ft.) downwards is 6 ft. to 15 ft. The total length of the embankments exceeds 600 miles. Owing to its confinement between these high banks, and to the great amount of sedimentary matter which the river brings down with it, its bed has been gradually raised, so that in its lower course it is often above the level of the surrounding country. A result is the rapid growth of the delta (1300–1600, 127 ac.; 1823–93, 174 ac.). The Po della Maestra advances 282 ft. annually, the Po delle Tolle 262 ft., the Po della Gnocca 111½ ft., and the Po di Goro 259 ft. The low ground between the lower Po and the lower Adige and the sea is known as Polesine.

Besides the delta of the Po and the large marshy tracts which it forms, there exist on both sides of it extensive lagoons of salt water, generally separated from the Adriatic by narrow strips of sand or embankments, partly natural and partly artificial, but having openings which admit the influx and efflux of the sea-water, and serve as ports for communication with the mainland. The best known and the most extensive of these lagoons is that in which Venice is situated, which extends from Torcello in the north to Chioggia and Brondolo in the south, a distance of above 40 m.; but they were formerly much more extensive, and afforded a continuous means of internal navigation by what were called "the Seven Seas" (Septem Mare), from Ravenna to Altinum, a few miles north of Torcello. That city, like Ravenna, originally stood in the midst of a lagoon; and the coast east of it to near Monfalcone, where it meets the mountains, is occupied by similar expanses of water, which are, however, becoming gradually converted into dry land.

The tract adjoining this long line of lagoons is, like the basin of the Po, a broad expanse of perfectly level alluvial plain, extending from the Adige eastwards to the Carnic alps, where they approach close to the Adriatic between Aquileia and Trieste, and northwards to the foot of the great chain, which here sweeps round in a semicircle from the neighbourhood of Vicenza to that of Aquileia. The space thus included was known in ancient times as Venetia, a name applied in the middle ages to the well known city; the eastern portion of it became known in the middle ages as Frioul or Friuli, a district still interesting because of its peculiar form of Romance speech.

Returning to the south of the Po, the tributaries of that river on its right bank below the Tanaro which flow from the Ligurian Apennines, generally dwindle in summer into insignificant streams. The principal are: (1) the Scrivia, a small but rapid stream flowing from the Apennines at the back of Genoa; (2) the Trebbia, a much larger river which rises near Torriglia within 20 m. of Genoa, flows by Bobbio, and joins the Po a few miles above Piacenza; (3) the Nure, a few miles east of the preceding; (4) the Taro, a more considerable stream; (5) the Parma, flowing by the city of the same name; (6) the Enza; (7) the Secchia, which flows by Modena; (8) the Panaro, a few miles to the east of that city; (9) the Reno, which flows by Bologna, but instead of holding its course till it discharges its waters into the Po, as it did in Roman times, is turned aside by an artificial channel into the Po di Primaro. The other small streams east of this have their outlet in like manner into the Po di Primaro, or by artificial mouths into the Adriatic between Ravenna and Rimini. The river Marecchia, which enters the sea immediately north of Rimini, may be considered as the natural limit of northern Italy. (*See* RUBICON.) The Savio is the only other stream of any importance which has always flowed directly into the Adriatic from this side of the Tuscan Apennines.

The narrow strip of coast-land between the Maritime Alps, the Apennines, and the sea (called in ancient times Liguria [*q.v.*]),

is throughout its extent, from Nice to Genoa on the one side, and from Genoa to Spezia on the other, almost wholly mountainous. The steep slopes facing the south enjoy so fine a climate as to render them very favourable for the growth of fruit trees, especially the olive, which is cultivated in terraces to a considerable height up the face of the mountains, while the openings of the valleys are generally occupied by towns or villages, some of which are favourite resorts.

From the proximity of the mountains to the sea the rivers in this part of Italy are generally mere mountain torrents. The largest descend from the Maritime Alps between Nice and Albenga. The Roja, which rises in the Col di Tenda and descends to Ventimiglia; the Taggia, between San Remo and Oneglia; and the Centa, which enters the sea at Albenga. The Lavagna, which enters the sea at Chiavari, is the only stream of any importance between Genoa and the Gulf of Spezia. But immediately east of that inlet (a remarkable instance of a deep land-locked gulf with no river flowing into it) the Magra, which descends from Pontremoli down the valley known as the Lunigiana, is a large stream, and brings with it the waters of the Vara. The Magra (Macra), in ancient times the boundary between Liguria and Etruria, may be considered as constituting on this side the limit of northern Italy.

The Apennines (*q.v.*), as has been already mentioned, here traverse the whole breadth of Italy, cutting off the peninsula properly so termed from the broader mass of northern Italy by a continuous barrier of considerable breadth, though of far inferior elevation to that of the Alps. The Ligurian Apennines are in fact only a continuation of the Maritime Alps. From the neighbourhood of Savona to that of Genoa they do not rise to more than 3,000 to 4,000 ft., and are traversed by passes of less than 2,000 feet. As they extend towards the east they increase in elevation; the Monte Bue rises to 5,915 ft., while the Monte Cimone (7,103 ft.) is the highest point in the northern Apennines, and thence between Tuscany and what are now known as the Emilian provinces a continuous ridge from the mountains at the head of the Val di Mugello (due north of Florence) runs to the point where they are traversed by the celebrated Furlo pass. The highest point in this part of the range is the Monte Falterona, above the sources of the Arno, which attains 5,410 feet. Throughout this tract the Apennines are generally covered with extensive forests of chestnut, oak and beech; while the upper slopes afford admirable pasturage.

2. **Central Italy.**—The geography of central Italy is almost wholly determined by the Apennines, which traverse it in a direction from about north-north-east to south-south-west, almost precisely parallel to that of the coast of the Adriatic from Rimini to Pescara. The line of the highest summits and of the watershed ranges is about 30 m. to 40 m. from the Adriatic, while about double that distance separates it from the Tyrrhenian sea on the west. In this part of the range almost all the highest points of the Apennines are found. Beginning from the group called the Alpi della Luna near the sources of the Tiber, which attain 4,435 ft., they are continued by the Monte Nerone (5,010 ft.), Monte Catria (5,590 ft.), and Monte Maggio to the Monte Pennino near Nocera (5,169 ft.), and thence to the Monte della Sibilla, at the source of the Nar or Nera, which attains 7,663 feet. Proceeding thence southwards, there are in succession the Monte Vettore (8,128 ft.), the Pizzo di Sevo (7,945), and the two great mountain masses of the Monte Corno, commonly called the Gran Sasso d'Italia, the most lofty of all the Apennines, attaining to a height of 9,560 ft., and the Monte della Maiella, its highest summit measuring 9,170 feet. Farther south no very lofty summits are found till we come to the group of Monti del Matese, in Samnium (6,660 ft.), which according to the division here adopted belongs to southern Italy. Besides the lofty central masses enumerated there are two other lofty peaks, outliers from the main range, and separated from it by valleys of considerable extent. These are the Monte Terminillo, near Leonessa (7,278 ft.), and the Monte Velino near the Lake Fucino, rising to 8,192 ft., both of which are covered with snow from November to May.

But the Apennines of central Italy, instead of presenting, like the Alps and the northern Apennines, a definite central ridge, with transverse valleys leading down from it on both sides, in reality constitute a mountain mass of very considerable breadth, composed of a number of minor ranges and groups of mountains, which preserve a generally parallel direction, and are separated by upland valleys, some of them of considerable extent as well as considerable elevation above the sea. Such is the basin of Lake Fucino (*q.v.*) while the upper valley of the Aterno, in which Aquila is situated, is 2,380 ft. above the sea. The valley of the Gizio (*see* SULMONA) communicates with the upper valley of the Sangro by a plain called the Piano di Cinque Miglia, at an elevation of 4,298 feet. Nor do the highest summits form a continuous ridge of great altitude for any considerable distance; they are rather a series of groups separated by tracts of very inferior elevation forming natural passes across the range, and broken in some places (as is the case in almost all limestone countries) by the waters from the upland valleys turning suddenly at right angles, and breaking through the mountain ranges which bound them. Thus the Gran Sasso and the Maiella are separated by the deep valley of the Aterno, while the Tronto breaks through the range between Monte Vettore and the Pizzo di Sevo.. This constitution of the great mass of the central Apennines has in all ages exercised an important influence upon the character of this portion of Italy, which may be considered as divided by nature into two great regions, a cold and barren upland country, bordered on both sides by rich and fertile tracts, and enjoying a warm but temperate climate.

The district west of the Apennines coincides in a general way with Etruria and Latium. The northern part of Tuscany is indeed occupied to a considerable extent by the underfalls and offshoots of the Apennines, which, besides the slopes and spurs of the main range that constitutes its northern frontier towards the plain of the Po, throw off several outlying ranges or groups. Of these the most remarkable is the group between the valleys of the Serchio and the Magra, commonly known as the mountains of Carrara. Two of the summits of this group, the Pizzo d'Uccello and the Pania della Croce, attain 6,155 feet and 6,100 feet. Another lateral range, the Prato Magno, which branches off from the central chain at the Monte Falterona, and separates the upper valley of the Arno from its second basin, rises to 5,188 feet.

The rest of this tract is for the most part a hilly, broken country, of moderate elevation, but Monte Amiata, near Radicofani, an isolated mass of volcanic origin, attains a height of 5,650 feet. South of this the country between the frontier of Tuscany and the Tiber is in great part of volcanic origin, forming hills with distinct crater basins, in several instances occupied by lakes (Lake of Bolsena, Lake of Vico and Lake of Bracciano). This volcanic tract extends across the Campagna of Rome, till it rises again in the lofty group of the Alban hills, the highest summit of which, the Monte Cavo, is 3,160 ft. above the sea. In this part the Apennines are separated from the sea, distant about 30 m., by the undulating volcanic plain of the Roman Campagna, from which the mountains rise in a wall-like barrier, of which the highest point, the Monte Gennaro, attains 4,165 feet. South of Palestrina again, the main mass of the Apennines throws off another lateral mass, known in ancient times as the Volscian mountains (now called the Monti Lepini), separated from the central ranges by the broad valley of the Sacco, a tributary of the Liris or Garigliano, and forming a large and rugged mountain mass, nearly 5,000 ft. in height, which descends to the sea at Terracina, and between that point and the mouth of the Liris throws out several rugged mountain headlands, which constitute the natural boundary between Latium and Campania, *i.e.*, of central Italy. Besides these offshoots of the Apennines there are in this part of central Italy several detached limestone mountains, rising like islands, of which the two most remarkable are the Monte Argentaro on the coast of Tuscany near Orbetello (2,087 ft.) and the Monte Circeo (1,771 ft.) at the extremity of the Pontine Marshes. The two valleys of the Arno (*q.v.*) and the Tiber (*q.v.*) form the key to the geography of central Italy west of the Apennines.

Towards the Adriatic the central range approaches much nearer

to the sea, and hence, the rivers that flow from it are of little importance. From Rimini southwards they are: (1) the Foglia; (2) the Metaurus (*q.v.*); (3) the Esino; (4) the Potenza; (5) the Chienti; (6) the Aso; (7) the Tronto; (8) the Vomano; (9) the Aterno; (10) the Sangro; (11) the Trigno, which forms the boundary of the southernmost province of the Abruzzi, and may therefore be taken as the limit of central Italy. This district is much broken up by these rivers and by smaller torrents, but is fertile, especially in fruit trees, olives and vines; and it has always been populous, with many small towns, but no great cities. Its chief disadvantage is the absence of ports, the coast preserving an almost unbroken straight line, with the single exception of Ancona, the only port worthy of the name on the eastern coast of central Italy.

3. **Southern Italy.**—The great central mass of the Apennines, which has traversed central Italy from north-west to south-east, continues in the same direction for about 100 m. farther, from the basin-shaped group of the Monti del Matese (which rises to 6,660 ft.) to the neighbourhood of Potenza, in the heart of the province of Basilicata, corresponding nearly to the ancient Lucania. The whole of the district known in ancient times as Samnium is occupied by an irregular mass of mountains, of much inferior height broken up into a number of groups, intersected by tortuous rivers. This mountainous tract, which has an average breadth of from 50 m. to 60 m., is bounded west by the plain of Campania, now called the Terra di Lavoro, and east by the much broader and more extensive tract of Apulia, composed partly of level plains, but for the most part of undulating downs, contrasting strongly with the mountain ranges of the Apennines, which rise abruptly above them. The central mass of the mountains, however, throws out two outlying ranges, the one to the west, which separates the Bay of Naples from that of Salermo, and culminates in the Monte S. Angelo above Castellammare (4,720 ft.), while the detached volcanic cone of Vesuvius (nearly 4,000 ft.) is isolated from the neighbouring mountains by an intervening strip of plain. On the east side the Monte Gargano (3,465 ft.), a detached limestone mass projects in a bold spur-like promontory into the Adriatic, forming the only break in the otherwise uniform coast-line of Italy on that sea.

From the neighbourhood of Potenza, the main ridge of the Apennines runs nearly due south, within a short distance of the gulf of Policastro, and thence to the Monte Pollino, the last lofty summit. The range is, however, continued through the modern Calabria, to the southern extremity or "toe" of Italy, but the broken limestone range which is the true continuation of the chain as far as the neighbourhood of Nicastro and Catanzaro, and keeps close to the west coast, is flanked on the east by a great mass of granitic mountains, rising to about 6,000 ft., and covered with vast forests, from which it derives the name of La Sila. A similar mass, separated from the preceding by a low neck of Tertiary hills, fills up the whole of the peninsular extremity of Italy from Squillace to Reggio. (*See* ASPROMONTE.)

The long spur-like promontory which projects towards the east to Brindisi and Otranto is merely a continuation of the low tract of Apulia, with a dry calcareous soil of Tertiary origin. The Monte Vulture, which rises in the neighbourhood of Melfi and Venosa to 4,357 ft., is of volcanic origin. Eastward from this the ranges of low bare hills called the Murgie of Gravina and Altamura gradually sink into those which constitute the peninsula between Brindisi and Taranto as far as the cape of Sta Maria di Leuca, the south-east extremity of Italy. This projecting tract, the "heel" of Italy, in conjunction with the great promontory of Calabria, forms the Gulf of Taranto, about 70 m. in width, and somewhat greater depth.

Of the rivers of southern Italy the Liris (*q.v.*) which has its source in the central Apennines above Sora, not far from Lake Fucino, and enters the gulf of Gaeta about 10 m. E. of the city of that name brings down a considerable body of water; as does also the Volturno, which rises in the mountains between Castel di Sangro and Agnone, flows past Isernia, Venafro and Capua, and enters the sea about 15 m. from the mouth of the Garigliano. About 16 m. above Capua it receives the Calore, which flows by Benevento. The Silarus or Sele enters the gulf of Salerno a few miles below the ruins of Paestum. Below this the watershed of the Apennines is near to the sea on the west. Hence the rivers that flow into the Adriatic and the gulf of Taranto have much longer courses, though all partake of the character of mountain torrents. Proceeding south from the Trigno, there are: (1) the Biferno and (2) the Fortore, both rising in the mountains of Samnium, and flowing into the Adriatic west of Monte Gargano; (3) the Cervaro, south of this great promontory; (4) the Ofanto, the *Aufidus* of Horace, which rises about 15 m. W. of Conza, and in its lower course flows near Canosa and traverses the battlefield of Cannae (*q.v.*); and (5) the Bradano, which rises near Venosa, almost at the foot of Monte Vulture and flows towards the south-east into the gulf of Taranto, as do the Basento, the Agri and the Sinni. The Crati, which flows from Cosenza northwards, and then turns abruptly eastward to enter the same gulf, is the only stream worthy of notice in Calabria; while the arid limestone hills projecting eastwards to Capo di Leuca have no rivers at all. The only important lakes in Italy are those on or near the north frontier, already mentioned.

The lakes of central Italy, which are comparatively of trifling dimensions, belong to a wholly different class. The most important of these was the Lacus Fucinus (*q.v.*). Next in size is the Trasimene lake (*q.v.*). The neighbouring lake of Chiusi is of similar character, but much smaller dimensions. All the other lakes of central Italy, in the volcanic districts west of the Apennines, occupy deep cup-shaped hollows, which have undoubtedly at one time formed the craters of extinct volcanoes. Such is the Lago di Bolsena, the smaller Lago di Vico (Ciminian lake), and the Lago di Bracciano, while to the south of Rome the lakes of Albano and Nemi have a similar origin.

The only lake in southern Italy is the small Lago del Matese in the heart of the mountain group of the same name. On the coast of the Adriatic north and south of the promontory of Gargano are brackish lagoons communicating with the sea.

For the three great islands of Sicily, Sardinia and Corsica, *see* the separate articles. Of the smaller islands that lie near the coasts of Italy, the most considerable is that of Elba (*q.v.*). North of this, and about midway between Corsica and Tuscany, is the small island of Capraia (*q.v.*). Gorgona (*q.v.*), about 25 m. farther N., is still smaller. South of Elba are the equally insignificant islets of Pianosa (*q.v.*) and Montecristo (*q.v.*), while Giglio (*q.v.*) lies much nearer the mainland, immediately opposite the mountain promontory of Monte Argentaro. The islands farther south in the Tyrrhenian Sea are of an entirely different character. Of these Ischia and Procida, close to the northern headland of the bay of Naples, are of volcanic origin, as is the case also with the more distant group of the Ponza islands (*q.v.*). The island of Capri, on the other hand, opposite the southern promontory of the Bay of Naples, is a precipitous limestone rock. The Aeolian or Lipari islands (*q.v.*), a remarkable volcanic group, belong rather to Sicily than to Italy.

The Italian coast of the Adriatic presents a great contrast to its opposite shores, for while the coast of Dalmatia is bordered by a succession of islands, great and small, the long and uniform coast-line of Italy from Otranto to Rimini presents not a single adjacent island; and the small outlying group of the Tremiti islands (north of the Monte Gargano and about 15 m. from the mainland) alone breaks the monotony of this part of the Adriatic.

Geology.—The geology of Italy is mainly dependent upon that of the Apennines (*q.v.*). On each side of that great chain are found extensive Tertiary deposits, sometimes, as in Tuscany, the district of Monferrato, etc., forming a broken, hilly country, at others spreading into broad plains or undulating downs, such as the Tavoliere of Puglia, and the tract that forms the spur of Italy from Bari to Otranto.

Besides these, and leaving out of account the islands, the Italian peninsula presents four distinct volcanic districts. In three of them the volcanoes are entirely extinct, while the fourth is still in great activity.

1. The Euganean hills form a small group extending for about

10 m. from the neighbourhood of Padua to Este, and separated from the lower offshoots of the Alps by a portion of the wide plain of Padua. Monte Venda, their highest peak, is 1,890 ft. high.

2. The Roman district extends from the Alban hills (*see* ALBANUS MONS) to the Ciminian hills, and thence to the mountains of Radicofani and Monte Amiata (*q.v.*). It is generally held that these volcanoes were at first submarine (which would account for the stratification found, and for the excellent quality of the volcanic tufa so much used for building stone) and that the coast was gradually raised. (*See* LATIUM.)

3. The volcanic region of the Terra di Lavoro is separated by the Volscian mountains from the Roman district. The highest cone of Roccamonfina, at the north-north-west end of the Campanian plain called Montagna di Santa Croce, is 3,291 feet. The Phlegraean fields embrace all the country round Baiae and Pozzuoli and the adjoining islands. Monte Barbaro (Gaurus), north-east of the site of Cumae; Monte San Nicola (Epomeus), 2,589 ft. in Ischia; and Camaldoli, 1,488 ft., west of Naples, are the highest cones. The lakes Averno (Avernus), Lucrino (Lucrinus), Fusaro (Palus Acherusia), and Agnano are within this group, which has shown activity in historical times. A stream of lava issued in 1198 from the crater of the Solfatara, which still continues to exhale steam and noxious gases; the Lava dell' Arso came out of the north-east flank of Monte Epomeo in 1302; and Monte Nuovo, north-west of Pozzuoli (455 ft.), was thrown up in three days in Sept. 1538. Since its first historical eruption in 79, Vesuvius (*q.v.*) has been in constant activity.

4. The Apulian volcanic formation consists of the great mass of Monte Vulture.

The whole of the great plain of Lombardy is covered by Pleistocene and recent deposits. It is a great depression—the continuation of the Adriatic sea—filled up by deposits brought down by the rivers from the mountains. The depression was probably formed during the later stages of the growth of the Alps.

Climate and Vegetation.—The geographical position of Italy, extending from about 46° to 38° N., renders it one of the hottest countries in Europe. But the effect of its southern latitude is tempered by its peninsular character, bounded as it is on both sides by seas of considerable extent, as well as by the great range of the Alps with its snows and glaciers to the north. There are thus irregular variations of climate. Great differences also exist with regard to climate between northern and southern Italy, due in great part to other circumstances as well as to differences of latitude. Thus the great plain of northern Italy is chilled by the cold winds from the Alps, while the damp warm winds from the Mediterranean are to a great extent intercepted by the Ligurian Apennines. Hence this part of the country has a cold winter climate, so that while the mean summer temperature of Milan is higher than that of Sassari, and equal to that of Naples, and the extremes reached at Milan and Bologna are a good deal higher than those of Naples, the mean winter temperature of Turin is actually lower than that of Copenhagen. The lowest recorded winter temperature at Turin in 5° F. Throughout the region north of the Apennines no plant will thrive which cannot stand occasional severe frosts in winter, so that not only oranges and lemons but even the olive tree cannot be grown, except in specially favoured situations. But the strip of coast between the Apennines and the sea is not only extremely favourable to the growth of olives, but produces oranges and lemons in abundance, while even the aloe, the cactus, and the palm flourish in many places. The climatic frontier between Italy and Central Europe is thus formed rather by the Apennines than by the Alps.

Central Italy also presents striking differences of climate and temperature according to the greater or less proximity to the mountains. Thus the greater part of Tuscany, and the provinces adjacent to Rome, enjoy a mild winter climate, and are well adapted to the growth of olives as well as vines, but it is not until after passing Terracina, in proceeding along the western coast towards the south, that the vegetation of southern Italy develops in its full luxuriance. Even in the central parts of Tuscany, however, the climate is very much affected by the neighbouring mountains, and the increasing elevation of the Apennines as they proceed south produces a corresponding effect upon the temperature. But it is when we reach the central range of the Apennines that we find the coldest districts of Italy. In all the upland valleys of the Abruzzi snow begins to fall early in November, and heavy storms occur often as late as May. The district from the south-east of Lake Fucino to the Piano di Cinque Miglia, enclosing the upper basin of the Sangro and the small lake of Scanno, is the coldest and most bleak part of Italy south of the Alps. Still farther south-east, Potenza has almost the coldest climate in Italy, and certainly the lowest summer temperatures. But nowhere are these contrasts so striking as in Calabria.

The shores, especially on the Tyrrhenian sea, present almost a continued grove of olive, orange, lemon, and citron trees, which attain a size unknown in the north of Italy. The sugar-cane flourishes, the cotton-plant ripens to perfection, date-trees are seen in the gardens, the rocks are clothed with the prickly-pear or Indian fig, the enclosures of the fields are formed by aloes and sometimes pomegranates, the liquorice-root grows wild, and the mastic, the myrtle, and many varieties of oleander, and cistus form the underwood of the natural forests of arbutus and evergreen oak. But 5 or 6 m. from the shore, and often even less, the scene changes. High districts covered with oaks and chestnuts succeed to this almost tropical vegetation; a little higher up and we reach the elevated regions of the Pollino and the Sila, covered with firs and pines, and affording rich pastures even in the midst of summer, when heavy dews and light frosts succeed each other in July and August, and snow begins to appear at the end of September or early in October. Along the shores of the Adriatic, which are exposed to the north-east winds, blowing coldly from over the Albanian mountains, delicate plants do not thrive so well in general as under the same latitude along the shores of the Tyrrhenian sea.

Southern Italy indeed has in general a very different climate from the northern portion of the kingdom; and, though large tracts are still occupied by rugged mountains of sufficient elevation to retain the snow for a considerable part of the year, the districts adjoining the sea enjoy a climate similar to that of Greece and the southern provinces of Spain. Unfortunately several of these fertile tracts suffer severely from malaria (*q.v.*), and especially the great plain adjoining the Gulf of Tarentum, which in the early ages of history was surrounded by a girdle of Greek cities (some of which attained to almost unexampled prosperity), has for centuries past been given up to almost complete desolation.

It is remarkable that, of the vegetable productions of Italy, many of which are at the present day among the first to attract the attention of the visitor are of comparatively late introduction, and were unknown in ancient times. The olive, indeed, in all ages clothed the hills of a large part of the country; but the orange and lemon are a late importation from the East, while the cactus or Indian fig and the aloe, both of them so conspicuous on the shores of southern Italy, as well as of the Riviera Ponente, are of Mexican origin, and consequently could not have been introduced earlier than the 16th century. The same remark applies to the maize or Indian corn. Many botanists are even of opinion that the sweet chestnut, which now constitutes so large a part of the forests that clothe the sides both of the Alps and the Apennines, and in some districts supplies the chief food of the inhabitants, is not originally of Italian growth; it is certain that it had not attained in ancient times to anything like the extension and importance which it now possesses. The eucalyptus is of quite modern introduction; it has been extensively planted in malarious districts. The characteristic cypress, ilex and stone-pine, however, are native trees, the last-named flourishing especially near the coast. The proportion of evergreens is large and has a marked effect on the landscape in winter.

Fauna.—The chamois, bouquetin and marmot are found only in the Alps, not at all in the Apennines. In the latter the bear was found in Roman times, and there are still a few remaining. Wolves are more numerous, though only in the mountainous districts; the flocks are protected against them by large white sheep-dogs, who have some wolf blood in them. Wild boars are also found in mountainous and forest districts. Foxes are common in

the neighbourhood of Rome. The sea mammals include the common dolphin (*Delphinus delphis*). The birds are similar to those of central Europe; vultures, eagles, buzzards, kites, falcons, and hawks are found in the mountains. Partridges, woodcock, snipe, etc., are among the game birds; but all kinds of small birds are also shot for food, and their number is thus kept down, while many members of the migratory species are caught by traps in the foothills on the south side of the Alps, especially near the lake of Como, on their passage. Large numbers of quails are shot in the spring. Among reptiles the various kinds of lizard are noticeable. There are several varieties of snakes, of which three species (all vipers) are poisonous. Of sea-fish there are many varieties, the tunny, the sardine, and the anchovy being commercially the most important. Some of the other edible fish, such as the palombo, are not found in northern waters. Small cuttlefish are in common use as an article of diet. Tortoiseshell, an important article of commerce, is derived from the *Thalassochelys caretta,* a sea turtle. Of fresh-water fish the trout of the mountain streams and the eels of the coast lagoons may be mentioned. The tarantula spider and the scorpion are found in the south of Italy.

CONSTITUTION AND GOVERNMENT

The Vatican palace, the Lateran palace, and the papal villa at Castel Gandolfo, declared extraterritorial by the law of 1871, are now included in the new Papal State. The small republic of San Marino is the only other enclave in Italian territory. Italy is a constitutional monarchy, in which the executive power belongs exclusively to the sovereign, while the legislative power is shared by him with the parliament. He holds supreme command by land and sea, appoints ministers and officials, promulgates the laws, coins money, bestows honours, has the right of pardoning, and summons and dissolves the parliament. Treaties with foreign powers, however, must have the consent of parliament. The sovereign is irresponsible, the ministers, the signature of one of whom is required to give validity to royal decrees, being responsible. Parliament consists of two chambers, the senate and the chamber of deputies, which are nominally on an equal footing, though practically the latter is more important. The senate consists of princes of the blood who have attained their majority, and of an unlimited number of senators above 40 years of age, who are qualified under any one of 21 specified categories—by having either held high office, or attained celebrity in science, literature, etc. In 1928 there were 375 senators exclusive of ten members of the royal family. Nomination is by the king for life. Besides its legislative functions, the senate is the highest court of justice in the case of political offences or the impeachment of ministers.

Under the electoral law of 1928, the chamber is to consist of 400 deputies, and the whole kingdom is to form a single constituency. The 13 National Confederations of industry (*Confederazioni nazionali dei sindacati*) can propose 400 candidates between them (being eventually to be represented by a fixed number of deputies; but in the first instance they are to propose double the number of candidates by which they will ultimately be represented) and other associations, approved by a special committee of five senators and five deputies, can propose candidates up to the number of 200. The Grand Council of the Fascist Party will then form and publish in the *Official Gazette* the final list of candidates, not being restricted in its choice to those already proposed; and this list is to be voted on on the third Sunday after its publication as a whole, and by a simple "Yes" or "No." If the list is rejected (which may be regarded as extremely improbable) the court of appeal will order and fix the date of fresh elections. In these, lists of candidates may be submitted by all associations etc., which contain as many as 5,000 members who are qualified as electors; but these lists may not include more than three-quarters of the deputies to be elected. Each list is to be marked by an emblem, and, after approval by the court of appeal is to be voted on as a whole, that which obtains the majority of votes being carried as a whole *i.e.,* on the *scrutin de liste* system. The remaining seats in the chamber are to be distributed among the remaining lists in proportion to the votes they receive, *i.e.,* on a system of proportional representation.

What, if any, is the rôle of the Fascist Grand Council under this contingency is, as has been pointed out, not altogether clear; and it is probable that the rejection of its list has hardly been seriously contemplated; for the Grand Council, though its position was not regularized until 1928, has been the source from which all the acts of Fascism have emanated, and approval of the laws, which it has proposed by the chamber and the senate, has been a formality. It has now been enacted that it must be consulted on all constitutional questions (such as questions regarding the throne and the king, relations between Church and State, the nomination and prerogatives of the head of the Government); that it is the supreme co-ordinating organ of the régime; that ministers are *ex officio* members; and that it is to keep a list of possible ministers; that its decisions must be unanimous and its meetings secret; that it is to be summoned by the Duce, who settles all its agenda. Its members belong to three categories —members for an undetermined period, such as the Quadrumviri, the four leaders of the "march on Rome"; members of the Fascist hierarchy, during the period of their service, and members for three years (subject to prolongation) "who have deserved well of the nation and of the revolution." The right to vote is extended to all Italian citizens of 21 years of age and over, or to married men with children of 18 years of age and over. The elector must be either a contributor to a syndicate or confederation, or pay at least 100 lire a year in direct taxation, or be an employee of, or receive a pension from the State or a commune, or be a priest of the Roman Catholic or any other Church or denomination recognized by the State. The number of electors for 1929 was 9,460,727.

Senators and deputies receive no salary but have free passes on railways throughout Italy and on certain lines of steamers. Parliaments are quinquennial, but the king may dissolve the chamber of deputies at any time, being bound, however, to convoke a new chamber within four months. The executive must call parliament together annually. Each of the chambers has the right of introducing new bills, as has also the Government but all money bills must originate in the chamber of deputies. The consent of both chambers and the assent of the king is necessary to their being passed. Ministers may attend the debates of either house but can only vote in that of which they are members. The sittings of both houses are public and an absolute majority of the members must be present to make a sitting valid. The prime minister and head of the Government as his official title now runs holds the portfolios of the interior, foreign affairs, colonies, war, marine and air. The other ministries are finance, public instruction, communications, corporations (guilds), justice. Each minister is aided by an under-secretary of State. There is a Council of State with advisory functions, which can also decide certain questions of administration, especially applications from local authorities and conflicts between ministries, and a court of Accounts, which has the right of examining all details of state expenditure.

The corporative or guild state is organized so as to give an efficient representation and an authoritative voice to associations of both employers and employed. Both are systematically organized in local, provincial and inter-provincial syndicates and unions leading up to national confederations of employers and workers representing all branches of production and all forms of activity. Those employed in State and Government service and in public charities are represented by special associations, comprising in 1928 62% of Italian manufacturers and 82% of all industrial workers, percentages which it is intended shall gradually rise until all are included. There are also intermediate national federations for each branch of industry, which are to study technical and administrative problems so as to improve output and reduce production costs; and there is a confederation of workers' syndicates, all under the general Fascist Confederation of industry, with a ministry of guilds (*corporazioni*) representing the authority of the State.

Provincial economic councils under the presidency of the prefects have also been formed, which have to carry out the orders

of the ministry of national economy and have taken the place of the old chambers of commerce. Their members are partly elective and partly Government functionaries resident in the locality. Agreements on wages and conditions of labour stipulated between these unions become binding on all employers and workers for the territories concerned, whether they have become members of the unions or not, and they must, if employers, contribute one day's wages per annum for each man in their employ, and, if workers, one day's pay, to these unions. Strikes and lock-outs are forbidden, and disputed points must be settled by the labour courts. The legal working day is eight hours, with a weekly day of rest and a yearly holiday. At the same time, in its labour charter the State declared in favour of private initiative—only when occasion demands will the State step in to safeguard national interest. The workers cannot be dismissed on the score of illness (unless prolonged) or military service, and are entitled to contributory insurance against accidents, sickness (including tuberculosis), unemployment and old age. The unions are to provide vocational training and organize employment bureaux, to which the employers must have recourse, giving preference to Fascists.

For the *Opera Nazionale Dopolavoro see* section on Education.

The provincial administration has similarly been brought completely under the control of the central Government. Each province has a prefect as its head directly responsible to the minister of the interior; he is the direct representative of the central executive, and is to act, not only against the enemies of the régime, but also against violence of any sort or kind, preserving order and exercising a strict control in matters of finance. The secretaries of the various federations and organizations dependent on the Fascist party are to work in subordination to and in collaboration with the prefects. There are provincial "rectorates," taking the place of the previously existing provincial deputations and councils, each consisting of a presiding officer and "rectors," all of whom are to be appointed by royal decree. The sittings of these bodies are to be private.

Titles of Honour.—The former existence of so many separate sovereignties and "fountains of honour" gave rise to a great many hereditary titles of nobility. Besides many hundreds of princes, dukes, marquesses, counts, barons and viscounts, there are a large number of persons of "patrician" rank, persons with a right to the designation *nobile* or *signori,* and certain hereditary knights or cavalieri. In the "Golden Book of the Capitol" (*Libro d'Oro del Campidoglio*) are inscribed 321 patrician families, and of these 28 have the title of prince and eight that of duke, while the others are marquesses, counts or simply patricians. For the Italian orders of knighthood *see* KNIGHTHOOD AND CHIVALRY: *Orders of Knighthood.* The king's uncle is duke of Aosta, his son is prince of Piedmont and his cousin is duke of Genoa.

Justice.—The judiciary system of Italy was mainly framed on the French model. Italy has courts of cassation at Rome, Naples, Palermo, Turin, Florence, 22 appeal court districts, 116 tribunal districts and 1,063 *mandamenti,* each with its own magistracy (*pretura*), 116 assize court districts and 327 detached *sezioni di pretura.* In 17 of the principal towns there are also *pretori* who have exclusively penal jurisdiction. For minor civil cases involving sums up to 100 lire, *giudici conciliatori* have also jurisdiction, while they may act as arbitrators up to any amount by request. The Roman court of cassation is the highest, and in both penal and civil matters has a right to decide questions of law and disputes between the lower judicial authorities, and is the only one which has jurisdiction in penal cases.

The *pretori* have penal jurisdiction concerning all misdemeanours (*contravvenzioni*) or offences (*delitti*) punishable by imprisonment not exceeding three months or by fine not exceeding 1,000 lire. The penal tribunals have jurisdiction in cases involving imprisonment up to ten years, or a fine exceeding 1,000 lire while the assize courts, with a jury, deal with offences involving imprisonment for life or over ten years, and have exclusive jurisdiction (except that the senate is on occasion a high court of justice) over all political offences. Appeal may be made from the sentences of the *pretori* to the tribunals, and from the tribunals to the courts of appeal; from the assize courts there is no appeal except on a point of form, which appeal goes to the court of cassation at Rome. This court has the supreme power in all questions of legality of a sentence, jurisdiction or competency.

The penal code is now being unified and reformed. A special military tribunal for crimes against the state or the Fascist régime has recently been instituted. In civil matters there is appeal from the *giudice conciliatore* to the *pretore* (who has jurisdiction up to a sum of 1,500 lire), from the *pretore* to the civil tribunal, from the civil tribunal to the court of appeal, and from the court of appeal to the court of cassation.

The statistics of civil proceedings vary greatly from region to region. Whereas the general average for the whole country was 29·7 per 1,000 inhabitants in 1924, the figure for Tuscany (the lowest) was only 14·4, and no region of northern Italy exceeded 26·7 (Liguria). Farther south, on the other hand, the figures are much higher—Abruzzi 32·3; Sicily 35·3; Basilicata 41·1; Campania and Molise 42·9; Lazio 46·4; Apulia 53·2; Calabria 57·4; while Sardinia has the enormous figure of 95·9. For criminal proceedings, if we exclude mere offences against regulations, or *contravvenzioni* (*see* below) with a general average of 16·71 per 1,000 for 1924, the variation is similar, the Marches and Umbria coming lowest with 9·89 per 1,000 inhabitant, while Liguria (18·59) and Venezia Giulia (19·57) are the highest for northern Italy. For the south the figures are: 15·23 for Sicily; 20·99 for Lazio; 22·18 for Apulia; 25·19 for Campania and Molise; 25·86 for Basilicata; 26·46 for the Abruzzi; 31·72 for Sardinia and 32·85 for Calabria, in most cases showing a considerable diminution on those for 1923.

A royal decree of 1891 established three classes of prisons: judiciary prisons, for persons awaiting examination or persons sentenced to arrest, detention or seclusion for less than six months; penitentiaries of various kinds (*ergastoli, case di reclusione, detenzione* or *custodia*), for criminals condemned to long terms of imprisonment; and reformatories, for criminals under age and vagabonds. Capital punishment was abolished in 1877, penal servitude for life being substituted. This generally involves solitary confinement of the most rigorous nature, and, as little is done to occupy the mind, the criminal not infrequently becomes insane. Capital punishment has, however, been reintroduced for crimes against the State. Certain types of dangerous individuals and political prisoners are relegated after serving a sentence in the ordinary convict prisons, and by administrative, not by judicial process, to special penal colonies known as *domicilii coatti* or "forced residences." The establishments are, however, unsatisfactory, being mostly situated on small islands, where it is often difficult to find work for the *coatti,* who are free by day, being only confined at night. They receive a small and hardly sufficient, allowance for food of 10 lire a day, which they are at liberty to supplement by work if they can find it or care to do it. "Confino politico" or forced residence under surveillance, may also be inflicted: but as to this no figures are available.

Notwithstanding the construction of new prisons and the transformation of old ones, the number of cells for solitary confinement is still insufficient for a complete application of the penal system established by the code of 1890, and the moral effect of the association of the prisoners is not good, though the system of solitary confinement as practised in Italy is little better. The total number of prisoners, including minors and inhabitants of enforced residences, was 76,066 (2·84 per 1,000 inhabitants) in 1871 and on Dec. 31, 1903 was 65,819 (including 6,044 women, or less than 10%). Of these 31,219 were in lockups, 25,145 in penal establishments, 1,837 minors in Government and 4,547 in private reformatories, and 3,071 (males) were *coatti,* or inmates of forced residences (all on small islands). In 1928 there were 30,423 men and 3,566 women in prisons, of whom about two thirds were awaiting trial; 11,317 men and 293 women in penal establishments; 1,932 males in Government and 564 in private reformatories (the females, 941 in number, being sent only to the latter); and 564 *coatti* were inmates of forced residences.

Crime.—Statistics of offences, including *contravvenzioni* or

breaches of by-laws and regulations, exhibit a considerable increase per 100,000 inhabitants since 1887, and even some increase on the figures of 1897. The figure was 1,783·45 per 100,000 in 1887; 2,164·46 in 1892; 2,546·49 in 1897; 2,497·90 in 1902; and 3,159 in 1924 (1,671 crimes and 1,488 *contravvenzioni*). The increase is partly covered by *contravvenzioni,* but almost every class of penal offence shows a rise including homicide, and that has risen considerably since 1902: 5,418 in 1880; 3,966 in 1887; 4,408 in 1892; 4,005 in 1897; 3,202 in 1902; and 4,259 in 1924 (of the last many must have been due to political disputes); and Italy remains, owing to the use of the knife, the European country is which homicide is most frequent.

Procedure, both civil and criminal, is somewhat slow, and the preliminary proceedings before the *juge d'instruction* occupy much time; and in murder trials, by the large number of witnesses called (including experts) and the lengthy speeches of counsel, have sometimes been dragged out to an unconscionable length; but much has been done recently to "speed up" the procedure. In 1902, of 884,612 persons accused of penal offences, 13·12% were acquitted during the period of the *instruction;* 30·31 by the courts; 46·32 condemned; and the rest acquitted in some other way. This shows that charges, often involving preliminary imprisonment, had been brought against an excessive proportion of persons who either were not or could not be proved to be guilty; but in 1925 the figures were very different. Of 984,095 persons accused, 15·4% were acquitted during the *instruction;* 22·6% by the courts; and the remaining 62% were condemned.

As in most civilized countries, the number of suicides in Italy has increased from year to year and the rate which was 63·6 per 1,000,000 in 1901, has gone up to 92 per 1,000,000. Trieste has the highest rate (446 per 1,000,000) of any city of Italy.

POPULATION AND STATISTICS

National Growth.—A remarkable general increase of the Italian population took place between 1910 and 1925. The losses due to the war, to epidemics and disasters and to the decrease of births in the years 1916–19, failed to check the increase, since they were balanced by the return of a number of emigrants (estimated at about 1,000,000) while comparatively few, about 363,000 have since left the country. Thus, it is estimated that the 34,600,000 enumerated in the 1911 census, giving a density of 121 to the sq.km. had increased at the end of 1925 to 40,548,683, or 131 to the sq.m. (including the restored territories, which are more sparsely populated than the peninsula), and this in a country two-thirds mountainous or very hilly, poor in minerals and with a soil exploited by some 3,000 years of cultivation.

The birth-rate, like that of most countries, shows a continuous decline since the '70s, but infant mortality has also diminished. The increase in the number of marriages has compensated for the decrease during the war, but the birth-rate per marriage is only at the pre-war level.

This rapid increase has resulted in the flooding of the labour market. The number of workers between the ages of 16 and 25 is probably about 24,000,000 as against about 20,500,000 in 1911. The difficulty of absorbing this mass of labour would have been even greater than it has been were it not for improvements in industrial equipment, factory organization, agricultural technique and also the extension of Italian territory. The pressure, however, is increased by the great number of war victims, who are unable to contribute their full share of work. Notwithstanding the difficulty of finding an outlet for Italy's surplus population by emigration and the existence of a certain amount of unemployment (the official figures for the end of July 1928, were 247,021), the present régime is desirous of effecting a large increase in it, being firmly persuaded that man power counts high in the greatness of a nation. Various measures have been taken to this end, such as the formation of a national maternity and infancy board, the imposition of a tax on bachelors (35 lire between 25 and 35, 50 lire between 35 and 50, 25 lire between 50 and 65 per annum, which is susceptible of increase), from which priests, seriously wounded soldiers, officers (whose marriage is subject to conditions) and all foreigners are exempt, and a large measure of exemption from taxation for the heads of families with seven or more children. Any attempt at spreading Malthusian tenets is to be sternly dealt with, and general and family morality are being upheld in various ways.

The new reclamation scheme, to which 3,800,000,000 lire has been allotted, to be spread over 30 years (an equal sum being spent by the landowners), while the scheme itself is to be completed in 14 years, will provide more land for cultivation: and a migratory scheme whereby families are removed from overpopulated districts to places where labour is required, will also help in this regard. 5,962,508 ac. are to be reclaimed as follows: 3,301,665 in Northern, 590,058 in Central, and 1,635,648 in Southern Italy, 114,935 in Sicily and 317,202 in Sardinia. Five million acres more have been declared to be fit for more intensive cultivation and if the landowners do not undertake this in accordance with the plans of the Government experts, so that the transformation of agriculture may be carried out with the least possible delay, the prefect of the province may step in and take the work over; or if no improvements are carried out at all, the State will (as has already been done near Rome) simply take possession of the land—on the principle that the State takes precedence of the individual, and that on his good conduct depends the continuance of private ownership. Compensation is to be fixed by the State, and the Savings Banks of Lombardy and Turin, two of the most important, have been placed under Fascist presidents, who are not likely to cause any delay in granting the necessary funds. It has been calculated that some 200,000 men will be eventually employed in carrying out the scheme, and that food for some 10,000,000 more Italians will eventually be grown at home. For comparison it may be stated that from the union of Italy to March 1928, 2,720,647,059 lire had been spent on land reclamation, of which 1,086,189,757 lire had been provided by the present Government (since October 1922), though, owing to the fall in the value of the lire, this is in reality only about one-tenth of the whole. A new *Ente Nazionale pu la Cooperazione,* instituted in 1926, is charged with the reorganization of the co-operative system, which has been most successful in the case of the War Veterans Association (*Opera Nazionale dei Combattenti*) in the sphere of land reclamation and land settlement.

Census Figures.—The table on p. 756 gives the area and population of each province and region in Italy in 1881. By 1927, as a result of the war of 1914–18, new provinces had been acquired and many of the old provinces had been reorganized, and so the table also shows the area of the acquired provinces and of the new divisions of the old provinces. In addition, the distribution of the 1921 population in these new administrative divisions, along with the density of the population per square mile, and the number of communes in each province, is indicated.

The actual population (not the resident or the "legal") of Italy since 1770 is approximately given in the following table (the first census of the kingdom as a whole was taken in 1871):—

1770	14,689,317	1871	26,801,154
1800	17,237,421	1881	28,459,628
1825	19,726,977	1901	32,475,253
1848	23,617,153	1911	34,671,377
1861	25,016,801	1921	38,756,433

It is estimated that the total population resident in Italy in 1927 was 40,799,000.

The average density increased from 257·21 per sq.m. in 1881 to 293·28 in 1901 and 320 in 1921. In Venetia, Emilia, the Marches, Umbria and Tuscany, the proportion of "concentrated" population (*i.e.,* population resident in the town or village which forms the centre of each commune) was only from 45 to 59% in 1921: in Calabria, the Abruzzi, Piedmont, Liguria, Lombardy, Venezia Tridentina, the proportion rose from 72 to 82%; in Venezia-Giulia, Lazio, Campania, Basilicata, Apulia, Sicily and Sardinia, it ran from 84 to 93%, being highest of all in the last named.

The following towns had a population of over 100,000 in 1922 (city only, not commune) Bari delle Puglie 109,990, Bologna,

Provinces and regions	1881 Area in sq.m.	1881 Population	1927 Area in sq.m.	Population 1921	Density per sq.m.	Number of communes
Alessandria	1,950	729,710	1,960	781,750	397·8	..
Aosta	..	..	1,836	226,885	123·4	..
Cuneo	2,882	635,400	2,870	623,598	217·4	..
Novara	2,553	675,926	1,387	384,342	277·1	..
Turin	3,955	1,029,214	2,116	1,026,558	485·1	..
Vercelli	..	..	1,162	340,513	297·6	..
PIEDMONT	11,340	3,070,250	11,331	3,383,646	298·7	1,489
Genoa	1,582	760,122	683	769,689	112·7	..
Imperia	..	..	456	150,835	330·2	..
Porto Maurizio	455	132,251	..	..	..	..
Savona	..	..	614	205,460	334·6	..
Spezia	..	..	345	209,482	667·2	..
LIGURIA	2,037	892,373	2,098	1,335,466	636·5	274
Bergamo	1,098	390,775	1,076	555,686	516·1	..
Brescia	1,845	471,568	1,823	652,225	362·1	..
Como	1,091	515,050	797	456,948	573·3	..
Cremona	695	302,097	685	357,605	522·3	..
Mantua	912	295,728	903	376,901	416·8	..
Milan	1,223	1,114,991	1,181	1,772,542	1,500·9	..
Pavia	1,290	469,831	1,114	469,425	383·4	..
Sondrio	1,232	120,534	1,233	131,184	106·6	..
Varese	..	..	446	307,718	665·3	..
LOMBARDY	9,386	3,680,574	9,258	5,080,234	547·2	1,872
Belluno	1,293	174,140	1,276	234,583	179·2	..
Padua (Padova)	823	397,762	826	588,043	711·9	..
Rovigo	685	217,700	684	287,238	419·1	..
Treviso	960	375,704	956	548,487	573·9	..
Udine	2,541	501,745	2,755	755,732	274·3	..
Venice	934	356,708	944	519,208	544·4	..
Verona	1,188	394,065	1,185	523,390	436·7	..
Vicenza	1,052	396,349	1,056	542,346	519·1	..
VENETIA	9,476	2,814,173	9,682	3,999,027	413·0	812
Bolzano	..	..	2,808	235,487	83·9	..
Trento	..	..	2,563	406,260	158·5	..
VENEZIA TRIDENTINA	..	..	5,371	641,747	119·4	554
Fiume	..	..	270	85,543	316·8	..
Gorizia	..	..	1,030	200,707	194·8	..
Pola	..	..	1,536	299,295	194·9	..
Trieste	..	..	471	325,940	692·0	..
Zara	..	..	43	18,623	433·0	..
VENEZIA GIULIA and ZARA	..	..	3,350	930,108	289·5	222
Bologna	1,448	464,879	1,465	642,674	438·4	..
Ferrara	1,012	230,807	1,019	364,015	339·1	.
Forli	725	251,110	1,122	391,026	453·9	..
Modena	987	279,254	1,003	395,513	393·6	..
Parma	1,250	267,306	1,339	361,786	280·8	..
Piacenza	954	226,758	1,018	291,400	291·0	..
Ravenna	715	218,359	715	257,604	360·1	..
Reggio nell' Emilia	876	244,959	885	347,095	392·3	..
EMILIA	7,967	2,183,432	8,566	3,033,113	367·2	342
Aquila degli Abruzzi	2,484	353,027	1,945	338,338	173·9	..
Campobasso	1,691	363,434	1,783	355,270	199·2	..
Chieti	1,138	343,948	1,001	333,644	333·3	..
Pescara	..	..	472	166,918	353·6	..
Teramo	1,067	254,806	750	205,810	274·4	..
ABRUZZI E MOLISE	6,380	1,317,215	5,951	1,399,980	235·2	455
Arezzo	1,273	238,744	1,274	298,519	234·8	..
Florence	2,265	790,776	1,497	794,081	530·4	..
Grosseto	1,738	114,295	1,735	164,990	96·3	..
Livorno	133	121,612	471	225,518	479·9	..
Lucca	558	284,484	769	389,519	506·5	..
Massa and Carrara	687	169,469	447	178,510	399·3	..
Pisa	1,179	283,563	942	326,937	347·1	..
Pistoia	..	..	284	140,375	494·3	..
Siena	1,471	205,926	1,471	247,842	168·4	..
TUSCANY	9,304	2,208,869	8,890	2,766,291	310·0	281
Ancona	762	267,338	748	334,654	448·1	..
Ascoli Piceno	796	209,185	805	265,164	330·5	..
Macerata	1,087	239,713	983	265,149	269·9	..
Pesaro and Urbino	1,118	223,043	1,118	280,718	251·2	..
MARCHES	3,763	939,279	3,654	1,145,685	313·5	254
Perugia	..	..	2,417	476,699	197·2	..
Terni	..	..	908	162,292	178·6	..
UMBRIA	3,748	572,060	3,325	638,991	192·1	84
Frosinone	..	..	1,182	378,137	319·9	..
Rieti	..	..	1,058	149,011	142·9	..
Rome	..	..	3,226	1,223,397	379·2	..
Viterbo	..	..	1,166	193,538	166·8	..
LAZIO	4,663	903,472	6,632	1,944,143	293·1	367
Avellino	1,172	392,619	1,165	403,385	349·3	..
Benevento	818	238,425	999	299,665	300·0	..
Caserta	2,033	714,131	..	..	..	..
Naples	350	1,001,245	1,204	1,967,077	1,639·8	..
Salerno	1,916	550,157	1,908	584,313	306·5	..
CAMPANIA	6,289	2,896,577	5,376	3,254,440	603·5	543
Bari delle Puglie	2,065	679,499	1,990	924,384	464·5	..
Brindisi	..	..	758	229,146	302·3	..
Foggia	2,688	356,267	2,683	458,502	179·1	..
Lecce	2,623	553,298	1,007	410,122	407·3	..
Taranto	..	..	936	274,907	293·7	..
APULIA	7,376	1,589,064	7,374	2,297,061	317·8	244
Matera	..	..	1,464	139,463	95·2	..
Potenza	3,845	524,504	2,391	329,094	133·0	..
BASILICATA	..	..	3,855	468,557	121·4	126
Catanzaro	2,030	433,975	2,034	514,123	252·4	..
Cosenza	2,568	451,185	2,566	495,884	193·1	..
Reggio di Calabria	1,221	372,723	1,219	502,311	412·1	..
CALABRIA	5,819	1,257,883	5,819	1,512,318	259·9	417
Caltanisetta	1,263	266,379	814	247,388	302·8	..
Castrogiovanni	..	..	986	260,143	264·1	..
Catania	1,917	563,457	1,378	754,409	547·5	..
Agrigento	1,172	312,487	1,175	411,281	364·0	..
Messina	1,246	460,924	1,254	582,064	470·3	..
Palermo	1,948	699,151	1,927	860,306	450·9	..
Ragusa	..	..	580	252,546	435·4	..
Syracuse	1,442	341,526	853	284,068	333·4	..
Trapani	948	283,977	968	409,247	422·2	..
SICILY	9,936	2,927,901	9,935	4,061,452	408·9	367
Cagliari	5,204	420,635	3,572	415,683	116·4	..
Nuoro	..	..	2,824	191,582	66·6	..
Sassari	4,090	261,367	2,903	256,909	81·6	..
SARDINIA	9,294	682,022	9,299	864,174	93·0	364
THE KINGDOM OF ITALY	110,623	28,459,628	119,714	38,756,433	323·7	9,067

162,111, Catania 234,871, Florence 747,791, Genoa 316,217, Messina 114,051, Milan 712,844, Naples 757,251, Palermo 317,735, Rome 656,266, Turin 482,117, Trieste 228,583, Venice 162,695.

A comparison with the 1901 "town" figures is frequently misleading: for that was in reality the *popolazione agglomerata* not merely in the principal centre of the commune, but in *all* the centres (frazioni) or villages—as distinct from the *popolazione sparsa,* or scattered population. In 1921 the figures for the principal centre are given. On the other hand, it is to be noticed that the often surprisingly large increase in the town population since the 1901 census is not always accompanied by a corresponding increase in that of the commune: and in that case it will generally be found that the town boundaries have been enlarged, so as to include a large number of the population within the *dazio* (or *octroi*) area. There have been, however, bitter complaints of the decrease of population in some of the cities of north Italy, notably Turin and Bologna; and in most large towns except Rome and Naples the deaths exceed the births.

A decrease in population similar to that in the Alpine valleys of Piedmont (*q.v.*) may be noticed, also in those of Lombardy, *e.g.,* the Valtellina. These valleys often have no through routes and do not attract tourists as much as the corresponding French valleys.

The population of the different parts of Italy differs in character and dialect; and there is little community of sentiment between north and south. Modes of life and standards of comfort and morality in north Italy and in Calabria are widely different; the former being far in front of the latter. Much, however, is effected towards unification, by compulsory military service, it being the principle that no man shall serve within the military district to which he belongs. In almost all parts the idea of personal loyalty (*e.g.,* between master and servant) retains an almost feudal strength. The inhabitants of the north—the Piedmontese, Lombards and Genoese especially—have suffered less than those of the rest of the peninsula from foreign domination and from the admixture of inferior racial elements, and the cold winter climate prevents the heat of summer from being enervating. They, and also the inhabitants of central Italy, are more industrious than the inhabitants of the southern provinces, who have hardly recovered from centuries of misgovernment and oppression, and are naturally more hot-blooded and excitable. The Sicilians and Sardinians have something of Spanish dignity, but the former are one of the most mixed and the latter probably one of the purest races of the Italian kingdom. Physical characteristics differ widely; but as a whole the Italian is somewhat short of stature, with dark or black hair and eyes, often good looking. Both sexes reach maturity early.

Births, Marriages, Deaths.—Birth and marriage rates vary considerably, being highest in the centre and south (Umbria, the Marches, Apulia, Abruzzi and Molise and Calabria) and lowest in the north (Piedmont, Liguria and Venetia), and in Sardinia. The death-rate is highest in Apulia, in the Abruzzi and Molise, and in Sardinia, and lowest in the north, especially in Venetia and Piedmont.

Taking the statistics for the whole kingdom, the annual marriage-rate for the years 1876–80 was 7·53 per 1,000; in 1881–85 it rose to 8·06; in 1886–90 it was 7·77; in 1891–95 it was 7·41, and in 1896–1900 it had gone down to 7·14 (a figure largely produced by the abnormally low rate of 6·88 in 1898), and in 1925 was 7·42 (having been as high as 13·99 in 1920, 11·54 in 1921), and below 3 per 1,000 in 1916–18. Divorce is forbidden by the Roman Catholic Church, and only 1,337 judicial separations were obtained from the courts in 1924, more than half of the demands made having been abandoned. Of the whole population in 1901, 57·5% were unmarried, 36·0% married, and 6·5% widowers or widows, and in 1921 the figures were much the same, only 45,070 persons being noted as legally separated. The illegitimate births show a decrease, having been 6·95 per 100 births in 1872, 5·72 in 1902 and 5 in 1925 with a rise, however, in the intermediate period as high as 7·76 in 1883. The birth-rate shows a corresponding decrease from 38·10 per 1,000 in 1881 to 33·29 in 1902, 27·79 in 1925 and 27·2 in 1926. The male births are now about 6% in excess of the female, but there is a greater male mortality, so that, while in 1871 there was an excess of 143,370 males over females in the total population, in 1881 the excess was only 71,138, and in 1901 there were 169,684, and in 1921, 531,506 more females than males. The death-rate (excluding still-born children) was, in 1872, 30·78 per 1,000; in 1899 it had decreased to 21·89, and in 1925 to 16·79. The excess of births over deaths varies considerably—in 1880 it was only 3·12 per 1,000 owing to a very low birth-rate, but has averaged about 11·05 per 1,000 from 1896 to 1925. In 1926 the total of births was 1,134,616, and in 1927 1,121,072 (4% still-born); the deaths were 680,074 and 631,897, giving natural increases of about 409,000 and 444,000 respectively. The influence of the war period will be seen in the subjoined table:—

Period	Marriages per 1,000 of pop.	Births per 1,000 of pop.	Deaths per 1,000 of pop.	Natural increase§ per 1,000 of pop.
1908–10 . . .	8·01	33·30	20·07	11·40
Normal pre-War* period . . .	7·53	31·86	19·61	12·14
War period† . .	3·43	20·53	22·99	1·83
Post War period‡ .	10·31	30·00	17·60	12·60
Average of years 1911–24. . .	7·40	27·80	19·60	8·25

*1909–15 for births, 1909–14 for all other columns.
†1916–19 for births, 1915–18 for all other columns.
‡1919–24 for births, 1920–24 for all other columns.
§Excess of live births over deaths.

Occupations.—The population over 10 years of age was divided as follows in the census of 1921:

	Males	Females	Total
1. Agriculture (including hunting and fishing) . . .	7,146,884	3,117,222	10,264,106
2. Industrial	4,081,204	1,273,391	5,354,595
3. Commerce	875,151	226,826	1,101,977
4. Administration, public and private (including defence)	675,889	46,735	722,624
5. Religion, liberal professions and arts	310,475	231,815	542,295
6. Domestic service . . .	65,017	380,614	445,631
7. Non-professional . . .	1,984,302	10,547,003	12,531,305

Emigration.—The movement of emigration before 1914 was divided into two currents, temporary and permanent—the former going chiefly towards neighbouring European countries and to North Africa, and consisting of manual labourers, the latter towards trans-oceanic countries, principally Brazil, Argentina and the United States. These emigrants remained abroad for several years, even when they did not definitively establish themselves there. There was a tendency towards increased emigration during the last quarter of the 19th century, owing to growth of population, and the over-supply of and low rates of remuneration for manual labour in various Italian provinces.

Year	Temporary emigration		Permanent emigration	
	Total no. of emigrants	Per every 100,000 of population	Total no. of emigrants	Per every 100,000 of population
1881 .	94,225	333	41,607	147
1891 .	118,111	389	175,520	578
1901 .	281,668	865	251,577	772

From the next table will be seen the direction of emigration in the years specified:—

	1900	1901	1902	1903	1904	1905
Europe . .	181,047	244,298	236,066	215,943	209,942	266,982
N. Africa . .	5,417	9,499	11,771	9,452	14,709	11,910
U.S. and Canada	89,400	124,636	196,723	200,383	173,537	322,627
Mexico (Central America) . .	2,069	997	766	1,311	1,828	2,044
South America .	74,168	152,543	85,097	78,699	74,209	111,943
Asia and Oceania	691	1,272	1,086	2,168	2,966	2,715
Total . .	352,792	533,245	531,509	507,956	477,191	718,221

In 1911 the Italians abroad numbered 5,500,000, including those who had emigrated long before that date but had retained their nationality, and whose children had declared themselves Italians. In the 40 years 1872–1913 emigration had effected a reduction of at least 3,800,000 persons in the natural increase of the population of Italy. During the war the movement naturally slackened. Conscription, and the intense demand for man-power at home removed alike the possibility of and the incentive to migration. The total number of emigrants in the four years was, in fact, barely three-fifths of the pre-war annual average. With the return of peace began a feverish race abroad, which was at its height in 1920 when those who had returned from the United States during the war realized that if they delayed they might not be able to get back at all. The number of those repatriated in 1921–22 amounted to about half the total number of emigrants, but in 1926 were not much more than a quarter. In all probability the proportion was formerly greater, since nearly all of those in Europe and about 55% of those overseas returned for the winter. Nevertheless, when a census of Italians abroad was taken in 1924 it was found that there were 9,910,676 of them scattered about the world. For statistics of the movement of population and the restriction of migration to the United States *see* MIGRATION.

The present stream of emigrants differs considerably from that of 1909–13 in respect of quantity and quality, countries of destination and districts of origin. The restrictions introduced by the United States and other countries have not only reduced the total number of emigrants, but have tended especially to exclude the southern Italians. The number of Italian emigrants to the United States fell from 142,514 in 1921 to 52,182 in 1922, and in 1926 to 34,524.

Percentage Distribution of Italian Emigration

Destination	From North Italy		From Central Italy		From South Italy	
	1909–13	1922–24	1909–13	1922–24	1909–13	1922–24
Europe and the Mediterranean basin . .	31	46	7	6	4	6
Countries overseas . . .	9	13	7	5	42	24

The following table shows the number of emigrants for the last few years for which statistics are available:

	1922	1923	1924	1925	1926
France . . .	99,464	167,982	201,715	145,529	111,252
Other European countries . .	51,091	31,692	30,728	26,101	23,306
Africa . . .	4,485	5,496	7,044	6,685	6,888
Asia	865	406	168	149	159
Oceania . . .	4,226	963	4,498	5,182	4,783
North America .	45,737	59,944	39,369	31,834	37,759
Central America .	227	470	754	614	369
South America .	75,175	123,004	80,378	63,987	79,294
Total . . .	281,270	389,957	364,614	280,081	263,810

The character of the emigrants may be seen from the following able:

Percentage of Emigrants

Period	Agriculturists	Labourers	Bricklayers, masons, etc.	Industrial workers	Domestic servants	Other occupations
1909–13 .	32	30	12	12	3	11
1919 .	16	13	9	17	17	28
1920 . .	26	20	10	22	12	10
1926 . .	28	12	12	18	22	8

Emigration has, however, been much reduced since 1926 as a esult of a definitely adopted policy. In the first half of 1927 0,825 Italians emigrated, the majority permanently; while for the rst three months of 1928 the figures were: Permanent emigrants, 1,946; temporary emigrants, 12,044; Italians making temporary isits abroad for reasons of business, study, etc., 6,976. Passports re no longer granted without due cause shown.

It should be noted that Italian emigration into France—the only country to which they now go in at all considerable numbers, for not only the United States, but the Argentine Republic, Australia and Canada, have all stiffened their immigration laws—is carefully disciplined, the emigrants being formed into groups and subjected to supervision by the Italian consular authorities, with a view to the preservation of their national character and civilization. The institution of the *Fasci all' estero* (*see* FASCISM) will undoubtedly tend to this end in all countries; and it is quite clear that the absorption of the emigrants into the country which receives them is the last thing that Italy desires. Those Fascists, for instance, who do not send their children to Italian schools, where such are available, are to be expelled from the party; and they are required to wear the party badge, except where this is expressly forbidden by the laws of the country in which they are. Provision is made for the return of expectant mothers so that their children may be born in Italy.

See *L'Emigrazione Italiana dal 1910 al 1923* (Rome, 1926) and *L'Emigrazione Italiana regli anni 1924, 1925* (Rome, 1927).

EDUCATION

Public instruction in Italy is regulated by the State, which maintains public schools of every grade, and requires that other public schools shall conform to the rules of the State schools. No private person may open a school without State authorization. Schools may be classed thus:—

1. Elementary, of two grades, of the lower of which there must legally be at least one for boys and one for girls in each commune; while the upper grade elementary school is required in communes having normal and secondary schools or over 4,000 inhabitants. In both the instruction is free. They are maintained by the communes, sometimes with State help. The age limit is six to nine years for the lower grade, and up to 12 for the higher grade, attendance being obligatory at the latter also where it exists. 2. Secondary, instruction (i.) classical in the *ginnasi* and *licei*, the latter leading to the universities; (ii.) technical. 3. Higher education—universities, higher institutes and special schools.

Of the secondary and higher educatory methods, in the normal schools and licei the State provides for the payment of the staff and for scientific material, and often largely supports the ginnasi and technical schools, which should by law be supported by the communes. The universities are maintained by the State and by their own ancient resources; while the higher special schools are maintained conjointly by the State, the province, the commune and (sometimes) the local chamber of commerce.

In education, as in other matters, the State, according to the Fascist conception of it (*see* FASCISM) must intervene from the very beginning. Boys from the age of five or six join the Balilla under the *Opera Nazionale Balilla* (Balilla was a boy, who, by throwing a stone at an Austrian, began the insurrection of Dec. 5–10, 1746, in Genoa), while girls are enrolled by the *Opera Nazionale delle Piccole Italiane*, and eventually pass to the women's Fasci. New text-books are to be written in order that the children may be brought up in the Fascist spirit, and all teachers who are found to be lacking in it are to be dismissed. A number of women teachers of boys' classes have already been weeded out. From the Balilla the boys pass, at 15, to the *Avanguardisti*, and, having previously received a semi-military training, at the age of 18, are qualified to take the oath of allegiance to the king and to Fascist principles and receive their rifles. Eventually, all young Italians will, so it is intended, pass through these stages; so that, when the young children of the present generation have come to maturity, citizenship and Fascism will be synonymous and conterminous, which they are at present far from being, as the Fascist party only numbers about a million members, and refuses to admit more of the older generation to its ranks.

Higher education has not been exempt from the general evolution of the State in the Fascist sense; *i.e.*, that the individual is subservient to the State, which has his well-being at heart, but refuses to be ruled by those countless units of which society is composed. Whereas the reforms of Giovanni Gentile allowed the

free creation of new institutions for secondary education, permission to do so was suspended for five years from 1926, and the Government now has the right to modify, create or suppress professorships and faculties in all universities, the complaint having been raised that they were too numerous (*e.g.*, no less than 25 faculties of jurisprudence in Italy). The number of small universities is, as a fact, excessive; and if economics can be effected in this direction, funds will be released for the encouragement of research. But the universities, too, are to be investigated in order to test their efficiency in carrying out Fascist principles, and the general aim is to complete the "Fascistization" of all education in regard both to staff and curriculum.

In this connection the *Opera Nazionale Dopolavore* (O.N.D.), with its million members, may be mentioned as doing excellent work. It is a movement which rightly claims to be both humanitarian and utilitarian; being intended to help and direct the working-classes in spending their hours of leisure and repose, co-ordinating what is already done by individual firms and employers, and by already existing societies and clubs, for the work-people. Thus it concerns itself with both physical and mental culture—the latter including evening schools, lectures, etc., etc.—the two being combined in excursions to places of interest. Membership is granted to clubs or societies, and not to individuals; and considerable reductions in price of railway fares, admission fees to museums, discounts, etc., etc., are allowed. The federal political secretaries of the Fascist party are, as a rule, provincial commissioners, and therefore are able to keep a check on the associations admitted and their political activities.

In a higher social grade, the same tendency is apparent, and the *Confederazione Olimpica Nazionale Italiana* (C.O.N.I.) is now the superior organization for all forms of physical recreation in which Italy can be represented at the Olympic games. Its authority can be carried to considerable lengths—as when it declared two tennis players who refused to play in an international match against France to have lost their amateur status. Indeed, one of the features of the Fascist régime is the attention devoted to physical culture. A training college for physical instructors has been started in Rome; and activity in promoting games and sports may be seen on every side. Playing fields are being provided everywhere. Englishmen, however, cannot lose sight of the fact that the persistent retention, in some cities, and especially in Rome, of the long break at midday for a heavy meal, with the consequent double journey home (and even its institution in cases where it did not exist), in all professions and employments which do not involve actual manual labour, detains the workers, at almost all times of the year, too late in the evening to render it possible for them to take any physical exercise; whereas in spring and autumn, at any rate, a different time-table would certainly allow of this. Once this reserve has been made, one can have nothing but praise for the new spirit, and for the way in which the work is practically being carried out. The latest game adopted by the athletic clubs is Rugby football.

The number of persons unable to read and write has very greatly decreased, both absolutely and in proportion to the number of inhabitants. The census of 1871 gave 73% of illiterates, that of 1881, 67%, and that of 1901, 56% (*i.e.*, 51·8 for males and 60·8 for females), while that of 1921 gave 24 for males and 30 for females. In Piedmont there were 17·7% of illiterates above six years (the lowest) and in Calabria 78·7% (the highest), the figures for the whole country being 48·5, while in 1921 there were 7% in Piedmont, and only 2% in Venezia Tridentina, while there were still 58% in Calabria and 50% or more in the rest of the south, and in Sicily and Sardinia, the figures for the whole country being 27%. As might be expected, progress has been most rapid wherever education, at the moment of national unification, was most widely diffused. For instance, the number of bridegrooms unable to write their names in 1872 was in the province of Turin 26%, and in the Calabrian province of Cosenza 90%; in 1899 the percentage in the province of Turin had fallen to 5%, while in that of Cosenza it was still 76%. In 1925 it was 0·5 in Piedmont and 30% in Calabria, where 48% of the brides were illiterate. Infant asylums (where the first rudiments of instruction are imparted to children between two and a half and six years of age) and elementary schools have increased in number. There has been a corresponding increase in the number of scholars. Thus:—

Year	Infant asylums (Public and private)		Daily elementary schools (Public and private)	
	Number of asylums	Number of scholars	Number of schoolrooms	Number of scholars
1885–86 .	2,083	240,365	53,628	2,252,898
1890–91 .	2,296	278,204	57,077	2,418,692
1901–02 .	3,314	355,594	61,777	2,733,349
1924–25 .	5,828	473,652	116,031	3,644,606

The teachers in 1901–02 numbered 65,739 and in 1924–25, 94,197, or about 40 scholars per teacher.

The rate of increase in the public State-supported schools has been much greater than in the private schools. School buildings have been improved and the qualifications of teachers raised. Nevertheless, many schools are still defective, both from a hygienic and a teaching point of view; while the economic position of the elementary teachers, who in Italy depend upon the communal administrations and not upon the State, is still in many parts of the country extremely low.

The law of 1877 rendering education compulsory for children between six and nine years of age has been the principal cause of the spread of elementary education. The law has been, however, imperfectly enforced, for financial reasons. In 1901–02 only 65% out of the whole number of children between six and nine years of age were registered in the lower standards of the elementary and private schools, and in 1924–25 there were still 1,174,830 children who, though theoretically obliged to go to school, did not do so. In 1925–26 the Government supplementary schools (*Scuole Complementari*) numbered 429, with 55,586 scholars, 234 private schools taking another 9,155 scholars. Private institutions and working-class associations have striven to improve the intellectual conditions of the working classes, and popular universities have attained considerable development. The number of institutes devoted to secondary education remained almost unchanged between 1880–81 and 1895–96. In some places the number was even diminished by the suppression of private educational institutes. But the number of scholars increased considerably, and showed a ratio superior to the general increase of the population. The greatest increase has taken place in technical education, where it has been much more rapid than in classical education. There are three higher commercial schools, with academic rank, at Venice, Genoa and Bari, and 11 secondary commercial schools; and technical and commercial schools for women at Florence and Milan. The number of agricultural schools has also grown, although the total is relatively small when compared with population. The attendance at the various classes of secondary schools in 1925–26 is shown by the table on p. 765.

The schools, generally much smaller, which do not obtain equality with Government schools are some of those conducted by religious orders, or else those in which a sufficient standard is not reached.

The total attendance of students in the various faculties at the different universities and higher institutes is as follows:—

	1882	1902	1925–26
Law	4,801	8,385	9,391
Philosophy and letters . . .	419	1,703	3,649
Medicine and surgery . . .	4,428	9,055	10,540
Professional diploma, pharmacy .	798	3,290	3,424
Mathematics and natural science .	1,364	3,500	6,122
Engineering.	982	1,293	5,589
Agriculture	145	507	860
Commerce	128	167	4,909
Various	..	..	1,028
Total	13,065	27,900	45,512

The professors are ordinary and extraordinary, and free professors (*liberi docenti*), corresponding to the German *Privatdozenten*, are also allowed to be attached to the universities.

	1925–26	
	Schools	Pupils
Ginnasi—		
Government	277	52,716
On an equal footing with Government schools	49	
Not on such a footing	262	16,459
Total	588	69,175
Technical schools—		
Government	97	43,432
On an equal footing	15	
Not on such a footing	282	13,730
Total	394	57,162
Licei—		
Government	163	17,693
On an equal footing	23	
Not on such a footing	101	2,573
Total	287	20,266
Technical institutes—		
Government	(*See* Technical Schools above)	
On an equal footing		
Not on such a footing		
Nautical institutes—		
Government	17	1,714
On an equal footing	(No details)	
Not on such a footing		
Pupil teachers' colleges (Instituti Magistrali—classes due to the law of 1923)—		
Government	89	22,169
Private	160	5,816
Total	249	27,985
Licei scientifici—		
Government	53	5,786
Private	43	1,543
Total	96	6,329
Licei femminili	6	88

The universities were as follows in 1925–26, with their respective numbers of students, degrees and certificates awarded:—

	Students	Degrees and certificates awarded	Professors	Other instructors and teachers
Bari	668	67	20	34
Bologna	2,140	329	58	237
Cagliari	411	72	34	65
Catania	1,248	166	47	110
Florence	1,108	149	53	211
Genoa	1,409	272	57	237
Macerata	102	30	7	5
Messina	757	113	28	49
Milan	1,324	164	45	135
Modena	783	168	31	35
Naples	5,145	851	72	379
Padua	2,439	275	56	154
Palermo	1,886	343	54	227
Parma	440	86	26	17
Pavia	1,365	257	50	58
Perugia	346	58	17	22
Pisa	1,096	182	55	155
Rome	4,453	680	100	372
Sassari	203	27	14	21
Siena	447	62	25	82
Turin	2,049	364	65	149
Total	29,819	4,715	914	2,754

The following are non-governmental:—

Camerino	472	63	13	10
Ferrara	198	65	7	19
Milan (Sacro Cuore)	240	27	19	38
Urbino	126	45	3	10
Total	1,036	200	42	77

Statistics of the other institutions for higher education for 1925–26 are as follows:—

	Students	Degrees or certificates granted	Professors and instructors
Schools of Engineering—			
Bologna	191	71	23
Milan	1,518	271	81
Naples	1,283	184	40
Padua	454	135	30
Palermo	316	86	22
Pisa	103	52	20
Rome	606	193	35
Turin	1,243	339	31
School of Naval Engineering, Genoa	261	54	24
Higher Naval Institute, Naples	242	18	26
School of Architecture, Rome	122	10	28
School of Industrial Chemistry, Bologna	140	21	12
Higher Veterinary Institutes—			Data incomplete
Bologna	287	53	
Milan	111	22	
Naples	132	28	
Parma	46	9	
Perugia	80	15	
Pisa	114	28	
Turin	85	19	
Higher Normal school Pisa	27	5	
	7,361	1,613	
Secondary teachers' training colleges—			
Governmental			
Florence	233	53	12
Messina	82	30	11
Rome	186	70	12
Private			
Milan	144	3	18
Naples	87	38	11
Turin	306	11	9
	1,038	205	73

Special institutions for Higher Education.

Institutions	Students	Certificates or degrees granted	Professors and instructors
Higher schools for economics and commercial science—			
Bari	345	38	12
Catania	292	28	16
Genoa	600	89	27
Naples	699	92	14
Rome	860	117	22
Turin	584	90	20
Trieste (university)	453	43	22
Venice	670	88	44
Luigi Bocconi Commercial University, Milan	574	91	35
Institute of Economy and Commercial Science, Palermo	147	16	22
Higher Institute of Agriculture—			Data incomplete
Bologna	282	26	
Milan	129	25	
Perugia	106	36	
Pisa	109	21	
Portici	153	20	
Higher Institute of Agriculture and Forestry, Florence	81	2	
Cesare Alfieri Institute of Social Sciences, Florence	179	37	15
Oriental Institute, Naples	60	..	11
Total	6,323	859	..

The total expenditure on all counts proposed and authorized for the financial year 1927–28 by the Ministry of Public Instruction amounted to 1,359,473,000 lire.

Academies.—The Accademia dei Lincei was founded in 1603 by Federico Cesi, but ceased to exist in 1651. After various attempts it was revived in 1847 by Pius IX., and in 1875 by Victor Emmanuel II. It now has two classes—physical, mathematical and natural sciences, with 65 Italian ordinary members and the same number of corresponding members, and 100 foreign members, and moral, historical and philological sciences, with 58 members in each of the three categories mentioned. It produces important publications, and is able to encourage research by means of the valuable prizes in its gift. It occupies the Palazzo Corsini in Rome.

The Accademia d'Italia, recently founded, is to consist of not more than 60 members, with an annual stipend of 30,000 lire: but so far only a few of them have been appointed. Its official residence is the Farnesina, which has been purchased by the Government for that purpose (famous for Giulio Romano's frescoes of the story of Psyche), almost opposite the Palazzo Corsini.

Libraries.—These are numerous in Italy, those even of small cities being often rich in manuscripts and valuable works. Statistics collected in 1893–94 and 1896 revealed the existence of 1,831 libraries, either private (but open to the public) or completely public. The public libraries have been enormously increased since 1870 by the incorporation of the treasures of suppressed monastic institutions, but have suffered seriously from lack of funds during and immediately after the war. The richest in manuscripts is that of the Vatican, especially since the purchase of the Barberini library in 1902; it now contains over 34,000 mss. The Vatican archives are also of great importance. Most large towns contain important State or communal archives, in which a considerable amount of research is being done by local investigators; the various societies for local history in the various regions of Italy (*Società di Storia Patria*) do very good work and issue valuable publications; the treasures which the archives contain are by no means exhausted. The private archives of the great families often contain documents of the highest interest: but only the Caetani family has so far felt their publication to be a duty, and acted accordingly. (*See* GAETA.) Libraries and public archives are under the superintendence of the ministry of public instruction. A separate department of this ministry under a director-general has the charge of antiquities and fine arts, making archaeological excavations and supervising those undertaken by private persons (permission to foreigners, even to foreign schools, to excavate in Italy is rarely granted), and maintaining the numerous State museums and picture galleries, for which admission fees far higher than in any other country are charged. The exportation of works of art and antiquities from Italy without leave of the ministry is forbidden (though it has in the past been sometimes evaded). An inventory of those objects, the exportation of which can in no case be permitted, has been prepared; and the ministry has at its disposal a fund of 500,000 lire for the purchase of important works of art of all kinds.

Religion.—The great majority of Italians—97·12%—are Roman Catholics. Besides the ordinary Latin rite, several others are recognized. The Armenians of Venice maintain their traditional characteristics. The Albanians of the southern provinces still employ the Greek rite and the Greek language in their public worship, and their priests, like those of the Greek Church, are allowed to marry. Certain peculiarities introduced by St. Ambrose distinguish the ritual of Milan from that of the general church. Up to 1871 the island of Sicily was, according to the bull of Urban II., ecclesiastically dependent on the king, and exempt from the canonical power of the pope.

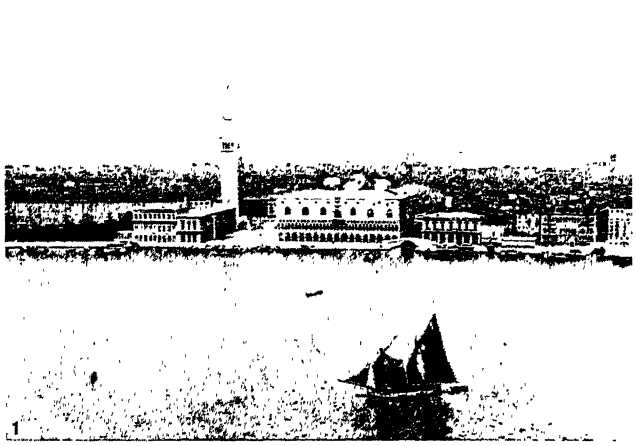
The territorial authority of the papal see was practically abolished in 1870 but it was re-established by the Lateran treaty of 1929 which gave the pope sovereignty over his Vatican City. (*See* FASCISM, VATICAN.) In the same city in which the administrative functions of the body politic are centralized there has always existed the court of the spiritual potentate, ruling over the Catholic world. Protestants numbered some 65,000, of whom half were Italian and half foreign in 1901. Figures were not given in the last two censuses. Of the former 22,500 were Waldensians. The number of Jews was returned as 36,000, but is certainly higher. There are, besides, in Italy some 2,500 members of the Greek Orthodox Church. There were in 1901 20,707 parishes in Italy, 68,444 secular clergy and 48,043 regulars (monks, lay brothers and nuns). The size of parishes varies from province to province, Sicily having larger parishes in virtue of the old Sicilian church laws, and Naples, and some parts of central Italy, having the smallest. The Italian parishes had in 1901 a total gross revenue, including assignments from the public worship endowment fund, of £1,280,000 or an average of £63 per parish; 51% being revenue from glebe lands.

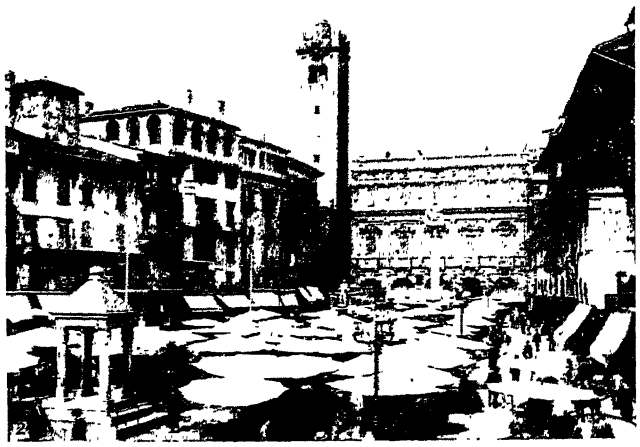
The kingdom is divided into 271 sees and ten abbeys, or prelatures *nullius dioceseos*. The dioceses are as follows:—

A. 6 suburbicarian sees—Ostia and Velletri, Porto and Sta. Rufina, Albano, Frascati, Palestrina, Sabina—all held by cardinal bishops.

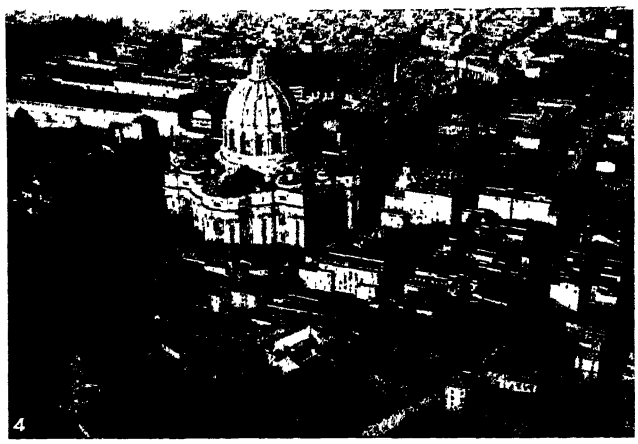
B. 39 ecclesiastical provinces, each under a metropolitan, composed of 150 suffragan dioceses not counting 7 in Jugo-Slavia. Their position is indicated in the following table:—

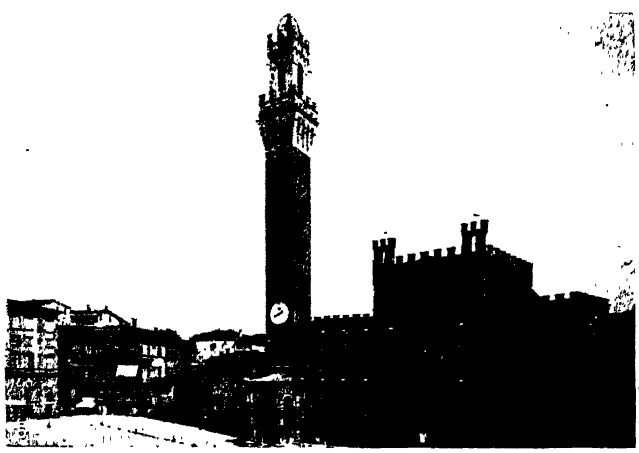
Metropolitans	*Suffragans*
Acerenza-Matera	Anglona-Tursi, Tricarico Venosa.
Bari	Conversano, Ruvo-Bitonto.
Benevento	S. Agata de' Goti, Alife, Ariano, Ascoli Satriano Cerignola, Avellino, Bojano, Bovino, Larino, Lucera, S. Severo, Telese (Cerreto), Termoli.
Bologna	Faenza, Imola.
Brindisi and Ostuni	No suffragan.
Cagliari	Galtelli-Nuoro, Iglesias, Ogliastra.
Capua	Caiazzo, Calvi-Teano, Caserta, Isernia-Venafro, Sessa.
Chieti and Vasto	No suffragan.
Conza and Campagna	S. Angelo de' Lombardi-Bisaccia, Lacedonia, Muro Lucano.
Fermo	Macerata-Tolentino, Montalto, Ripatransone, S. Severino.
Florence	Borgo S. Sepolcro, Colle di Val d'Elsa, Fiesole, S. Miniato, Modigliana, Pistoia-Prato.
Genoa	Albenga, Bobbio, Chiavari, Savona-Noli, Tortona, Ventimiglia.
Gorizia and Gravesca	Parengo, Pola, Trieste, Capodistria.
Lanciano and Ortona	No suffragan.
Manfredonia and Viesti	No suffragan.
Messina	Lipari, Nicosia, Patti.
Milan	Bergamo, Brescia, Como, Crema, Cremona, Lodi, Mantua, Pavia.
Modena	Carpi, Guastalla, Mass-Carrara, Reggio.
Monreale	Caltanisetta, Girgenti.
Naples	Acerra, Ischia, Nola, Pozzuoli.
Oristano	Ales-Terralba.
Otranto	Gallipoli, Lecce, Ugento.
Palermo	Cefalù, Mazzara, Trapani.
Pisa	Leghorn, Pescia, Pontremoli, Volterra.
Ravenna	Bertinoro, Cervia, Cesena, Comacchio, Forlì, Rimini, Sarsina.
Reggio Calabria	Bova, Cassano, Catanzaro, Cotrone, Gerace, Nicastro, Oppido, Nicotera-Tropea, Squillace.
Salerno	Acerno, Capaccio-Vallo, Diano, Marsico-Nuovo and Potenza, Nocera dei Pagani, Nusco, Policastro.
Sassari	Alghero, Ampurias and Tempio, Bisarhio, Bosa.
S. Severino	Cariati.
Siena	Chiusi-Pienza, Grosseto, Massa Marittima, Sovana-Pitigliano.
Syracuse	Caltagirone, Noto, Piazza-Armerina.
Sorrento	Castellammare.
Taranto	Castellaneta, Oria.
Trani-Nazareth-Barletta, Bisceglie	Andria.
Turin	Acqui, Alba, Aosta, Asti, Cuneo, Fossano, Ivrea, Mondovi, Pinerolo, Saluzzo, Susa.
Urbino	S. Angelo in Vado-Urbania, Cagli-Pergola, Fossombrone, Montefeltro, Pesaro, Sinigaglia.
Venice (patriarch)	Adria, Belluno-Feltre, Ceneda (Vittorio), Chioggia, Concordia-Portogruaro, Padua, Treviso, Verona, Vicenza.











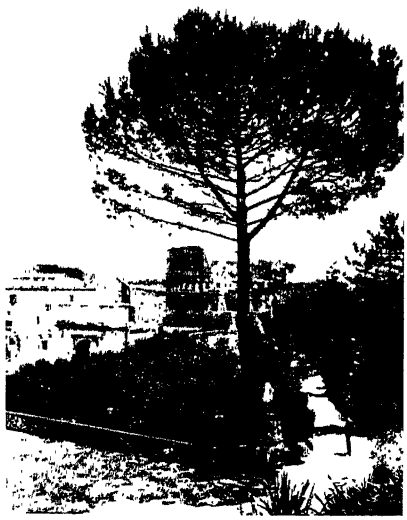


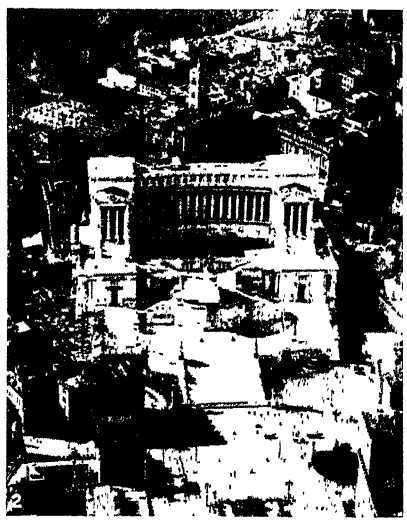
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ANCIENT TOWNS OF ITALY

1. View of Venice looking across the Grand Canal. In the centre is the Campanile of St. Mark's, a tower 325 feet high, begun in the 9th and finished in the 15th century. In 1902 it collapsed, but an exact reproduction was erected 1903–12. In front of the Campanile is the old library. To the right is the Renaissance Palace of the Doges. Behind may be seen the domes of the Basilica of St. Mark
2. The Piazze delle Erbe, centre of the life of Verona, occupies the site of the Roman Forum. In the background on the left is the 14th century Torre del Gardello. To the right is the 17th century baroque Maffei palace
3. View of Taormina looking towards Mt. Etna from the ancient Greek Theatre. In the foreground is the stage of the second largest antique theatre in Sicily which was erected in the Hellenistic period and rebuilt under the Romans
4. Aerial view of the Basilica of St. Peter's, Rome, showing the Palace of the Vatican to the left. In front of the basilica (in the background of the picture) is the Piazza San Pietro, the ellipse of which is enclosed by a quadruple colonnade of 284 Doric columns and 88 pillars
5. Siena. The Palazzo Pubblico, built in the 14th century, the communal centre of the mediaeval city. The "Torre del Mangia," 334 feet in height, rises at the left
6. Aerial view of the port of Civitavecchia. It was the chief port of the old papal state. The present harbour works are built on the ancient foundations dating from the time of Trajan

ITALY

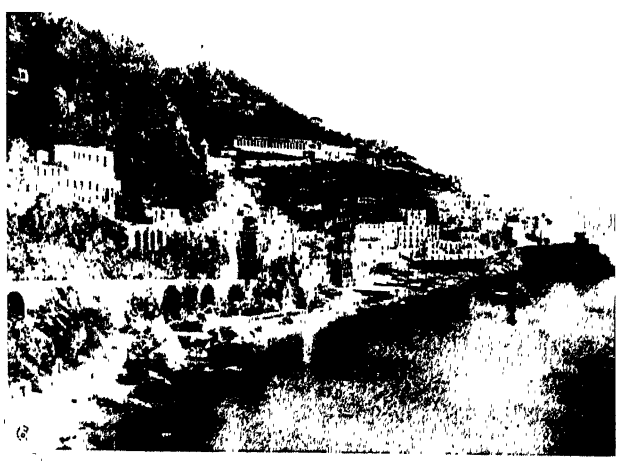














PHOTOGRAPHS, (1, 2, 5, 6, 7) PUBLISHERS PHOTO SERVICE, (3) DONALD MCLEISH, (4) ALINARI

VIEW OF ROME AND THE ITALIAN COUNTRYSIDE

1. View of the Colosseum, taken from the Palatine Hill, Rome
2. Air view of Rome, showing the monument of Victor Emmanuel II. in the foreground and the old city with the ruins of the Forum in the back. The monument by Giuseppe Sacconi, symbolizing the achievement of Italian unity, was begun in 1885 and dedicated in 1911
3. The Lake of Orta, the most western of the Italian lakes, situated among the foot hills of the Alps, not far from the Swiss border. The small island, San Giulio, is occupied chiefly by villas
4. View on the Italian Riviera near Genoa
5. The road to Anacapri on the Island of Capri. Constructed in 1874 and restored in 1923, the road winds its way up the face of the cliff for a thousand feet. In many places it is hewn in the solid rock
6. Amalfi, a small town on the Gulf of Salerno, southeast of Naples. It has been the seat of an archbishop since 987, and as a maritime republic in the early Middle Ages rivalled Genoa and Pisa
7. A view of Capri from the Anacapri road (*see* fig. 5). The mountainous island of Capri lies three miles from the Punta della Campanella in the Bay of Naples

Romae, first issued in ms. before the days of printing, could hardly be found, but its very flaws betrayed the need for more adequate statements, and revisions soon came. A more fruitful spur to accurate knowledge of antiquities was the desire of artists to collect and study the ancient fragments in order to improve their own workmanship. The Pisani in the 13th century turned to antiquarian studies for this purpose, Donatello shaped his later style on antique models, and Michelangelo began his modelling with a study of the collection of antiques that the Medicis had made in Florence. Similarly painters sought for hints in the buried rooms that contained the wall decorations of Rome's imperial palaces.[1] In a room of Nero's "Golden House," discovered and first entered in the 14th century, Pinturicchio scratched his name while going through with torch and notebook, and designs from the same rooms were copied and used by Giovanni da Udine and Raphael in decorating the loggia of the Vatican. Even more diligent and exact was the study of Roman architectural remains by the Renaissance architects. Brunelleschi made an exhaustive study of the Roman monuments before he began the construction of the dome of Santa Maria del Fiore in 1417, Raphael, who for several years was commissioner of antiquities at Rome, drew up elaborate plans for the publication of ancient monuments, Bramante and Michelangelo, who had to prepare themselves for the task of designing St. Peter's, spent much time in the study of such structures as the Pantheon and Constantine's Basilica. The voluminous notebooks of architects, some of which have only recently been published[2] (of Sangallo, Peruzzi, Ligorio, Palladio, Labacco and others), reveal a keener study and saner comprehension of the principles of Roman architecture than was possessed by students of the 17th century. Since many structures seen by these men have since disappeared their notebooks have proved to be of inestimable value to modern archaeologists. Finally, there were men at the very dawn of the Renaissance who comprehended the value of the information contained in ancient inscriptions. Cola di Rienzi, for instance, in 1347 read to the people the fragment of Vespasian's *Lex de Imperio,* engraved on bronze and then stored at the Lateran, to prove that in antiquity the emperors of Rome derived their power from the people.

THE RENAISSANCE

The First Museum.—The Renaissance had a far larger store of architectural remains to draw upon than we, but of statuary, however, there was but little. Though the Constantinian description of the city had mentioned the existence of 3,785 bronze statues in Rome in the 4th century, Poggio, when travelling through the city in the 15th century, could find only the "Capitoline wolf" and the equestrian statue of Marcus Aurelius; and to-day we have but few more. Bronze, of course, had suffered most from the vandals of the dark ages, but antique marble statues were almost as scarce in Poggio's day. However, the great activity in building which set in at Rome in the 15th century led to quarrying in the old ruins in search of building materials and in such delving many marble statues were found which if noticed by artists were saved from the contractors' limekilns. Pope Sixtus IV., who was guilty of destroying several old structures in his search for materials, is to be thanked for starting the good custom at Rome (the Medicis had anticipated him at Florence) of saving such statuary by founding the Capitoline museum in 1471. A generation later (1506) Julius II. set apart the Belvedere court in the Vatican palace for a museum, and the Laocoön group found that year was placed there, to be accompanied soon by the Apollo Belvedere and the Apollonius torso. Soon after, Michelangelo at public expense set up the equestrian statue of Marcus on the Capitoline and arranged the fragments of the consular fasti, recently found, in a room in the Capitoline especially adapted for them.

Destruction of Ancient Remains.—Excavations were not yet conducted purely for the acquisition of knowledge of art or of the past. In Lanciani's four valuable volumes on the *Storia degli Scavi di Roma* (1902–12), which gives the documentary reference to discoveries made before 1600, there is rarely a mention of excavations made purely in the interest of science. The digging was more or less haphazard mining for objects to sell or to use in decorating villas, or it was conducted under papal concession with stipulations to produce so many cartloads of marble or travertine. In such cases the fragmentary statues found all too frequently went into the limekiln. For constructional work Roman marble had gone far and wide. There are precious marbles in the cathedral of Aix-la-Chapelle that were brought from Rome by Charlemagne; a large part of the cathedral of Pisa was built in the 11th century from stuff quarried out of Roman ruins. The Baptistry of Florence and the cathedral of Orvieto are largely of Roman material and even portions of Westminster Abbey. Practically all the palaces and churches of Renaissance Rome had their marbles out of the old ruins. Nearly half the Colosseum, a large part of the Basilica Iulia, of the Circus Maximus and of many other buildings were sold to contractors. Almost all the buildings of the Forum now represented by rubble heaps of concrete and brick had their marble walls stripped off by quarrymen long before the scientific excavator cleared away the débris in the 19th century. Fortunately the art-loving draughtsman was often at hand to sketch the architectural decorations before they were hauled off, and the scholar often had a chance to copy the inscriptions before they were destroyed. And though marble made a very fine lime, and fragments of statuary therefore risked much in being discovered, there was a good demand for statuary after the end of the 14th century. From that time most of the best objects brought to the surface doubtless survived.

In 1466 Flavio Biondo published a *Roma instaurata* which was much more than an improvement on the traditional guide-books. It rejected mediaeval legends, and described old Rome from a careful study of classical texts, attempting also (with no little success) to identify the ruins then existing. The book is modern in the spirit of its scholarship, and its publication proves that many were interested in what may legitimately be called archaeology. In 1453 Biondo's *Italia Illustrata* did the same work for a large part of Italy. To be sure the modern reader discovers many errors in these two books, but if we approach them from the *Mirabilia* rather than from the point of view of nearly 400 years of research we can only admire the merits of this courageous scholar. In many respects he reminds one of Laurentius Valla, a contemporary, who has been called the first of the moderns because of his keen historical criticism. Biondo's spirit was equally critical, though he usually gives the results of his solitary argumentation rather than his argument. We are not surprised that in 1478 Rome had an Academy of Antiquarii devoted to the study of topography and monuments as well as of texts.

After the disastrous looting of Rome by Charles V. in 1527, interest in ancient art wanes for a time. The popes of the 16th century after Julius II. did little for the museums and were very free in giving grants to contractors to tear down and use the materials of old monuments. Thus the tomb of Caecilia Metella and the Ianus Quadrifrons were saved only by the remonstrances of the populace after grants had been given to dispose of them. The famous Septizonium stood till 1588 when Sixtus V. ordered Fontana to use its materials for the repairs of several churches and public buildings.

Inscriptions.—Meanwhile a scientific interest in inscriptions was growing. We have seen how Rienzi made use of one to demonstrate an historical fact. Ciriaco of Ancona[1] (*c.* 1390–*c.* 1450), attracted to the subject by a collection of inscriptions made by Poggio, made careful copies in his extensive mercantile journeys, inspired by the conviction that these stones often gave facts of history more reliably than the texts. His collection, made before the invention of printing, did not survive as a unit, but his mss. were generously used by other scholars. After him others made similar collections, often catching the stone on the way to the limekiln and rescuing its readings. The large collection of Panvinius (1529–68) seems to have fallen into the hands of

[1]Ashby, *Drawings of Ancient Paintings in English Collections,* Brit. School, 1914–16; Weege in *Jahrb. Arch. Inst.* 1913, p. 217.

[2]*E.g.,* Bartoli, *I. Monumenti Antichi nei Disegni degli Uffizi;* Ashby, *Drawings attributed to Andreas Coner* (Brit. School, 1904).

[1]*See* Sandys, *Latin Epigraphy* (1927), p. 22.

Smetius, a diligent Dutch epigrapher, and his in turn (as published with additions by Lipsius, 1588) went into the first great corpus of inscriptions that purported to be complete, the famous collection of Gruter (1603). Scaliger (1540–1609) made this corpus available for antiquarian studies by classifying its great store of facts in 24 indexes. Fabretti (1619–1700) was the next scholar who gathered and interpreted inscriptions with success, publishing his great work on the Roman aqueducts in 1680. Maffei (1675–1755) did valuable service by submitting to keen criticism the large collection of Muratori; Marini (1742–1815) emended and explained the difficult inscriptions of the Fratres Arvales (1795), and finally Count Borghesi (1781–1860) by his keen analysis of the accumulated material and his vast series of studies in history and administration which were based largely upon epigraphical sources, determined and illustrated the methods of epigraphy. Mommsen, inspired by the work of Borghesi, elaborated a plan for a new and more scientific collection of all Latin inscriptions and, publishing a volume to serve as a model, persuaded the Berlin Academy to undertake the publication of a complete corpus on this plan. Since 1863 the volumes of this *Corpus Inscriptionum Latinarum* have been issued in a consistent stream.

17TH AND 18TH CENTURIES

Private Collections.—To return to the subject of sculpture, it was chiefly in the 16th century that the great princely collections of Italy were formed, the older Borghese (later sold to Napoleon), the Barberini, the Pamphili treasures, the even more remarkable ones of the Ludovisi and the Giustiniani, not to mention a number of smaller ones. Parts of these were made up by purchase, but digging on the vast estates of the princes themselves yielded no small part of them. When some of these nobles were forced to sell portions of their collections, the courts of Madrid and Dresden began to buy antiquities extensively, and in the 17th and 18th centuries Englishmen made purchases for the decoration of their country places (*see* Poulsen, *Greek and Roman Portraits in English Country Houses,* 1922). Thus English, French and German dilettanti became interested in Greek and Roman art and had no small share in encouraging a more careful study of the subject. It was because of such expansion of interest that Spon and Wheler made their valuable records in Italy and Greece in 1676, and Stuart and Revett followed their lead to Athens in 1751. Indeed a "Society of Dilettanti" was formed in London in 1733 to encourage not only travel and collecting but the explanation and respectable publication of antiquities. It was in fact this society which supported the sumptuous publication of Stuart and Revett. And it was through the wider archaeological interests encouraged by this society that English critics of art were competent to appreciate the real value of the Elgin marbles when they reached London, thus escaping the consequences of Winckelmann's incompletely based judgments.

Herculaneum.—Meanwhile Herculaneum and Pompeii had become known. In 1709 an Austrian count sunk a shaft through the lava where it was known that the ruins of Herculaneum lay. By good fortune the ancient theatre was soon found and many pieces of statuary recovered. In 1738 King Charles of Naples continued the work with the use of French engineers. Diaries of valuable objects found were now kept, though not yet systematic records of the daily excavations. In 1753 the splendid "villa of the papyri" with its scores of statues was discovered. Two years later the Accademia Ercolanese was formed which between 1757 and 1792 published eight finely illustrated volumes of excavated objects, and these, though deficient in aesthetic analyses, are still of value as a record. Charles III. also made trial excavations at Pompeii, where the débris was more easily moved. His engineers began with some 12 men, burrowing here and there for chance finds. Not till 1763, when the advice of the Accademia Ercolanese was followed, was the débris permanently removed from the excavated portions. Notes of finds were still kept in desultory fashion. A careful record of daily work was not thought of, and no attempt made to preserve what was not immediately taken to the museum.

Winckelmann.—In 1755 Winckelmann, inspired by the collection of antiquities which Dresden had acquired from Rome, went south to study. He spent years with the collections of Rome and Herculaneum, and as a fruit of this study issued in 1764 his epoch-making *History of Ancient Art.* Here for the first time after antiquity an attempt was made to outline the history of art from early Egyptian times (the Vatican had a few examples of Egyptian art discovered in the débris of Rome) to late Roman times. To be sure there were at Rome and Naples very few examples of genuine Greek art; consequently Winckelmann could not produce a well-proportioned history. Indeed the English dilettanti of the period had acquired in their travels in Greece a more accurate comprehension of the best in ancient art though they were at the time more concerned in describing and analyzing portions than in recording the story of the whole. It is of course a small matter whether or not we call Winckelmann the father of archaeology. Several artists of the Renaissance had as sure an appreciation of aesthetic values as he, some of his contemporaries knew Greek art better, the historical perspective and the critical sense were by no means new. The services of Winckelmann were of the kind that particularly appeal to the scholar in that his book provided a model of careful description, aided the memory and gave points of view for the classification of new discoveries. The book was very influential at the time, and when before the end of the century the new Pio-Clemente museum was opened in the Vatican the elder Visconti wrote the catalogue of the splendid collection with a mastery of the technique that owed much to Winckelmann.

The Napoleonic period brought new funds and some enthusiasm for excavations. The work at Pompeii was pushed with more vigour and with some system. The architect Mazois brought out a valuable publication of objects found there. The eagerness to find works of art worthy of the museum was still dominant, but it was no longer the sole object; the savants in Napoleon's train cannot be denied an appreciation of the encyclopaedists' view-point. At Rome the most important archaeological work of this régime was the very costly excavation of the centre of Trajan's forum, a work not then finally completed. During this very period, however, Italian archaeology came near receiving a severe blow in that Napoleon removed to Paris many of the best works of the art of Rome (1797), and with them the able archaeologist Visconti. However with the fall of Napoleon the papal delegate to the peace conference successfully reclaimed most of the treasures that had belonged to the Vatican and Capitoline museums. Italy thus regained its position of first importance for students of classical archaeology.

THE 19TH CENTURY

Upon the re-establishment of the papal government the good work of excavation continued. Carlo Fea began systematic excavations in the upper end of the Forum in 1813 which he continued till 1820. His meticulous records he published in his *Miscellanea,* which were rightly considered models of accuracy. He has a strong claim to be considered the founder of scientific excavations, though Fabretti's excellent study of the Roman aqueducts in 1680 and Marini's brilliant exposition of the Arval brothers' records (1795) rank as high among publications. An epoch in archaeology is marked by the foundation of the Instituto di Corrispondenza Archeologica in 1829 by an international group of some 70 scholars, about equally divided between Italian, German, French and English savants. Its purpose was to get support from as wide a circle of scholars and dilettanti as possible for good reporting and publication of finds, to raise the standards of work, to discuss antiquities in frequent sessions and to gather an adequate library at Rome. The head of the institute was the duc de Blacas, while the more active spirits were the German savants, Gerard and Bunsen, the Italian, Carlo Fea and the Dane, Zoega. The annual publications, called the *Annali* and the *Bullettino,* and the occasional *Monumenti Inediti* kept the members all over Europe well informed in careful reports of all important work progressing, and did much to encourage excavators to do their work in the most approved fashion. After many vicissitudes the body finally (in 1871) emerged as the German Archae-

ological Institute, which is still doing excellent work at Rome.

During the 19th century official and unofficial excavations were carried on all over Italy. (*See* Michaelis, *A Century of Archaeological Discoveries,* Eng. trans. 1908.) A brief survey of what was accomplished in the Roman Forum will best reveal the trend of archaeological work. Since 1800 there has at least been no more sheer vandalic quarrying. Indeed the wholesale mining of the 15th and 16th centuries had not left many usable pieces of building material in the débris. Hence the excavators of the last century had little hope of finding much except bare foundations with which to reconstruct the ground plans of the old Forum. However, the spirit of historical criticism, revealed in the works of Vico, Gibbon and Niebuhr, was now also the driving spirit of the archaeologists. Hence we are not surprised to find that Carlo Fea, placed in charge of excavations by Pope Pius VII. in 1803, determined upon a thorough removal of all débris, and an orderly recording of finds for the central purpose of reconstructing the plans of the buildings of which he should find traces. He worked systematically at both ends of the Forum, near the arch of Septimius Severus and near the arch of Constantine. The French Government continued with no loss of zeal from 1810 to 1813, adding the Velia near the arch of Titus to the programme. (A few years later, 1821, Valadier was commissioned by Pius VII. to restore the arch.) With the return of Pius VII. Carlo Fea again was placed in charge, now delving into the débris near the three columns of Castor. Some aid was now accepted from foreigners interested in the work, as the duchess of Devonshire and the duc de Blacas, who was the French ambassador. From 1827 to 1835 much was accomplished near the Temple of Concord, and a portion of the Basilica Iulia was uncovered under the direction of Nibby. Pius IX. employed the somewhat too imaginative Canina who continued the work at the west end of the Forum. Fea, Nibby and Canina unfortunately were all somewhat misled by the fantastic plans of the Forum drawn by the 17th century architects. Piale, in 1832, submitted these plans to sharp criticism, but failed to carry conviction against the voluminous and picturesque publications of Canina. It was not till about the middle of the century that archaeologists reached some degree of consensus about the correct orientation of the Forum and the right designation of several of the foundations. After Canina's death excavations progressed very slowly until 1870 when the new royal government took up the work with vigour, placing in charge Pietro Rosa, who had excavated on the Palatine for Napoleon III.; Rosa cleared a large part of the Basilica Iulia and of the central part of the Forum during the next six years. Unfortunately he sometimes left his finds in tantalizing confusion. In 1876 Fiorelli, who had developed an excellent technique at Pompeii (1860–75), came to Rome to take charge. He knew the value of meticulous reporting and was influential in having the Royal Academy (dei Lincei) begin in 1876 the very valuable official publication of excavations in the *Notizie degli Scavi.* He cleared most of the area along the Sacred Way from the Temple of Divus Iulius to the Arch of Titus; and in 1882–84 Lanciani, to whom Roman topography owes very much, demonstrated in the clearing of the *atrium Vestae* that archaeologists needed not only to excavate and report but so to protect the ruins and dispose of the objects found that the student might correctly read the meaning of what was left.

The imperial street level had now been reached throughout the central part of the Forum, and after 1884 the State suspended work until more properties could be bought. However, several individuals, notably Huelsen, Nichols and Richter, were permitted to make researches which proved fruitful. Meanwhile historical criticism was somewhat influencing archaeology in that it demanded data on the period of early Rome, and insisted that the spade must penetrate beneath the imperial pavements. In 1898, when Guido Baccelli was minister of public instruction, the energetic and imaginative architect Giacomo Boni was placed in charge of excavations and permitted to dig to lower levels. The results were startling. In 1899 the "black stone" was found and beneath it the famous archaic inscription with many primitive objects about it. Then there came to light the old Vulcanal, primitive drains, foundations and decorative terra-cottas of the early republic, and finally in 1901–03 the primitive *sepulcretum* on the edge of the Forum, which at once explained many traditions regarding primitive Rome. The public was perhaps more ready to appreciate the new researches than the archaeologists to interpret them, but scholars of all nations, especially of the archaeological schools now established in Rome, men like Huelsen, Richter and Ashby aided in the publication and in the discussion of the finds. The Instituto, which had become the German Institute in 1871, had excellent scholars on its staff, the French school had been established in 1873, the American school of classical studies in 1894, and the British school in 1901. The Forum was to these a fruitful laboratory of observation. After 1904 Boni shifted his interests more and more to the Palatine, but since his notes on excavations there have not yet been published the end of the story must be omitted.

Meantime there were many sporadic finds of importance all through Italy, some in systematic excavations, others in the course of private building operations. The Alexander mosaic, which indirectly contributed much to the history of painting, came to light at Pompeii in 1831, the Lateran Sophocles at Terracina in 1837, the Vatican copy of the Apoxyomenus of Lysippus at Rome in 1849, the Augustus of Prima Porta in 1863, the foundations of the Capitoline Temple in 1865, the house of Livia in the French excavations of the Palatine in 1869, the house of the Farnesina gardens in 1878, the Apollonius bronze pugilist in 1884, the Ludovisi throne in 1887, the silver treasure of Boscoreale in 1895 and the last fragments of the Ara Pacis in 1903.

ETRUSCAN AND PREHISTORIC

Etruria.—In Etruria occasional finds had been made ever since the Renaissance and gathered to public and private museums. These had created a local interest in Etruscan art, but a general enthusiasm was hardly aroused until 1827, when some tombs with remarkable wall-paintings were opened at Corneto (Tarquinia). The very next year Lucien Bonaparte found that his estate in Etruria contained a large part of the vast cemetery of ancient Vulci, and the feverish excavations that followed brought to light hundreds of the finest Greek vases. When these were carefully published by Gerhard in the *Rapporto Volcento* of the Archaeological Institute in 1831, which contained the first logical classification of such ware, the real study of Greek vase-painting began. When in 1836 Regolini and Galassi found the remarkable tomb which bears their name at Cervetri and the objects were placed by Pope Gregory XVI. in the Vatican, the artistic outlook was at once widened by connecting Etruria with the East. François, in 1844, found the splendid black-figured vase at Chiusi which is now in Florence, and this proved stimulating to archaeological study by filling a serious lacuna in the story of vase-painting. When in 1848 Dennis issued his remarkable work called *Cities and Cemeteries of Etruria,* which may still be read with pleasure and admired for its exact observation, most of the important sites of Etruria had been discovered and to a large extent exploited.

Meanwhile Campana had, in private excavations conducted largely for the sake of enlarging his own collection, found the tomb at Veii, named after him (1842). It was not till 1850 that he disclosed the *Grotta dei relievi* at Cervetri, with its painted stuccoes and its remarkable terra-cotta sarcophagus. He was exceedingly successful in the Etruscan field, but in his enthusiasm he neglected sadly to record his excavations, and when because of bankruptcy his magnificent collection was sold, the larger parts to Paris and St. Petersburg (Leningrad), Italy had lost not only very precious relics of past art but also much of the evidence that is essential to the proper comprehension of the art. Campana was, of course, a man of his times, working for himself in a divided Italy where uniform State supervision of excavations could not exist. During this period it was largely due to the activities of the Archaeological Institute at Rome that specialists were at times allowed to inspect diggings, report them with some care, and by their reports shame exploiters into some respect for scientific interests. But it was only after the unification of Italy, when

such excavations were placed under the supervision of a State department, that they could be properly controlled and adequately published. It would be difficult to overstate the debt that art and archaeology owe to the royal government of Italy for its enlightened interest, its generous expenditure of funds for excavations, museum buildings and publications, and for its intelligent choice of genuine scholars to conduct the necessary work where political jobbery might otherwise have crept in.

Prehistoric Archaeology.—Prehistoric archaeology has come to be exceedingly important in Italy, but was slow in awaking notice because of the wealth of classical works of art to be found. The Terremare sites of the Po valley were locally known in the 18th century, but were pronounced Cimbric or Boian sites of little interest. Carlo Fea had the breadth of view to give a valuable description of the Iron Age cemetery found by chance in the Alban hills in 1817, but the objects found were not properly cared for nor was their importance generally understood. The real interest was awakened only after the first Hallstatt finds had attracted scholarly attention in 1846 and the pile-dwellings of Zurich had been found in 1854. In 1853 the Villanovan cemetery near Bologna was discussed by Senator Gozzadini, who proposed the theory, which is now again receiving attention, that the "Villanovans" were Proto-Etruscans. Mortillet, excited by the discoveries at Zurich, set out to find similar settlements on the borders of the Italian lakes, and succeeded in 1860. The next year Gastaldi made a first attempt at explaining the construction of the Terremare sites, and Pigorini, with an enthusiasm and keen judgment which have for 60 years been so fruitful for Italian prehistory, turned to the problem in 1862 and in 1864. After giving a good survey of this field of study at the anthropological congress at Stockholm in 1874, he founded in 1875 the *Bullettino di Paletnologia Italiana,* which at once became a leading publication distinguished for thoroughness and sanity. He now built up a remarkable prehistoric museum at Rome and induced the government to grant funds for systematic excavations on prehistoric sites and to impose a careful supervision over private excavations. Colini, who later had charge of the museum in the Villa Giulia (devoted largely to Etruscology), also turned his talents to the study of prehistoric remains, issuing an important series of studies in this field. Taramelli has also worked tirelessly on the island of Sardinia, and Orsi, while chiefly interested in the Greek civilization of Sicily and Magna Graecia, has by no means neglected the prehistoric sites of his field. Montelius, with his monumental work *La Civilisation primitive en Italie,* was useful in spreading a knowledge of this work, as were in England Peet's *The Stone and Bronze Ages in Italy* (1909), and Randall-MacIver's *The Villanovans* (1924) and the *Iron Age in Italy* (1927). The remarkable corpus of prehistoric finds contained in Von Duhn's *Italische Gräberkunde* I. (1924) is a work of profound erudition by a scholar who has for 50 years been reporting all the important excavations with a steady judgment and unsurpassed grasp of the subject.

Recent Excavations.—During the last 20 years excavations have continued with renewed vigour by the Government, and usually in the charge of the most competent scholars. Of these we can mention only the most important. In the north the researches at Este and in Picenum have led to discoveries of very great importance to anthropology, and abundant material has been found at Bologna, Vulci, Veii, Terni and in the Alban hills for the further study of the Villanovan period.

For Etruscan studies, Caere has yielded exceedingly fine Greek vases besides valuable funerary objects and inscriptions, which will aid in restoring the history of Etruscan culture from the earliest days till Roman times. Unfortunately, very few of these tombs have been published (for a summary report on recent work *see* Mengarelli in *Studi Etruschi,* 1926, p. 145). Veii has proved unexpectedly fruitful. The foundations of a three-cella temple were found, and near it considerable fragments of a 6th-century terra-cotta group representing a contest between Apollo and Hercules, possibly an *akroterion* of the temple. The Apollo, removed to the Villa Giulia, is a masterpiece of its century (*Not. d. Sc.,* 1919). On the acropolis of the city have been found parts of the old city wall, foundations of several Etruscan dwellings, two public buildings, and a large elliptical basement, which is supposed to be the foundation for a straw-thatched town hall of very early date. Farther north were discovered the stone walls of a 7th-century dwelling-house of five rooms—the oldest structure of its kind in Italy (*Not. d. Sc.,* 1913 and 1922, 206, 380). The tombs have proved that Veii was once a Villanovan city which fell into the hands of Etruscan rulers some time before Rome's foundation.

At Populonia, which prospered on the manufacture of the iron ore of Elba, many important finds have been made. During the World War numerous shiploads of iron slag from the ancient Etruscan furnaces were removed for re-smelting, and in the process an old cemetery was uncovered. These graves and others near by were found to be well-stored with urns, arms and ornaments, the first harvest of which A. Minto has published in a volume entitled *Populonia.* A similar series of excavations at Marsiliana has also been published by the same scholar. At Orvieto a 4th-century Etruscan temple with excellent pedimental terra-cottas has been found, important especially because of the tendencies of contemporary Greek art which they reflect. Good illustrations of these finds were published in *Dedalo* (1925, p. 136). Vignanello has yielded good Greek vases as well as much Etruscan ware. A grave at Todi has been found to contain numerous red-figured vases and some good Etruscan armour. Finally, at Rome, on Monte Mario behind the Vatican, casual building operations revealed a very interesting 7th-century Etruscan village built over the site of an early Bronze age settlement. A special journal for Etruscology called the *Studi Etruschi* was launched at Florence in 1926. The *corpus* of Etruscan inscriptions has also been advanced by several fascicles with many new inscriptions, but no real advance has yet been made toward their interpretation.

RECENT FINDS IN ROME

The city of Rome still yields a constant stream of ancient works of art. The Government has secured possession of the Capitoline hill and with characteristic zeal at once ordered the excavation of the site of Rome's chief temple. The massive foundations of Tarquin's structure were laid bare and found to agree with the dimensions recorded by ancient authorities (*Not. d. Sc.,* vol. xviii., 1921). Unfortunately, none of the decorative terra-cottas of the old temple have as yet come to light, but an interesting deposit of early votive objects have been found not far from it. On the Palatine the rear of the Imperial palace was cleared in 1905, and excellent wall paintings and mosaics of the Claudian and Neronian periods brought to light in abandoned rooms beneath. In similar rooms found under the front of the palace were discovered wall decorations of great historical interest dating from the Ciceronian period (*see* ROME, *Palatine*). Recently the so-called "Villa Mills" has been stripped of its modern decorations to facilitate the examination of the walls which prove to be ancient. The most valuable treasure yielded by the Palatine in recent years is the exquisite but still unpublished *Nike.*

The Government has now excavated a large part of the Augustan Forum. The numerous architectural fragments found from the Temple of Mars Ultor, the portico near by and the marble covering of the enclosing wall are of great beauty and precision, and several inscriptions of historical importance have also come to light. This excavation is continuing north-west into Trajan's forum and south-east into Nerva's forum. Furthermore the Theatre of Marcellus has been freed from its clutter of ugly shops, the temple of Fortuna in the Forum Boarium, two unidentified temples near S. Nicola dei Cesarini have been liberated, and the Mausoleum of Augustus is being thoroughly studied.

Many rooms of Nero's "Golden House" near the Colosseum were cleared. The débris had been searched long ago for works of art, but the walls, protected by the super-imposition of Hadrian's buildings, were found to be decorated in a style resembling that of the "Claudian" rooms of the Palatine. The small and richly coloured panels set in embroidered stucco are excellently executed but overloaded in design, as are the Renaissance loggia arabesques which they inspired. In many places on the walls

were found the signatures of Renaissance artists who had crawled over the débris to study the ceiling decorations (partial report in *Jahrb. Arch. Inst.*, 1913, p. 217). Among statues recently found there should be mentioned, besides the *Nike*, an excellent portrait of Augustus (*Not. d. Sc.*, 1910, 223), an "Artemis" from Aricia (*Jahrb. Arch. Inst.* 1922, 112), an excellent bronze representing a youth of the Julio-Claudian house, taken to New York (*Am. Jour. Arch.*, 1915). Furthermore, some forgotten fragments of great importance, which have long been lying and awaiting study in the basement of the Vatican, include a fine head from a Parthenon metope and a good copy of one of the "Tyrannicides."

During the World War there was discovered under the railway outside of Porto Maggiore a mysterious underground "Basilica" in almost perfect preservation, probably of the 1st century A.D. It had been built by sinking shafts in which the concrete walls and the piers of the nave were moulded. After a concrete vault had been cast over the walls, the enclosed earth had been removed and the walls and ceiling plastered and very richly stuccoed in low relief with mythological and genre scenes. It is, perhaps, the best preserved monumental structure of the Roman world, and the lavish stucco work, though not quite as delicate as that of the house found in the Farnesina garden, shows an ease and freedom of execution which gives it high rank. Scholars incline to the belief that it was the meeting-place of a group devoted to some mystical cult (Carcopino, *La Basilique Pythagoricienne*, 1927). The tomb of the Aurelii found on the Viale Manzoni (*Mon. Ant.*, 1922) has awakened much comment because of its excellent figures in fresco and the Christian symbolism that some of the paintings seem to contain. There is a seated figure before a flock that seems to symbolize Christ as judge. Eleven excellent standing figures have with less certainty been identified with the Apostles. The new excavations of imperial Rome constantly disclose the evidence of oriental cults. The two largest Mithraea known have also come to light in this period, one under S. Clemente, the other under the baths of Caracalla (*Not. d. Sc.*, 1912). The tomb of the Scipios has at last been carefully examined and restored.

Beneath the church of San Sebastian were found a number of decorated columbaria of the 1st century made for pagan cremation, which in the 2nd century were converted into Christian burial places. The area was then levelled off and a room for funeral banquets constructed. The walls of this room contained a great number of invocations to Peter and Paul rudely scratched. These finds will have an important place in early Christian history (*Not. d. Sc.*, 1923). Recent restorations of the churches of Santa Sabina, S. Quattro Coronati and S. Giorgio in Velabro have also revealed earlier structures of value to church history. In the rapid expansion of Rome since 1918 a very large number of tombs with sarcophagi, hundreds of important inscriptions, and three new series of catacombs have been found. These have been reported with commendable speed in the *Notizie degli Scavi.*

Outside of Rome the most important excavations in Latium have disclosed Horace's villa on his Sabine farm (*Mon. Antichi*, 1926, 457), an important votive deposit at Tivoli, details of Domitian's palace at Albano, of Hadrian's villa near Tivoli, a splendid and very old temple with fine terra-cottas at Lanuvio (*Mon. Ant.*, vol. 27, 1921), valuable fragments of a pre-Julian calendar at Anzio (*Not. d. Sc.*, vol. xviii., 1921), and a very important part of the seaport town of Ostia. At Ostia the finds are so numerous that a mere enumeration would require pages. The walls and gates of the oldest settlement (4th century ?), which Virgil seems to describe in his 7th book, have been disclosed; the more extensive wall of the 1st century B.C. has been traced throughout, and two of its excellently constructed gates cleared; the Forum of the late republic has been excavated, a temple of Rome and Augustus found at one end, and beneath the pavement of the Forum a series of barrack-rooms and offices of the oldest town. Many new temples, the offices of the city guard, the offices of the foreign shippers, the large cistern of the city, numerous State granaries, the foundations of what seems to be the earliest Temple of Jupiter, the municipal senate house, a very interesting safety storage house, and much else can now be studied. Of particular interest in revealing the plan of city dwellings are the extensive ruins of the "Casa di Diana" which, rising to three or four storeys, contained many suites of independent apartments which received their light through windows opening to the streets. This rather than the Pompeian type of dwelling we must now assume for the city of Rome. (*See* Calza, *Guida di Ostia*, 1925, and continued reports in *Notizie d. Scavi.*)

The excavations at Pompeii in 1925 yielded a magnificent Greek bronze Ephebus, perhaps the best work of art that the buried city has disclosed. The work of clearing the western part of the city has progressed uninterruptedly. A large number of houses of moderate size with fair wall paintings have been found, among them several of religious import—a Cybele group, a Pompeian Venus, a group of the twelve gods, and a series of interesting mythological scenes (*Not. d. Scavi*, 1927 ff.). Of particular interest are several houses with picturesque balconies, and an office decorated with representations of armour, supposed by some to be the headquarters of the *iuvenes*, the ancient "boy scouts." The newly found structures have been carefully restored and the paintings well protected from weathering and decay, but until recently publication has not always kept pace with excavations.

Finally, very important excavations have been diligently and carefully conducted on the Greek sites of lower Italy and Sicily. Gabrici published in two sumptuous volumes the discoveries made before the World War at Cumae (*Mon. Ant.*, vol. xxii.). Since Cumae was for centuries the Greek tutor of Italian barbarians, these volumes are indispensable to students of Greek and Italian history. Unfortunately, the excavations of the Temple of Apollo, the home of the sibyl whose oracles brought so many Greek rites to Rome, were stopped by the World War and left incomplete, but the sibyl's cave has been excavated in honour of Virgil's 20th centenary. In southern Italy Orsi has excavated Locri, Caulonia, Medma and other sites with striking finds of Greek vases, remarkably fine architectural decorations in terra-cotta, early Greek entablatures of great beauty, and large numbers of terra-cotta votive figures of no mean artistic value. ("Caulonia," *Mon. Ant.*, vol. xxiii. [1914–16], Oldfather, *Locri* in Pauly-Wissowa; *Not. d. Sc.*, 1917 for Medma.) At Ciro in Calabria he has found a remarkable head of an acrolithic Apollo of about 460 B.C. (*Atene e Roma*, 1925), and at Velia the remains of three important temples. Orsi has also published the finds from an important archaic Temple of Megara Hyblaea in *Mon. Ant.*, p. 110, (1921). But the most important work of the kind has been Orsi's extensive excavations in Syracuse, especially of the site and ruins of the great Temple of Athena. Here were found a rich store of objects from pre-Greek huts, of early Greek edifices and especially many exquisitely executed fragments of the 5th-century temple (*Not. d. Sc.*, 1910, and *Mon. Ant.*, 1918, pp. 354–762). The State has also begun a thorough-going archaeological survey of Italy, the first fascicle of which has been published by Prof. Lugli. (*See* also ROME: *Archaeology.*) (T. F.)

ECONOMIC AND SOCIAL CONDITIONS

Natural Economic Resources.—On the asset side of Italy's economic balance-sheet must be placed man-power, brains, geographical position, water-power; on the debit side, the absence of coal and fuel oils in commercial quantities, limited mineral resources, a high percentage of rocky mountainous territory, either unproductive or of low productive value.

For thousands of years Italian land has fed large populations, and its natural fertility would long ago have been exhausted had not human skill, aided in the last century by scientific knowledge, reintegrated the depleted wealth of its soil.

The recently reclaimed marsh lands in Venetia and Romagna possess a high degree of natural fertility, but there are no rich tracts of black alluvial soil as in the Ukraine, Hungary and Rumania. In Italy soil fertility is largely the work of man, the result of drainage, irrigation, careful tillage, and the copious use of natural and chemical fertilizers. Of these latter 104·7 kg. per hectare of arable land (exclusive of grass lands) were used in North Italy in 1925, 92·1 kg. in Central Italy, 26·5 in the South and the Islands. Their use is steadily increasing.

Mineral Resources.—There is some reason to believe that Italy's mineral resources have been underestimated in the past. This has certainly been the case with her iron ores, estimated in 1910 by Professor Sjögren in his work, *The Iron Ore Resources of the World,* at a maximum of 8,000,000 tons. Since that date some 13,000,000 tons of iron ore have been excavated from Italian mines, and their potential output is now placed as high as 150,000,000 tons. Deposits of ores of various kinds are found in various parts of the peninsula. The more important iron mines are in Elba, the Tuscan mainland, and in the high Alps in the province of Aosta. The most important Italian lignite beds are in Tuscany, which also has large deposits of iron pyrites, from which sulphuric acid is obtained, while the ash is treated and used for smelting iron. Sardinia, geologically a prolongation of the Iberian peninsula, is rich in ores:—iron, copper, zinc, lead, silver and mercury. Istria possesses important quicksilver mines, large bauxite deposits (with a potential output conservatively estimated at 10,000,000 tons), zinc mines, and a soft-coal bed of some importance. In Sicily and in Romagna, Italy has a European monopoly of sulphur. Some authorities maintain that considerable quantities of petroleum exist in her sub-soil, more especially in Emilia, but so far the output obtained is negligible. A strenuous effort is being made to utilize latent resources, such as leucite, a volcanic ash of which vast deposits are found in Italy, which is now made to yield potash salts and alumina.

The output of Italian mines 1876–1927 has been as follows:—

(*Metric Tons*)

Year	Iron ores	Pyrites	Zinc and lead	Coal, lignite, etc.	Total value gold lire
1876	255,035	4,460	98,438	116,399	53,317,353
1898	201,260	67,191	126,029	341,327	67,125,428
1911	380,268	165,263	178,177	557,137	81,967,675
1922	314,410	486,000	126,241	946,230	98,343,318
1927	426,300	604,300	231,120	1,106,070	152,393,775

It will be seen that the production of coal, the former sole basis of modern industry, is insignificant.

The insufficiency of the present production of ores to meet current needs is shown by the fact that in 1927 the output of iron ore was estimated at 426,000 tons against imports of scrap iron and steel amounting to 693,000 tons. Italy produced just over one million tons of coal and lignite and imported over 14 million tons of coal; she produced 5,800 tons of mineral oils and imported over 146·8 thousand tons. It is therefore evident that for these essentials she is dependent on foreign supplies.

Italy is abundantly supplied with excellent stone for all building requirements; her quarries of white and coloured marbles are famous and well-nigh inexhaustible. She has large supplies of borax and boric acid, and extensive beds of clay, lime, marl, kaoline, etc., for the needs of the brick, cement, porcelain and glass industries.

Output of Quarries

Quarries	1911–13 average	1924	1925	1926
	Tons	Tons	Tons	Tons
White and coloured marbles	509,723	468,398	577,640	590,250
Granite and porphyry	389,312	100,441	298,093	156,400
Talcum and steatite	18,620	32,168	33,620	35,000
Magnesite	453	13,436	15,146	15,150
Refractory clays	7,740	64,180	72,000	..
Pumice stone	16,233	31,090	47,900	37,000
Other stone, etc.	17,540,470	25,078,559	31,341,360	33,382,647

Agriculture.—Agriculture is by far the most important of Italian industries. About one third of the population over 10 years of age was returned as employed on the land by the census of 1921.

The average value of agricultural and forestry products for the three year period 1924–26 has recently been estimated between 48 and 50 thousand million lire, distributed as follows: Live stock 25%, wine 22%, cereals 19%, oil 5%, industrial plants 4%, roots 3%, legumes 2%, fruits and vegetables 15%, forests 4%.

Italian agriculture is extremely diversified; differences of altitude, soil, and climate allow the production of all European crops, from rye to rice, from apples to oranges, from hemp to cotton (of which a small quantity is grown in Sicily); while the very varied forms of land tenure prevailing in the different sections exhibit farming in its most evolved and its most primitive forms.

Of the total national area (approximately 310,055 sq.km.) 91·7% is productive, 25·85% being under cereal crops, 3·03% legumes, 0·86% industrial crops (hemp, sugar-beet, tobacco, flax and linseed), 0·92% roots, 0·56% garden truck, 15·02% forage crops. Arable land thus accounts for 46·24% of the productive total, 23·96% is under permanent grass and pasture; 4·39% is uncultivated but productive, and a little over one quarter (25·36%) under trees, shrubs, bushes and forests. These latter, including fine chestnut forests, cover 55,854 sq.km.

The following table shows that, while the area under cereals declined somewhat in the period 1923–26, as compared to 1909–13, total and per hectare yield increased, and *per capita* yield rose from 257 to 269 kg.

Area and Yield of Cereal Crops

	Average area 1923–26	% of 1909–13	Average production 1923–26	Yield per ha.	% of 1909–13
	ha.		(metric tons)		
Wheat	4,720,000	−1·3	5,827,400	1·2	+22·0
Rye	124,870	+1·8	163,800	1·3	+22·5
Oats	481,750	−3·7	585,100	1·2	+14·1
Barley	233,120	−5·3	233,400	1·0	+ 8·4
Rice	137,400	−5·0	598,800	4·3	+30·7
Maize	1,492,800	−7·1	2,609,600	1·7	+ 4·5

A national effort, promoted by the Government, was started in 1925 to increase the output of wheat, of which Italy now has to import on an average 2,400,000 tons, or approximately one-third of her annual requirements. Apart from some hundred thousand hectares, which may yet be added by land reclamation, it is not economically desirable to increase the large acreage already sown to this crop, but it is generally admitted that the yield could be raised from the present average of 1·2 metric tons per ha., to at least 1·5.

Rice, grown almost exclusively in a limited section of north Italy, is the only cereal crop of which Italy is an exporter. The rice area has declined in the last twenty years, but the yield per hectare has increased considerably.

Hemp of fine quality is an important industrial crop, and is exported in considerable quantities. The *Sugar Beet* crop, introduced into north Italy since 1895, has spread rapidly, giving rise to a sugar refining industry of considerable importance. Though the area devoted to *Tobacco* is limited, it has grown rapidly since the war, supplying the Tobacco Monopoly, formerly a large importer, with all the Kentucky and Levantine varieties it requires and leaving a considerable margin for export.

Area and Production of Industrial Crops

	Average area 1923–26	% of 1909–12	Average production 1923–26	Yield per ha.	% of yield in 1909–13
	ha.		(metric tons)		
Sugar beet	87,800	+75	2,573,900	2·9	+64
Hemp	88,700	+10	94,800	1·0	+15
Tobacco	35,875	+344	30,721	1·1	+294

Roots, tomatoes, and *fresh vegetables* are very important crops, meeting all home requirements and exported in large quantities. They supply the raw material for a large and growing canning and preserving industry. Their steady development is shown by the following figures:

	Average area 1923–26	% of 1909–12	Average production 1923–26	Yield per ha.	% of 1909–12
	ha.		(metric tons)		
Fresh vegetables . .	98,000	+79	891,300	..	+24
Tomatoes . . .	42,000	+40	617,200	1·4	+43
Potatoes	398,340	+22	2,055,600	5·9	+26

Italian climate and soil are pre-eminently suited to fruit growing, but heretofore this potential source of wealth has been inadequately considered. This is due to the fact that the farm has been first and foremost a self-supporting unit, but now that agriculture is increasingly thought of in terms of the leading national industry there is evidence that fruit-growing and preserving will take their proper place as important wealth-producing assets. Data for the total area under deciduous fruits are not available. Specialized commercial orchards are a recent development, confined mainly to north Italy, the general practice being to plant fruit trees in union with other crops. The total production of deciduous fruits and nuts in 1926 was estimated by the Ministry of National Economy at some 900,000 metric tons.

In Calabria and Sicily citrus fruit is of great economic importance. If Italian oranges rank second on the world's markets to those of Spain, her lemons, accounting for 54% of her citrus crop, hold the first place.

Wine accounts for nearly a quarter of the total money yield of Italian agriculture. Italy ranks next to France for the quantity produced (average 1922–26: 45,200,000 hectolitres) and boasts a great variety of wines, many of choice quality, but little known beyond her own frontiers, the chief exceptions being Marsala, Vermouth, Chianti and Barolo. Large quantities of the ordinary red wine from Apulian vineyards are exported to France for cutting native wines. Wine making is still mainly a farm industry. The trend is towards improving quality, standardizing types, concentrating and industrializing production.

Olive Oil.—Italy ranks second to Spain as a producer of olive oil. The area planted to olives shows a slight decline since the war, when the fuel famine led to their destruction in some districts. The annual money value of the oil has averaged in the post-war period over 2,000,000,000 lire. Apulia, Calabria, Tuscany and Sicily are the chief oil-producing centres.

Silk.—Some 600,000 farm families, mainly in north Italy and along the eastern coast, are engaged in rearing silk-worms. An abundant supply of mulberry leaves, the food of the worms, is essential, and steps are being taken to encourage the cultivation of this tree in other sections of the country where the industry could flourish. The cocoon crop dropped heavily during 1915–20, but has since regained the pre-war level, approximating, with seasonal variations, 45 million kilograms.

	Average area 1923–26	% of 1909–12	Average yield 1923–26		Per ha.	% of 1909–12 yield
	Ha.					
Vineyards .	896,000	−5·4	Wine (hl.)	45,276,000	10·6	+1·8
Vines grown with other crops .	3,434,000	−3·6				
Olives grown with other crops .	1,715,000	−2·4	Oil (hl.)	1,918,000	1·8	+4·8
Olives—special .	579,000	+2·6				
Mulberry leaves .	..	..	Metric tons	1,398	..	+33·2
Cocoons .	..	..	Kg.	43,500,000	..	+1·1

Fully one-third of the agricultural area (13,200,000 hectares) is under *forage crops*, three-fourths being natural pastures. As practically no land susceptible of economic cultivation is so used, this large area indicates the extent unsuited to other uses. The average production of forage, expressed in terms of hay, amounted in 1923–26 to 23·8 million metric tons.

As the latest *live stock* census was taken in 1918, when the major portion of the Venetian province was in enemy hands, we must go back to the 1908 census for complete data. An enquiry made in 1926, places the total number of cattle at 7·4 million, a 19% increase over the 1908 figures; sheep 12·3 million (106%); goats 3·1 million (14·1%); pigs 2·85 million (13·6%); horses 1·05 million (9·8%), and asses and mules 1,500,000 (49·2%). This estimate gives 26 head of cattle and 43·4 sheep per sq.km. of farm and forest land. The distribution of live stock is very uneven. The 1908 census shows 15·3 head of cattle per sq.km. of farm land in north, 3·5 in central, 2·6 in south Italy, and 2·2 in the islands. This points to one of the causes of the comparative agricultural poverty of the south, *i.e.*, the insufficiency of the live stock on the farm. Sheep and goats are more numerous south than north: 3·9 sheep per sq.km. in north, 12·9 in central, 14·8 in south Italy and 10·8 in the islands.

The *dairy industry* is of great economic importance with an output estimated in 1925 at some 250,000 metric tons of cheese and 50,000 of butter. Of the 50 odd varieties of Italian cheese, the best known are the hard *parmesan* and *pecorino* (the latter made from ewes' milk) and the soft *gorgonzola* and *bel paese*, in all of which a large export trade is done for an annual value approximating 450,000,000 lire.

Land Tenure.—*Farm land tenure* is of four main types: small freeholds, cash tenancy, crop sharing tenancy, and large estates. A small farm, whether freehold or leasehold, is defined by Italian economists as one affording steady work and a subsistence to the average sized farm family. When such crops as vines, citrus fruits or garden truck are raised, the area may be only a few "are" (0·025 acre), increasing to 10 or 20 hectares in districts where extensive farming prevails, and to as many as 30 in mountain districts where part of the land is uncultivated or wooded. In north Italy peasant proprietorship, now on the increase, is found mainly in the hill and mountain districts; in the south along the fertile and densely populated coast lands.

Cash tenancy is prevalent in the rich valley of the Po and in parts of Venetia, Emilia and Piedmont; but crop-sharing is the more prevalent and characteristic form of tenancy, leading to a highly diversified agriculture, the farm under this system being a self-supporting unit worked by the tenant and his family without hired labour. This form of farming is found in its most typical aspects in Tuscany, Umbria and the Marches.

Italian agriculture suffers from two opposite evils: the *latifundia* of the south, and the exceedingly small, one might say "pulverised" peasant ownership prevailing in mountain districts and in the south and Sardinia. The *latifundia* consist of undivided estates, varying from 200 to 1,000 hectares, cultivated in the time of the Romans by slave labour, and now by permanent labourers and their families hired by the bailiffs to whom the estates are farmed out by their absentee owners.

Agricultural Population.—The 1921 census classifies the *agricultural population* by families according to the occupation of their heads, as follows: operating owners, 1,392,642 (7,115,001 persons), being 162 per mil of total families composing the population; cash tenants 249,926 (1,592,295 persons) or 29 per mil; crop-sharing tenants 452,368 (3,096,447 persons) or 53 per mil; farm labourers, woodmen, shepherds, cattlemen, etc. 1,821,399 (8,293,983 persons) or 211 per mil. This represents a total of 3,916,325 families, consisting of 20,097,726 persons, or 455 per mil.

Prior to 1922 Italy had no distinct *agricultural policy*. In the north, agriculture made great progress during the fifty years of national unity, thanks to the energy and self-help of an enterprising population. Land reclamation in the Venetian provinces and in Romagna, a good network of roads and rails, irrigation, the spread of education and science all contributed to build up sound rural prosperity. In central Italy agriculture stagnated; some progress was made, but on the whole conditions were unsatisfactory. In the south the tariff war with France in the late '80s, the ravages of the phyloxera and the olive-fly,

aggravated by taxation too heavy for its feeble economic resources, led to widespread and severe depression, accompanied by poverty bordering on destitution among the peasantry. Towards 1885 emigration, mainly to North and South America, was resorted to, and was soon practised on a scale of alarming proportions. The first result was to aggravate the economic crisis by rendering labour scarce and relatively expensive, leading to the suspension of farming over considerable areas. But after an interval of years things began to right themselves. The remittances sent home by emigrants provided a steady influx of capital.

Land reclamation is another item on the programme. Since 1870 900,000 hectares have been drained, mostly in the Venetian provinces, of which approximately one-third since 1922. Much of the land is extremely fertile. Work is now going forward on another 600,000 ha. and plans, already approved, provide for a further 700,000. This will bring the total up to the 2,200,000 hectares requiring such treatment. Not only is provision made for draining these lands, but the work is completed by bringing them under cultivation, providing roads, farm-buildings and water supply, and, where necessary, irrigation. A law enacted in 1927 provides for the "integral" reclamation of all land susceptible of such treatment estimated at some 2,500,000 hectares.

Power.—The possession of water power has enabled Italy to take her place in the ranks of modern industrial countries. An official estimate published in 1919 placed the total hydraulic power of Italian watercourses at 5,000,000 h.p. under normal conditions, falling to 2,500,000 in exceptionally dry seasons. In 1918 Government concessions for watercourses with a potential of 1,500,000 h.p. had been granted. Since then Italy has acquired the mountainous province of the upper Adige with its many waterfalls, and much has been done to increase and control her hydraulic resources by building dams, reservoirs, and artificial lakes for storing the overflow of the rainy season, allowing of its utilization throughout the year. At the end of 1925, 800,000,000 c.m. of water could be thus stored, and dams and reservoirs were under construction to provide for the storage of a further 600,000,000.

The Italian Alps and pre-Alps cover an area of 32,000 sq.km. and it is estimated that, by utilizing all their available water, 2 kw. per sq.m. could be secured under favourable conditions, equivalent to 16 to 20 thousand million kw.h. of current, or as much power as could be obtained from 20,000,000 tons of coal. According to the same estimates, the Apennines could yield 5 to 6 thousand million kw.h. per annum to swell the potential total.

In Italy the development of the hydro-electric industry followed close on the discovery of the revolving magnetic field by Gallileo Ferraris and of the converter by Gaulard. In 1892–95 the important hydraulic power stations supplying electric current to Rome and Milan were erected, and a programme was soon under way for utilizing the watercourses of each hydrological basin. The need of co-ordinating the industrial requirements of each zone with available resources led to the growth of a complex high-tension system, supplying the needs of several consuming centres. Installed units grew rapidly: 86,000 kw. in 1898; 426,000 in 1908; 1,240,000 in 1918; 2,370,000 in 1926. At the beginning of 1928 the figure exceeded 2,600,000 kw., out of an estimated potential total of 6 million. About three-quarters of this installed power is derived from the Alps.

The consumption of electric power expressed in millions of kw.h. has grown as follows: 1908, 1,000; 1918, 4,111; 1923, 6,166; 1927, 8,887, of which about one-tenth for lighting.

The power system is based on the exchange of current between the several regions. The water supply in the north is most abundant during the summer months when the Alpine snows melt; in the central sections the winter rains swell the torrents of the Apennines. By developing long distance high-tension transmission, much has been done to compensate these ups and downs. At the end of 1925 over 45,000 km. of high-tension lines had been laid, besides the hundreds of thousands of kilometres required for local distribution. In 1927 over 1,600 km. of electric cable lines had a voltage exceeding 100,000 volts.

This magnificent power system has been built up by private enterprise with private capital. Under the Act of October 1919, concessions for the use of watercourses, over which the State claims preeminent domain, can be granted to companies for a fixed term of years, a subsidy of 80 lire per kw. installed being paid for a period of 15 years. When the concession lapses, the hydraulic plants revert to the State, which enjoys a right of pre-emption on the electric plants connected therewith.

Notwithstanding the remarkable development of hydraulic power, Italy's *coal* requirements have not fallen below the pre-war level; indeed, they tend to increase with the erection of new steam power-stations, the heavier railway traffic, the growing use of gas, and the general development of productive activities. There is considerable talk of utilizing on a larger scale national fuel resources, consisting mainly of lignite of low calorific content, but in 1927 they supplied barely one of the 15,000,000 tons of coal and kindred fuels consumed in that year. War and post-war conditions reduced imports from an average of 10,800,000 tons in 1913 to 5,600,000 in 1920; but from that year on they gradually recovered, and in 1927 exceeded 14,000,000 tons, of which Great Britain supplied 6,400,000 (as against 9,400,000 in 1913), while Germany's contribution rose to 5 million, including deliveries on reparation account and from the Saar.

The need for integrating hydraulic by steam-power stations is increasingly felt. In 1926, 200,000 tons of coal were used by such plants with a potential total of about 500,000 kw.; railway and tram services consumed 3,400,000 tons; steel foundries 1,500,000; gasometers 1,300,000 and shipping 1,000,000 to 1,500,000.

The following table shows Italian fuel consumption (coal, liquid fuels and electric power) expressed in terms of coal.

Year	Metric tons	Year	Metric tons
1872 . . .	1,132,544	1912 . . .	12,554,137
1882. . . .	2,327,600	1922 . . .	13,602,863
1892	4,120,201	1927 . . .	24,779,838
1902 . . .	5,726,760		

The use of fuel oils as a source of power is hindered by heavy customs and sales duties; nevertheless, the growing importance of motor traffic and the large tonnage fitted with oil engines has greatly raised consumption, and imports have risen from 250,000 tons in 1913 to nearly 1,000,000 in 1927.

Industrial Policy.—When Italy attained national unity her traditions were those of a trading rather than a manufacturing country, and her major economists, among them the great statesman, Count Cavour, were free traders. But her position as a debtor country, the dependence of the south on an impoverished agriculture, and the desire to foster infant industries, gradually led to the adoption of a moderately protectionist policy, embodied in the tariff of 1887. Changed conditions made it necessary to enact in 1921 a new tariff, amended in 1923.

Geographically, north Italy is the industrial section of the country, for although its splendid, intensive agriculture is by far its biggest industry, yet proximity to large export markets, the cheap electric power available for the past 20 years, and the more advanced social status of the population have led to an economy characterised by a fine balance between farming and manufactures. From central Italy downwards agriculture predominates, though special legislation enacted since 1896 has favoured industrial growth in Naples and its vicinity. In the past decade the metal, shipbuilding and textile trades of that section have developed rapidly, and a considerable growth of these activities may be expected in other southern sections as a result of the power which the great hydro-electric plants erected since the war in Calabria and elsewhere are making available.

Industries.—The industrial census taken in Oct. 1927, returns 728,150 industrial establishments occupying 3,965,501 persons. Although a very large aggregate of Italian production comes from small workshops and factories run by their owners, a bird's-eye view of industrial progress is afforded by the following data for joint-stock companies engaged in leading industries, showing growth in the past fifty years. To facilitate comparisons the capital investment is expressed in gold lire:

Capital Invested in Industrial Joint-stock Companies
(Millions of gold lire)

	1872	1882	1892	1902	1912	1922	1927
Textiles (including artificial silk)	15·7	18·6	124·7	171·6	490·0	928·4	1,431·5
Mining	32·5	37·1	47·2	73·2	178·3	349·8	564·7
Metals and engineering	11·7	22·9	52·3	141·0	709·5	1,794·4	1,769·7
Electrical	0·5	0·5	15·5	116·5	463·0	1,211·3	2,122·3
Chemical and rubber	14·5	24·0	48·6	107·4	290·8	649·0	824·4
Food industries	22·4	30·6	42·4	126·4	355·4	714·6	874·0

While the large proportion of small and medium sized concerns continues to be a characteristic feature of Italian industry, there is a growing tendency toward industrial concentration through amalgamations and mergers.

The largest investment is that in the hydro-electric industries: 504 million lire in 1913, 6,656 million paper lire in 1927. The 1927 census returns the number of works engaged in generating or distributing power, light and water at 5,913, in which 62,060 persons were occupied.

In 1913 the *mining industry* had an output valued at 191·5 million lire and employed some 120,000 workers, of whom 19,000 in the sulphur mines. American competition has since led to a severe crisis in the Italian sulphur industry, whose output fell from an average of 511,040 tons a year for the 10 year period 1900–09 to 167,339 tons in 1922, a crisis only partially remedied by a subsequent marketing agreement. The war greatly stimulated the output of Italian iron and fuel ores, but in 1919 depression set in, and notwithstanding the additional mines acquired in the annexed territories, output in 1922 fell far below pre-war levels in quantity and value. Since 1925 conditions have improved. The 1927 census returns 5,107 concerns engaged in mining and quarrying, employing 96,479 persons; the reduction in number as compared to 1913 is essentially due to the situation in the sulphur mines.

The importance of the Italian *metal industries* is limited. In this field Italy aims at becoming self-sufficient, but here her ambitions cease. Under the stimulus of war needs important modern plants were erected and productive capacity greatly enlarged. With peace came industrial deflation and keen depression, followed since 1923 by a moderate revival. At the end of 1927 the steel industry had a potential output of 1 million tons of pig iron and 2,500,000 tons of steel. The actual output of Italian steel-works in the 3 year period 1925–27 averaged 1·7 million tons, while imports averaged 0·9 million. The *iron and steel industries* consume an annual average of 1 million tons of ore, of which 754,000 tons are Italian; 2 million tons of coal; 1,500,000 tons of scrap of which 700,000 Italian; 480,000 tons of pig iron of which 380,000 Italian. Some 40,000 men are employed at an annual wage cost of 200 million lire. The fixed and circulating capital investment is estimated at 2,000 million lire. The high cost of coal and the limited market, unsuited to standardized mass production, account for high production costs.

Since the war Italy is smelting her *zinc ores*, formerly exported. The production of aluminium is another recent development; large new works have been erected for treating Italian bauxite, and others for obtaining alumina from the large volcanic leucite beds, and it is expected that Italy in the next few years will become independent of foreign supplies of aluminium.

The 1927 census returns 2,225 establishments employing 111,263 persons engaged in the metal industries.

The output of iron and steel, mercury and refined sulphur, 1876–1927, has been, in metric tons:—

Year	Pig iron	Iron and steel	Mercury	Refined sulphur
1876	18,599	94,080	93	116,041
1898	12,387	254,966	173	502,351
1911	302,931	1,001,181	955	414,161
1922	157,599	1,045,955	1,541	167,339
1927	596,100	1,530,600	1,999	305,500

After a period of war expansion, the engineering trade experienced a severe deflation crisis in 1922, potential production having greatly outstripped demand. The more important branches of the industry are *shipbuilding* with 220,000 tons of shipping in 1926 as against an average of 29,400 tons in 1909–13, or 64,900 including the tonnage built in the important yards then under Austrian rule and since annexed to Italy; *automobile construction*, with an annual output of some 60,000 cars in 1927 as against a pre-war 5 to 6 thousand; *railway rolling stock and locomotives* supplying all home needs and exporting a small margin. The manufacture of textile machinery has greatly developed since 1919 and is rendering Italy independent of foreign supplies. The trend is toward amalgamation and standardization, the goal in view being quality production. The 1927 census returns 80,277 engineering shops occupying 469,185 persons.

The Italian *chemical industries* grew up as a by-product of the farm: citrate of lime, citric acid, tartaric acid, essential oils, and tans being characteristic products, and the manufacture of fertilizers the main activity. Here again war needs acted as a stimulus, multiplying the manufacture of caustic alkalis and creating the dye industry. Since 1919 *artificial silk*, rightly grouped with the chemical industries, has leapt into prominence, and in 1926 Italy held the second place among producers of this important fibre. These industries are organized in three National Federations: (1) *Chemical trades*, approximately 1,000 firms, over 2,200 million lire capital, over 70,000 workers; (2) *fertilizers*, 55 firms, over 1,300 million lire capital, 10–15 thousand workers; (3) *artificial silk*, 16 firms, 2,000 million lire capital, over 30,000 workers. The 1927 census returns 5,175 establishments (exclusive of artificial silk) occupying 97,531 persons. Amalgamation and rationalization have increased efficiency. The growth of output is notable:

Year	Inorganic acids	Alkali	Explosives	Compressed gas	Hydrogen	Oxygen
	Met. tons	Met. tons	Met. tons	Cu. met.	Cu. met.	Cu. met.
1893	66,038	..	3,044	1	..	..
1901	244,988	2,500	2,920	183	10,849	5,601
1914	657,040	11,000	3,200	2,269	600,000	300,000
1920	481,810	46,390	1,882	2,230	917,150	1,334,300
1926	1,197,620	250,050	5,304	8,100	905,000	7,871,000

The *textile trades* are the most important branch of Italian industry, supplying about 80% of home requirements and leaving a large margin for export. *Silk*, of which Italy produces the raw material, ranks first. The raw silk industry is equipped with some 48,000 reeling basins, and 1,466,435 spindles, and has an annual average output (1924–25) of 5 million kg. of reeled and thrown silk, and 1·7 million kg. of spun silk. The output of the silk weaving industry is expanding; in 1926 there were 250 silk weaving mills with 22,000 power looms, employing 38,000 workers.

Cotton spinning and weaving has been carried on in all its branches for the past 50 years, the period of most rapid growth being that comprised within the years 1904–08. In 1926 the industry was equipped with 5 million spindles, 150,000 power looms, and 160 printing machines. The average output is estimated at 180,000 metric tons of yarn and 165,000 metric tons of cloth, valued around 6,000 million lire. Some 272,000 workers are employed in the mills which produce all qualities and descriptions of yarns and materials, the trend being toward higher counts and finer fabrics.

In 1926 the Italian *woollen and worsted* mills had 630 combing machines, 600,000 carding spindles, 20,500 power looms, the number having more than doubled since 1907. Some 60,000 workers are engaged in this industry, the output of which has greatly improved in quality during the last 15 years. It was valued in 1926 at 2,500 million lire.

The 1927 census returns for the textile industries, inclusive of artificial silk, show that they are carried on in 10,355 establishments employing 636,687 persons.

The *clothing industries* covering those engaged in the manu-

ture of hats, shoes, gloves, hosiery, ready made clothing, dressing, etc., employ nearly half a million people; 339,520 are ployed in the *food* industries, inclusive of the important canning preserving industry, working largely for the export market, large sugar refineries with an average output in 1923–25 of ,000 metric tons of sugar.

he importance of the *small and artistic* industries is evidenced he figure of 1,200,000 artisans, returned by the recent census n in connection with the professional organization of the san class under the guild law.

ransport and Communications.—The topography of the ian peninsula, cut off from Europe by the Alpine massif, travd from north to south by the Apennines, with no navigable rs, places great natural difficulties in the way of transport communications. These have been enhanced by the difference ealth and general progress between north and south, a differ- reflected in road and railway development.

oads.—The north is well supplied with roads while the eco- ic life of the south has been greatly hampered by their insuffi- cy. In 1926 Italy had 62,000 km. of main roads, of which 59 were national highways financed by the Government. An ortant road-building programme is now being put into effect ie southern provinces.

ailways.—Formidable natural difficulties had to be overcome rovide the country with an adequate railway system. Italian ay engineers had to tunnel great mountains; build railroads teep gradients very often in sharp zig-zag curves along ow ledges overhanging the sea and passing through an almost terrupted series of tunnels, as in the case of the Spezia- oa line. The eastern and western coasts, separated, as they by high mountain chains, had to be connected through a series nnels.

ie Italian railway system was built by private initiative and, the exception of 1,600 km., since 1860. In 1905 the main (13,422 km.) were nationalized, 3,053 km. remaining in hands of private companies. In 1925 the State and private ays had a total length of 23,042 km.; 52·8 km. per 100,000 bitants and 6·8 km. per 100 sq.km. In that year the State rail- carried 114 million passengers and 65·2 million metric tons ods, the traffic varying from a maximum of 8·8 million tons he Milan district to a minimum of 0·6 million for that of io Calabria. To intensify traffic between north and south offset the economic disadvantage to southern agriculture of ong haul, differential tariffs were introduced when the rail- were nationalized, the rate per km. being lower as the dis- traversed increases.

ectric traction is of special importance to Italy as offering cape from her dependence on foreign coal supplies. This was mized before the war and a beginning had been made. In , 689 km. had been electrified. In 1928 the length so run isen to 1,700 km. for the State and 1,005 km. for private rail- . The programme in hand provides for the electrification of ther 650 km. by 1930. Inter-urban electric tram lines are a important subsidiary service, running a total length of km.

otor Traffic.—The growth of motor traffic is retarded in Italy w *per capita* income, high cost of petrol, and heavy taxation otor cars. This is reflected in the comparatively small num- f motor vehicles in circulation: 104,449 automobiles, 16,767 notors in 1927. Nevertheless public automobile services play portant part in the transport of passengers and goods, con- ng up the more remote localities with railway stations and l centres. In 1926, 3,295 autobuses ran regularly along 61,847 of road, in the ratio of one for each 19 km. Practically all nportant roads are served by automobile lines, often running mpetition with electric trams and railway services.

ipping.—The possession of a strong merchant marine is a er of vital importance to a country with so long a sea-coast aly. Progress in this direction has been constant: in 1881 .W. tonnage 93,698 tons, in 1913 876,885 tons. Heavy losses red during the war and in 1919 tonnage had been reduced 1,822 tons. In that year Italy acquired the shipping belonging to the registers of the ports of Julian Venetia, building went on steadily, and in 1927 the net steam tonnage stood at 1,750,997 tons and net motor tonnage at 162,122 tons, mostly built in Italian yards. Regular services are run to all parts of the world, and the percentage of cargo entering and clearing Italian ports in Italian bottoms rose from 51·60 in 1913 to 67·78 in 1927.

Ports.—There are over 150 sea ports in Italy, of which 66 have an annual goods traffic exceeding 250,000 tons. At the close of the war a credit of 900 million lire, payable in 70 annual instalments, was voted for enlarging and improving the leading ports. By far the most important is Genoa, with a goods traffic of 7·7 million metric tons in 1927, followed at a distance by Trieste (2·5 million tons), Naples (2·3 million tons), Venice (2·5 million tons), Leghorn (2·2 million tons), Savona (1·4 million tons), and Palermo (0·8 million tons).

An average annual tonnage of 113·2 million tons entered and cleared Italian ports during the years 1911–13, and 31·0 million tons of goods were handled; for the period 1925–27 the figures stood respectively at 127·7 and 34·7 million tons. Free zones exist in the fourteen leading ports.

Inland navigation is of very limited importance. Since the war a canal system connecting the Lombard and Venetian provinces with the Port of Venice has been completed, known as the Victory Canal, and there is some local traffic on the Italian Lakes. In central and southern Italy such communications are practically non-extant.

Air Lines.—A beginning has been made with air transport. In April 1928 four regular air lines were open to the public: Rome–Venice–Vienna, Genoa–Rome–Naples–Palermo, Rome–Cagliari, and Brindisi–Vallona–Constantinople. Lines are being organized connecting Rome with Munich, Barcelona, and Bengasi, besides a daily Rome–Milan return service. Italian air lines carried 12,506 passengers in 1927.

Posts and telegraphs (including wireless) are Government services. So were the telephones until 1923 when, with the exception of international and a few inter-urban lines, they were leased to private companies. In 1922 there were 1,470 inter-urban telephone lines covering circuits of 73,426 km. In 1927 the number had risen to 2,720 and the length of the circuits to 121,273 km.; international lines rose from 20 to 58, and their length from 1,195 to 3,408 km. The number of urban lines rose from 439 to 757.

In 1927 the development of *broadcasting and radio telephony* was still in its infancy, but active measures were being taken under Government auspices to encourage its expansion through more general use.

The industrial census (1927) returns the total number of concerns engaged in transport and communications of all descriptions by land and sea (inclusive of Government services and State railways) at 106,897 employing 508,587 persons.

Fisheries.—The yield of the Italian fishing industry does not suffice to meet home requirements, as shown by the fact that Italy imports annually from 5 to 6 thousand tons of fresh, and some 70,000 tons of dried, smoked, and salted fish. Tunny fish is caught in considerable quantities off Sicily and sardine fisheries are of importance. Some sponges and coral are also obtained. But the waters of the Mediterranean and Adriatic are poor as compared to those of the North and other seas. Over 42,000 men are engaged in the fishing trades, carried on mostly as a small industry, though here again the trend, encouraged by the Government, is towards organization on modern industrial lines, not only of fishing but of the fish market.

Foreign Trade.—In the 50 odd years of Italian unity trade has steadily expanded as shown by the following figures, calculated for the sake of comparability on the basis of 1913 prices:

	Imports (millions of lire)	Exports (millions of lire)	Total trade (millions of lire)
Average 1871–73 . .	865·5	876·0	1,741·5
Average 1911–13 . .	3,578·9	2,370·9	5,949·8
Average 1924–26 . .	3,999·5	3,303·5	7,303·0

The percentage increase (average 1871–73=100) has been:

	Imports	Exports	Total trade
Average 1871–73 . .	100	100	100
Average 1911–13 . .	404	270	341
Average 1924–26 . .	462	377	419

Allowing for the increase of population (26·8 million in 1871–73; 40·4 million in 1924–26) per capita trade has increased as follows:

	Imports	Exports	Total trade
1871–73 Lire . . .	32	33	65
1911–13 „ . . .	100	68	168
1924–26 „ .	99	82	181

Agricultural and industrial expansion is evidenced by the changes in the percentages for the several categories of imports and exports:

	Percentage of total trade					
	Imports			Exports		
	1871–73	1911–13	1924–26	1871–73	1911–13	1924–26
Raw materials .	13·9	22·8	21·0	8·8	5·8	4·7
Semi-manufactured	8·9	11·3	11·6	13·3	9·5	9·8
Finished products	14·3	14·1	9·8	6·0	12·6	19·5
Foods and animals . .	12·5	12·0	12·3	22·3	11·9	11·3

While the percentage of food imports has not increased and that of food exports has declined, the figures indicate that, on the whole, home production of food has grown with the growth of population, and also that Italy has become an importer of raw materials and an exporter of manufactured goods.

The *per capita* difference between imports and exports in the three periods considered was as follows (excess of imports = +; excess of exports = −):

Class of goods	(Lire)		
	1871–73	1911–13	1924–26
Raw materials	+3·30	+29	+29·50
Semi-manufactured	−2·80	+ 2·90	+ 3·30
Finished products	+5·40	+ 2·50	−17·0
Foods and animals	−6·30	− 0·10	+ 1·90

The modified economic situation is reflected and confirmed by the percentage figures showing the participation of agriculture and manufactures:

Percentage of Exports Classified According to Their Nature

Class of goods	1871–73	1911–13	1924–26
Agricultural raw materials . . .	35·0	25·6	24·1
Do semi-manufactured	6·9	14·0	8·5
Manufactures obtained from agric. raw materials	42·3	27·2	24·8
Do from non-agric. raw materials. .	15·8	33·2	42·6
	100	100	100

The one class of goods for which exports exceed imports is that of textile fibres and their products, with a favourable balance of 2,268·5 million lire in 1926, and of 2,789·3 million in 1927. Raw and artificial silk yarns and cotton goods are big items in these totals.

The distribution of Italy's foreign trade between the several markets has also changed considerably. In 1871–73 five-sixths of her exports were sold on European markets, France absorbing over one-third of all Italian exports. In 1913 Germany had taken the place of France both for imports and exports. In 1925 the American continents took over one-fifth of total Italian exports, the share of Europe had fallen from five-sixths to less than two-thirds, 6·6% was sold to African countries, and a small percentage went to Australia. As regards imports, the United States has become the chief source of supply since 1915, far out-distancing any other country. In Europe the Italian import trade is distributed fairly equally between France, Germany and Great Britain. Imports from Argentina and India are increasing. The predominating position of the United States is largely due to the elimination of Russia as a leading grain exporting country. The difficulties met with in securing coal have led Italy to distribute her purchases of this commodity among several countries, instead of relying almost exclusively on Great Britain, as in pre-war days.

Italy has a second and very effective remedy in the increasing use of "white coal," through the rapid development of hydro-electric generation in her mountain streams.

Two items account for Italy's unfavourable trade balance, wheat and coal. In 1927 the trade deficit amounted to 4,753 million lire. In that year Italy imported 3,535 million lire of wheat, and 1,918 million lire of coal, apart from the quantities obtained on account of German reparations. Thus the cost of imported wheat and coal exceeded the total trade deficit by 700 million lire. Hydro-electric development and electric traction notwithstanding, coal imports are likely to increase rather than decline; the efforts to increase the yield of wheat will have achieved much if they avoid the need of expanding imports as population grows. The probabilities of increasing exports depend largely on the possibility of reducing costs by further rationalization of production and more especially by improved credit facilities and the better organization of the export market. To promote these ends the Government established in 1926 the National Export Institute, a semi-official body placed under the direction of eminent business men. Among other matters it is promoting the determination of official standards for staple exports and the grading of farm products sent abroad under a national export mark.

The Balance of International Payments.—Italy's trade balance showed an average annual deficit of 129·4 million lire for the ten year period 1875–84; of 344·9 million for the period 1885–95; of 227·3 million for 1895–1904; of 978·2 million from 1905–14; of 8,281·3 million paper lire for the 5 war years 1914–19; of 7,651·2 lire for the 8 year period 1920–27, inclusive of the huge trade deficit of 15,048 million lire of 1920. A comparison of the average deficit for the last three pre-war years 1911–13—L.1,208 million—with that for the three years 1924–26, reduced for purposes of comparison to 1913 values—L.696 million—shows however that the balance between imports and exports is now improving as compared to the situation prior to 1913. The large and ever growing trade deficit was met before the war by Italy's invisible exports. In 1910 her balance of international debits and credits was set forth by Bonaldo Stringher, Director of the Bank of Italy, in the following statement:

Italian balance of payments	Debits	Credits
	(millions of lire)	
Trade deficit	1,166	..
Deficit on ocean carriage of emigrants . .	15	..
Deficit on service of Govt. and industrial securities	68	..
Deficit on profits as between foreign establishments in Italy and Italian estab'ts abroad .	45	..
Net emigrant remittances	..	470
Net tourist expenditures	..	450
Surplus on postal settlements	..	200
Net gold exports	..	17
Ocean freights, railway receipts, banking commissions, Peter's pence etc.	..	157
Millions of lire	1,294	1,294

In 1913, according to calculations made by the *Credito Italiano* Bank, the balance of debits and credits closed for Italy with a surplus of 56 million lire, of which 50 million invested abroad.

A recent study (Pasquale Jannaccone, *La Bilancia del dare e dell'avere internazionale,* 1927) shows the following situation for the war years 1915–18:

Balance of payments	Debits	Credits
	(millions of lire)	
Trade deficit	30,000	..
Deficit on service of Govt. and industrial securities	1,000	..
Surplus on ocean freights	..	5,000
Emigrant remittances	..	2,500
Foreign charters	3,330	..
	34,330	7,500
Creation of foreign debt	..	23,330
Foreign credits on Italian banks	..	3,500
	34,500	34,500

is statement shows a big economic deficit, payments being bal-ced by the creation of a debt of 26,830 million lire.

In 1919 and 1920 the situation became yet more serious; the de deficit, according to the recently revised figures of the Cen-l Statistical Institute, amounted to 19,400 million lire, the t of foreign charters stood at 2,000 million, offset by barely ooo million for net receipts from ocean freights, emigrant re-ttances and tourist expenditure. The deficit was covered by ther creation of foreign debt and by the sale of Government urities abroad.

An improvement set in with 1921 as shown by the following ation for the 3 years 1922–24:

Balance of payments	Debits	Credits
	(millions of lire)	
Trade deficit	16,000	..
Ocean freight surplus	..	2,000
Emigrant remittances	..	7,400
Tourist expenditures	..	7,500
Deficit on profits and dividends paid abroad over those cashed in Italy	2,170	..
Peter's Pence and sundry receipts	..	1,200
	18,170	18,170
Foreign investments	1,145	..
Govt. and ind. securities repurchased from foreigners	650	..
Govt. loans placed abroad	..	47
Private indebtedness abroad and foreign lira credits	..	1,818
	19,965	19,965

is statement shows an economic balance, the trade deficit being vered by invisible exports.

As the above tables show, the decade 1915–24 closed with an nomic deficit of over 40,000 million lire, and the creation of a e amount of foreign debt, of which 30,000 million national and ooo million private indebtedness.

In 1925 and 1926 Italy once more closed her international bal-ce of debits and credits with an economic surplus, according to studies made by Prof. Borgatta and quoted by the Minister Finance, the trade deficit for those years being more than offset invisible exports. In 1926 a new asset item was provided by large loans secured by Italian business enterprises in the United tes and in Great Britain, amounting by the end of 1927 to ,756,904,639, at the stabilized rate of 19 lire to the dollar. As se loans have been made for productive purposes, more es-ially the further development of hydro-electric enterprises, y may fairly be considered as a source of wealth rather than a drain on national resources.

Banking and Credit.—The latest statistical data available for banks are those for 1926, which give 430 ordinary joint-stock, 530 co-operative, 307 private, 162 savings and 4,000 rural co-operative banks: a total of 5,429. Besides these there are the non-profit making public utility pledge banks and special institutions for agricultural and land credit.

The ordinary joint-stock banks fall into three classes: national, regional, and provincial or local. The growth of joint-stock banking is shown by the figures for the capital investment in such companies, expressed, for purposes of comparability, in gold lire:

Capital Invested in Joint-stock Banks

Millions of gold lire						
1872	1882	1892	1902	1912	1922	1927
738·9	478·7	450·3	341·6	719·7	1,408·6	1,728·1

On Dec. 31, 1914, there were 197 joint-stock banks with a capital of 800 million lire, on Dec. 31, 1927, 508 banks with 5,262·6 million lire (paper) capital.

The movement of leading items on balance sheets of a group of banks (about half the total) is given at the bottom of this page. Although the number considered differs, the growth shown by the several items holds good as the increase in the number considered is approximately proportionate to the increase in the total number existing, which grew from 189 at the end of 1913 to 416 at the end of 1924.

These figures show growth, despite the progressive depreciation of the lira. Taking 100 as the index in 1913, capital and reserves stood at 444 in 1924, bank deposits at 747, cheques in circulation at 2,113; debts to correspondents at 1,657; cash balances and discounts at 1,076; brokers' loans and advances at 1,046 and securities at 912.

The recent rapid growth of banking activities is reflected in the following figures:

	Capital and reserves (millions of lire)		Deposits and current account (millions of lire)	
	1924	1926	1924	1926
Joint-stock banks (No. 367)	2,950·9	4,207·5	8,073·9	8,945·1
Co-operative banks (No. 432)	433·5	624·3	4,957·2	5,174·1
Savings banks (No. 137)	693·7	815·7	10,593·1	12,132·0

Prior to 1926 no special legislation regulated banking activities; since then, the consent of the Minister of Finance must be had for amalgamating existing banks and for opening new ones or branches thereof. National joint-stock banks must have a capital of not less than 50 million lire, regional banks of not less than 10 million, provincial banks of not less than 5 million. The ratio between capital and deposits and the maximum credit assignable to one customer is laid down, and joint-stock banks are placed under the supervision of the bank of issue. (*See* BANCA D'ITALIA.)

Co-operative Banking has played an important part in Italian agricultural and industrial development. The movement started in 1864, when Luigi Luzzatti was instrumental in organizing the first *Banca Popolare* (Peoples' Bank) on the lines of the German *Schultz Delitzsche* Banks, modified to meet Italian requirements by introducing the principle of limited liability. Besides supplying credit to small manufacturers and traders, the *Banche Popolari* make a special feature of short term agricultural credit. In 1924

Year	No. of banks	Capital and reserve	Deposits	Cheques	Debts to correspondents	Cash balances and discounts	Brokers' loans and advances	Securities
913	92	646·1	1,415·9	47·5	1,079·4	1,641·7	351·6	425·7
918	126	913·1	3,275·4	213·3	4,705·2	5,338·1	589·0	915·0
919	138	1,308·7	4,581·5	741·9	7,092·3	8,271·3	753·5	1,562·9
920	152	1,716·4	6,524·6	998·6	10,599·5	11,191·6	1,785·0	2,146·7
922	204	2,326·7	8,242·7	843·2	14,591·0	14,978·5	1,935·4	2,786·1
924	236	3,287·6	10,584·8	1,004·1	17,672·8	17,672·8	3,684·4	3,888·3

they numbered 827, with 495,000 members, and a share capital of L. 4,576,146, property valued at L. 218,665,000, deposits standing at 4,168,247,000 and discounts at L. 2,742,841,000.

Rural co-operative banks, introduced in 1883 mainly through the efforts of Senator Leone Wollemborg, on the pattern of the Raiffesen banks of Germany, provide personal credit for small farmers on the collective guarantee of all their members. They have played a valuable part in freeing the peasant farmer from usury. The latest available figures show an aggregate of 3,500, with deposits of over 1,000 million lire and outstanding loans for 700 million lire.

The following figures for the 10 Italian Clearing Houses reflect the growth of banking activity:

Year	Cheques, etc. cleared	Difference settled % of total cleared
	Million lire	
1910	58,064	7·7
1913	65,622	7·1
1926	1,297,535	3·5
1927	768,107	..

A series of laws enacted between 1897 and 1914 organized special regional *agricultural credit banks* to supply circulating capital and credit for farm improvements. The results secured were, however, inadequate. The total loans amounted in 1926 to 515·7 million lire. In 1927 the whole system was revised and unified. A National Consortium for farm improvement credit was formed with the participation of the State, the banks, social insurance funds, land credit, and similar institutes. An initial capital of 275 million lire was subscribed and the Consortium empowered to issue bonds up to ten times that amount against loans extinguishable by annuities in 30 years. Regional agricultural credit institutes were formed to provide circulating capital against a lien on growing crops, stocks and equipment. The capital mobilized for this form of credit amounts approximately to 2,000 million lire.

Land credit is provided by special departments of the leading savings banks and by the *Istituto Italiano di Credito Fondiario* in Rome. In 1926 their outstanding bonds amounted to 1,630 million lire, outstanding loans to 1,669·4 million, mortgage securities to 2,944 million.

The *Istituto Nazionale di Credito Edilizio* finances the building of dwelling houses for the working and middle classes.

The *Post Office Savings Banks,* established in 1875, collect the small savings of the working and lower middle classes. The deposits have grown steadily: 1,773·2 million lire in 1910; 1,971·8 million in 1915; 6,934·7 million in 1920; 10,056·0 million in 1927. These funds are deposited with the *Cassa Depositi e Prestiti,* which also holds security deposits made with the Courts, the capital held for civil service and other pensions, and similar funds, with which it makes loans to provinces, municipalities and consortiums for public works (roads, aqueducts, sanitation, school buildings, etc.) for an amount which, at the end of 1926, totalled 4,505 million lire out of total available funds amounting at the same date to 12,823·5 millions.

Monetary Régime.—When Italy became a united kingdom in 1859, the monetary system was on a gold basis, but in 1866 the needs of the war against Austria led to the issue of inconvertible paper money. Under the law of 1874 the monetary system was revised and the issue privilege confirmed for six of the banks formerly issuing notes for the several States amalgamated to form the new Kingdom. In 1881 a foreign loan of 100 million lire was placed with a view to repealing the inconvertible currency régime, but the times were not yet ripe for such a reform which was formal rather than effective, until a decree of 1889 brought theory into keeping with practice by recognizing the inconvertible nature of the note issue.

Yet in spite of this the lira maintained its gold parity within narrow limits until 1892, when the unfortunate Abyssinian war, coinciding with a banking crisis and economic depression, caused lira exchange to fall, averaging 27·94 to the pound sterling in 1894. From 1901 until 1914 the lira was again at par, the dollar quotation in that year averaging 5·28. With the World War, depreciation set in, checked by official pegging. At the end of 1919 the dollar was quoted at 8·70, but as soon as the market reacquired its freedom the quotation soared to an average of 21·12 in 1920. In July 1926 the bottom was touched, the dollar being quoted that month at an average of 30·53. The Government had recourse to resolute credit and currency deflation, the exchange market was strictly controlled, imports checked, foreign travel curtailed. The market reacted, and in June 1927 the dollar was quoted at 17·93, a gain of nearly 50%. The rapid upward trend, which was dislocating production and trade, was then checked by the Treasury, which had accumulated a large *masse de manoeuvre* of foreign valuta, and the lira remained stable around 18·20 to the dollar until the new legal parity was fixed at 19·46 in December 1927, and the currency once more placed on a gold or gold exchange basis. (*See* BANCA D'ITALIA.)

Prices.—The first decade of the 20th century witnessed in Italy as elsewhere a steady rise in the trend of commodity prices, consequent on the falling value of gold. The wholesale index number in 1910 had risen to 111·8 (100=average 1901–5). The two years 1911–2 witnessed a further rise (13·68%) accounted for by the abnormal conditions arising from Italy's war with Turkey; in 1914 prices had returned to the 1910 level. From then onwards war conditions and progressive currency depreciation demoralized the markets and prices soared, as shown by the following table:

	Average rate of dollar exchange	Bachi wholesale commodity price index	Official rate for gold	Gold price index	Purchasing power of lire
1913	5·28	100	100	100	100
1915	6·18	133	119·3	111	75·18
1916	6·57	200	126·8	157·6	50·00
1917	7·41	306	143·0	213·9	32·67
1918	7·85	409	151·5	269·9	24·44
1919	8·70	366	169·8	215·5	27·32
1920	21·12	624	408·1	152·9	16·02
1921	23·577	578	455·4	126·9	17·30
1922	21·10	562	409	137·4	17·79
1923	21·76	575	420·9	136·9	17·39
1924	23·00	585	444	131·7	17·07
1925	25·09	690	484·4	142·4	14·49
1926	25·72	708	500·71	140·7	14·12
1927	19·61	591	378·3	156·4	16·89

National Finance.—The first twelve years of Italian unity (1862–74) witnessed the administrative consolidation of the new Kingdom and the initial stages of its economic growth, entailing heavy capital outlay on railroads and other essential equipment. During this period the budget closed year after year with a gradually declining deficit until in 1875, as a result of parsimonious and able financial administration, it was balanced. During the next decade economic conditions improved and expenditure was met out of receipts until the financial year 1885–6 opened a new series of deficits, coinciding with acute economic depression. This difficult period closed in 1897–8 when the budget was once more balanced, followed by twelve years of slow but steady progress, notably assisted by the steady inflow of emigrant remittances which had become an important item of national income. The budget closed each year with a substantial surplus, the lira rose to par and stood even at a premium on gold, and in 1906 8,000 million lire of consolidated debt were converted from 4% to 3·75 and subsequently to 3·50% stock. The war declared in 1911 with Turkey for the acquisition of Italy's North African colony of Lybia, initiated a new series of deficits, which from 1914–5 onwards rose to dizzy heights; shown by the table on page 787.

In October 1922 when the Fascist Government came into power the deficit stood at the alarming figure of 15,760·4 million lire and the Treasury account was burdened with a debt of 42,129·6 million lire. It must however be noted that most of the enormous rise in expenditure and the huge figure for Treasury liabilities in

Budget Receipts and Expenditures

Year	Millions of lire		
	Revenue	Expenditure	Deficit
1913–14	2,523·7	2,687·6	−163·9
1914–15	2,560·0	5,359·4	−2,835·4
1919–20	15,207·5	23,093·4	−7,885·9
1921–22	19,700·6	35,461·0	−15,760·4

1921–22 did not represent transactions for that year, but arose from the need of making an accountancy settlement for past and residual war year liabilities, and consisted largely of "giro" items not entailing actual disbursements.

The remedy applied was simple and in keeping with the principles of classic finance: revenue was increased, mainly by extending income tax to farmers until then exempted, by keying up the administration, simplifying taxation, checking evasions, and at the same time reducing expenditure. The deficit was progressively reduced to 3,028·8 million lire in 1922–23 and to 418·4 million in 1923–24; 1924–25 closed with a surplus of 417·2 million lire, the first for 13 years. The mass of Treasury liabilities were revised, settled, and written off. The financial year 1925–26 closed with the conspicuous surplus of 2,268 million lire, of which however 1,800 million were invested in capital outlay to ensure economic reconstruction and national defence, leaving a net surplus of 468·8 million available for the reduction of debt. The National Accounts closed on 31st June 1927 as follows: Revenue L.21,449·8 million, Expenditure L.21,014·0 million, Surplus L.435·7 million.

National Debt.—In the 50 years preceding the World War Italy had incurred a growing national debt (1) to meet budgetary deficits, (2) to build railways and provide the country with other capital equipment, (3) to meet financial and banking difficulties by the issue of Government stock. In 1914 the national debt, funded and floating, stood at 15,766 million lire. War expenditure and post-war reconstruction was met by four internal loans and the issue of Treasury bills on an unprecedented scale, with the following results:

National Internal Debt (millions of lire)

	1914	1919	1922	1927
Funded debt	14,840	34,416	56,600	82,247
Floating debt	926	25,797	36,043	1,176
	15,766	60,213	92,643	86,423

As these figures show, the total debt has been reduced by 6,200 million lire since 1922 and the major portion of the dangerous floating debt retired or funded.

To finance her purchases of munitions and other provisions in the United States and Great Britain, Italy had recourse during the war to loans from those countries, which she funded at the end of 1925 in the amount of $2,042·3 million and £250 million respectively, payable in 62 annuities. Her liabilities under the agreements are met by an Autonomous Sinking Fund into which all payments from Germany in cash or kind under the Dawes plan on account of reparations are paid, and which provides the funds required for the annual instalments covering interest and capital amortization. The Government estimates that these reparation receipts suffice to cover its war debt liabilities, and has repeatedly stated, both in and out of Parliament, that no further demand can be made of the Italian taxpayer on this account beyond the integral transfer of all reparation receipts to its two allied creditors.

Apart from these war-debts, the service of which is not a budget liability, the only foreign debt is the 100 million dollar loan obtained in 1925 from Morgan and Company, the proceeds of which were used to refund part of the Treasury debt to the Bank of Italy as a preliminary step toward currency stabilization.

In comparing pre- and post-war figures the progressive depreciation of the lira must, of course, be borne in mind, but if this reduces the gold value of the deficits and the debt, it must also be remembered that the depreciation itself represents the heaviest toll which the war has taken of the nation's accumulated wealth.

Taxation.—As the figures show, the revenue collected in 1926–27 was nearly ten times that of 1913–14, and had approximately twice its gold value. Approximately another 6,000 million lire are levied annually by local government bodies. This places a very heavy burden of taxation on the nation, heavier, in proportion to income, than that of any other country, and equivalent to 20% of total estimated private income, as compared to 13·5% thus levied in 1913–14.

The ratio in which the several sources of revenue contributed to the total in 1926–27 is as follows:

Income from national property (State railways, etc.)	2·38%
Direct taxation	27·49%
Stamp and registration duties on business	16·87%
Tax on note currency and transports	1·09%
Stamp duty on consumption	0 64%
Excise and Customs	25·99%
Surtax on income for war cripples	0·17%
State monopolies	20·60%
Sundry	4·77%
	100·00%

In response to popular demand a capital levy was enacted in 1919 on fortunes exceeding 50,000 lire at rates ranging from 4·5 to 50 per cent. In practice this amounts to a tax on wealth levied over a period of 30 years. Another law of the same period taxed war super-profits at the rate of 100%, a demagogic measure which caused a maximum of trouble to industry, hindering its transition from a war to a peace basis, while yielding a minimum of benefit to the Treasury.

Since 1923 the Government has repealed the innumerable taxes enacted during the war period and simplified the whole fiscal system. Recognizing the need of encouraging the accumulation of wealth in a country which suffers from scarcity of capital, all death duties have been repealed on property transmitted within the family circle up to the third degree of kinship; proportionate rates have replaced progressive in income and other taxes, and the rates themselves are being gradually lowered. A sur-tax on total income, and a tax on bachelors (this last to finance the cost of benevolent legislation in favour of mothers and children) are the two new taxes imposed; wheat growing has been encouraged by the re-enactment of an import duty on wheat and flour.

An effort has been made to reform local taxation by attributing a percentage of certain Government taxes to the provinces and municipalities and curtailing their right to levy rates. Strict control of local government expenditure by the central authority which appoints the Podestàs and the town secretaries who have taken the place of the elected mayors and councils is a feature of the programme for placing local finance on a sound basis.

Social and Industrial Conditions. *Wages.*—Taking the wage paid in 1914 as 100, the index number in July 1925, a typical post-war year, showed the following increases for leading occupations, reflecting the general wage movement both in industry and in agriculture:

Occupation	Hourly wage		
	Paper lire	Gold	Real wage
Cotton spinning—women	750	150	136
Cotton weaving—women	1,029	206	187
Masons	785	157	142
Navvies	877	175	135
Skilled engineers	765	153	139

The average wage paid in May 1925 for a normal eight hour day in the following trades was:

Average wage in leading occupations	L.
Woolen manufactures	16·22
Cotton manufactures	13·85
Silk weaving	14·68
Artificial silk mills	14·79
Steel works	25·92
Ship yards	20·50
Engineering trades	22·29
Electrical trades	23·19

The aforegoing wages represent the average for each of the trades mentioned.

In most of the leading Italian industries the pay of the worker generally consists of a basic wage, corresponding to an average normal level of production, plus a premium for output in excess of this normal; in the period of currency fluctuations it became customary to add to the wage a high cost of living bonus fluctuating with the cost of living index. This index fell considerably in 1927 and toward the close of that year a 20% wage reduction covering this bonus was effected in almost all occupations.

Under recent legislation wages are regulated by collective agreements valid at law for all workers engaged in a given occupation. (*See* FASCISM, ECONOMICS OF.)

It is estimated that the cost of labour represents from 15% to 20% of total production costs in Italian manufacturing industries.

compulsory as from 1928. These various forms of insurance are on a contributory basis, integrated by Treasury endowments, and are administered by the Social Insurances Fund which in 1926 held on this account 3,565 million lire. A further extension of the system to cover general sickness and other risks is under consideration. (*See* FASCISM, ECONOMICS OF.)

The cost of social insurance to industry has grown steadily since the war: figures available for 1926 place it at L.841,437,079, of which 58% for old age, invalidity and unemployment insurance, 26% for industrial accident insurance (met out of a separate fund), 3% for sickness insurance in the annexed provinces, 2% for accident insurance in agriculture, 0·4% for maternity benefits, and 8% for sundry special forms of insurance. In 1926 1,249,400 workers were insured with the Social Insurances Fund, and the average per capita cost to the nation was L.20·70.

Unemployed in Italian Industries, 1922–27

Industry	1922		1924		1925		1926		1927	
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
Agriculture and fishing	194,125	49,104	82,862	17,420	35,739	9,020	50,172	9,254	130,842	23,764
Mines and quarries	20,156	19,112	6,656	2,680	3,557	1,264	3,151	1,492	11,984	2,854
Manufacturing of agricultural raw materials	35,469	24,604	17,915	11,256	12,279	9,267	17,041	11,916	30,930	19,819
Metal industries	73,708	52,652	33,314	17,098	17,249	7,927	14,938	8,009	37,227	16,648
Textile industries	40,572	26,524	16,160	10,448	11,040	6,548	27,834	15,130	63,459	29,314
Construction, buildings, roads, etc.	173,180	76,410	74,926	22,850	39,533	11,645	39,704	11,168	125,167	36,657
Chemical industries	10,527	6,438	4,688	2,015	3,109	1,353	2,738	1,747	5,647	2,689
Salesmen and clerks	29,515	25,115	17,759	10,718	12,597	8,631	10,481	8,990	16,826	11,741
Public employees	9,701	6,384	5,835	3,503	4,502	3,010	5,553	2,371	5,587	3,245
Office personnel	16,536	16,031	18,594	15,658	15,397	11,375	8,094	7,457	11,121	7,692
Not specified	3,835	1,363	2,056	1,944	2,171	1,657	2,424	1,507	3,657	2,080
Total—all industries	606,819	304,242	280,765	115,590	156,659	72,211	181,493	79,678	414,283	214,603

The number of unemployed in Italy declined from the high point of 1922 to a minimum in the summer season of 1925, but increased again to a high level in the winter of 1927. Detailed figures for the different branches of industry are given in the above table:—

Labour Legislation.—Immediately after the war the eight hour day was adopted by agreement in almost all occupations. In 1923 the normal working hours were fixed by law at 8 per day or 48 per week, subject to exceptions for seasonal industries, and overtime was regulated. In 1924 Italy ratified the Washington 8 hour Convention under the proviso that it would come into force only when ratified by Germany, Great Britain, France, Switzerland, and Belgium. Since 1907 the worker is entitled by law to a weekly rest of 24 hours.

Italy has ratified the Washington Convention on night work for women and children; the employment of women before and after childbirth is regulated by law. Children under 12 may not be employed in industry, and between the ages of 12 and 15 employment is conditional on a 6th grade (lower in country districts) school certificate, and on a medical certificate of fitness for the proposed occupation. In heavy or dangerous occupations, specified in the act, the age of admission is higher.

In 1927 the several municipal regulations in force regarding hygienic and other conditions in factories and workshops were replaced by a general law requiring *inter alia* the provision, in large works, of baths, refectories, rest rooms, rooms where mothers can nurse their infants at fixed intervals, and, when conditions require it, temporary or permanent dormitories, all of which must come up to specified standards.

Social Insurances.—Since 1894 a law makes the employer responsible for accidents befalling his workers in connection with their occupation, for which they are entitled to compensation. In 1898 provision for voluntary old age and invalidity insurance was enacted for industrial workers, in 1919 it was made compulsory and extended to unemployment and maternity. General sickness insurance is at present limited to the provinces acquired from Austria under the Peace Treaties, where it was already in force. In 1927 insurance of workers against tuberculosis was made

Relief Work.—From the early middle ages onwards a very great number of charitable works have been founded in Italy to relieve the poor, the sick, the aged, orphans, foundlings, deficients, etc., and vast wealth has been assigned for these purposes, placed almost exclusively under the auspices or the direct administration of the Roman Catholic Church. The unification of Italy in 1859 was followed by legislation to regulate these charitable foundations, which by the laws of 1862 and 1890, subsequently amended and codified in the law of 1927, are placed under municipal Boards of Charity (*Congregazioni di Carità*) now consisting of members appointed by the Podestà and of representatives nominated by the registered occupational unions or syndicates. (*See* FASCISM, ECONOMICS OF.) The whole system is placed under the supervision of a special division of the Ministry of the Interior whose budget in 1926–27 carried an item of 45 million lire for integrating the cost of relief work. In 1927 there were in Italy approximately 30,000 legally recognized charitable institutions, owning some 3,000 million lire worth of property, engaged in the care of the sick (hospitals, convalescent homes, sea-bathing sanitoriums, etc.), the aged, the infirm, physical or moral defectives, orphans and foundlings. The indigent sick are entitled to hospital care, the cost of their maintenance being refunded to the hospitals by the municipalities to which they belong. Besides this, the care of the sick and necessitous poor is provided for by doctors, midwives, and district nurses paid by the Ministry of the Interior.

Under a law of 1927 all the institutions for the relief and protection of mothers and children have been grouped under a special official *Work for the Relief of Maternity and Childhood.* Acting directly or through its subsidiary organs, it provides for destitute or deserted mothers, extends help to infants and children under 5 years of age belonging to needy families, cares for physically or mentally defective children, and materially or morally neglected or delinquent minors who are placed under its guardianship until the age of 18. It is financed by endowments, donations, Government grants (30 million lire in 1928–29), and the proceeds of the tax on bachelors.

Three other incorporated *Works* care, one for war invalids, another for war orphans, the third for children orphaned by

earthquakes.

Recent legislation in the field of relief and welfare work aims at securing through Government control the co-ordination of all charitable efforts so as to avoid duplication and overlapping, and to ensure efficient and economic administration, while respecting the fundamentally voluntary character which has always been the distinguishing trait of Italian charitable works.

Housing and Sanitation. *Housing.*—With the exception of Naples, there was no housing problem in Italy prior to 1900. It arose with the rise of industrialism. Legislation enacted in the period 1902–08 encouraged the erection of inexpensive dwellings for the working classes and for civil servants by the grant of tax exemptions to co-operative building and loan associations. In 1908 this legislation was codified, and a notable impulse given to the housing movement by the establishment of a central housing commission and the foundation of the *Istituto Case Popolari* and the *Co-operative Institute for Houses for Civil Servants*. The erection of houses for railway servants was encouraged and financed by the Government. To meet the grave housing crisis following the war a 25 year exemption from house tax was granted to new buildings and generous credit facilities were supplied by State subsidized banks, more especially to co-operative building associations—often co-operative only in name. The results obtained were inadequate and often unsatisfactory. Since 1923 a new trend has been given to the effort. Tax exemption had been extended to small apartments so as to encourage private enterprise to meet the demand for houses; special credit facilities are afforded to the *Institute for Houses for Civil Servants*, and to the *Istituto Case Popolari*, both of which sell the apartments they build on the hire-purchase system to their inmates. At the end of 1927 the housing crisis was not solved but its intensity was greatly diminished.

Sanitation.—National health services are placed under the General Direction of Public Health of the Ministry of the Interior, which enforces pure food laws, compulsory vaccination and compulsory notification of infectious disease. Provision is made for organized effort for the prevention of malaria by land and agricultural reclamation, the destruction of mosquitoes and the free distribution of quinine to workers in malarious districts. Deaths from this scourge still average some 4,000 a year, and whole populations, more especially in Sardinia, Latium and southern Italy, are enfeebled by it. The anti-malaria campaign is entrusted to the Red Cross Association. The table which follows shows the prevalence of the more common infectious diseases during the period 1922–1927, inclusive:

Houses Quarantined for Infectious Diseases

Disease	1922	1923	1924	1925	1926
Measles	46,471	75,024	98,279	164,484	98,158
Scarlet fever	11,965	13,418	18,871	16,733	16,062
Typhoid fever	25,316	27,626	28,074	24,264	35,649
Typhus fever	..	1	3	..	34
Diphtheria and croup	11,347	11,138	15,883	15,383	14,923
Smallpox	534	495	432	195	112
Puerperal fever	1,551	1,820	2,141	2,110	1,678
Malaria	234,656	188,937	250,911	283,109	220,602
Pellagra	303	495	432	195	112
Rabies	5,546	8,012	8,554	9,578	8,727
Malignant blisters	2,029	2,205	2,728	2,383	1,753

The prevention and treatment of venereal diseases has been intensified. A special, nation-wide anti-tuberculosis campaign has been started, working through provincial associations regulated by an act of 1927. Through them, all the efforts in this direction are co-ordinated, and special dispensaries, sea and mountain sanitoriums, hospital accommodation, and open-air schools for predisposed children are provided. The funds hitherto assigned are proving inadequate and means to enlarge them are being studied, in connection also with the compulsory insurance of industrial workers against tuberculosis recently enacted. In 1926–27 laws were enacted providing a special institute for cancer research work and the study of radiotherapeutics. The manufacture and sale of narcotics is strictly regulated. A law of 1927 provides for the opening of municipal and provincial hygiene laboratories for research work in hygiene.

A great and sustained effort has been made to provide all parts of the country with adequate *drainage and water services*. The greatest feat of hydraulic engineering accomplished in this direction in Italy and one of the greatest in the world is the building of the Apulian aqueduct which carries water from the western slopes of the Apennines, above Naples, over and through that mountain chain, to the waterless Apulian provinces. The work of building the 1,600 km. of the main aqueduct was begun in 1906 and completed in 1915. From this main line the water is conveyed to 250 municipalities, previously without water supply. The work is rapidly approaching completion. Minor though important aqueducts have been or are now being built in a great many parts of the south and on the islands, notably in the rich and prosperous island of Sardinia.

Savings.—Scarcity of accumulated capital is a characteristic of the Italian economic situation. This is due not to lack of thrift but to the comparative poverty of the nation, operating in all its categories and classes on a very small margin of profit. The war drew very heavily on Italian reserves, and the depreciation of the lira, now stabilized, after many vicissitudes, at approximately one quarter of its pre-war parity, drained national savings. Yet notwithstanding all these adverse circumstances, aggravated by industrial depression, savings now exceed the pre-war figures:

Savings deposits

	1913	1927	Index No. (1913 = 100)
	(Millions of lire)		
Post office	2,091·2	10,056·0	481·68
Savings banks	2,727·2	13,906·5	509·92
The 5 leading banks	584·8	3,390·5	579·8
Peoples' banks	144·5	973·8	673·9
Regional banks	516·0	4,024·6	779·9

In 1925 interest bearing postal bonds were issued; at the end of 1927 they represented a saving of 384·8 million lire.

Insurance in its several branches is a form of saving expanding rapidly of late years, the participation of Italian companies in the total rising from 58% in 1912 to over 90% in 1924, due partly to the acquisition of the important insurance companies of Trieste, and partly to the growth of the State Life Insurance Institute which in 1924 accounted for 22% of all the premiums issued. The latest available figures for the whole of the insurance movement are those for 1924.

Premiums Collected by Insurance Companies

	1903	1912	1924
	(Millions of lire)		
Italian companies:			
Life	16·1	29·8	277·8
Other risks	44·2	86·2	544·8
Total	60·3	116·0	822·6
Foreign companies:			
Life	26·5	41·7	2·6
Other risks	25·8	42·8	81·0
Total	52·3	84·5	83·6
Grand total	112·6	200·3	906·2

That insurance is becoming more and more popular in Italy is shown by the fact that in 1924 the State Life Insurance Institute collected 193·8 million lire in premiums, and 338·1 million in 1926.

In 1926 the Social Insurances Fund collected 479·1 million lire in premiums on account of compulsory insurance against invalidity, old age, and unemployment; the National Accident Insurance Fund held 130·5 million at the same date.

The funds held by the State Life Insurance Institute, the Social Insurances and the Accident Insurance Funds are loaned under law for financing works of public utility and land and agricultural credit.

(O. R. A.)

DEFENCE

The defence of Italy will be treated in three sections: Military, Naval and Air Force, in accordance with the several branches of the defensive services concerned.

MILITARY

In her 2,000 years of history, Italy can boast of a proud military tradition, which endured even when the country was divided and occupied by the foreign invader. At the fall of the Roman Empire, Italy was overrun and devastated for a long period by invading barbarians, but towards the end of the 11th and the beginning of the 12th century, an effort was made, in the cities, against feudalism, militia being formed in each town and armed for the defence of their independence. It was the militia who defeated the German legions of the Emperor Frederick Barbarossa at Legnano in 1176, and it was the Communal Militia of the City of Siena who fought and won a brilliant victory over the troops of the Florentine Guelphs.

The Communes, later, were turned into principalities in whose service arose the "Compagnie di Ventura" some of which soon became famous, among which the most famous is that of St. George, founded by Alberico da Barbiano in the 14th century from which emanated such noted leaders as Uguccione della Fagiola, Braccio da Montone, il Gatamelata; Muzio Attendolo Sforza, Count di Carmagnola and above all Bartolomeo Colleoni. Amongst the various Princes only the head of the house of Savoy, then ruling over Piedmont, formed and personally commanded his army. The Duke Emanuel Filibert was the founder in 1560. Other notable commanders, unable to find a field for their activities in Italy, gave their services to the great powers, then waging war in Europe, and amongst these warriors we find the names of Giovanni dalle Bande Nere, Alessandro Farnese and Ambrogio Spinola in the service of Spain, Raimondo Montecucculi and Prince Eugene of Savoy in the service of Austria.

At the outbreak of the French Revolution, the only national army in existence in Italy was that of Piedmont, and later when Napoleon constituted the Cisalpine Republic, Lahor, his lieutenant, formed a nucleus of Italian troops, who in 1797 defeated the Pontifical army. In 1804 an army commanded by General Lechi was formed, composed solely of Italians; this legion together with the troops of the kingdom of Naples took part in nearly all the Napoleonic campaigns. In 1812 it was the legions of Lechi and Pino which saved the great army from disaster, by overpowering the Russians at Malojaroslavetz on Oct. 24.

Later the idea of Independence caused the initiation of the wars against Austria (1848–49) and attempts at liberation were made by such volunteers as Garibaldi, Manara, Dandolo, Morosini and Bixio. In 1855–56 Piedmont took part in the Crimean War and in 1859, with sturdy help from France, Lombardy was liberated from the Austrians. In 1860–61 Garibaldi with his legendary 1,000 men, crushed the Bourbons in Sicily and Naples, and the Piedmont army wrested the provinces of Marche and Umbria from the Pontifical States. In 1866 the third War of Independence, although meeting with disaster at first, led to the annexation of Venice and in 1870 the kingdom of Italy was formed with Rome as its capital.

The modern army began with the reunion of the Sardinian and Neapolitan forces, with which in the campaign of 1859–60 the contingents of Lombardy, Tuscany, Emilia, Garibaldi and the survivors of the Bourbon army joined forces. In 1880 Italy started her colonial policy with the conquest of Eritrea, where the scanty preparations and the inferiority of the numbers of her troops, resulted in the unfortunate, but nevertheless valourous battles of Dogali, Amba Alagi, and Adua. Very soon after Somaliland was conquered, and in 1911 the expedition of Tripoli and Cirenaica terminated with the victory at Sid Bilal on September 20, 1912 which persuaded the Turks to make peace. On May 24, 1915 Italy entered the European conflict on the side of the Allies. Her army fought for 42 months under extremely difficult conditions on the arid stones of the Carso, and amid the glaciers of the Cadore and Adamello, gaining numerous successes, amongst them the conquest of Gorizia.

In October 1917 a vast Austro-German offensive resulted in a breach of the Italian front at Caporetto (*q.v.*), and in consequence the whole of the Italian army had to fall back on to the line of the Piave where all further attacks were successfully resisted and repulsed. On this line took place the abortive Austrian offensive of June 1918 and subsequently the final decisive victory of the Italians at Vittorio Veneto. Italian troops cooperated with those of the Allies in Albania, Macedonia, France, Palestine, Murmansk, Serbia and Siberia. In the last few years the army has engaged in small but important colonial operations in Somaliland, in Lybia and in Cirenaica for the dispersion of rebels.

Organization.—The organization of the Italian army to-day is based on the following lines:—(1) To ensure, in time of peace, a force sufficiently large to guarantee the safety of the country against sudden aggression. (2) To dispose of a number of large units, which will constitute on their completion to full strength, a force large enough for the necessity of the first period of the war. (3) To train a certain number of recruits every year in order to constitute a reserve force sufficient to complete the actual units, and form new units in time of war.

The Army is divided into:—(a) Permanent Army and (b) Reserve force. The high military authorities are:—1 Ministry of War, 1 Army Council, 4 Army Commands (Chiefs of which take over commands only in time of war).

The Ministry of War is composed of:—The Minister of the Cabinet, the Command of the General Staff, various general directorates and inspectors of the various units.

The Cabinet co-ordinates the work of all the various branches of the Ministry. The Command of the General Staff has the care of all technical questions for the preparation for war. It is composed of:—The Chief of the General Staff, Assistant-Chief of the General Staff, 1 Major General, various officers. The Army Council exists solely for consultative purposes to advise the Minister on military questions of great importance.

The composition of the various corps is: *Infantry Regiments:*—87 Infantry of the Line, 3 Grenadier, 12 Bersaglieri Cyclists, 9 Alpine, 1 Tank. *Cavalry Regiments:*—12 Cavalry. *Artillery Regiments:*—30 Field Artillery, 3 Mountain Artillery (Pack Artillery), 1 Horse Artillery, 12 Heavy Field Artillery, 5 Heavy Artillery, 3 Regiments and 1 group Coast Artillery, 12 Units Anti-aircraft Artillery, Direction and Artillery Works. *Engineer Regiments:*—12 Engineer, 1 Bridging, 1 Railway Engineers, 2 Wireless Telegraphists, Fortification Bureau and Engineer Works.

Artillery Service:—12 Directions of Artillery, 3 Arsenals, 1 Small Arms factory, 1 pyrotechnic factory, 1 fuse factory, 1 powder factory, 1 optical research laboratory, 1 range table office, 2 centres for artillery practice.

Engineer Service:—13 fortification offices (with various numbers of offices detached); 1 Construction Works of Military Engineering; 1 Centre for studies for sappers, miners, teleferists, bridging engineer; 1 Centre for Railway studies; 1 Centre for Telegraphists and Wireless Telegraphists and Telephonists; 1 Centre for Aerostatics; 1 Military Institute of Wireless Telegraphy and Electrotechnics; 1 Wireless and Electrotechnic Works; 34 fixed Military Pigeon Houses.

Medical Corps Services:—12 principal Military Hospitals; 12 secondary Military Hospitals; 8 Garrison Infirmaries; 1 Military Chemist Institute; 2 Bathing Establishments; 1 Military Climatic Camp; 1 Military Chemical Bromatological Laboratory; 1 Medical Stores.

Military Commissariat Service:—4 Central Stores for Clothing and Equipment; 1 Factory for Clothing and Equipment; 2 establishments for the preparation of preserved foodstuffs; a large number of bakeries, mills, etc.

Recruiting and Distribution.—The recruiting regulations in existence are the "Testo Unico delle leggi sul Reclutamento del R°Esercito" approved by Royal decree N° 1437 August 5, 1927.

Compulsory service is the rule for all citizens with the following exceptions:—(1) Those who have not full Italian citizenship, (2) Subjects of the Dodecanese Isles, (3) Natives of the Colonies. Those who have been condemned to imprisonment for cer-

Estimates of the War Ministry for the Financial Years 1913–14, 1926–27, 1927–28, 1928–29

Expenditure	1913–14	1926–27	1927–28	1928–29
Ordinary expenditure:				
General expenses	3,843,700	12,820,000	14,545,300	15,285,300
Life debt	39,049,000	161,937,500	165,450,000	180,350,000
Army	279,494,377	1,750,841,000	1,758,436,000	1,735,495,000
Royal carabineers	29,566,230	462,142,800	460,300,000	438,530,000
Funds at the disposal of the War Ministry	3,616,500	33,288,400	34,000,000	34,000,000
Total ordinary expenditure	355,569,807	2,421,000,000	2,432,731,300	2,403,660,300
Extraordinary expenditure:				
General expenses	216,500	110,665,000	113,100,000	40,640,000
Army	3,6523,900	200,000,000	200,000,000	190,000,000
Expenses depending on the war	22,877,628	4,500,000	3,800,000	2,000,000
Expenses for building for various military uses	380,000	30,027,746	25,027,745	12,027,745
Various expenses	..	..	..	4,300,000
Movement of capital	28,720,000	2,400,000	2,400,000	3,000,000
Appropriation in aid	8,091,542	..	..	..
Total extraordinary expenses	96,809,570	347,592,746	344,327,745	251,967,745
Total expenses	452,379,377	2,768,592,746	2,777,059,045	2,655,628,045

tain crimes are also excluded from military service.

The periods for active service are:—ordinary (18 months), reduced (not less than 6 months), minimum (3 months). The reduced and minimum periods are applied for certain family reasons or for special services rendered to the country by some member of the family. Those who live abroad are exempted temporarily or definitely, as well as Catholic missionaries and parish priests.

Service is sometimes delayed for students, and for those who have a brother already serving. The period of conscription for the ranks is from 21 to 39 years of age. The number of young men to be incorporated every year in the various corps is fixed by the War Ministry. The recruiting system used is regional for the Alpine troops, national for certain specialities (Railways, Aerostatics, Armoured cars and Chemical Services), mixed but almost regional for all the other troops. Mobilisation is almost entirely regional with few exceptions. With this system it is easier to unify the various and different elements of the regions of Italy, and at the same time to allow for a rapid mobilisation.

The whole of the state is subdivided in 13 Military Regions:—11 Regions of Territorial Army Corps Commands; 2 Insular Regions (Sicily and Sardinia). These are in their turn subdivided into 2 or 3 Divisional Zones (altogether 29 zones) comprising in their turn a certain number of Districts (altogether 105). The following organs of Command have no Territorial jurisdiction:—3 superior Commands of Cavalry; 30 Commands of Infantry Brigades; 3 Commands of Alpine Brigades.

Training Doctrine.—The tactical regulations tend to give great importance to the manoeuvres of infantry, and although the scheme recognizes the importance of mechanical means, the infantryman is still considered to be the most important element. The infantry platoon is the smallest unit and is composed of:—1 machine gun section, armed with 2 light machine guns, 3 sections of riflemen. To the rifles of the latter a "blunderbuss" grenade thrower is fixed, which has a capacity of throwing a grenade to a maximum range of 200 metres with a large angle of descent. It is prescribed that the infantry should advance till the minimum distance from the enemy is reached, usually 200 metres, when instead of rifle fire, the bomb is used. Reconnoissance is no longer left to the cavalry divisions, but is the rôle of swift moving units, composed of cavalry, cyclists, mechanised artillery, etc. Tactical direction is entrusted to the army corps commanders. The advance of the large units is made by successive bounds from one position to another.

In the attack, the action of the artillery must begin very early, and the artillery commanders must have a double system of *liaison*, that is, with their own superior commands and with those of the infantry commands, so that the centralisation and decentralisation of the artillery fire should be made possible. The infantry are taught to advance as far as they can without firing and if possible use only the rifle-grenades to overcome the last resistance of the enemy and to hurl themselves against the enemy lines.

In the defence a position is organized in 3 zones:—(1) outpost zone, (2) position of resistance zone, (3) deployment zone.

Land Frontier.—The land frontier from the Mar Ligure to the Carnaro along the Alps has a length of 1.600 km. of which 450 km. divides Italy from France, 592 from Switzerland, 333 from Austria and 225 from Jugoslavia. Everywhere difficult and rough mountainous ground is prevalent. The frontier line between Italy and France starts from Ponte S. Luigi (between Ventimiglia and Mentone) and follows the mountain crests till it reaches M. Dolent in the Mont Blanc Range. This part of the frontier is crossed by 3 railways (Frejus, Valle Roja, and Cornice) and 6 international roads. The Italo-Swiss frontier runs from M. Dolent to the Piz Lat (passo di Resia) but diverges from the mountain crests to form the big Swiss salient of the Canton Ticino, of a depth of nearly 100 km. (this part is inhabited by a population of Italian nationality) which comes down into the plain of Lombardy within a distance of 35 km. from Milan. The minor salients of Poschiavo and Val Monastero are also Swiss territory. This portion of the frontier is crossed by 3 railways (Sempione, Gottardo, Bernina) and 10 international roads.

The Italo-Austrian frontier runs from Piz Lat to Monte Forno, following the geographical confine between the 2 slopes of the Alps. The frontier line is crossed by 3 railways (Brennero, Dobbiaco and Tarvisio) and 5 international roads.

The Italo-Jugoslavian Frontier goes from Monte Forno to Fiume following the crests of the Alps. It is crossed by 4 railways (Tarvisio-Jesenice; Piedicolle; Postumia-Lubiana; Fiume-Sussak) and 11 international roads.

The whole frontier is a mountainous one, of great height, which explains why Italy must of a necessity keep an army specially trained and equipped for mountain warfare; and the greater importance given to infantry than to mechanised forces, can be readily understood. All the permanent fortifications existing on the frontiers are now obsolete and without any military value.

(A. G. C.)

NAVY

The Italian Navy is a comparatively modern creation. Its rapid growth may be traced from the efforts of the Mingetti Cabinet and more particularly of Admiral Saint-Bon and Signor Brin, who found the naval defences of Italy almost non-existent after the disaster of Lissa (*q.v.*). During his three years of office the admiral laid the foundation upon which Brin afterwards built up the new fleet.

Realising that she could not hope to rival France in numbers,

Statistics Showing the Efforts of the Italian Army and Results Gained During the European War 1915–18

(a) Mobilised Forces to 1918	5,182,000 (of which 114,000 appertained to the R. Navy)	
(b) Forces used in action		
To May 28, 1915	Officers	22,806
	Ranks	843,419
	Non-military	1,628
	Total	867,853
To January 1, 1916	Officers	33,326
	Ranks	980,889
	Non-military	3,858
	Total	1,018,073
To July 2, 1916	Officers	46,434
	Ranks	1,427,391
	Non-military	3,656
	Total	1,477,481
To January 7, 1917	Officers	53,975
	Ranks	1,694,513
	Non-military	4,616
	Total	1,753,104
To October 6, 1917	Officers	71,758
	Ranks	2,088,686
	Non-military	5,711
	Total	2,166,155
To January 5, 1918	Officers	66,359
	Ranks	1,827,835
	Non-military	3,357
	Total	1,897,551
To October 5, 1918	Officers	78,730
	Ranks	2,092,368
	Non-military	4,164
	Total	2,175,262
(c) Material		
Artillery	At the outbreak of War, pieces	2,121
	At the Armistice, pieces. (not including 614 pieces on the Territorial anti-aircraft artillery)	7,995
Machine guns	At the outbreak of War	618
	At the Armistice	19,934
Aeroplanes at the front	1915	58
	1918	1,055
Motor vehicles (including motor tractors and motor bicycles)	At the outbreak of War	5,000
	At the Armistice	37,100
(d) Losses	Dead	680,000
	Mutilated	452,000
	Wounded	1,100,000
(e) (Artillery and small arms captured from the Austro-Hungarian Army)	Artillery pieces of various calibre	4,066
	Rifles	490,000
	Machine guns	8,500

Italy devoted her engineering and constructive genius to the creation of individual warships of great strength; in fact, it may be said that she set the example of building monster ships armed with monster guns.

As early as 1901 two battleships had been laid down, carrying two 12 in. and twelve 8 in. guns. It is true that the first Italian "Dreadnought," the "Dante Alighieri," was not laid down until 1909, whereas the first all-12 in. British ship was on the stocks in 1905, but the celebrated Italian designer, Col. Cuniberti, had got out a contemporary design for a ship of twelve 12 in. as compared with the ten 12 in. of the British "Dreadnought."

In the period immediately prior to the World War Italy was pursuing a modest but methodical naval policy dictated primarily by the necessity for maintaining a fleet capable of meeting that of Austro-Hungary. The eyes of the Italian people and Government turned as naturally to a possible aggressor across the Adriatic as those of the English turned across the Channel in the days before the entente with France. When Italy came into the World War on May 22, 1915, the naval forces of these hostile neighbours were composed as follows:—

	Italy	Austro-Hungary
Battleships	23	20
Light cruisers and scouts	9	7
Torpedo boats	93	87
Submarines	21	7

It will be seen that Italy had an appreciable preponderance of strength in heavy ships, and this proved most valuable both to herself and her allies in neutralising any effective activities on the part of the main Austro-Hungarian fleet.

In the course of the War the Italian Navy lost five battleships, one scout, eight destroyers, six torpedo boats, eight submarines and 11 auxiliary vessels. It was responsible for the destruction of three Austrian battleships, two destroyers, two torpedo boats and eight submarines. Two of the Austrian battleships were sunk in harbour; one in a daring raid with motor launches under Capt. Rizzo Luigi and the second by Surgeon-captain Paulucci Raffaele, who swam into the port of Pola and fixed a mine to the hull of the Austrian flagship. The energies of the Italian Navy were also devoted to maintaining an anti-submarine barrage across the Otranto channel in conjunction with British naval forces, and in coastal operations. (*See* SUBMARINE CAMPAIGN.)

As a result of the Washington Conference (*q.v.*), Italy agreed to accept a ratio of two in capital ships as compared with five for Great Britain and the United States, three for Japan and two for France.

Since the War she, like France, has concentrated such resources as she can devote to her fleet on modernising her cruiser, destroyer and submarine forces, and on providing for her naval air needs.

In 1928 the Italian fleet was composed as follows:—

	Built	Building
Battleships	5	Nil
Coast defence ship	1	Nil
Cruisers	13	6
Aircraft carriers	1	Nil
Flotilla leaders	11	12
Destroyers	64	3
Torpedo boats	47	Nil
Submarines	45	18
Sloops (including four mine-layers)	24	Nil
Coastal motor boats	132	4
Gun boats and dispatch vessels	9	Nil
River gun boats	2	Nil
Mine sweepers	48	Nil

Of the cruisers "building," two are of 10,000 tons and four of 5,000. Two more 10,000 ton cruisers were projected at that date.

Administration.—The Italian Navy is administered by a Ministry of Marine consisting of the Department of the minister, the Directorates of naval personnel and naval duties, of civil personnel and general questions, of ordnance and armament supply and of naval construction, medical services, accountancy and of naval engineering and works. There is a chief and assistant chief of staff and the naval staff is divided into eight bureaux.

The board of admirals consists of a president, two ordinary members, ten extraordinary members (admirals and generals), a certain number of non-voting extraordinary members (directors of general and central services) and certain officers, not below the rank of captain, whom the minister of marine and the president of the board of admirals may desire to consult.

The Supreme council of the Navy consists of a president, four ordinary members, seven extraordinary members (five military and two civil), a certain number of non-voting extraordinary members (the director and the directors of general and central

services).

The principal naval commands are three in number:—

(1) Commander-in-chief of the upper Tyrrhenian naval department, headquarters at Spezia.

(2) Commander-in-chief of the lower Tyrrhenian naval department, headquarters at Naples.

(3) Commander-in-chief of the Ionian and Adriatic naval department, headquarters at Taranto.

Enlistment.—All Italian subjects are liable to military service and of those who are called up a certain number may be posted to the Royal Navy. These recruits are chosen from men of less than 1·60 metres in height. The higher ratings are engaged on a long service system. (E. A.)

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AIR FORCE

The air forces of Italy during the World War and until the end of 1922 were divided into a military air service under the Ministry of War and a naval air service under the Ministry of Marine. On the assumption of power by Signor Mussolini in October 1922 one of his earliest acts was to endeavour to lay the foundations of a strong and independent Air Force.

By Royal Decree No. 62 dated Jan. 24 1923, he created the Commissariato per l'Aeronautica or Air Department and charged it with the duty of drawing up an organization. The Air Department was placed under the control of the Under Secretary of State for Home Affairs with the title of Vice Commissioner for Aeronautics.

As a result of the Air Department's studies the Regia Aeronautica or Royal Italian Air Force was created by Royal Decree No. 645 dated March 28, 1923, and the main lines of its organization were laid down.

The Air Department was divided into two branches: (1) the Comando Generale or Military Branch, and (2) the Intendenza Generale or Civilian Branch, both of which were under the control of the Vice Commissioner for Aeronautics who was directly responsible to the High Commissioner for Air, Signor Mussolini himself. The Comando Generale was responsible for all the air units and flying schools, while the Intendenza Generale became responsible for the development of civil aviation, all questions of supply and technical services, pay and accounts, and initial flying training for the Regia Aeronautica. The marked division of control over the essential services of the military air force led to difficulties, however, and after 18 months the Intendenza Generale was dissolved and its sub-departments were placed directly under the control of the Vice Commissioner who thus found himself responsible for The Comando Generale, The Directorate of Air Engineering and Construction, The Directorate of Administration and Personnel, The Air Traffic Office. In April 1925 an Air Staff was created with a Chief of Staff at the Air Commissariat, and shortly after a decree laying down the definite organization and strength of the Regia Aeronautica and creating a system of territorial commands was issued. In August 1925 the name of the Air Commissariat was changed to Ministry for Aviation, a ministry analogous to the British Air Ministry, responsible for the direction of the Regia Aeronautica and for the furtherance and control of civil aviation.

It will be seen that under Mussolini's powerful direction the Italian Air Services previously languishing and disorganized have been revived in a manner which is little short of miraculous. Recent exploits by chosen pilots of whom the Marchese de Pinedo is *facile princeps* has shown how quickly and brilliantly the revival has been brought about. It can be said that the Regia Aeronautica holds premier place in the imagination and affection of the Italian public, and the appointment of General Balbo as Under Secretary of State for Air has provided during the past year a further spur to its activities and enthusiasm.

Organization.—The combatant branch (or Arma Aeronautica) of the Regia Aeronautica is divided into (a) The Independent Air Force (Armata Eerea), (b) The Army Air Service (Aeronautica per il Regio Esercito), (c) The Navy Air Service (Aeronautica per la Regia Marina) and (d) the Colonial Air Service (Aeronautica per le Regie Truppe Coloniali). It is proposed to aim at a total of 182 Squadrons, totalling 1,600 aircraft, and 6 airships, by 1931.

The duties of these four branches of the Regia Aeronautica may be briefly stated as follows: (a) The Independent Air Force is designated for offensive and defensive air action in war. (b) The Army Air Service is to provide air power for the various Army Commands. (c) The Navy Air Service is responsible for duties assigned to it by the various Naval Commands in peace and war. All airships are allotted to this branch. (d) The Colonial Air Service operates under orders issued by the Colonial Military authorities and is financed by the Ministry for Colonial Affairs. For the purposes of administration and organization Italy has been divided into Territorial Air Zones the Headquarters of which are situated at Milan, Bologna, Naples, Palermo and Cagliari.

The semi-rigid type of airship is used and 4 ships of varying sizes are now under construction or already in commission. A sum of approximately 650,000,000 lira was voted for the Regia Aeronautica during the year 1927–28. Approximate figures of personnel are: Officers (all categories) 1,500, Pilots (officers and other ranks) 1,200, other ranks (not pilots) 16,000. The number of Aircraft of the 1st Line is: Aircraft 1,000 (approximately), Airships 4. (A. R. B.)

HISTORY

From the fall of the Roman empire till modern times the Italians have had no political unity, no independence, no organized existence as a nation. Their history is not the history of a united people, centralizing and absorbing its constituent elements by a process of continued evolution, but of a group of cognate populations, exemplifying various types of constitutional development.

The early history of Italy will be found under ROME and allied headings. The following article is therefore mainly concerned with events succeeding 476 A.D., when Romulus Augustulus was succeeded by Odoacer. Prefixed to this are two sections dealing respectively with (*a*) ancient languages and peoples in Italy, and (*b*) the unification of the country under Augustus, the growth of the road system, etc. The subsequent history is divided into three periods: (*c*) from 476 to 1796; (*d*) from 1796 to 1914; (*e*) from 1914 onwards.

Ancient Languages and Peoples.—The ethnography of ancient Italy is involved in obscurity. The country attracted, even in early ages, successive swarms of invaders from the north. Ancient writers are agreed as to the diversity of races that were found within the limits of the peninsula. The traditions transmitted to us are often conflicting, while the idioms that prevailed in Italy in and before the 5th century B.C. are preserved, if at all, only in a few scanty and fragmentary inscriptions. (See, *e.g.*, LATIN LANGUAGE, OSCAN, VOLSCI, UMBRIAN LANGUAGE, ETRUSCAN LANGUAGE, and below.) These imperfect materials combined with the notices derived from ancient writers and the evidence of archaeological excavations furnished results of reasonable certainty.

The name "Italians" was at one time confined to the Oenotrians. According to Antiochus of Syracuse (*apud* Dion. Hal. *Ant. Rom.* ii. 1), the name of Italy was first applied only to the southern portion of the Bruttium peninsula (now known as Calabria). But in the time of that historian, as well as of Thucydides, the names of Oenotria and Italia, which were then regarded as synonymous, included the shore of the Tarentine gulf as far as Metapontum and thence across to the gulfs of Laus and Poseidonia on the Tyrrhenian sea. It thus comprised only the two provinces subsequently known as Lucania and Bruttium (*see* references *s.v.* "Italia" in R. S. Conway's *Italic Dialects*, p. 5). The name seems to be a Graecized form of an Italic *Vitelia*, from the stem *vitlo-*, "calf," and perhaps meant "calf-land," "grazing-land."

The term Italy now comprises the whole peninsula with the northern region as far as the Alps. Only the Etruscans did not

speak an Indo-European language. Apart from Etruscan and the dialects of the Greek colonies, like Cumae, Neapolis, Tarentum, from the south to the north, the different languages or dialects in separate existence between 600 and 200 B.C. were: (1) Sicel, (2) South Oscan and Oscan, (3) Messapian, (4) North Oscan, (5) Volscian, (6) East Italic or "Sabellic," (7) Latinian, (8) Sabine, (9) Iguvine or "Umbrian," (10) Gallic, (11) Ligurian and (12) Venetic.

It is probable that Venetic, East Italic and Messapian are connected, and, with the ancient dialects spoken in Illyria (*q.v.*), might be provisionally entitled the Adriatic group. The Sicel language was of Indo-European character. How far the language or languages spoken in Bruttium and at certain points of Lucania, such as Anxia, differed from Oscan is not clear (*see* BRUTTII). No inscriptions can be referred with certainty to the language of the Ligures. Other evidence seems to link them with the *-CO-* peoples. It is difficult to determine the dates of the earliest appearance of Gallic tribes in the north of Italy. Archaeological stratification shows that the Gallic period supervened upon the Etruscan. The Celtic and Etruscan elements together occupied the greater part of the district between the Apennines and the Alps down to its Romanization in the course of the 2nd century B.C. Their linguistic neighbours were Ligurian in the south and south-west, and the Veneti on the east.

A large force of Gauls came as far south as Rome in the year 390 B.C. Some part of this horde settled in what was henceforward known as the *Ager Gallicus*, the easternmost strip of coast later known as Umbria, including the towns of Caesēna, Ravenna and Arīminum. A bilingual inscription (Gallic and Latin) of the 2nd century B.C. was found as far south as Tuder, the modern Todi (*Italic Dialects*, ii. 528; Stokes, *Bezzenberger's Beiträge*, 11, p. 113).

As to the languages of the Italic group in the narrower sense, (*a*) Oscan; (*b*) the dialect of Velitrae, commonly called Volscian; (*c*) Latinian (*i.e.*, Latin and its nearest congeners, like Faliscan); and (*d*) Umbrian (or, as it may be called, Iguvine), two principles of classification offer themselves; the first purely linguistic, the second linguistic and topographical. There is a broad distinction between the dialects which preserved the Indo-European velars and the dialects which converted the velars wholly into labials; for example, Latinian *quis* contrasted with Oscan, Volscian and Umbrian *pis* (*see* further LATIN LANGUAGE).

The only Latinian dialects of which, besides Latin, we have inscriptions are Faliscan and Marsian (*see* FALISCI, MARSI). The place-names of the Aequi (*q.v.*) suggest that they belong to the same group in this respect. Except, therefore, for a very small and apparently isolated area in the north of Latium and south of Etruria, all the tribes of Italy, though their idioms differed in certain particulars, are left undiscriminated. Tradition asserts very strongly (1) the identity of the Sabines and Samnites; (2) the conquest of an earlier population by this tribe; and (3) evidence of the identity of the Sabines with the ruling class; *i.e.*, the patricians, at Rome itself.

The ethnical or tribal and oppidan names of communities belonging to the Sabine stock are marked by the use of the suffix *-NO-* as in *Sabini*. There is some linguistic evidence that this stratum of population overcame an earlier population, which used, generally, ethnica in *-CO-* or *-TI-* (as in *Morruci, Ardeates*, transformed later into *Marrucini, Ardeatini*).

From this it follows that:—

(1) Latin will be counted the language of the earlier plebeian stratum of the population of Rome and Latium, probably once spread over a large area of the peninsula, and akin in some degree to the language or languages spoken in north Italy before either the Etruscan or the Gallic invasions.

(2) What is called Oscan represented the language of the invading Sabines (more correctly Safines).

(3) What is called Volscian, known only from the important inscription of the town of Velitrae, and what is called Umbrian, known from the famous Iguvine Tables with a few other records, would be regarded as Safine dialects, spoken by Safine communities more or less isolated in the midst of the earlier and possibly partly Etruscanized populations. As early as the 4th century B.C. their language had suffered corruptions which it escaped both in the Samnite mountains and in Rome.

CONSOLIDATION OF ITALY

In the very earliest times the name of Italy was correctly applied only to the southern part of the peninsula, and was only gradually extended to the central regions, such as Latium and Campania, which were designated by writers as late as Thucydides and Aristotle as in Opicia. Under Roman rule the term was confined to the regions of the central and southern districts, exclusive of Cisalpine Gaul, and this continued to be its official signification down to the end of the republic. But the name came to be generally employed as a geographical term at a much earlier period. Thus we already find Polybius repeatedly applying it to the whole country as far as the foot of the Alps; and this was a familiar use of the term in the days of Cicero and Caesar. The official distinction was, however, still retained. Cisalpine Gaul still constituted a "province," and it was not till Caesar crossed the Rubicon that he entered Italy.

Augustus gave a definite administrative organization to Italy as a whole, and his division into 11 regions continued in official use till the reign of Constantine.

The first region comprised Latium, including the Volsci, Hernici and Aurunci (*q.v.*), together with Campania and the district of the Picentini. It thus extended from the mouth of the Tiber to that of the Silarus (*see* LATIUM).

The second region included Apulia and Calabria, together with the land of the Hirpini (*q.v.*).

The third region contained Lucania and Bruttium; it was bounded on the west coast by the Silarus, on the east by the Bradanus.

The fourth region comprised all the Samnites (except the Hirpini), together with the Sabini (*q.v.*) and the cognate tribes. It was separated from Apulia on the south by the river Tifernus, and from Picenum on the north by the Matrinus.

The fifth region was composed solely of Picenum, extending along the coast of the Adriatic from the mouth of the Matrinus to that of the Aesis, beyond Ancona.

The sixth region was formed by Umbria, in the more extended sense of the term, as including the Ager Gallicus, along the coast of the Adriatic from the Aesis to the Ariminus, and separated from Etruria on the west by the Tiber.

The seventh region consisted of Etruria, extending from the Tiber to the Tyrrhenian sea, and separated from Liguria on the north by the river Macra.

The eighth region, termed Gallia Cispadana, comprised the southern portion of Cisalpine Gaul, and was bounded on the north by the river Padus or Po, from above Placentia to its mouth. It was separated from Etruria and Umbria by the Apennines; and the river Ariminus was substituted for the Rubicon as its limit on the Adriatic.

The ninth region comprised Liguria, extending along the seacoast from the Varus to the Macra, and inland as far as the river Padus, which constituted its northern boundary from its source in Mt. Vesulus to its confluence with the Trebia just above Placentia.

The tenth region included Venetia from the Padus and Adriatic to the Alps, with the neighbouring peninsula of Istria, and to the west the territory of the Cenomani (*q.v.*).

The 11th region, known as Gallia Transpadana, included all the rest of Cisalpine Gaul from the Padus on the south and the Addua on the east to the foot of the Alps.

Roads.—The mainstay of the Roman military control of Italy was the splendid system of roads. As the supremacy of Rome extended itself over Italy, the Roman road system grew, each fresh conquest being marked by the pushing forward of roads through the newly-won territory, and the establishment of fortresses. It was in Italy that the military value of a network of roads was first appreciated by the Romans. And it was for military reasons that from mere cart-tracks they were developed into permanent highways. From Rome roads radiated in all

directions. Communications with the south-east were mainly provided by the Via Appia and the Via Latina, which met close to Casilinum, 3m. N.W. of Capua, the centre of the road system of Campania. Here the Via Appia turned eastward towards Beneventum, while the Via Popilia continued in a south-easterly direction through the Campanian plain and the mountains of Lucania and Bruttium as far as Rhegium. Other roads ran south from Capua to Cumae, Puteoli (the most important harbour of Campania), and Neapolis. From Beneventum, another important road centre, the Via Appia itself ran south-east through the mountains past Venusia to Tarentum on the south-west coast of the "heel," and thence across Calabria to Brundusium; Trajan's alternative road ran north-east through the mountains and the lower ground of Apulia, reaching the coast at Barium. Both met at Brundusium, the principal port for the East.

The only high road of importance from Rome eastwards, the Via Valeria, was not completed as far as the Adriatic before the time of Claudius; but on the north and north-west started the main highways which communicated with central and northern Italy, and with all that part of the Roman empire which was accessible by land. The Via Salaria, a very ancient road, with its branch, the Via Caecilia, ran north-eastwards to the Adriatic coast as did the Via Flaminia, which reached the coast at Fanum Fortunae, and thence followed it to Ariminum. The Via Flaminia was the earliest and most important road to the north; and it was soon extended (in 187 B.C.) by the Via Aemilia running through Bononia as far as Placentia, in a straight line between the plain of the Po and the foot of the Apennines. In the same year a road was constructed over the Apennines from Bononia to Arretium. Along the west coast the Via Aurelia ran up to Pisa and was continued by another Via Aemilia to Genoa. Thence the Via Postumia led to Placentia and Cremona, while the Via Aemilia and the Via Iulia Augusta continued along the coast into Gallia Narbonensis. The road system of Cisalpine Gaul was mainly conditioned by the rivers which had to be crossed, and the Alpine passes which had to be approached. Cremona, on the north bank of the Po, was an important meeting point of roads, and Hostilia another; so also was Patavium, and Aquileia, farther east.

As to the roads leading out of Italy, from Aquileia roads diverged northward into Raetia, eastward to Noricum and Pannonia, and southwards to the Istrian and Dalmatian coasts. Farther west came the roads over the higher Alpine passes—the Brenner from Verona, the Septimer and the Splügen from Clavenna (Chiavenna), the Great and the Little St. Bernard from Augusta Praetoria (Aosta), and the Mont Genèvre from Augusta Taurinorum (Turin). Westward two short but important roads led from Rome on each side of the Tiber to the great harbour at its mouth.

See references in articles ROME, LATIUM, etc.

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FROM 476 TO 1796

The year 476 opened a new age for the Italian people. Odoacer, a chief of the Herulians, deposed Romulus Augustulus, the last emperor of the West, and placed the peninsula beneath the titular sway of the Byzantine emperors. At Pavia the barbarian conquerors of Italy proclaimed him king, and he received from Zeno the dignity of Roman patrician. Thus began that system of mixed government, Teutonic and Roman, which impressed the institutions of new Italy from the earliest date with dualism, and vested supreme authority in a non-resident autocrat.

In 488 Theodoric, king of the East Goths, received commission from the Greek emperor, Zeno, to undertake the affairs of Italy, and in 493 defeated and killed Odoacer. Theodoric respected the Roman institutions which he found in Italy, and governed by ministers chosen from the Roman population. But the Goths, except in the valley of the Po, resembled an army of occupation rather than a people numerous enough to blend with the Italic stock, and in religion they were Arians—circumstances calculated to excite the Italians to rebellion. When, therefore, Justinian undertook the reconquest of Italy, his generals, Belisarius and Narses, were supported by the south. The struggle between Greeks and Goths lasted from 539 to 553, when Teias, the last Gothic king, was finally defeated. At its close the provinces of Italy were placed beneath Greek dukes controlled by an exarch, who ruled in the Byzantine emperor's name at Ravenna.

This new settlement lasted but a few years. Narses had employed Lombard auxiliaries in his campaigns against the Goths; and when he was recalled in 565, the Lombards and their allies passed southward under King Alboin in 568. Pavia offered stubborn resistance; but after a three years' siege it was taken, and Alboin made it the capital of his new kingdom.

Numerous as they were, the Lombards had not strength nor multitude enough to occupy the whole peninsula. Venice, which since the days of Attila had offered an asylum to Roman refugees from the northern cities, Genoa, Ravenna, Rome and the sea-coast cities of the south, and the islands, Sicily, Sardinia and Corsica, remained untouched. Thus the Lombards neither occupied the extremities nor subjugated the brain centre of the country. The strength of Alboin's kingdom was in the north; but after his murder in 573, the semi-independent chiefs of the Lombard tribe, who borrowed the title of dukes from their Roman predecessors, seem to have been contented with consolidating their power in the districts each had occupied. The duchies of Spoleto in the centre, and of Benevento in the south, were but loosely united to the kingdom at Pavia. Italy was broken up into three separate areas—the new Lombard kingdom; Ravenna, the garrison city of the Byzantine emperor; and Rome, the rallying point of the old nation, under the successor of St. Peter.

The rule of the Lombards proved at first far more oppressive to the native population, and had less understanding of their old customs, than that of the Goths had been. Though the Roman laws were still administered within the cities, yet the Lombard code was that of the kingdom; and the Lombards, being Arians, added the severe oppression of religious intolerance to that of martial despotism and cupidity. The Italians were reduced to the last extremity when Gregory the Great (590–604), having strengthened his position by diplomatic relations with the duchy of Spoleto, and brought about the conversion of the Lombards to orthodoxy, raised the cause of the remaining Roman population throughout Italy. When Leo the Isaurian published his decrees against the worship of images in 726, Gregory II. allied himself with Liudprand, the Lombard king, threw off allegiance to Byzantium, and established the autonomy of Rome. But the Lombards were unnatural allies, and increasingly the pope began to look for help in the Franks. Pippin twice crossed the Alps, and forced the Lombard king Aistolf to relinquish his acquisitions, including Ravenna, the Pentapolis, the coast towns of Romagna and some cities in the duchy of Spoleto. These he handed over to the pope of Rome, in 756, a donation which confirmed the papal see in the protectorate of the Italic party, conferred upon it sovereign rights, and placed the popes in the position held by the Greek exarch. The south of Italy, however, was comparatively unaffected. The dukes of the Greek empire and the Lombard dukes of Benevento, together with a few autonomous commercial cities, still divided southern Italy between them (*see* LOMBARDS).

THE FRANKISH EMPERORS

The Franco-Papal alliance held within itself that ideal of mutually supporting papacy and empire which exercised so powerful an influence in mediaeval history. When Charles the Great (Charlemagne) deposed his father-in-law Desiderius, the last Lombard king, in 774, and when he was crowned emperor by Leo III. at Rome in 800, he did but complete and ratify the compact offered to his grandfather, Charles Martel, by Gregory III. Charles took possession of the kingdom of Italy, as limited by Pippin's settlement. The pope was confirmed in his rectorship of the cities ceded by Aistolf, with the further understanding that in the future he might claim the protectorate of such portions of Italy, external to the kingdom, as he should be able to acquire. The kingdom of Italy, transmitted on his death by Charles the Great, and after-

wards confirmed to his grandson Lothar by the peace of Verdun in 843, stretched from the Alps to Terracina. The duchy of Benevento remained tributary, but independent. The cities of Gaeta and Naples, Sicily and the so-called Theme of Lombardy in South Apulia and Calabria, still recognized the Byzantine emperor. Venice stood aloof, professing a nominal allegiance to the East.

Internally Charles left the affairs of the Italian kingdom much as he found them, except that he appears to have pursued the policy of breaking up the larger fiefs of the Lombards, substituting counts for their dukes, and adding to the privileges of the bishops. We may reckon these measures among the earliest advantages extended to the cities, which still contained the bulk of the old Roman population. It should also here be noticed that the changes introduced into the holding of the fiefs were chief among the causes why the feudal system took no permanent hold in Italy. Feudalism was not at any time a national institution. The hierarchy of dukes and marquises and counts consisted of foreign soldiers; and the rapid succession of conquerors, each endeavouring to weaken the remaining strength of his predecessor, prevented this alien hierarchy from acquiring fixity by permanence of tenure.

The Italians acknowledged eight kings of the house of Charles the Great, ending in Charles the Fat, who was deposed in 888. After them followed ten sovereigns, all more or less alien, the last of whom was Berengar II. who in 961 ceded his rights to Otto the Great. Anarchy and misery are the main features of the long period between the death of Charles the Great and the descent of Otto. Early in the 9th century the Saracens began to occupy Sicily, overran Calabria and Apulia, took Bari and threatened Rome. In 890 the Greeks established themselves again at Bari, and ruled the Theme of Lombardy through an officer entitled the Catapan. Early in the 10th century the papacy fell into the hands of a noble family, known eventually as the counts of Tusculum, who almost succeeded in rendering the office hereditary, and in uniting the civil and ecclesiastical functions of the city under a single member of their house. During this time the popes abandoned, not only their high duties as chiefs of Christendom, but also their protectorate of Italian liberties; while the invasion of the Magyar barbarians, who overran the north of Italy, reduced its fairest provinces to the condition of a wilderness. The cities exposed to pillage by Huns in the north and Saracens in the south, and ravaged on the coast by Norse pirates, asserted their right to defend themselves. Within the circuit of their ramparts, the bishops already began to exercise authority in rivalry with the counts, to whom since the days of Theodoric, had been entrusted the government of the Italian burghs. Agreeably to feudal customs, these nobles retired from the town and built themselves fortresses on points of vantage in the neighbourhood. Thus the titular king of Italy found himself simultaneously at war with those great vassals, with the turbulent factions of the Roman aristocracy, with unruly bishops, and with a multitude of minor counts and barons. The last king of the quasi-Italian succession, Berengar II., marquis of Ivrea (951–961), made a vigorous effort to restore the authority of the kingdom. But he stood alone against a multitude, unanimous in their intolerance of discipline. His predecessor in the kingdom, Lothar, had left a young and beautiful widow, Adelheid. Berengar imprisoned her upon the Lake of Como, but she escaped to the castle of Canossa, where the great count of Tuscany espoused her cause, and appealed in her behalf to Otto the Saxon. The king of Germany descended into Italy, and took Adelheid in marriage; and Berengar, in the extremity of his fortunes, had recourse himself to Otto, making a formal cession of the Italian kingdom to the Saxon as his overlord. By this slender tie the crown of Italy was joined to that of Germany; and the formal right of the elected king of Germany to be considered king of Italy and emperor may be held to have accrued from this epoch.

THE GERMAN EMPERORS

Berengar gained nothing by his act of obedience to Otto. Otto entered Lombardy in 961, deposed Berengar, assumed the crown in Sant' Ambrogio at Milan, and in 962 was proclaimed emperor by John XII. at Rome. Henceforward Italy changed masters according as one or other of the German families secured supremacy beyond the Alps. By this revolution the Italian kingdom virtually ceased to exist, and was merged in the German kingdom; and, since for the German princes Germany was of necessity their first care, Italy from this time forward began to be abandoned to the slowly-working influences which tended to divide her into separate states. Among the centrifugal forces which determined the future of the Italian race must be reckoned, first and foremost, the new spirit of municipal independence which Otto encouraged by placing the enclosures of the chief burghs beyond the jurisdiction of the counts. Within those precincts the bishops and the citizens were independent of all feudal masters but the emperor. He further broke the power of the great vassals by redivisions of their fiefs. In this way, feudalism received a powerful check in Italy. The Italian nation was not indeed as yet apparent. But the conditions under which it could arise and reconstruct out of the ruins of its past glories a new civilization of its own now at last existed. The nobles fortified themselves in strong places outside the cities, and gave their best attention to fostering the rural population. Within the cities and upon the open lands the Italians, in this and the next century, doubled, trebled and quadrupled their numbers. A race was formed strong enough to keep the empire itself in check, strong enough, except for its own internecine contests, to have formed a nation equal to its happier neighbours.

Otto III.'s untimely death in 1002 introduced new discords. Rome fell once more into the hands of her nobles. The Lombards chose Ardoin, marquis of Ivrea, for king, and Pavia supported his claims against those of Henry of Bavaria, who had been elected in Germany. Milan sided with Henry; and this is perhaps the first eminent instance of cities being reckoned powerful allies in the Italian disputes of sovereigns. Ardoin retired to a monastery, where he died in 1015. Henry nearly destroyed Pavia, was crowned in Rome and died in 1024. After this event, Heribert, the archbishop of Milan, invited Conrad, the Franconian king of Germany, into Italy, and crowned him with the iron crown of the kingdom.

The intervention of this man, Heribert, compels us to turn a closer glance upon the cities of north Italy. In Milan we hear for the first time the word *Comune*, the citizens first form themselves into a *Parlamento*, the archbishop organizes the hitherto voiceless, defenceless population into a community capable of expressing its needs, and an army ready to maintain its rights. To Heribert is attributed the invention of the *Carroccio*, which played so singular and important a part in the warfare of Italian cities. A huge car drawn by oxen, bearing the standard of the burgh, and carrying an altar with the host, this carroccio, like the ark of the Israelites, formed a rallying point in battle, and reminded the armed artisans that they had a city and a church to fight for. It must not, however, be supposed that at this epoch the liberties of the cities were fully developed. The mass of the people remained unrepresented in the government. It still needed nearly a century of struggle to render the burghers independent of lordship, with a fully organized commune, self-governed in its several assemblies. The maritime cities were more advanced than the others. Not to mention Venice, which had not yet entered the Italian community, and remained a Greek free city, Genoa and Pisa were rapidly rising into ill-defined autonomy. Their command of fleets gave them incontestable advantages, as when, for instance, Otto II. employed the Pisans in 980 against the Greeks in Southern Italy, and the Pisans and Genoese together attacked the Saracens of Sardinia in 1017.

Hildebrand.—During the reign of Conrad II., the party of the counts of Tusculum revived in Rome; and Crescentius, claiming the title of consul in the imperial city, sought once more to control the election of the popes. When Henry III., the son of Conrad, entered Italy in 1046, he found three popes in Rome. These he abolished, and, taking the appointment into his own hands, gave German bishops to the see. These German popes were short-lived and inefficient; and unless it could be purged of crying scandals—of the subjection of the papacy to the great Roman nobles, of its subordination to the German emperor and of its internal demoralization—the condition of the church seemed

desperate. The Tuscan monk, Hildebrand, throughout three papacies, during which he controlled the counsels of the Vatican, and before he himself assumed the tiara, laid down a programme of reform including these three points: (1) the celibacy of the clergy; (2) the abolition of ecclesiastical appointments made by the secular authority; (3) the vesting of the papal election in the hands of the Roman clergy and people, presided over by the curia of cardinals. But before turning to the tremendous revolution which Hildebrand inaugurated, it will be necessary to describe events in southern Italy, upon which in no small measure his success depended.

The Norman Conquest of the Two Sicilies.—The moment had arrived when the provinces in the south, hitherto detached from the Italian *regno*, beyond the jurisdiction of Rome, included in no parcel of Italy proper, were about to enter definitely and decisively within the orbit of the Italian community. Some Norman adventurers, on pilgrimage to St. Michael's shrine on Monte Gargano, lent their swords in 1017 to the Lombard cities of Apulia against the Greeks. Twelve years later we find the Normans settled at Aversa under their Count Rainulf. From this central point spread their power in all directions, until they made themselves the most considerable force in southern Italy. William of Hauteville was proclaimed count of Apulia. His half-brother, Robert Guiscard, received from Leo IX. the investiture of all present and future conquests in Apulia, Calabria and Sicily, which he agreed to hold as fiefs of the Holy See. Nicholas II. ratified this grant, and confirmed the title of count. Having consolidated their possessions on the mainland, the Normans, under Robert Guiscard's brother, the great Count Roger, undertook the conquest of Sicily in 1060. After a prolonged struggle of 30 years, they wrested the island from the Saracens; and Roger, dying in 1101, bequeathed to his son Roger a wealthy and important kingdom in Calabria and Sicily. In 1127, upon the death of his cousin Duke William, who ruled in Apulia, Roger united the whole of the future realm. In 1130 he assumed the style of king of Sicily.

By the consolidation of Apulia, Calabria and Sicily into a powerful kingdom, and by recognizing the overlordship of the papal see, the house of Hauteville influenced the destinies of Italy with more effect than any of the princes who had previously dealt with any portion of the peninsula. The southern *regno*, in the hands of the popes, proved an insurmountable obstacle to the unification of Italy, led to French interference in Italian affairs, introduced the Spaniard and maintained in those rich southern provinces the reality of feudal sovereignty long after this alien element had been eliminated from the rest of Italy (*see* NORMANS; SICILY: *History*).

The Investiture Controversy.—In 1073 Hildebrand was elevated to the papacy as Gregory VII. In the next year after his election Hildebrand convened a council, and passed measures enforcing the celibacy of the clergy. In 1075 he caused the investiture of ecclesiastical dignitaries by secular potentates of any degree to be condemned. These two reforms inflamed the bitterest hostility. Henry IV., king of Germany, but not crowned emperor, convened a diet in the following year at Worms, where Gregory was deposed and excommunicated. The pope followed with a counter-excommunication, releasing the king's subjects from their oaths of allegiance. A war was thus declared between the two chiefs of western Christendom, which was not to close until 1122. Gregory received material assistance from Countess Matilda of Tuscany. She was the last heiress of the great house of Canossa, whose fiefs stretched from Mantua across Lombardy, passed the Apennines, included the Tuscan plains, and embraced a portion of the duchy of Spoleto. It was in her castle of Canossa that Henry IV. performed his three days' penance in the winter of 1077; and there she made the cession of her vast domains to the Church. That cession, renewed after the death of Gregory (1085) to his successors, conferred upon the popes indefinite rights, of which they afterwards availed themselves in the consolidation of their temporal power.

Gregory's immediate successors, Victor III., Urban II., and Paschal II., carried on his struggle with Henry IV. and his antipopes, encouraging the emperor's son to rebel against him, and stirring up Europe for the first crusade. When Henry IV. died, his own son's prisoner, in 1106, Henry V. crossed the Alps, entered Rome, forced Paschal II. to crown him and compelled the pope to grant his claims on the investitures. Scarcely had he returned to Germany when the Lateran disavowed all that the pope had done, on the score that it had been extorted by force. France sided with the Church. Germany rejected the bill of investiture, but a new seizure of Rome proved of no avail. The emperor at last abandoned the contest which had distracted Europe. By the concordat of Worms, 1122, he surrendered the right of investiture by ring and staff, and granted the right of election to the clergy. The popes were henceforth to be chosen by the cardinals, the bishops by the chapters subject to the pope's approval. On the other hand, the pope ceded to the emperor the right of investiture by the sceptre. But the popes were really victors. They remained independent of the emperor, but the emperor had still to seek the crown at their hands (*see* PAPACY; INVESTITURE).

AGE OF THE COMMUNES

Rise of the Free Cities.—The final gainers, however, by the war of investitures, were the Italians. The antagonism of the popes to the emperors, which became hereditary in the Sacred College, forced the former to assume the protectorate of the national cause. And on the other hand, during the 47 years' war, the communes grew in self-reliance, strength and liberty. The age of real autonomy, signalized by the supremacy of consuls in the cities, had arrived.

In the republics, government was carried on by officers called consuls, varying in number according to custom and according to the division of the town into districts. These magistrates were originally appointed to control and protect the humbler classes. But, in proportion as the people gained more power, the consuls rose into importance, superseded the bishops and began to represent the city in transactions with its neighbours. Popes and emperors who needed the assistance of a city had to seek it from the consuls, and thus these officers gradually converted an obscure and indefinite authority into what resembles the presidency of a commonwealth. They were supported by a deliberative assembly, called *credenza*, chosen from the more distinguished citizens. In addition to this privy council, we find a *gran consiglio*, consisting of the burghers, and a still larger assembly called *parlamento*, which included the whole adult population. Though the institutions of the communes varied in different localities, this is the type to which they all approximated. The privileged burghers formed the aristocracy of the town, who by their wealth, usually derived from trade and industry, and birth, held its affairs within their custody.

Under their consuls the Italian cities rose to a great height of prosperity and splendour. It is also to be noticed that the people now began to be conscious of their past. They recognized the fact that their blood was Latin as distinguished from Teutonic, and the study of Roman law received a new impulse. The very name consul, no less than the Romanizing character of the best architecture of the time, points to the same revival of antiquity.

The rise of the Lombard communes produced a sympathetic revolution in Rome. A monk named Arnold of Brescia stirred up the Romans to shake off the temporal sway of their bishop. Rome, ever mindful of her unique past, listened to Arnold's preaching. A senate was established, and the republic was proclaimed. The title of patrician was revived and offered to Conrad, king of Italy, but not crowned emperor. Conrad refused it, and the Romans conferred it upon one of their own nobles. Though these institutions borrowed high-sounding titles from antiquity, they were in reality imitations of the Lombard civic system. The pope was unable to check this revolution, which is now chiefly interesting as further proof of the insurgence of the Latin as against the feudal elements in Italy at this period (*see* ROME: *History*).

The division of the country between the pope's and emperor's parties inflicted upon Italy the ineradicable curse of party-warfare. Rome attempted to ruin Tivoli, and Genoa Pisa; Milan fought with Cremona, Cremona with Crema, Pavia with Verona, Verona with Padua, Piacenza with Parma, Modena and Reggio with

Bologna, Bologna and Faenza with Ravenna and Imola, Florence and Pisa with Lucca and Siena, and so on through the whole list of cities. The nearer the neighbours, the more rancorous and internecine was the strife. Italy was, in fact, too small for her children. As the towns expanded, they perceived that they must mutually exclude each other. The pope's cause and the emperor's cause were of comparatively little moment to Italian burghers; and the names of Guelph and Ghibelline, which before long began to be heard in every street, on every market-place, had no meaning for them. These watchwords are said to have arisen in Germany during the disputed succession of the empire between 1135 and 1152, when the Welfs of Bavaria opposed the Swabian princes of Waiblingen origin. But in Italy, although they were severally identified with the papal and imperial parties, they really served as symbols for jealousies which altered in complexion from time to time and place to place.

Frederick Barbarossa.—Under the imperial rule of Lothar the Saxon (1125–37) and Conrad the Swabian (1138–52), these civil wars increased in violence owing to the absence of authority. Neither Lothar nor Conrad was strong at home; the former had no influence in Italy, and the latter never entered Italy at all. But when Conrad died, the electors chose his nephew Frederick, surnamed Barbarossa, who united the rival honours of Welf and Waiblingen. Frederick immediately determined to reassert the imperial rights in his southern provinces. When he first crossed the Alps in 1154, Lombardy was, roughly speaking, divided between two parties, the one headed by Pavia professing loyalty to the empire, the other headed by Milan ready to oppose its claims. In reality Frederick came to supersede self-government by consuls, to deprive the cities of the privilege of making war on their own account and to extort his regalian rights of forage, food and lodging for his armies. The diet was opened at Roncaglia near Piacenza, where Frederick listened to the complaints of Como and Lodi against Milan, of Pavia against Tortona and of the marquis of Montferrat against Asti and Chieri. The plaintiffs in each case were imperialists; and Frederick's first action was to redress their supposed grievances. Outside the gates of Rome he was met by a deputation from the senate he had come to supersede, who addressed him in words memorable for expressing the republican spirit of new Italy face to face with autocratic feudalism. Moved only to scorn and indignation by the rhetoric of these presumptuous enthusiasts, Frederick marched into the Leonine city, and took the imperial crown from the hands of Adrian IV. In return for this compliance, the emperor delivered over to the pope his troublesome rival, Arnold of Brescia, who was burned alive by Nicholas Breakspear, the only English successor of St. Peter. The gates of Rome itself were shut against Frederick; and even on this first occasion his good understanding with Adrian began to suffer. The points of dispute between them related mainly to Matilda's bequest, and to the kingdom of Sicily, which the pope had rendered independent of the empire by renewing its investiture in the name of the Holy See. In truth, the papacy and the empire had become irreconcilable. Having obtained his coronation, Frederick was forced to withdraw by the citizens, while Milan prepared herself against the storm which threatened. In the ensuing struggle the citizens of that great city rose to the altitude of patriotic heroism. They rebuilt Tortona, punished Pavia, Lodi, Cremona and the marquis of Montferrat. Then they fortified the Adda and Ticino, and waited for the emperor's next descent. He came in 1158 with a large army and sat down before the walls of Milan. Famine forced the burghers to partial obedience, and Frederick held a victorious diet at Roncaglia. Here the jurists of Bologna appeared, armed with their new lore of Roman law, and expounded Justinian's code in the interests of the German empire. Frederick placed judges of his own appointment, with the title of podestà, in all the Lombard communes; and this stretch of his authority, while it exacerbated his foes, forced even his friends to join their ranks against him. The war, meanwhile, dragged on. Crema yielded after an heroic siege in 1160. Milan was invested in 1161, starved into capitulation after nine months' resistance, and destroyed. Frederick then withdrew across the Alps. But, in the interval between his second and third visit, a league was formed against him in north-eastern Lombardy. Verona, Vicenza, Padua, Treviso, Venice entered into a compact to defend their liberties; and when he came again in 1163, the imperial cities refused to join his standards.

INTERNECINE STRIFE

The Lombard League.—Meanwhile the election of Alexander III. to the papacy in 1159 added a powerful ally to the republican party. Opposed by an anti-pope whom the emperor favoured, Alexander relied for support upon the anti-imperialist communes. They in return gladly accepted a champion who lent them the prestige and influence of the church. When Frederick once more crossed the Alps in 1166, he advanced on Rome but was again forced to depart. In April 1167 a new league was formed between Cremona, Bergamo, Brescia, Mantua and Ferrara. In December of the same year this league allied itself with the elder Veronese league, and received the addition of Milan, Lodi, Piacenza, Parma, Modena and Bologna. The famous league of Lombard cities was now established. Novara, Vercelli, Asti and Tortona swelled its ranks; only Pavia and the Montferrat remained imperialist between the Alps and Apennines. Frederick fled for his life by the Mont Cenis, and in 1168 the town of Alessandria was erected to keep Pavia and the marquisate in check. In the emperor's absence, Ravenna, Rimini, Imola and Forli joined the league, which now called itself the "Society of Venice, Lombardy, the March, Romagna and Alessandria." For the fifth time, in 1174, Frederick entered his rebellious dominions. The fortress town of Alessandria stopped his progress with those mud walls contemptuously named "of straw," while the forces of the league assembled at Modena and obliged him to raise the siege. In the spring of 1176 Frederick threatened Milan. His army was near Legnano, when the troops of the city, assisted only by a few allies from Piacenza, Verona, Brescia, Novara and Vercelli, met and overwhelmed it. The victory was complete. Frederick escaped alone and opened negotiations with Alexander in Venice. Here a truce for six years was concluded with the Lombard communes. But although they had humbled and utterly defeated their foreign lord, and proved their strength in combination, all that they claimed was municipal autonomy; the right to manage their own affairs within the city walls, to fight their battles as they chose, and to follow their several ends unchecked. There was as yet no trace of an Italian national spirit.

When the truce expired in 1183, a permanent peace was ratified at Constance. The signatories of the peace of Constance were divided between leaguers and imperialists. On the one side we find Vercelli, Novara, Milan, Lodi, Bergamo, Brescia, Mantua, Verona, Vicenza, Padua, Treviso, Bologna, Faenza, Modena, Reggio, Parma, Piacenza; on the other, Pavia, Genoa, Alba, Cremona, Como, Tortona, Asti, Alessandria. Venice, who had not yet entered the Italian community, is conspicuous by her absence. According to the terms of this treaty, the communes were confirmed in their right of self-government by consuls, and their right of warfare. The emperor retained the supreme courts of appeal within the cities, and his claim for sustenance at their expense when he came into Italy.

The privileges confirmed to the Lombard cities by the peace of Constance were extended to Tuscany, where Florence had begun her career of freedom and prosperity. The next great chapter in the history of Italian evolution is the war of the cities against the nobles. The city communes were everywhere surrounded by castles; and, though the feudal lords had been weakened by the events of the preceding centuries, they continued to be formidable enemies. But, partly by mortgaging their property to rich burghers, partly by entering the service of the cities as *condottieri* (mercenary leaders), partly by espousing the cause of one town against another, and partly by forced submission after the siege of their strongholds, the nobles were gradually brought into connection of dependence on the communes. These, in their turn, forced the nobles to leave their castles, and to reside within the walls. By these measures the counts became citizens, the rural population ceased to rank as serfs, and the Italo-Roman population of the towns absorbed into itself the remnants of Franks, Germans and

other foreign stocks. But while it would be impossible to exaggerate the importance of this revolution, which ended by destroying the last vestige of feudalism and was a decided step forward, it introduced a new source of discord. The nobles fortified their houses, retained their military habits, and carried on feuds in the streets and squares. The war against the castles became a war against the palaces; and the system of government by consuls proved inefficient to control these clashing elements. This led to the establishment of podestàs, whose business it was to arbitrate and keep the peace. Invariably a foreigner, elected for a year with power of life and death and control of the armed force, but subject to a strict account at the expiration of his office, the podestà might be compared to a dictator invested with limited authority. The citizens chose him, and voluntarily submitted to his rule.

Frederick II.—Barbarossa, perceiving the advantage that would accrue to his house if he could join the crown of Sicily to that of Germany, procured the marriage of his son Henry VI. to Constance, daughter of King Roger, and heiress of the Hauteville dynasty. When William II., the last monarch of the Norman race, died, Henry VI. claimed that kingdom in his wife's right, and was recognized in 1194. Three years afterwards he died, leaving a son, Frederick, to the care of Constance, who in her turn died in 1198, bequeathing the young prince, already crowned king of Germany, to the guardianship of Innocent III. The pope honourably discharged his duty, until his ward outgrew the years of tutelage, and became a fair mark for ecclesiastical hostility. Among the principal events of Innocent's reign must be reckoned the foundation of the two orders, Franciscan and Dominican. A second great event was the fourth crusade, undertaken in 1198, which established the naval and commercial supremacy of the Italians in the Mediterranean. The Venetians, who contracted for the transport of the crusaders, and whose blind doge Dandolo was first to land in Constantinople received "one quarter and a half" of the Greek empire for their spoils. The Venetian ascendancy in the Levant dates from this epoch; for though the republic had no power to occupy all the domains ceded to it, Candia was taken, together with several small islands and stations on the mainland. The formation of a Latin empire in the East increased the pope's prestige; while at home it was his policy to organize Countess Matilda's heritage by the formation of Guelph leagues, over which he presided. From the Tuscan league Pisa, consistently Ghibelline, stood aloof. Rome itself again at this epoch established a republic, with which Innocent would not or could not interfere. Meanwhile the Guelph and Ghibelline factions were beginning to divide Italy into minute parcels. Not only did commune range itself against commune under the two rival flags, but party rose up against party within the city walls. The introduction of the factions into Florence in 1215, owing to a private quarrel between the Buondelmonti, Amidei and Donati, is a celebrated instance of what was happening in every city.

After the death of Otto IV., Honorius III., Innocent's successor, crowned Frederick emperor in Rome (1220). In his single person he combined the prestige of empire with the crowns of Italy, Sicily, Sardinia, Germany and Burgundy; and in 1225, by marriage with Yolande de Brienne, he added that of Jerusalem. There was no prince greater or more formidable in the habitable globe. Italy seemed to lie prostrate before the emperor. In 1227, Frederick, who had promised to lead a crusade, was excommunicated by Gregory IX. because he was obliged by illness to defer his undertaking. The Guelph towns of Lombardy again raised their levies. Frederick enlisted his Saracen troops at Nocera and Lucera, and appointed the terrible Ezzelino da Romano his vicar in the Marches of Treviso, to quell their insurrection. Having established Ezzelino in Verona, Vicenza and Padua, he defeated the Milanese and their allies at Cortenuova in 1237. Gregory IX., fearing lest the Guelph party would be ruined by this check, made alliance with Venice and Genoa, fulminated a new excommunication against Frederick, and convoked a council at Rome to ratify his ban in 1241. The Genoese undertook to bring the French bishops to this council. Their fleet was attacked at Meloria by the Pisans, and utterly defeated. The French prelates went in silver chains to prison in the Ghibelline capital of Tuscany. In 1243 a new pope, Innocent IV. was elected, who prosecuted the war with still bitterer spirit. Forced to fly to France, he there, at Lyons, in 1245, convened a council, which enforced his condemnation of the emperor. The mendicant monks stirred up the populace to acts of fanatical enmity. To plot against him, to attempt his life by poison or the sword, was accounted virtuous. The crimes of his vicar Ezzelino increased the horror with which he was regarded. Parma revolted against him; the only gleam of success which shone on his ill-fortune was the revolution which placed Florence in the hands of the Ghibellines in 1248. Next year Bologna defeated his troops and took his son Enzo prisoner at Fossalta. Hunted to the ground and broken-hearted, Frederick expired at the end of 1250 in his Apulian castle of Fiorentino. By birth and breeding an Italian, highly gifted and widely cultivated, liberal in his opinions, a patron of literature, a founder of universities, he anticipated the spirit of the Renaissance. At his court Italian started into being as a language. His laws were wise. He was capable of giving to Italy a large and noble culture. But the commanding greatness of his position proved his ruin. Emperor and king of Sicily, he was the natural enemy of popes, who could not tolerate so overwhelming a rival.

POPE VERSUS EMPEROR

Guelph and Ghibelline.—The cause of Frederick's son Conrad was sustained in Lower Italy by Manfred, one of his many natural children; and when Conrad died in 1254, Manfred still acted as vicegerent for the Swabians, who were now represented by a boy, Conradin. Innocent IV. and Alexander IV. continued to make head against the Ghibelline party. The most dramatic incident in this struggle was the crusade preached against Ezzelino. This tyrant had made himself justly odious; and he was hunted to death in 1259. While the Guelph faction gained in Lombardy by the massacre of Ezzelino, the Ghibellines revived in Tuscany after the battle of Montaperti, which in 1260 placed Florence at their discretion. Manfred headed the Ghibellines, and there was no strong counterpoise against him. In this necessity Urban IV. and Clement IV. invited Charles of Anjou to enter Italy and take the Guelph command. They made him senator of Rome and vicar of Tuscany, and promised him the investiture of the *regno* provided he stipulated that it should not be held in combination with the empire. Charles accepted these terms, and was welcomed by the Guelph party as their chief throughout Italy. Manfred was defeated and killed in a battle near Benevento in 1266; and, when Conradin, aged 16, descended from Germany to make good his claims to the kingdom, he, too, was defeated at Tagliacozzo in 1267. Less lucky than his uncle, Conradin escaped with his life to die upon the scaffold at Naples. The popes had been successful though at a heavy cost; but this first invitation to French princes brought with it incalculable evils.

Charles of Anjou, supported by Rome, and recognized as chief in Tuscany, was the most formidable of the Italian potentates. In his turn he now excited the jealousy of the popes. Gregory initiated the policy of establishing an equilibrium between the parties, which was carried out by his successor Nicholas III. Charles was forced to resign the senatorship of Rome and the overlordship of Lombardy and Tuscany. In 1282 he received a more decided check, when Sicily rose against him in the famous rebellion of the Vespers. He lost the island, which gave itself to Aragon; and thus the kingdom of Sicily was severed from that of Naples, the dynasty in the one being Spanish and Ghibelline, in the other French and Guelph. Meanwhile a new emperor had been elected, the prudent Rudolf of Habsburg, who abstained from interference with Italy, and who confirmed the territorial pretensions of the popes by solemn charter in 1278. Henceforth Emilia, Romagna, the March of Ancona, the patrimony of St. Peter and the Campagna of Rome held of the Holy See and not of the empire. The imperial chancery made a deed of gift which placed the pope in the position of a temporal sovereign. The Guelph party now grew stronger than ever, through the crushing defeat of the Pisans by the Genoese at Meloria in 1284. She never held her head so high again after this victory. The Mediterranean was left to be fought for by Genoa and Venice, while Guelph Florence

grew still more powerful in Tuscany. The Guelph party was held together by a less tight hand even in cities so consistent as Florence. Here in the year 1300 new factions, subdividing the old Guelphs into Neri and Bianchi, had acquired such force that Boniface VIII., a violently Guelph pope, called in Charles of Valois to pacify the republic and undertake the charge of Italian affairs. After quarrelling with the French king, Philip le Bel, Boniface fell into the hands of the Colonna family at Anagni, and died, either because of violence or of mortification, in Oct. 1303.

After the election to the papacy of a Frenchman, Clement V., the seat of the papacy was transferred to Avignon. Thus began that "Babylonian" exile of the popes which placed them in subjection to the French crown and ruined their prestige in Italy. This enfeeblement of the papal authority, coinciding as it did with the practical elimination of the empire from Italian affairs, gave a long period of comparative independence to the nation. This period of Italian history is immortalized by Dante who sets forth the mighty struggle between pope and emperor. But the real conflict is a social one, between civic and feudal institutions, between commercial and military interests, between progress and conservatism. Guelph democracy and industry idealize the pope. The banner of the Church waves above the camp of those who aim at positive prosperity and republican equality. Ghibelline aristocracy and immobility idealize the emperor. The prestige of the empire, based upon Roman law and feudal tradition, attracts imaginative patriots and systematic thinkers. The two ideals are counterposed and mutually exclusive. No city calls itself either Guelph or Ghibelline till it has expelled one-half of its inhabitants; for each party is resolved to constitute the state according to its own conception. The struggle is waged by two sets of men who equally love their city, but would rule it upon diametrically opposite principles, and fight to the death for its possession. Meanwhile each party forms its own organization of chiefs, finance-officers and registrars at home, and sends ambassadors to foreign cities of the same complexion. A network of party policy embraces and dominates the cities of Italy. The victory in the conflict practically falls to the hitherto unenfranchised plebeians. The elder noble families die out or lose their preponderance. New houses rise into importance; a new commercial aristocracy is formed. Burghers of all denominations are enrolled in one or other of the arts or gilds, and these trading companies furnish the material from which the government or *signoria* of the city is composed. Plebeian handicrafts assert their right to be represented on an equality with learned professions and wealthy corporations. The ancient classes are confounded and obliterated in a population more homogeneous, more adapted for democracy and despotism.

In addition to the parliament and the councils which have been already enumerated, we now find a *council of the party* established within the city. The consuls are merged in *ancients* or *priors*, chosen from the arts. A new magistrate, the *gonfalonier of justice*, appears in some of the Guelph cities, with the special duty of keeping the insolence of the nobility in check. Meanwhile the podestà still subsists; but he is no longer equal to the task of maintaining an equilibrium of forces. He sinks more and more into a judge, loses more and more the character of dictator. His ancient place is occupied by the *captain of the people*, acting as head of the ascendant Guelphs or Ghibellines who undertakes the responsibility of proscriptions, decides on questions of policy, forms alliances, declares war and is often little better than an autocrat.

AGE OF THE DESPOTS

After the death of Frederick II. Italian affairs were managed by Manfred and by Charles of Anjou, the supreme captains of the parties, under whose orders acted the captains of the people in each city. The contest being carried on by warfare, it followed that the captains in the cities were chosen for their military skill, and warrior dynasties arose, in many cases descended from the old nobility absorbed into the bourgeoisie. Thus the Della Scala dynasty arose in Verona, and the Carraresi in Padua. The Estensi made themselves lords of Ferrara; the Torriani headed the Guelphs of Milan. At Ravenna we find the Polenta family, at Rimini the Malatestas, at Parma the Rossi, at Piacenza the Scotti, at Faenza the Manfredi. In Tuscany, where the Guelph party was very strongly organized, and the commercial constitution of Florence kept the nobility in check, the communes remained as yet free from hereditary masters. Yet generals from time to time arose, the Conte Ugolino della Gherardesca at Pisa, Uguccione della Faggiuola at Lucca, the Conte Guido da Montefeltro at Florence, who threatened the liberties of Tuscan cities with military despotism.

After the commencement of the 14th century, the civil wars decreased in fury, and at the same time it was perceived that their effect had been to confirm tyrants in their grasp upon free cities. Growing up out of the captain of the people or signore of the commune, the tyrant annihilated both parties for his own profit and for the peace of the state. In him, for the first time, the city attained self-consciousness; the blindly working forces of previous revolutions were combined in the will of a ruler. The tyrant's general policy was to favour the multitude at the expense of his own caste. He won favour by these means, and completed the levelling down of classes, which had been proceeding ever since the emergence of the communes.

Decline of Civil War.—In 1309, Robert, grandson of Charles, the first Angevin sovereign, succeeded to the throne of Naples, and became the leader of the Guelphs in Italy. In the next year Henry VII. of Luxembourg crossed the Alps soon after his election to the empire, and raised the hopes of the Ghibellines. Italy had entered on a new phase of her existence, and Dante's *De monarchia* represented a dream of the past which could not be realized. Henry established imperial vicars in the Lombard towns, confirming the tyrants, but gaining nothing for the empire in exchange for the titles he conferred. After receiving the crown in Rome, he died at Buonconvento, a little walled town south of Siena, in 1313. The profits of his inroad were reaped by despots. From this epoch dates the supremacy of the Visconti of Milan. In Tuscany Castruccio Castracane, Uguccione's successor at Lucca, became formidable. In 1325 he defeated the Florentines at Alto Pascio, and carried home their *carroccio* as a trophy of his victory over the Guelphs. Louis the Bavarian, the next emperor, made a similar incursion in the year 1327, with even greater loss of imperial prestige. Equally contemptible in its political results and void of historical interest was the brief visit of John of Bohemia, son of Henry VII., whom the Ghibellines next invited to assume their leadership. He sold a few privileges, conferred a few titles, and recrossed the Alps in 1333. In spite of repeated efforts on the part of the Ghibellines, the imperialists gained no permanent advantage. The Italians were tired of fighting, and each city accepted a master to quench party strife, encourage trade, and make the handicraftsmen comfortable. Even the Florentines in 1342 submitted for a few months to the despotism of the duke of Athens, and had he not mismanaged matters, he might have held the city in his grasp. Italy was settling down and turning her attention to home comforts, arts and literature. Boccaccio, the contented bourgeois, succeeded to Dante, the fierce aristocrat.

The most marked proof of the change which came over Italy towards the middle of the 14th century is furnished by the companies of adventure. The burghers no longer fought themselves, but played the game of warfare by the aid of mercenaries. Ecclesiastical overlords, prosperous republics, with plenty of money to spend but no leisure or inclination for camp-life; cautious tyrants courting popularity by exchanging conscription for taxation—all combined to favour the new system. Mercenary troops, originally foreign adventurers, soon appeared under their own captains, who hired them out to the highest bidder, or marched them on marauding expeditions up and down the less protected districts. As the companies grew in size and improved their discipline, it was seen by the Italian nobles that this kind of service offered a good career for men of spirit, who had learned the use of arms. To leave so powerful and profitable a calling in the hands of foreigners seemed both dangerous and uneconomical. Therefore, after the middle of the century, this profession fell into the hands of natives. The first Italian who formed an ex-

clusively Italian company was Alberico da Barbiano, a nobleman of Romagna, and founder of the Milanese house of Belgiojoso. In his school the great condottieri (*q.v.*), Braccio da Montone and Sforza Attendolo were formed; and henceforth the battles of Italy were fought by Italian generals commanding native troops. But the new companies of adventure were in no sense patriotic. They sold themselves for money, irrespective of the cause which they upheld; and, while changing masters, they had no care for any interests but their own. In the hands of able captains, like Francesco Sforza or Piccinino, these mercenary troops became moving despotisms, draining the country of its wealth, and always eager to fasten and found tyrannies upon the provinces they had been summoned to defend. Battles became all but bloodless; diplomacy and tactics superseded feats of arms and hard blows in pitched fields. In this way the Italians lost their military vigour, and the whole political spirit of the race was demoralized. The purely selfish bond between condottieri and their employers, whether princes or republics, involved intrigues and treachery which ended by making statecraft in Italy synonymous with perfidy.

It must further be noticed that the rise of mercenaries was synchronous with a change in the nature of Italian despotism. The tyrants, as we have already seen, established themselves as captains of the people, vicars of the empire, vicars for the Church, leaders of the Guelph and Ghibelline parties. They were accepted by a population eager for repose, who had merged old class distinctions in the conflicts of preceding centuries. As their tenure of power grew firmer, they advanced dynastic claims, assumed titles, and took the style of petty sovereigns. Their government became paternal; and, though there was no limit to their cruelty when stung by terror, they used the purse rather than the sword. Thus was elaborated the type of despot which attained completeness in Gian Galeazzo Visconti and Lorenzo de' Medici, who substituted cunning and corruption for violence. The lesser people tolerated him because he extended the power of their city and made it beautiful with public buildings. The bourgeoisie, protected in their trade, found it convenient to support him. The nobles, turned into courtiers, placemen, diplomatists and men of affairs, ended by preferring his authority to the alternative of democratic institutions. A lethargy of well-being, broken only by the pinch of taxation for war costs, or by occasional outbursts of cruelty, descended on the population of cities which had boasted of their freedom. Only Florence and Venice, at the close of the period upon which we are now entering, maintained their republican independence. And Venice was ruled by a close oligarchy; Florence was passing from the hands of her oligarchs into the power of the Medicean merchants.

Between the year 1305, when Clement V. settled at Avignon, and the year 1447, when Nicholas V. re-established the papacy upon a solid basis at Rome, the Italians approximated more nearly to self-government than at any other epoch of their history. At the end of this century and a half, five principal powers divided the peninsula; and their confederated action during the next 45 years (1447–92) secured for Italy a season of peace and brilliant prosperity. These five powers were the kingdom of Naples, the duchy of Milan, the republic of Florence, the republic of Venice and the papacy.

The Two Sicilies.—After the death of Joanna II. of Naples in 1435, who had had no children, the kingdom was fought for between René of Anjou and Alfonso, surnamed the Magnanimous, king of Sicily, both of whom had been adopted by the late queen. During the war of succession which ensued, Alfonso was taken prisoner by the Genoese fleet in Aug. 1435, and was sent a prisoner to Filippo Maria at Milan, who supported René. Here he proved so incontestably the advantage which might ensue to the Visconti from his alliance, if he held the *regno*, that he obtained his release and recognition as king. Alfonso now reigned alone and undisturbed in Lower Italy, combining for the first time since the year 1282 the crowns of Sicily and Naples. When he died in 1458 he bequeathed Naples, which he had seized by conquest, to his natural son Ferdinand, while Sicily and Aragon passed together to his brother John, and so on to Ferdinand the Catholic. The 23 years of Alfonso's reign were the most prosperous and splendid period of south Italian history. He had become an Italian in taste and sympathy, entering with enthusiasm into the humanistic ardour of the earlier Renaissance, encouraging men of letters at his court, administering his kingdom on the principles of an enlightened despotism, and lending his authority to establish that equilibrium in the peninsula upon which the politicians of his age fully believed that Italian independence might be based.

Milan.—Milan was ruled by the Visconti, and when in 1349, after the murder of Luchino, his brother John, archbishop of Milan, assumed the lordship of the city, he extended the power of the Visconti over Genoa and other parts of north Italy. He died in 1354, and his heritage was divided between three members of his house, Matteo, Bernabò and Galeazzo. In the next year Matteo was assassinated by order of his brothers, who made an equal partition of their subject cities—Bernabò residing in Milan, Galeazzo in Pavia. Galeazzo married his daughter Violante to the English duke of Clarence, and his son Gian Galeazzo to a daughter of King John of France. When he died in 1378, this son murdered his uncle Bernabò, and thus became the most formidable of Italian despots. Immured in his castle at Pavia, accumulating wealth by systematic taxation and methodical economy, he organized mercenary troops and threatened the whole of Italy with conquest. Gian Galeazzo, partly by force and partly by intrigue, pushed his dominion to the very verge of Venice, and, having subjected Lombardy to his sway, proceeded to attack Tuscany, when the plague suddenly cut short his career in 1402. Seven years before his death Gian Galeazzo bought the title of duke of Milan and count of Pavia from the emperor Wenceslaus, but no sooner was he dead than the essential weakness of an artificial state became apparent. The Visconti's own generals, Facino Cane, Pandolfo Malatesta, Jacopo dal Verme, Gabrino Fondulo, Ottobon Terzo, seized several Lombard cities. In others the petty tyrants whom the Visconti had uprooted reappeared. The Estensi recovered their grasp upon Ferrara and the Gonzaga upon Mantua. Venice strengthened herself between the Adriatic and the Alps. Florence reassumed her Tuscan hegemony. Meanwhile Gian Galeazzo had left two sons, Giovanni Maria and Filippo Maria. Giovanni, a monster of cruelty and lust, was assassinated by some Milanese nobles in 1412; and now Filippo set about rebuilding his father's duchy. Herein he was aided by the troops of Facino Cane, who, dying opportunely at this period, left considerable wealth, a well-trained band of mercenaries, and a widow, Beatrice di Tenda. Filippo married and then beheaded Beatrice after a mock trial for adultery. He subsequently spent a long career in the attempt to carry out his schemes of Italian conquest. Venice and Florence offered a determined resistance; nor was Filippo equal in ability to his father. In the course of his wars with Florence and Venice, the greatest generals of this age were formed—Francesco Carmagnola, who was beheaded at Venice in 1432; Niccolò Piccinino and Francesco Sforza. Sforza received the hand of Filippo's natural daughter, Bianca, and when the Visconti dynasty ended by the duke's death in 1447, he pretended to espouse the cause of the Milanese republic, which was then reestablished; but he played his cards so subtly as to make himself, by the help of Cosimo de' Medici in Florence, duke *de facto* if not *de iure*. Once seated in the duchy of Milan, he displayed rare qualities as a ruler; for he not only entered into the spirit of the age, which required humanity and culture from a despot, but he also knew how to curb his desire for territory. The conception of confederated Italy found in him a vigorous supporter.

Florence.—After the expulsion of the duke of Athens in 1343, and the great plague of 1348, the Florentine proletariat rose up against the merchant princes, and in 1378, the Ciompi rebellion placed the city for a few years in the hands of the Lesser Arts. The revolution was but temporary, and the necessities of war and foreign affairs soon placed Florence in the power of an oligarchy headed by the great Albizzi family. They fought the battles of the republic with success against the Visconti, and widely extended the Florentine domain over the Tuscan cities. Pisa was then enslaved, and Florence gained access to the sea. However, throughout this period a powerful opposition was gathering

strength. It was led by the Medici, who sided with the common people, and increased their political importance by the accumulation and wise employment of vast commercial wealth. In 1433 the Albizzi and the Medici came to open strife. Cosimo de' Medici was exiled to Venice. In the next year he returned, and by a system of corruption and popularity-hunting, combined with the patronage of arts and letters, established himself as the real but unacknowledged dictator of the commonwealth. He supported Francesco Sforza in Milan, foreseeing that the dynastic future of his own family and the pacification of Italy might be secured by a balance of power in which Florence should rank on equal terms with Milan and Naples.

Venice.—The republic of Venice differed essentially from any other state in Italy. The constitution of the commonwealth had slowly matured itself through a series of revolutions. During the earlier days of the republic the doge had been a prince elected by the people, and answerable only to the popular assemblies. The several steps whereby the members of the grand council, formed in 1172, succeeded in eliminating the people from a share in the government, and reducing the doge to the position of their ornamental representative, cannot here be described. In 1297 an act was passed confining the grand council to a fixed number of privileged families, in whom the government was henceforth vested by hereditary right. The establishment in 1311 of the Council of Ten completed that famous constitution, which endured till the extinction of the republic in 1797. Meanwhile, throughout the middle ages, it had been the policy of Venice to confine her energies to commerce in the East. The first entry of any moment made by the Venetians into strictly Italian affairs was in 1336, when the republics of Florence and St. Mark allied themselves against Mastino della Scala, and Venice took possession of Treviso. After this, for 30 years, between 1352 and 1381, Venice and Genoa contested the supremacy of the Mediterranean. They fought their duel out upon the Bosporus, off Sardinia, and in the Morea, with various success. From the first great encounter, in 1355, Venice retired well-nigh exhausted, and Genoa was so crippled that she placed herself under the protection of the Visconti. The second and decisive battle was fought upon the Adriatic. The Genoese fleet under Luciano Doria defeated the Venetians off Pola in 1379, and seized Chioggia. Thus the Venetians found themselves blockaded in their own lagoons. Meanwhile a fleet was raised for their relief by Carlo Zeno in the Levant, and the admiral Vettor Pisani, who had been imprisoned after the defeat at Pola, was released to lead their forlorn hope from the city side. The Genoese in their turn were now blockaded in Chioggia, and forced by famine to surrender. The losses of men and money which the war of Chioggia entailed signed her naval ruin. During this second struggle with Genoa, the Venetians had been also at war with the Carraresi of Padua and the Scaligers of Verona. In 1406, after the extinction of these princely houses, they added Verona, Vicenza and Padua to their territories. Their career of conquest, and their new policy of directing Italian affairs were confirmed by the long dogeship of Francesco Foscari (1423–57). When Constantinople fell in 1453, the old ties between Venice and the Eastern empire were broken, and she now entered on a wholly new phase of her history. Ranking as one of the five Italian powers, she was also destined to defend Western Christendom against the encroachments of the Turk in Europe. (*See* VENICE: *History.*)

The Papacy.—By their settlement in Avignon, the popes relinquished their protectorate of Italian liberties, and lost their position as Italian potentates. Rienzi's revolution in Rome (1347–54), his establishment of a republic, and the rise of dynastic families in the cities of the Church, claiming the title of papal vicars, but acting in their own interests, weakened the authority of the Holy See. Although Cardinal Albornoz conquered Romagna and the March in 1364, the legates who resided in those districts were not long able to hold them against the local despots. At last Gregory XI. returned to Rome, and Urban VI., elected in 1378, put a final end to the Avignonian exile. But the Great Schism, which now distracted Western Christendom, so enfeebled the papacy, and kept the Roman pontiffs so engaged in ecclesiastical disputes, that they had neither power nor leisure to occupy themselves with their temporal affairs. The threatening presence of the two princely houses of Orsini and Colonna, alike dangerous as friends or foes, rendered Rome an unsafe residence. Even when the schism was nominally terminated in 1415 by the council of Constance, the next two popes held but a precarious grasp upon their Italian domains. At the same time, the growing conviction that a federation was necessary proved advantageous to the popes as sovereigns. They gradually assumed the style of despots and made use of the humanistic movement, then at its height, to place themselves in a new relation to Italy. The election of the distinguished humanist Thomas of Sarzana as Nicholas V. in 1447, opened a period of temporal splendour, which ended with the establishment of the popes as sovereigns. Soon after assuming the tiara, he found himself without a rival in the Church; for the schism ended by Felix V.'s resignation in 1449. Nicholas began to rebuild and to fortify Rome, determining to render it once more a capital worthy of its high place in Europe.

Confederated Italy.—Italy was now for a brief space independent. The humanistic movement had created a common culture, a common language and sense of common nationality. All political institutions tended towards despotism. The Medici became yearly more indispensable to Florence, the Bentivoglio more autocratic in Bologna, the Baglioni in Perugia; and even Siena was ruled by the Petrucci. But this despotism was of a mild type. The princes were Italians; they shared the common enthusiasms of the nation for art, learning, literature and science; they studied how to mask their tyranny with arts agreeable to the multitude. When Italy had reached this point, Constantinople was taken by the Turks. On all sides it was felt that the Italian alliance must be tightened; and one of the last, best acts of Nicholas V.'s pontificate was the appeal in 1453 to the five great powers in federation. As regards their common opposition to the Turk, this appeal led to nothing; but it marked the growth of a new Italian consciousness.

Having become despots, the popes sought to establish their relatives in principalities. The word nepotism acquired new significance in the reigns of Sixtus IV. and Innocent VIII. But though the country was convulsed by no great struggle, the following years were marked by appalling increase of political crime; *e.g.*, the revolt of the barons against Ferdinand I. of Naples (1464), the murder of Galeazzo Maria Sforza at Milan (1476), and the plot of the Pazzi to destroy the Medici (1478). After Cosimo de' Medici's death in 1464, the leadership of the Florentine republic passed to his son Piero, who left it in 1469 to his sons Lorenzo and Giuliano. These youths assumed the style of princes, and it was against their lives that the Pazzi, with the sanction of Sixtus IV., made assault. Giuliano was murdered, but Lorenzo escaped to tighten his grasp upon the city, which now loved him and was proud of him. During the following 14 years he made himself absolute master of Florence. Apprehending the importance of Italian federation, Lorenzo, by his personal tact and prudence, secured peace and a common intelligence between the five powers. His own family was fortified by the marriage of his daughter to a son of Innocent VIII., which procured his son Giovanni's elevation to the cardinalate, and involved two Medicean papacies and the future dependence of Florence upon Rome.

AGE OF INVASIONS

The year 1492 opened a new age for Italy. In this year Lorenzo died, and was succeeded by his son Piero; France passed beneath the personal control of Charles VIII.; the fall of Granada freed Spain from her embarrassments, Columbus discovered America, destroying the commercial supremacy of Venice; last, but not least, Rodrigo Borgia assumed the tiara as Alexander VI. In this year Italy was once more drawn into the vortex of European affairs. After Galeazzo Maria's assassination, his crown passed to a boy, Gian Galeazzo, who was in due course married to a granddaughter of Ferdinand I. of Naples. But the government of Milan remained in the hands of this youth's uncle, Lodovico, surnamed Il Moro, who resolved to become duke of Milan. The king of Naples was his natural enemy and he suspected that

Piero de' Medici might abandon his alliance. Feeling himself alone, with no right to the title he was bent on seizing, he had recourse to Charles VIII. of France, whom he urged to make good his claim to the kingdom of Naples, which rested on the will of King René of Anjou. Charles finally agreed to invade Italy. He crossed the Alps in 1495, passed through Lombardy, entered Tuscany, freed Pisa from the yoke of Florence, witnessed the expulsion of the Medici, marched to Naples and was crowned there —all this without striking a blow. Meanwhile Lodovico procured his nephew's death, and raised a league against the French in Lombardy. Charles hurried back from Naples, and narrowly escaped destruction at Fornovo in the passes of the Apennines, returning to France in 1495. Little was left him of his recent acquisitions; but he had convulsed Italy by this invasion, destroyed her equilibrium, exposed her military weakness and political disunion, and revealed her wealth to greedy and more powerful nations.

The princes of the house of Aragon, now represented by Frederick, a son of Ferdinand I., returned to Naples, and Florence made herself a republic. At this crisis she was ruled by the monk Girolamo Savonarola, who inspired the people with a thirst for freedom, preached the necessity of reformation, and placed himself in direct antagonism to Rome. After a short but eventful career, the influence of which was long effective, he lost his hold upon the citizens. Alexander VI. procured a mock trial, and his enemies had him put to death in 1498. In this year Louis XII. succeeded Charles VIII. upon the throne of France. As duke of Orleans he had certain claims to Milan through his grandmother Valentina, daughter of Gian Galeazzo, the first duke, and in 1499 Louis entered and subdued the Milanese. Lodovico escaped to Germany, returned the next year, was betrayed by his Swiss mercenaries and sent to die at Loches in France. In 1500 Louis concluded a treaty at Granada with Ferdinand the Catholic, whereby the French and Spanish kings were to divide the spoil. The conquest was easy; but, when it came to a partition, Ferdinand played his ally false. He made himself supreme over the two Sicilies, which he now reunited under a single crown. Three years later Louis signed the treaty of Blois (1504), whereby he invited the emperor Maximilian to aid him in the subjugation of Venice.

The stage was now prepared for the ruin of Italy. Spain, France, Germany, with their Swiss auxiliaries, had been summoned upon various pretexts to seize her provinces. Then, too late, patriots like Machiavelli perceived the suicidal self-indulgence of the past, which, by substituting mercenary troops for national militias, left the Italians at the absolute discretion of their neighbours. The game was in the hands of French, Spanish and German invaders, and no scheme for combination against common foes arose in the peninsula. Each petty potentate strove for his own private advantage in the confusion; and at this epoch the chief gains accrued to the papacy. Aided by his terrible son, Cesare Borgia, Alexander VI. chastised the Roman nobles, subdued Romagna and the March, threatened Tuscany, and seemed to be upon the point of creating a Central Italian state in favour of his progeny, when he died suddenly in 1503 while Cesare was ill. His conquests reverted to the Holy See. Julius II. continued Alexander's policy, but no longer in the interest of his own relatives. It became the nobler ambition of Julius to aggrandize the Church, and to reassume the protectorate of the Italian people. With this object, he secured Emilia, carried his victorious arms against Ferrara, and curbed the tyranny of the Baglioni in Perugia. Quarreling with the Venetians in 1508, he combined the forces of all Europe by the league of Cambrai against them; and, when he had succeeded in his first purpose of humbling them, he turned round in 1510, uttered his famous resolve to expel the barbarians from Italy, and pitted the Spaniards against the French. It was with the Swiss that he hoped to effect this revolution; but the Swiss, formed for mercenary warfare, proved a perilous instrument in the hands of those who used them, and were hardly less injurious to their friends than to their foes. In 1512 the battle of Ravenna between the French troops and the allies of Julius—Spaniards, Venetians and Swiss—was fought. Gaston de Foix bought a doubtful victory dearly with his death; and the allies immediately afterwards expelled the French from Lombardy. Julius II. had only exchanged one set of foreign masters for another. As a consequence of the battle of Ravenna, the Medici returned in 1512 to Florence.

When Leo X. was elected in 1513, Rome and Florence rejoiced; but Italy had no repose. Louis XII. had lost the game, and the Spaniards were triumphant. By the victory of Marignano in 1515 Francis I., having now succeeded to the throne of France, regained the Milanese and broke the power of the Swiss, who held it for Massimiliano Sforza, the titular duke. Leo for a while relied on Francis; for the vast power of Charles V., who succeeded to the empire in 1519, as in 1516 he had succeeded to the crowns of Spain and Lower Italy, threatened the whole of Europe. Leo, however, in 1521, changed sides, allied himself to Charles, and died after hearing that the imperial troops had again expelled the French from Milan. At the decisive battle of Pavia in 1525, Francis was taken prisoner, and Italy lay open to the Spanish armies. Meanwhile Leo X. had been followed by Adrian VI., and Adrian by Clement VII. of the house of Medici. The year 1527 was signalized by the famous sack of Rome. An army of mixed German and Spanish troops, pretending to act for the emperor, but which may rather be regarded as a vast marauding party, entered Italy under their leader Frundsberg. After his death Rome was taken by assault. The Constable de Bourbon, who commanded the army, was killed in the first onslaught; Clement was imprisoned in the castle of St. Angelo; Rome was abandoned to the rage of 30,000 ruffians. As an immediate result of this disaster, Florence shook off the Medici and re-established the republic. But Clement, having made peace with the emperor, turned the remnants of the army which had sacked Rome against his native city. After a desperate resistance, Florence fell in 1530. Alessandro de' Medici was placed there and, on his murder in 1537, Cosimo de' Medici, of the younger branch of the ruling house, was make duke, and bequeathed to his descendants the grand-duchy of Tuscany.

SPANISH-AUSTRIAN ASCENDANCY

It was high time, after the sack of Rome in 1527, that Charles V. should undertake Italian affairs. By the treaty of Barcelona in 1529 the pope and emperor made terms. By that of Cambrai in the same year France relinquished Italy to Spain. Charles then entered the port of Genoa, and on Nov. 5, met Clement VII. at Bologna. He there received the imperial crown, and summoned the Italian princes for a settlement of all disputed claims. Francesco Sforza, the last and childless heir of the ducal house, was left in Milan till his death, which happened in 1535. The republic of Venice was respected in her liberties and Lombard territories. The Este family received a confirmation of their duchy of Modena and Reggio, and were invested in their fief of Ferrara by the pope. The marquisate of Mantua was made a duchy; and Florence was secured, as we have seen, to the Medici. The great gainer by this settlement was the papacy, which held the most substantial Italian state, together with a prestige that raised it far above all rivalry. The rest of Italy became but a dependence upon Spain. Charles V., it must be remembered, achieved his conquest and confirmed his authority far less as emperor than as king of Spain. A Spanish viceroy in Milan and another in Naples, supported by Rome and by the minor princes who followed the policy dictated to them from Madrid, were sufficient to preserve the whole peninsula in a state of somnolent inglorious servitude. From 1530 until 1796, that is, for a period of nearly three centuries, the Italians had no history of their own. Italy only too often became the theatre of desolating and distracting wars. But these wars were fought for the most part by alien armies; the points at issue were decided beyond the Alps; the gains accrued to foreign royal families. Italy, intellectually first among the peoples, was now politically and practically last; and nothing to her historian is more heartrending than to watch the gradual extinction of her spirit in this age of slavery.

In 1534 Alessandro Farnese, who owed his elevation to his sister Giulia, one of Alexander VI.'s mistresses, took the tiara

with the title of Paul III. He conferred the duchy of Parma on his family, and his descendants held it until 1731. Paul III.'s pontificate was further marked by important changes in the Church. In 1540 he approved of Loyola's foundation, and secured the powerful militia of the Jesuit order. The Inquisition was established with almost unlimited powers in Italy, and the press was placed under its jurisdiction. Henceforth it was impossible to publish or to utter a word which might offend the despots of Church or State.

In 1556, Philip II., by the abdication of his father, Charles V., became king of Spain. He already ruled the Two Sicilies and the duchy of Milan. In the next year Ferdinand, brother of Charles, was elected emperor. Gian Pietro Caraffa, who was made pope in 1555 with the name of Paul IV., endeavoured to revive the ancient papal policy of leaning upon France. He encouraged the duke of Guise to undertake the conquest of Naples, as Charles of Anjou had been summoned by his predecessors. But such schemes only led to a languid, lingering Italian campaign, which was settled by Philip's victories over the French at St. Quentin and Gravelines. The peace of Câteau Cambrésis, signed in 1559, left the Spanish monarch undisputed lord of Italy. Of free commonwealths there now survived only Venice, which, together with Spain, achieved for Europe the victory of Lepanto in 1573; Genoa, which, after the ineffectual Fieschi revolution in 1547, abode beneath the rule of the great Doria family, and held a feeble sway in Corsica; and the two insignificant republics of Lucca and San Marino.

Rise of Savoy.—The future hope of Italy, however, was growing in a remote and hitherto neglected corner. Emmanuel Philibert, duke of Savoy, represented the oldest and not the least illustrious reigning house in Europe, and his descendants were destined to achieve the unity and independence of Italy (*see* SAVOY, HOUSE OF).

When Emmanuel Philibert succeeded to his father Charles III. in 1553, he was a duke without a duchy. But the princes of the house of Savoy were a race of warriors; and what Emmanuel Philibert lost as sovereign he regained as captain of adventure in the service of his cousin Philip II. The treaty of Câteau Cambrésis in 1559, and the evacuation of the Piedmontese cities held by French and Spanish troops in 1574, restored his state. By removing the capital from Chambéry to Turin, he completed the transformation of the dukes of Savoy from Burgundian into Italian sovereigns. Emmanuel Philibert was succeeded by his son Charles Emmanuel I., who married Catherine, a daughter of Philip II. He seized the first opportunity of annexing Saluzzo, which had been lost to Savoy in the last two reigns, attacked Geneva and threatened Provence. Henry IV. of France forced him in 1601 to relinquish Bresse and his Burgundian possessions. In return he was allowed to keep Saluzzo. Charles Emmanuel then attempted the acquisition of Montferrat, but after several campaigns he only secured a few places on the borders of that province.

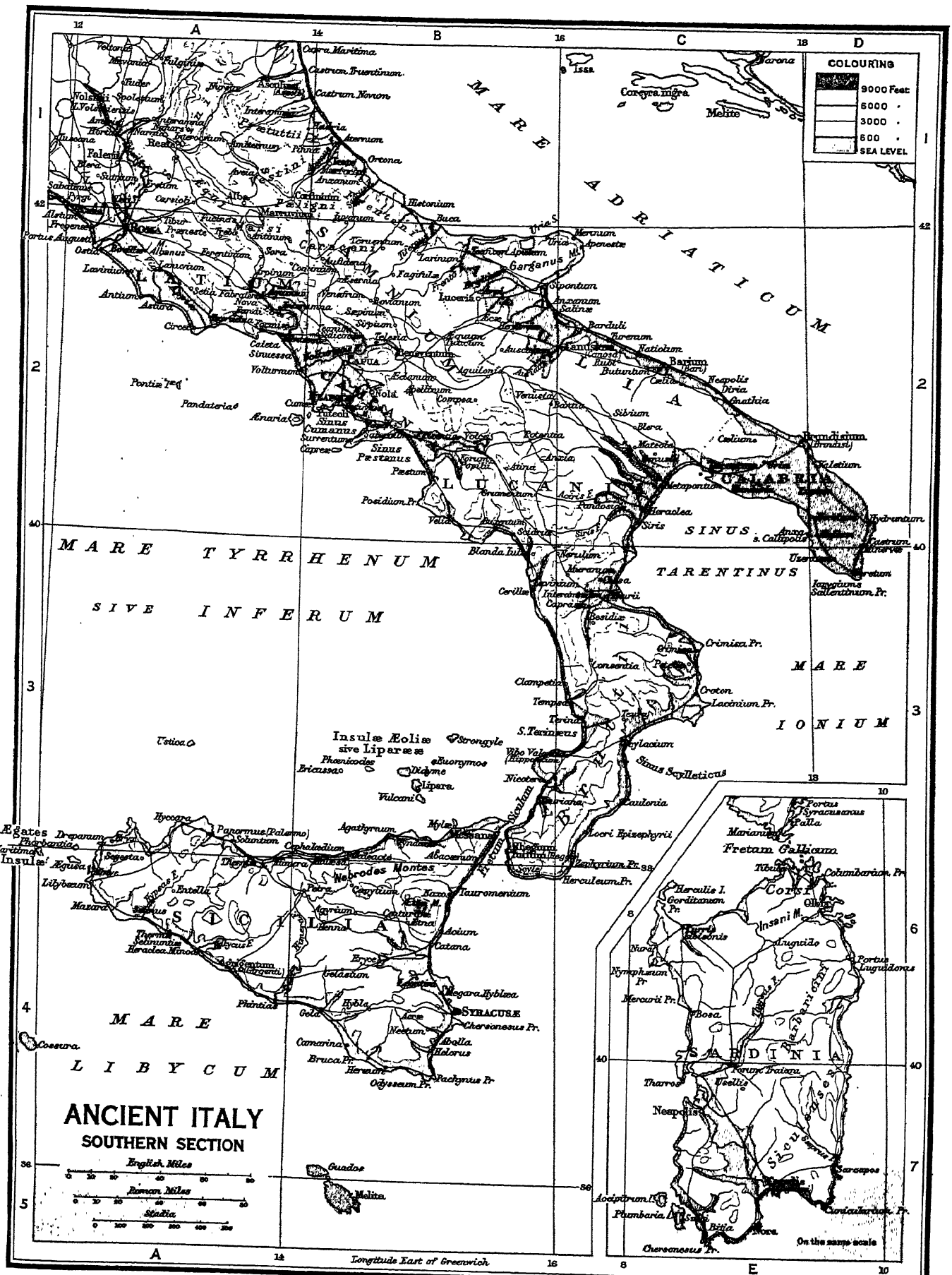
The Gonzaga, and several other ancient ducal families, died out about this time. The legitimate line of the Estensi ended in 1597 by the death of Alfonso II., the last duke of Ferrara. He left his domains to a natural relative, Cesare d'Este. Urban VIII., however, put in a claim to Ferrara, which, it will be remembered, had been recognized a papal fief in 1530. Cesare d'Este had to content himself with Modena and Reggio, where his descendants reigned as dukes till 1794. Under the same pontiff, the Holy See absorbed the duchy of Urbino on the death of Francesco Maria II., the last representative of Montefeltro and Della Rovere. The popes were now masters of a territory embracing a large part of Countess Matilda's legacy, in addition to Pippin's donation, and the patrimony of St. Peter. Urban's predecessor, Paul V., advanced so far as to extend his spiritual jurisdiction over Venice, which, up to the date of his election (1605), had offered the single instance in Italy of a national church. The republic managed the tithes, and the clergy acknowledged no chief above their own patriarch. Paul V. forced the Venetians to admit his ecclesiastical supremacy; but they refused to readmit the Jesuits, who had been expelled in 1606.

Venice rapidly declined throughout the 17th century. The loss of trade consequent upon the discovery of America and the sea-route to the Indies, had dried up her chief source of wealth. Prolonged warfare with the Ottomans, who forced her to abandon Candia in 1669, still further crippled her resources. Yet she kept the Adriatic free of pirates, notably by suppressing the sea-robbers called Uscocchi (1601–17), maintained herself in the Ionian islands, and in 1684 Francesco Morosini, upon whose tomb we still may read the title Peloponnesiacus, wrested the whole of the Morea from the Turks. But after his death in 1715 the republic relaxed her hold upon his conquests. Though the signory still made a brave show upon occasions of parade, it was clear that the State was relapsing into complete decay. The Spanish monarchy at the same epoch dwindled with apparently less reason. The revolt of Masaniello in Naples (1647), followed by rebellions at Palermo and Messina, which placed Sicily for a while in the hands of Louis XIV. (1676–78) were symptoms of progressive anarchy. The population, ground down by preposterous taxes and ill-governed, rose in blind exasperation against their oppressors. But the destinies of Italy were decided in the cabinets and on the battlefields of northern Europe, and the Italians themselves had no say in these events.

Italy, handled and rehandled, settled and resettled, during the dynastic wars of the Spanish, Polish and Austrian successions, changed masters without caring or knowing what befell the principals in any one of the disputes. The people came to be partitioned and exchanged without the assertion or negation of a single principle affecting their interests or rousing their emotions.

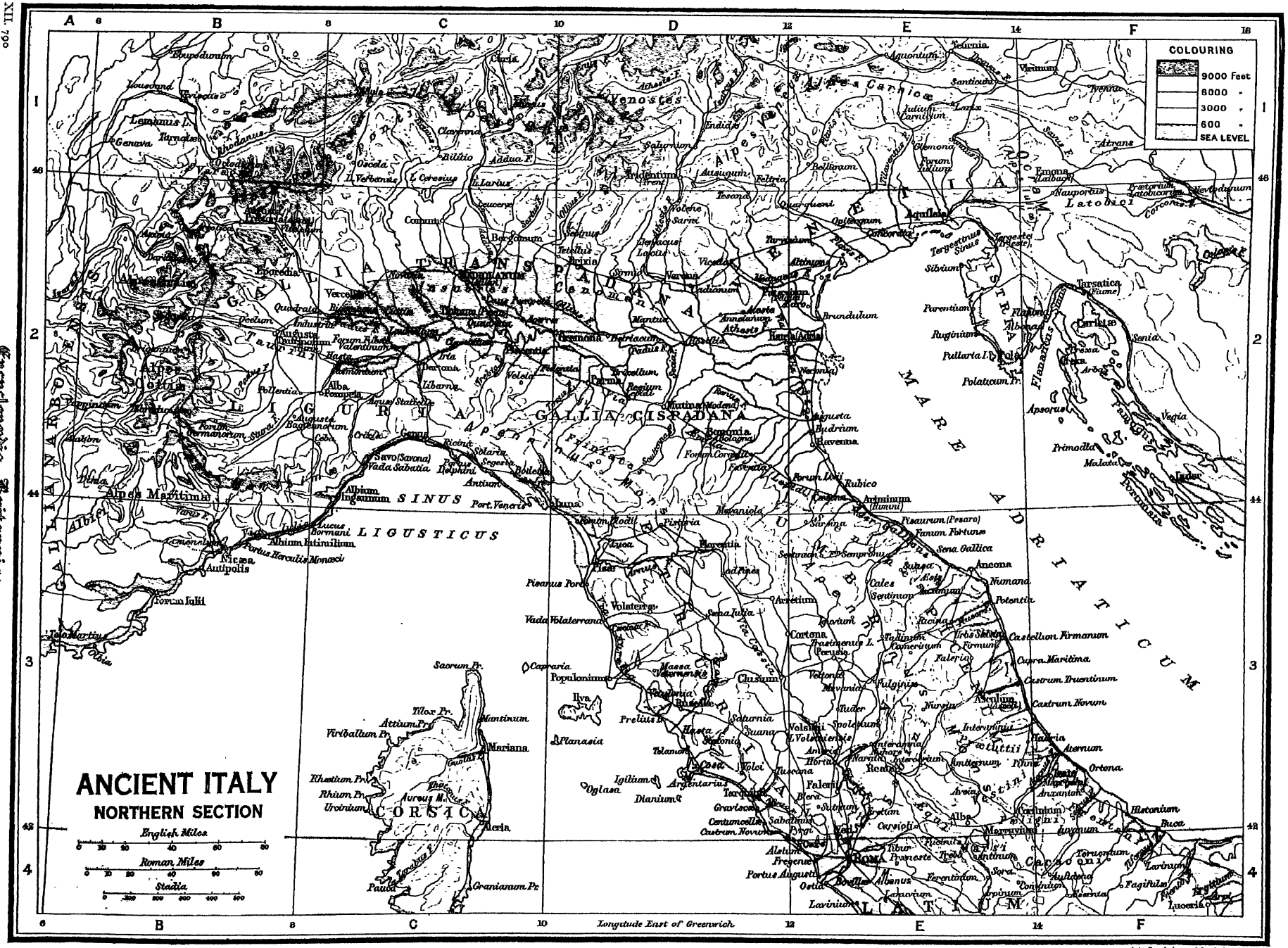
In 1700 Charles II. died, and with him ended the Austrian family in Spain. Louis XIV. claimed the throne for Philip, duke of Anjou. Charles, archduke of Austria, opposed him. The dispute was fought out in Flanders; but Lombardy felt the shock, as usual, of the French and Austrian dynasties. The French armies were more than once defeated by Prince Eugene of Savoy, who drove them out of Italy in 1707. Therefore, in the peace of Utrecht (1713), the services of the house of Savoy had to be duly recognized. Victor Amadeus II. received Sicily with the title of king. Montferrat and Alessandria were added to his northern provinces, and his state was recognized as independent. Charles of Austria, now emperor, took Milan, Mantua, Naples and Sardinia for his portion of the Italian spoil. Philip founded the Bourbon line of Spanish kings, renouncing in Italy all that his Habsburg predecessors had gained. Discontented with this diminution of the Spanish heritage, Philip V. married Elisabetta Farnese, heiress to the last duke of Parma, in 1714. He hoped to secure this duchy for his son, Don Carlos; and Elisabetta further brought with her a claim to the grand-duchy of Tuscany, which would soon become vacant by the death of Gian Gastone de' Medici. After this marriage Philip broke the peace of Europe by invading Sardinia. The Quadruple Alliance was formed, and the new king of Sicily was punished for his supposed adherence to Philip V. by the forced exchange of Sicily for the island of Sardinia. It was thus that in 1720 the house of Savoy assumed the regal title which it bore until the creation of the Italian kingdom in the next century. Though a despot, as all monarchs were obliged to be at that date, Victor Amadeus II. reigned with prudence, probity and zeal for the welfare of his subjects. He took public education out of the hands of the Jesuits, which, for the future development of manliness in his dominions, was a measure of incalculable value. In 1730 Victor Amadeus abdicated in favour of his son Charles Emmanuel III. Repenting of this step, he subsequently attempted to regain Turin, but was imprisoned in the castle of Rivoli, where he ended his days in 1732.

Austrian Ascendancy.—By the terms of the Treaty of Vienna of 1738, which closed the war of Polish succession, Don Carlos, the Spanish Bourbon, who had been proclaimed duke of Parma, on the extinction of the Farnese line in 1731, was now transferred to the Two Sicilies, while Francis of Lorraine, the husband of Maria Theresa, took Tuscany, where the Medici had come to an end with the death of Gian Gastone in 1737, and Parma. Milan and Mantua remained in the hands of the Austrians, while Charles Emmanuel acquired Tortona and Novara.



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When the emperor Charles VI., father of Maria Theresa, died in 1740, the three branches of the Bourbon house, ruling in France, Spain and the Sicilies, joined with Prussia, Bavaria and the kingdom of Sardinia to despoil Maria Theresa of her heritage. Lombardy was made the seat of war, and here the king of Sardinia acted as in some sense the arbiter of the situation. After war broke out, he changed sides and supported the Habsburg-Lorraine party. At first, in 1745, the Sardinians were defeated by the French and Spanish troops. But Francis of Lorraine, elected emperor in that year, sent an army to the king's support, which in 1746 obtained a signal victory over the Bourbons at Piacenza. Charles Emmanuel now threatened Genoa. The Austrian soldiers already held the town. But the citizens expelled them, and the republic kept her independence. In 1748 the Treaty of Aix-la-Chapelle, which put an end to the War of the Austrian Succession, once more redivided Italy. Parma, Piacenza and Guastalla were formed into a duchy for Don Philip, brother of Charles III. of the Two Sicilies, and son of Philip V. of Spain. The duchy of Modena was placed under the protection of the French. So was Genoa, which in 1755, after Paoli's insurrection against the misgovernment of the republic, ceded her old domain of Corsica to France.

From the date of this settlement until 1792, Italy enjoyed a period of repose and internal amelioration under her numerous paternal despots. The Austrian government in Lombardy under Maria Theresa was characterized by improved agriculture, regular administration, order, reformed taxation and increased education. The nobles and the clergy were rich and influential, but kept in order by the civil power. There was no feeling of nationality, but the people were prosperous and enjoyed profound peace. On the death of Maria Theresa in 1780, the emperor Joseph II. instituted much wider reforms. Feudal privileges were done away with, clerical influence diminished and many monasteries and convents suppressed, the criminal law rendered more humane and torture abolished largely as a result of G. Beccaria's famous pamphlet *Dei delitti e delle pene*. On the whole the Austrian rule in pre-revolutionary days was beneficial and far from oppressive, and helped Lombardy to recover from the ill-effects of the Spanish domination. It did little for the moral education of the people, but the same criticism applies more or less to all the European governments of the day. The emperor Francis I. ruled the grand-duchy of Tuscany by lieutenants until his death in 1765, when it was given, as an independent state, to his second son, Peter Leopold. The reign of this grand duke was long recalled as a period of internal prosperity, wise legislation and important public enterprise. In 1790 he succeeded to the empire, and left Tuscany to his son Ferdinand. The kingdom of Sardinia was administered upon similar principles; Charles Emmanuel made his will law, and erased the remnants of free institutions from his state. At the same time he wisely followed his father's policy on education and the Church. This is perhaps the best that can be said of a king who incarnated the stolid absolutism of the period. From this date, however, we are able to trace the revival of independent thought among the Italians. The European ferment of ideas which preceded the French revolution expressed itself in men like Alfieri, the fierce denouncer of tyrants, Beccaria, the philosopher of criminal jurisprudence, Volta, the physicist, and numerous political economists of Tuscany. The papacy, during this period, had to reconsider the question of the Jesuits, who made themselves universally odious, not only in Italy, but also in France and Spain. In the pontificate of Clement XIII. they ruled the Vatican, and almost succeeded in embroiling the pope with the concerted Bourbon potentates of Europe. His successor, Clement XIV., suppressed the order altogether by a brief of 1773.

(J. A. S.; L. V.)

THE NAPOLEONIC PERIOD, 1796–1814

At the end of the 18th century the Austrian Habsburgs possessed the duchies of Milan (including Mantua) and Tuscany; while through a marriage alliance with the house of Este of Modena it dominated that duchy and also had a few fiefs in Piedmont and in Genoese territory. By marrying her daughter, Maria Amelia, to the young duke of Parma, and another daughter, Maria Carolina, to Ferdinand of Naples, Maria Theresa consolidated Habsburg influence in the north and south of the peninsula. The Spanish Bourbons held Naples and Sicily, as well as the duchy of Parma. Of the nominally independent states the chief were the kingdom of Sardinia, ruled over by the house of Savoy, and comprising Piedmont, the isle of Sardinia and nominally Savoy and Nice, though the two provinces last named had virtually been lost to the monarchy since the campaign of 1793. The papacy exercised the temporal power over extensive dominions in central Italy. The republics of Venice and Genoa were in a state of decadence. The small states, Lucca and San Marino, completed the map of Italy. The worst governed part of the peninsula was the south, where feudalism lay heavily on the cultivators and corruption pervaded all ranks.

The campaign of 1796 (*see* NAPOLEONIC CAMPAIGNS) led to the awakening of the Italian people. Democratic propaganda, inspired by France, had already resulted in numerous clubs and secret societies, and every throne in Italy was insecure. The grand-duke of Tuscany recognized the French republic early in 1795. Napoleon's campaign of 1796 detached Sardinia from alliance with Austria and England. The response of a section of the Italians to the French propaganda helped his progress. Ferdinand of Naples sought for an armistice, the central duchies were easily overrun, and, early in 1797, Pope Pius VI. signed terms of peace with Bonaparte at Tolentino, practically ceding the northern part of his states. The districts of Reggio, Modena and Bologna had declared for a democratic policy, and an assembly was formed at Modena which abolished feudal dues and customs, declared for manhood suffrage and established the Cispadane republic (Oct. 1796).

The Cisalpine Republic.—While the French directory saw in the Milanese little more than a district which might be plundered and bargained for, Bonaparte, though by no means remiss in the exaction of gold and of artistic treasures, was laying the foundation of a friendly republic.

The Transpadane republic, or, as it was soon called, the Cisalpine republic, began its organized life on July 9, 1797, with a brilliant festival at Milan. The constitution was modelled on that of the French directory, but the French republic, through its general, Bonaparte, nominated and appointed the first deputies and administrators. In the same month it was joined by the Cispadane republic; and the terms of the Treaty of Campo Formio (Oct. 17, 1797), awarded to this now considerable state the Venetian territories west of the river Adige. A month later Bonaparte absorbed the Swiss district of the Valtellina (*q.v.*) in the Cisalpine republic.

Early in the year 1798, Venice with its mainland territories east of the Adige, inclusive of Istria and Dalmatia, went to the Habsburgs, while the Venetian isles of the Adriatic (the Ionian isles) and the Venetian fleet went to strengthen France. In June 1797, Genoa had also been compelled to undergo at Bonaparte's hands a remodelling on the lines already followed at Milan. The new Genoese republic, French in all but name, was renamed the Ligurian republic.

Occupation of Rome and Naples.—Before Napoleon set sail for Egypt, the French had taken possession of Rome. Joseph Bonaparte, then French envoy to the Vatican, encouraged democratic manifestations; and one of them, at the close of 1797, led to a scuffle in which a French general, Duphot, was killed. The French directory at once ordered its general, Berthier, to march on Rome; the Roman democrats proclaimed a republic on Feb. 15, 1798, and on their invitation Berthier and his troops marched in. The pope, Pius VI., was forthwith removed to Siena and a year later to Valence in the south of France, where he died. Thus fell the temporal power. The "liberators" of Rome thereupon proceeded to plunder the city.

These events brought revolution to the gates of the kingdom of Naples, the worst-governed part of Italy. A British fleet under Nelson, sent into the Mediterranean in May 1798, encouraged the Neapolitan court to a rupture with France. The Neapolitan troops at first occupied Rome, but they were soon scattered in flight; and the French troops, under Gen. Championnet, after crushing the stubborn resistance of the Neapolitan lazzaroni,

forced their way into Naples and proclaimed the Parthenopaean republic (Jan. 23, 1799). Much good work was done by the Neapolitan republicans during their brief tenure of power, but it soon came to an end owing to the course of events which favoured a reaction against France. At the close of 1798 the French directorate virtually compelled the young king of Sardinia, Charles Emmanuel IV., to abdicate at Turin. He retired to the island of Sardinia, while the French despoiled Piedmont, thereby adding fuel to the resentment rapidly growing against them in every part of Europe.

Treaty of Lunéville.—In the war of the Second Coalition the French armies in Italy were everywhere defeated by the Austro-Russian army, under Suvorov, and forced to evacuate Naples and central Italy. In many parts the peasants and townsfolk, enraged by the licence of the French troops, rose up in arms against them. The republics set up by the French at Naples, Rome and Milan, collapsed as soon as their forces retired; and a reaction in favour of clerical and Austrian influence set in with great violence. Even in the north the Austro-Russians drove the French before them, until only Genoa held out, defended by Masséna. Everywhere the old order of things was restored. The aged pope, Pius VI., died at Valence (Aug. 29, 1799), and on March 24, 1800, the conclave, assembled at Venice, elected Pius VII.

Such was the position of affairs when Bonaparte returned from Egypt and landed at Fréjus. The contrast presented by his triumphs to the reverses sustained by the armies of the French directory, was fatal to that body. After the *coup d'état* of Brumaire (Nov. 1799) he, as First Consul, began to organize an expedition against the Austrians (Russia having now retired from the coalition), in northern Italy. The campaign culminating at Marengo was the result. By that triumph, Bonaparte consolidated his own position in France and again laid Italy at his feet. The emperor Francis was forced to sue for peace which was finally concluded at Lunéville on Feb. 9, 1801. The Cisalpine and Ligurian republics (reconstituted soon after Marengo) were recognized by Austria on condition that they were independent of France. The rule of Pius VII. over the Papal States was admitted; and Italian affairs were arranged much as they were at Campo Formio: Modena and Tuscany now reverted to French control, their former rulers being promised compensation in Germany. Naples, easily worsted by the French, under Miollis, left the British alliance, and made peace by the treaty of Florence (March, 1801), agreeing to withdraw her troops from the Papal States, to cede Piombino and the Presidii (in Tuscany) to France, and to close her ports to British ships and commerce. King Ferdinand also had to accept a French garrison at Taranto and other points in the south.

REORGANIZATION OF ITALY

Bonaparte procured the cession to France of Parma; while the duke of Parma (husband of an infanta of Spain) was promoted by him to the duchy of Tuscany, now renamed the kingdom of Etruria; and on Sept. 21, 1802, Piedmont was incorporated in the French republic. Besides copying the Roman habit of planting military colonies, the First Consul imitated the old conquerors of the world by extending and completing the road system of his outlying districts, especially at those important passes, the Mont Cenis and Simplon; and public works in various parts of Piedmont, and the Cisalpine and Ligurian republics, attested to his foresight and wisdom. The universities of Pavia and Bologna were reopened and made great progress in this time of peace and growing prosperity. Somewhat later the construction of the Pavia canal was begun in order to connect Lake Como with the Adriatic for barge-traffic.

Bonaparte, now First Consul for life, felt strong enough to impose his will on the Cisalpine republic, and on the pretext of consolidating it, he invited 450 of its leading men to come to Lyons to a *consulta*. In reality he and his agents had already provided for the passing of proposals which were agreeable to him. It remained to find a chief. Talleyrand and French agents set to work on behalf of their master, with the result that he was elected president for ten years. He accepted that office with the Lombard count, Melzi, as vice-president. The constitution comprised a *consulta* charged with executive duties, a legislative body of 150 members and a court charged with the maintenance of the fundamental laws. In practice, the whole constitution was as autocratic as that of France after the changes brought about by Bonaparte in Aug. 1802. The Cisalpine now took the name of the Italian republic, and the Ligurian republic and that of Lucca remodelled their constitutions in a similar fashion.

The Kingdom of Italy.—The complete disregard shown by Napoleon for one of the chief conditions of the Treaty of Lunéville (Feb. 1801)—that stipulating for the independence of the Ligurian and Cisalpine republics—became more and more apparent every year. Finally, after the proclamation of the French empire (May 18, 1804) Napoleon decided to accept the crown of Italy which Melzi, Marescalchi, Serbelloni and others begged him to assume. Accordingly, on May 26, 1805, in the cathedral at Milan, he crowned himself with the iron crown of the old Lombard kings, using the traditional formula, "God gave it me: let him beware who touches it." On June 7 he appointed his step-son, Eugène Beauharnais, to be viceroy. Eugène soon found that his chief duty was to enforce the will of Napoleon. The republic of Lucca, along with Piombino, was awarded as a principality by the emperor to Elisa Bonaparte and her husband, Felice Baciocchi. In June 1805, the French emperor, at the supposed request of the doge of Genoa, declared the Ligurian republic to be an integral part of the French empire. As a result of this defiance to the sovereigns of Russia and Austria, the Third Coalition was formed between Great Britain, Russia and Austria, Naples soon joining its ranks.

Napoleon's victories forced Austria to make peace by the treaty of Pressburg, ceding to the kingdom of Italy her part of Venetia along with the provinces of Istria and Dalmatia. Napoleon next sent Joseph Bonaparte and Masséna southwards with a strong column, and compelled the Anglo-Russian forces to evacuate Naples. The Bourbon court sailed away to Palermo, where it remained for eight years under the protection afforded by the British. On Feb. 15, 1806, Joseph Bonaparte entered Naples in triumph, his troops capturing there 200 pieces of cannon. Gaeta, however, held out stoutly against the French. Sir Sidney Smith with a British squadron captured Capri (Feb. 1806) and the peasants of the Abruzzi and Calabria soon began to give trouble. Worst of all was the arrival of a small British force in Calabria under Sir John Stuart, which defeated the French with heavy loss near the village of Maida (July 4). Calabria rose in revolt, and the peasants dealt out savage reprisals to the French troops. On July 18, however, Gaeta surrendered to Masséna, who crushed the Bourbon rising in Calabria with great barbarity, and compelled the British force to re-embark for Sicily. Under Joseph, who had been duly proclaimed king of Naples on March 30, 1806, great progress was made in abolishing feudal laws and customs, in reforming the judicial procedure and criminal laws on the model of the *Code Napoléon*, and in attempting elementary education.

The peace of Tilsit (July 7, 1807) enabled Napoleon to press on his projects for securing the command of the Mediterranean. He failed to capture Sicily; Capri, however, fell to the French on Oct. 18, 1808, shortly after the arrival at Naples of the new king, Joachim Murat, Joseph Bonaparte being transferred from Naples to Madrid. Joseph left Naples on May 23, 1808; but it was not until Sept. 6 that Murat made his entry. A fortnight later his consort Caroline, Napoleon's sister, arrived, and soon showed a vigour and restlessness of spirit which frequently clashed with the dictates of her brother, the emperor, and the showy, unsteady policy of her husband. Early in 1808 Elisa Bonaparte and her husband, Baciocchi, rulers of Lucca and Piombino, became the heads of the administration in Tuscany, Elisa showing decided governing capacity.

Napoleon and the Papacy.—For some time past the relations between Napoleon and the pope, Pius VII., had been severely strained, chiefly because the emperor insisted on controlling the Church, both in France and in the kingdom of Italy, but also because the pontiff refused to grant the divorce between Jerome Bonaparte and the former Miss Patterson on which Napoleon early in the year 1806 laid so much stress. His desire further to

extend the continental system, that great engine of commercial war by which he hoped to assure the ruin of England, prompted the annexation of Tuscany and his intervention in the affairs of the Papal States, and in Feb. 1808 a French column under Miollis occupied Rome and deposed the papal authorities. Against this violence Pius VII. protested in vain. Napoleon, on April 2, annexed to the kingdom of Italy the papal provinces of Ancona, Urbino, Macerata and Camerino. After the occupation of Vienna the conqueror dated from that capital on May 17, 1809, a decree virtually annexing Rome and the *Patrimonium Petri* to the French empire. In reply the pope prepared a bull of excommunication against those who should infringe the prerogatives of the Holy See in this matter. Thereupon the French general, Miollis, who still occupied Rome, caused the pope to be arrested and carried him away northwards into Tuscany, thence to Savona; finally he was taken, by Napoleon's orders, to Fontainebleau. Thus, a second time, fell the temporal power of the papacy. By an imperial decree of Feb. 17, 1810, Rome and the neighbouring districts, including Spoleto, became part of the French empire; the *Code Napoléon* was introduced, public works were set on foot and great advance was made in the material sphere. Napoleon intended to make the city the second capital of the empire. Nevertheless the harshness with which the emperor treated the Roman clergy and suppressed the monasteries caused deep resentment to the orthodox.

COLLAPSE OF NAPOLEON'S RULE

In civil administration, law, judicial procedure, education and public works, Italy under Napoleon experienced great benefits, the results of which never wholly disappeared. On the other hand, she suffered from the rigorous measures of the continental system, which seriously crippled trade, while the drain of men to supply his armies in Germany, Spain and Russia was also a serious loss. A powerful Italian corps marched under Eugène Beauharnais to Moscow, and distinguished itself at Malo-Jaroslavetz, as also during the horrors of the retreat in the closing weeks of 1812. It is said that out of 27,000 Italians who entered Russia with Eugène, only 333 saw their country again.

The uncertainty caused by Murat's policy in 1813–14 had no small share in precipitating the downfall of Napoleon's power in Italy. After the battle of Leipzig (Oct. 16–19, 1813), Beauharnais' power crumbled away under the assaults of the now victorious Austrians, and was fatally compromised by the defection of Murat and the dissensions among the Italians. Very many of them, distrusting both of these kings, sought to act independently in favour of an Italian republic. Lord William Bentinck with an Anglo-Sicilian force landed at Leghorn on March 8, 1814, and issued a proclamation to the Italians bidding them rise against Napoleon in the interests of their own freedom. A little later he gained possession of Genoa. On April 16, 1814, Beauharnais signed an armistice with the Austrians who, under Gen. Bellegarde, entered Milan without resistance; and this event preluded the restoration of the old political order.

The arrangements made by the allies in accordance with the treaty of Paris (June 12, 1814) and the Final Act of the congress of Vienna (June 9, 1815), imposed on Italy boundaries which, roughly speaking, corresponded to those of the pre-Napoleonic era. To the kingdom of Sardinia, now reconstituted under Victor Emmanuel I., France ceded its old provinces, Savoy and Nice; and the allies insisted on the addition to that monarchy of the territories of the former republic of Genoa in order to strengthen it as a buffer state between France and the smaller states of central Italy. Austria recovered the Milanese, and all the possessions of the old Venetian republic on the mainland, including Istria and Dalmatia. The Ionian islands, formerly belonging to Venice, were, by a treaty signed at Paris on Nov. 5, 1815, placed under the protection of Great Britain. By an instrument signed on April 24, 1815, the Austrian territories in north Italy were erected into the kingdom of Lombardo-Venetia, which, though an integral part of the Austrian empire, was to enjoy a separate administration. Francis IV., son of the archduke Ferdinand of Austria and Maria Beatrice, daughter of Ercole Rinaldo, the last of the Estensi, was reinstated as duke of Modena. Parma and Piacenza were assigned to Marie-Louise, daughter of the Austrian emperor and wife of Napoleon, on behalf of her son, the little Napoleon, but by subsequent arrangements (1816–17) the duchy was to revert at her death to the Bourbons of Parma, then reigning at Lucca. Tuscany was restored to the grand-duke Ferdinand III. of Habsburg-Lorraine. The duchy of Lucca was given to Marie-Louise of Bourbon-Parma, who, at the death of Marie-Louise of Austria, would return to Parma, when Lucca would be handed over to Tuscany. The pope, Pius VII., returned to Rome in May, 1814, and was recognized by the congress of Vienna as the sovereign of all the former possessions of the Holy See. Ferdinand IV. of Naples, not long after the death of his consort, Maria Carolina, in Austria, returned from Sicily. He received back his dominions in their entirety, with the new title of Ferdinand I. of the Two Sicilies. The rash attempt of Murat in the autumn of 1815, which led to his death at Pizzo di Calabria, enabled the Bourbon dynasty to crush malcontents with all the greater severity. The reaction, which was dull and heavy in the dominions of the pope and of Victor Emmanuel, systematically harsh in the Austrian states of the north, and comparatively mild in Tuscany, excited the greatest loathing in southern Italy and Sicily, because there it was directed by a dynasty which had aroused feelings of hatred mingled with contempt.

There were special reasons why Sicily should harbour these feelings against the Bourbons. During eight years (1806–14) the chief places of the island had been garrisoned by British troops. Lord William Bentinck exercised a restraining influence on Ferdinand and Maria Carolina, and in 1812 a constitution modelled largely on that of England was passed by the estates. After the retirement of the British troops in 1814 the constitution lapsed, and the royal authority became once more absolute. But the memory of the benefits conferred by "the English constitution" remained and proved one of the influences which spurred on the Sicilians and the democrats of Naples to the efforts which they put forth in 1821, 1848 and 1860.

This result of British intervention was in some respects similar to that exerted by Napoleon on the Italians of the mainland. The general reactions after 1815 could not blot out from the minds of the Italians the recollections of the benefits derived from the just laws, vigorous administration and enlightened aims of the great emperor. The hard but salutary training which they had undergone at his hands had taught them that they were the equals of the northern races both in the council chamber and on the field of battle. It had further revealed to them that they were in all essentials a nation. (X.)

THE RISORGIMENTO

As the result of the Vienna treaties, Austria came to be the predominant power in Italy—Lombardy and Venetia she ruled directly, the duchies through Austrian princes, and the other states by indirect influence and alliances. Victor Emmanuel I. of Sardinia was more independent than the other Italian rulers and his dynasty was popular, but he was determined to restore the antiquated laws, institutions and conditions preceding the French revolution and to introduce the most bigoted reaction. In the Lombardo-Veneto, the Austrian administration was honest and efficient, but politically oppressive. Duke Francis of Modena was a reactionary tyrant; in Parma there was little oppression under Marie-Louise, and in Tuscany the rule of Ferdinand was mild, but demoralizing. The papal government was an incompetent theocracy with a corrupt administration and a police which, although barbarously tyrannical, was unable to cope with the anarchy and brigandage prevalent in some provinces. In Naples King Ferdinand retained some of the institutions and officials of Murat's régime, but a degrading bigotry became the basis of government and social life, while in Sicily, converted into a Neapolitan province and deprived of its constitution, Bourbon rule was particularly unpopular.

The newly-restored governments might easily have achieved popularity among peoples worn out by the terrible drain of men and money caused by the Napoleonic wars. But in their terror of revolution they failed to realize that the past régime had

wafted a breath of new life into Italy, and that the new-born idea of Italian unity was a force to be reckoned with. The masses were still politically indifferent, but in the upper classes there was a sense of despair at Italy's degradation and an incipient hatred of foreign rule, which found expression in the secret societies, particularly the Carbonari (*q.v.*). In 1820 a Carbonarist mutiny broke out in the Neapolitan army to the cry of "God, the king and the constitution." The king, in a panic, granted the constitution, which he swore to respect (July, 1820), but immediately after he repaired to the congress of Laibach (*see* LAIBACH, CONGRESS OF) and applied for military assistance with which to crush the revolution. Austria was entrusted with the task, and an Austrian army defeated the Neapolitan Liberals under Gen. Pepe at Riet (March 7, 1821), and restored Ferdinand's autocracy. The same year a Carbonarist mutiny broke out in Piedmont. Prince Charles Albert, the heir presumptive, felt a certain interest in Liberal ideas and was above all anti-Austrian, and when on the abdication of Victor Emmanuel and in the absence of the new king, Charles Felix, he was appointed regent, he granted the constitution; but Charles Felix returned, abrogated the constitution and crushed the revolution with Austrian assistance. He exiled Charles Albert, but resented Austria's attempt to have him excluded from the succession.

There had been some mild plotting against Austria in Lombardy, in consequence of which Count F. Confalonieri, the poet Silvio Pellico, and others, were imprisoned in the Spielberg for many years; the sufferings and heroism of the prisoners and Pellico's famous account of his imprisonment (*Le mie prigioni*) enlisted wide sympathy for the Italian cause throughout Europe.

The July revolution in Paris aroused great hopes among the Italian patriots, and in Feb. 1831 the Romagna and the March rose in revolt against the papal authorities who were expelled without difficulty; Louis Napoleon, afterwards emperor of the French, was among the insurgents. Similar risings broke out at Parma and Modena, but Austrian intervention restored papal and ducal rule, and Austrian forces remained for some years in occupation of Ferrara, while France occupied Ancona. The Powers addressed a memorandum to Pope Gregory XVI. recommending moderate reforms, but he paid no attention to it. Although the character of these agitations showed that the masses were still not yet ripe for a national movement, they proved the inability of the despotic governments to hold their own without foreign arms.

Mazzini and "Giovane Italia."—On April 27, 1831, Charles Albert succeeded Charles Felix as king of Sardinia. Immediately afterwards he received a letter from Giuseppe Mazzini exhorting him to put himself at the head of a movement for liberating and uniting Italy. Mazzini (*q.v.*) had formed an association among the Italian exiles at Marseille called the Giovane Italia (Young Italy) for the emancipation of Italy from foreign and domestic tyranny, and also from national faults of character. His great merit lies in his constant advocacy of the idea of Italian unity, and the Giovane Italia spread to all centres of Italian exiles. His attempt to raise a rebellion in Savoy only resulted in sentences of death or imprisonment on Liberal suspects, but the expedition of the Bandiera brothers to Calabria, organized by him, although unsuccessful, was significant as the first attempt by Italians from all parts of the country to promote revolution in the south. Side by side with the Mazzinian republican propaganda, the idea of regenerating Italy under Piedmontese auspices and the Savoy dynasty began to gain ground. Vincenzo Gioberti, who in 1843 published his treatise *Del primato morale e civile degli Italiani*, extolling the achievements and virtues of the Italians, advocated a federation of Italian States under the presidency of the pope, Cesare Balbo in his *Speranze d'Italia* (1844) also favoured a federation, but insisted on the expulsion of the Austrians from Italy. A third important publication was Massimo D'Azeglio's *Degli ultimi casi di Romagna*, exposing papal misgovernment.

On the death of Gregory XVI. in 1846, Cardinal Mastai Ferretti was elected pope as Pius IX. He was a kindly man of inferior intelligence, but the interest he evinced in Liberalism and the amnesty and administrative reforms which he granted aroused high hopes among the Italian patriots. Austria was much disturbed by his attitude and immediately reoccupied Ferrara, to the great indignation of the pope. Charles Albert had little sympathy with revolution, and was dominated by religious fervour, but he hated Austria and the advent of an apparently anti-Austrian pope conciliated his two strongest feelings.

Charles Louis, duke of Lucca, in 1847 sold his duchy to Leopold II. of Tuscany (the successor of Ferdinand III. since 1824) to whom it would have reverted in any case at the death of the duchess of Parma. At the same time Leopold ceded Lunigiana to Parma and Modena in equal parts, an arrangement which provoked the indignation of the inhabitants of the district. In Sept. 1847 Leopold gave way to the popular agitation for a national guard, in spite of Metternich's threats, and allowed greater freedom of the press.

Ferdinand I. of the Two Sicilies had died in 1825, and was succeeded by Francis I. At the latter's death in 1830 Ferdinand II. succeeded, an ignorant bigot who concentrated the whole of the executive in his own hands. On Jan. 12, 1848 a revolution broke out at Palermo under the leadership of Ruggiero Settimo, and the insurgents demanded the constitution of 1812 or complete independence. Disturbances occurred at Naples also, and the king, who could not obtain Austrian help, granted a constitution (Jan. 28).

1848–1849

Revolutions of 1848.—The news from Naples strengthened the demand for a constitution in Piedmont. Count Camillo Cavour, then editor of a new and influential paper called *Il Risorgimento*, had advocated it strongly, and monster demonstrations were held every day. Although the king disliked the idea, he granted (March 4, 1848) the hastily drafted charter destined to be the constitution of the future Italian kingdom. It provided for a nominated senate and an elective chamber of deputies, the king retaining the right of veto; the press censorship was abolished, and freedom of meeting, of the press and of speech were guaranteed. Balbo was called upon to form the first constitutional ministry. Three days later the grand-duke of Tuscany promised similar liberties, and a charter was promulgated on the 17th.

A demonstration in favour of Pius IX. on Jan. 3 at Milan was dispersed with unnecessary severity, but the revolution which broke out on March 8 in Vienna itself, led to the granting of feeble concessions to Lombardy and Venetia. But it was too late, and the famous Five Days' revolution began. It was a popular outburst of pent-up hate, unprepared by leaders, although leaders such as Luciano Manara soon arose. Field-marshal Radetzky occupied the citadel and other points of vantage; the desperate struggle lasted until the 22nd, when the Austrians, having lost 5,000 killed and wounded, were forced to evacuate the city. The rest of Lombardy and Venetia now flew to arms, and the Austrian garrisons, except in the Quadrilateral (Verona, Peschiera, Mantua and Legnano) were expelled. In Venice the people, under the leadership of Daniele Manin, rose in arms and forced the Austrian authorities to withdraw on March 22, after which the republic was proclaimed. At Milan, where there was a division of opinion between the monarchists under Casati and the republicans under Cattaneo, a provisional administration was formed and the question of the form of government postponed for the moment. Provisional governments were set up in Parma and Modena, and in Rome Pius, after calling down God's blessing on Italy, promulgated a constitution on Feb. 11.

The War of 1848.—There were now three main political tendencies, *viz.*, the union of north Italy under Charles Albert and an alliance with the pope and Naples, a federation of the different States, and a united republic of all Italy. All parties, however, were agreed in favour of war against Austria. The news of the Five Days of Milan produced the wildest excitement in Turin, and on March 23 the king declared war against Austria. Charles Albert could dispose of 90,000 men, including some 30,000 from central Italy, but he took the field with only half his force, and his delays lost him his best chances, enabling Radetzky to receive reinforcements from Austria. The pope, unable to resist the popular demand for war, allowed his army to depart (March 23), with instructions to act in concert with Charles Albert. But in his

encyclical of April 20, he stated that, as head of the Church, he could not declare war, although he was unable to prevent his subjects from following the example of other Italians. Tuscany and Naples had both joined the Italian league. The Piedmontese defeated the enemy at Pastrengo (April 30), but did not profit by the victory, and in the meantime a dispute had broken out at Naples between the king and parliament, barricades were erected and street fighting ensued (May 15); on the 17th Ferdinand dissolved parliament and recalled the army. A force of Tuscan volunteers was attacked by a superior body of Austrians at Curtatone and Montanaro, and defeated after a gallant resistance on May 27; Charles Albert captured Peschiera on May 30, and defeated Radetzky at Goito. But the withdrawal of the Neapolitans seriously embarrassed the Italians, and the whole Austrian army now turned on Vicenza, which after a brave resistance surrendered on June 10. All Venetia except the capital was thus once more occupied by the Austrians. On July 23–25 (first battle of Custoza) the Piedmontese were defeated and forced to retire on Milan with Radetzky's superior force in pursuit. The king was the object of a hostile demonstration in Milan, and returned to Piedmont with the remnants of his army. On August 6 Radetzky again entered Milan, and three days later an armistice was concluded between Austria and Piedmont, the latter evacuating Lombardy and Venetia.

Meanwhile, on July 7, the Venetian assembly declared in favour of fusion with Piedmont, and Manin, who had been elected president, resigned his powers to the royal commissioners. Soon after Custoza, however, the Austrians blockaded the city. In Rome the pope's authority weakened day by day, and disorder increased. The Mamiani ministry having failed to achieve anything, Pius summoned Pellegrino Rossi, a learned jurist who had long been exiled in France, to form a cabinet. On Nov. 15 he was assassinated, and the terrified pope fled in disguise to Gaeta (Nov. 25); when parliament requested him to return he refused even to receive the deputation. On Feb. 5, 1849, a constituent assembly was summoned, and on the 9th it voted the downfall of the temporal power and proclaimed the republic. Mazzini hurried to Rome and was chosen head of the triumvirate. On the 18th Pius invited the armed intervention of France, Austria, Naples and Spain to restore his authority. In Tuscany the government drifted from the moderates to the extreme democrats, and in Oct. 1848, Leopold reluctantly consented to a democratic ministry led by Guerrazzi and Montanelli. He refused, however, to concede a constituent assembly, and left Florence. On Feb. 8, 1849, the republic was proclaimed, and on the 21st, at the pressing request of the pope and the king of Naples, Leopold went to Gaeta.

Ferdinand did not openly break his constitutional promises until Sicily was reconquered. He now prorogued parliament, enacted stringent measures against the Liberals, and retired to Gaeta, the haven of refuge for deposed despots.

Charles Albert was determined that so long as he had an army in being he could not abandon the Lombards and the Venetians, whom he had encouraged in their resistance, without one more effort, though he knew full well that he was staking all on a desperate chance. On March 12, 1849, he denounced the armistice. His forces amounted to 80,000 men, including a Lombard corps and other volunteers. But the discipline and morale of the army were shaken and its organization faulty, and after some preliminary fighting Radetzky won the decisive battle of Novara (March 23) which broke up the Piedmontese army. The king, who had sought death in vain all day, had to ask terms of Radetzky; these proving extremely onerous, he abdicated in favour of his son Victor Emmanuel II., and departed at once for Portugal, where he died in a monastery a few months later.

Re-establishment of Autocracy.—Novara set Austria free to reinstate the Italian despots. Ferdinand at once re-established autocracy in Naples; though the struggle in Sicily did not end until May, when Palermo, after a splendid resistance, capitulated. In Tuscany disorder continued, until on May 25, 1849, Austrian troops entered Florence, and on July 28 Leopold returned to his capital. While his restoration was welcomed by a part of the people, the fact that Leopold had come under Austrian protection ended by destroying all loyalty to the dynasty, and consequently contributed not a little to Italian unity.

In Rome the triumvirate decided to defend the republic to the last; the defenders received a priceless addition to their strength in the person of Garibaldi, who in April, 1849, entered Rome with some 500 men. At this time France, as a counterpoise to Austrian intervention in other parts of Italy, decided to restore the pope. On April 25 Gen. Oudinot landed with 8,000 men at Civitavecchia, and on the 30th attempted to capture Rome by surprise, but was completely defeated by Garibaldi. The French republican Government, while pretending to treat with Mazzini, increased Oudinot's force to 35,000 men. At the same time, Austrian, Neapolitan and Spanish troops were converging on Rome. The Roman army (20,000 men) included, besides Garibaldi's red-shirted legionaries, volunteers from all parts of Italy, many of them wealthy young men of noble family. The Neapolitans were ignominiously beaten in May and retired to the frontier; but by the end of May, after desperate fighting, the French penetrated within the walls (June 29). Garibaldi quitted the city, followed by 4,000 of his men, and attempted to join the defenders of Venice. In spite of the fact that he was pursued by the armies of four Powers, he succeeded in reaching San Marino, whence, his force having melted away, he reached Piedmont and eventually America, to await a new call to fight for Italy.

After a heroic defence, conducted by Guiseppe Martinengo, Brescia was recaptured in April by the Austrians under Gen. Haynau, his atrocities earning him the name of "the Hyena of Brescia." In May they seized Bologna, and Ancona in June. Venice alone still held out; the assembly voted: "Venice resists the Austrians at all costs," and the citizens and soldiers, strengthened by the arrival of volunteers from all parts of Italy, showed the most splendid devotion in their hopeless task. By the end of May Venice was blockaded by land and sea, and on the 24th the city, reduced by famine, capitulated on favourable terms. Manin and a few others were excluded from the amnesty and went into exile.

The Italian cause had been crushed, but revolution and war had strengthened the feeling of unity, for Neapolitans had fought for Venice, Lombards for Rome, Piedmontese for all Italy. Piedmont was shown to possess the qualities necessary to constitute the nucleus of a great nation. It was now evident that the federal idea was impossible, for none of the princes except Victor Emmanuel could be trusted, and that unity and freedom could not be achieved under a republic, for nothing could be done without the Piedmontese army, which was royalist to the core. All reasonable men were thus convinced that the question of the ultimate form of the Italian government was secondary, and that the national efforts should be concentrated on the task of expelling the Austrians.

CAVOUR, AND "THE DECADE OF RESISTANCE"

The peace negotiations between Piedmont and Austria dragged on for several months, involving two changes of ministry, and D'Azeglio became premier. Through Anglo-French mediation Piedmont's war indemnity was reduced, and at last Austria agreed to amnesty all those compromised in the Lombard revolution save a very few; in August the peace terms were agreed upon. But it was not until the king's eloquent appeal from Moncalieri to his people's loyalty, and after a dissolution and the election of a new parliament, that the treaty was ratified (Jan. 9, 1850). The situation in Piedmont was far from promising. Legislation had to be entirely reformed, and the bill for abolishing the special jurisdiction for the clergy (*foro ecclesiastico*) and other mediaeval privileges aroused the bitter opposition of the Vatican as well as of the Piedmontese clericals. This same year (1850) Cavour, who had been in parliament for some time and had in his speech of March 7 struck the first note of encouragement after the gloom of Novara, became minister of agriculture, and in 1851 also assumed the portfolio of finance. A quarrel with D'Azeglio resulted in Cavour's resignation, but D'Azeglio was not equal to the situation, and he, too, resigned in Nov. 1852; whereupon the king appointed Cavour prime minister, a position which with short intervals he held until his death.

The Austrians in the period from 1849–59, known as the *decennio della resistenza* (decade of resistance), were made to feel that they were in a conquered country; for no self-respecting Lombard or Venetian would even speak to an Austrian. Austria, on the other hand, treated her Italian subjects with great severity. The Italian provinces were the most heavily taxed in the whole empire, and long terms of imprisonment and the bastinado, the latter even inflicted on women, were the penalties for the least expression of anti-Austrian opinion. The State trials at Mantua in connection with the discovery of a Mazzinian plot, conducted in the most shamelessly inquisitorial manner, resulted in five death sentences, including that of the priest Tazzoli, and many of imprisonment for long terms. On a charge of complicity an embargo was further laid on the property of many Lombard emigrants who had settled in Piedmont and become naturalized. The Piedmontese Government rightly regarded this measure as a violation of the peace treaty of 1850, and Cavour recalled the Piedmontese minister from Vienna.

Cavour's ideal for the present was the expulsion of Austria from Italy and the expansion of Piedmont into a North Italian kingdom; and although he did not yet think of Italian unity as a question of practical policy, he began to foresee it as a future possibility.

Realizing that by taking part in the Crimean War, Piedmont would gain for itself a military status and a place in the councils of the great Powers, and establish claims on Great Britain and France, Cavour negotiated a treaty of alliance (signed in Jan. 1855) and while Austria remained neutral, a well-equipped Piedmontese force of 15,000 men, under Gen. La Marmora, sailed for the Crimea. Everything turned out as Cavour had hoped. The Piedmontese troops distinguished themselves in the field, gaining the sympathies of the French and English; and at the subsequent congress of Paris (1856) where Cavour himself was Sardinian representative, the Italian question was discussed, and the intolerable oppression of the Italian peoples by Austria and the despots ventilated.

Austria at last attempted a more conciliatory policy towards her Italian subjects, but it was too late, and the immense majority of the people rejected these advances. The restored despots in the rest of Italy resumed their old methods of persecution, especially Ferdinand of Naples, whose treatment of political prisoners, including highly respectable men such as Silvio Spaventa, Luigi Settembrini and Carlo Poerio, called down upon him the fierce condemnation of W. E. Gladstone. The only exception was Leopold of Tuscany, but even his mildness failed to conciliate his people, owing to his dependence on Austria.

THE UNION OF ITALY

While Mazzini's influence declined, a new movement for the union of Italy under Victor Emmanuel gathered strength. The propaganda was organized by the Sicilian La Farina, by means of the *Società Nazionale*, and found many adherents, including not a few ex-republicans such as Manin, then an exile in Paris. Cavour gave secret encouragement to the movement, and ended by practically directing its activity through La Farina.

Napoleon III. and the War of 1859.—Both the king and his minister realized that Piedmont alone could not expel Austria from Italy without foreign assistance. Cavour now set himself to the task of isolating Austria and securing an alliance for her expulsion. The emperor Napoleon, almost alone amongst Frenchmen, had genuine Italian sympathies. But were he to intervene in Italy, the intervention would have to bring tangible advantages to France. Hence his hesitations and vacillations, which Cavour steadily worked to overcome. The attempt by the Mazzinian, Felice Orsini, to murder Napoleon (Jan. 14, 1858), although it failed, greatly impressed the emperor, as did Orsini's letter from prison exhorting him to intervene in Italy. Consequently negotiations with Cavour were resumed, and a meeting with him was arranged to take place at Plombières (July 20 and 21, 1858). There it was agreed that France should supply 200,000 men and Piedmont 100,000 for the expulsion of the Austrians from Italy, that Piedmont should be expanded into a kingdom of North Italy, that central Italy should form a separate kingdom, on the throne of which the emperor perhaps would place one of his own relatives, and Naples another, possibly under Lucien Murat; the pope, while retaining only the "Patrimony of St. Peter" (the Roman province), would be president of the Italian confederation. In exchange for French assistance Piedmont would cede Savoy and perhaps Nice to France; and a marriage between Victor Emmanuel's daughter Clothilde and Napoleon's nephew Prince Bonaparte, to which the emperor attached great importance, although not made a definite condition, was also discussed.

On Jan. 1, 1859, Napoleon astounded the diplomatic world by remarking to Baron Hübner, the Austrian ambassador, that he regretted that relations between France and Austria were "not so good as they had been"; and at the opening of the Piedmontese parliament on the 10th Victor Emmanuel pronounced the memorable words that he could not be insensible to the cry of pain (*il grido di dolore*) which reached him from all parts of Italy. Yet after these warlike declarations and after the signing of a military convention at Turin, Napoleon suddenly adopted the Russian suggestion of a congress to settle Italian affairs. The scheme was strongly opposed by Cavour, and Napoleon then insisted on disarmament by both Sardinia and Austria. Cavour saw the necessity of acceding to this demand of disbanding the volunteers who had flocked to Piedmont from all parts of Italy when war seemed imminent, and of reducing the regular army to a peace footing. But in Austria, where the war party was in the ascendant, the reserves were called out on April 12, and on the 23rd, before Cavour's decision was known, an ultimatum was sent to Turin demanding disarmament within three days. Cavour was delighted at the turn affairs had taken, as Austria now appeared the aggressor. On the 29th Francis Joseph declared war, and the next day his troops crossed the Ticino, a move which was followed by a French declaration of war. The actions of Montebello (May 20), Palestro (May 31) and Melegnano (June 8) and the battles of Magenta (June 4) and Solferino (June 24) all went against the Austrians. Garibaldi's volunteers raised the standard of insurrection and held the field in the region of the Italian lakes. After Solferino the allies prepared to besiege the Quadrilateral, but Napoleon drew back, unwilling, for many reasons, to continue the campaign. He saw the defects of his own army organization, and feared intervention by Prussia; he did not wish to create a too powerful Italian state at the foot of the Alps; and lastly, the war was far from popular in France. Consequently, without consulting Victor Emmanuel, Napoleon asked Francis Joseph for an armistice, which was agreed to. The king was informed, and on the 8th an armistice was arranged at Villafranca until Aug. 15. But the king and Cavour were terribly upset by this move, which meant peace without Venetia; Cavour hurried to the king's headquarters at Monzambano, and in excited, almost disrespectful, language implored him not to agree to peace. On this occasion, however, Victor Emmanuel proved the greater statesman of the two; he saw that, great as was the sacrifice, he must be content with Lombardy for the present, lest all be lost. On the 11th the two emperors met at Villafranca, where they agreed that Lombardy should be ceded to Piedmont, Venetia retained by Austria, and Italy made into a confederation with the pope as president. Victor Emmanuel regretfully signed the peace preliminaries, adding, however, *pour ce qui me concerne* (which meant that he made no undertaking with regard to central Italy), and Cavour resigned office. (*See* ITALIAN WARS.)

The Lombard campaign had produced important effects throughout the rest of Italy. A bloodless revolution in Florence forced the grand duke to depart on April 27, 1859. A provisional government was formed, led by Ubaldino Peruzzi, and was strengthened on May 8 by the inclusion of Baron Bettino Ricasoli, a man of great force of character, who became the real head of the administration, and all through the ensuing critical period aimed unswervingly at Italian unity. The rulers of Parma and Modena and the papal authorities in the legations were likewise expelled, provisional governments being set up, and the dictatorship of Victor Emmanuel invoked. In July the marquis D'Azeglio arrived at Bologna as royal commissioner.

Napoleon was resolutely opposed to the Piedmontese annexations in central Italy. But here Cavour intervened, for he was determined to maintain the annexations, at all costs. Although he had resigned, he remained in office until Rattazzi could form a new ministry; and while officially recalling the royal commissioners according to the preliminaries at Villafranca, he privately encouraged them to remain and organize resistance to the return of the despots, if necessary by force (*see* CAVOUR). Farini, who was elected dictator of Parma and Modena, and Ricasoli, who had become supreme in Tuscany, were now the men who by their energy and determination achieved the annexation of central Italy to Piedmont, in spite of the strenuous opposition of the French emperor and the weakness of many Italian Liberals. In August Marco Minghetti succeeded in forming a military league and a customs union between Tuscany, Romagna and the duchies; and Gen. Manfredo Fanti was sent by the Turin Government to organize the army of the Central League, with Garibaldi under him.

The terms of the treaty of peace signed at Zürich on Nov. 10 were practically identical with those of the preliminaries of Villafranca. Napoleon realized now that it would be impossible, without running serious risks, to oppose the movement in favour of unity, and he thereupon raised the question of the cession of Nice and Savoy as the price of his consent to the union of the central provinces with the Italian kingdom. In Jan. 1866 the Rattazzi ministry fell, and Cavour was again summoned by the king to the head of affairs.

Cavour realized the necessity of the sacrifice of Nice and Savoy if central Italy was to be won. The negotiations were long drawn out; but at last, on March 24, the treaty was signed whereby the cession was agreed upon. The king having formally accepted the voluntary annexation of the duchies, Tuscany and Romagna, appointed the prince of Carignano viceroy with Ricasoli as governor-general (March 22), and was immediately afterwards excommunicated by the pope. On April 2, 1860, the new Italian parliament, including members from central Italy, assembled at Turin.

GARIBALDI

On his death in May 1859 Ferdinand of Naples was succeeded by his son Francis II. The son indicated no intention of changing his father's policy, and, in spite of Napoleon's advice, refused to grant a constitution or to enter into an alliance with Sardinia. The result was a revolutionary agitation in Sicily, stirred up by Rosalino Pilo and Francesco Crispi. An invitation had been sent Garibaldi to put himself at the head of the movement; at first he had refused, but reports of the progress of the insurrection soon determined him to risk all on a bold stroke, and on May 5, he embarked at Quarto, near Genoa, with Bixio, the Hungarian Türr and some 1,000 picked followers, on two steamers. The preparations for the expedition, openly made, were viewed by Cavour with mixed feelings. With its object he sympathized; yet he could not give official sanction to an armed attack on a friendly power, nor on the other hand could he forbid an action enthusiastically approved by public opinion. On the 11th Garibaldi landed at Marsala, without opposition, defeated the Neapolitan forces at Calatafimi on the 15th, and on the 27th entered Palermo in triumph, where he proclaimed himself, in King Victor Emmanuel's name, dictator of Sicily. By the end of July, after the hard-won victory of Milazzo, the whole island, with the exception of the citadel of Messina, was in his hands.

It was all-important that whatever victories Garibaldi might win should be won for the Italian kingdom, and, above all, that no ill-timed attack on the Papal States should provoke an intervention of the Powers. But Garibaldi, who wished to keep a free hand, refused to agree to the annexation of Sicily to Piedmont.

On Aug. 8, in spite of the protests and threats of most of the Powers, the Garibaldians began to cross the straits, and in a short time 20,000 of them were on the mainland. The Bourbonists offered no serious resistance, and on Sept. 6 King Francis and his family sailed for Gaeta; and the next day Garibaldi entered Naples alone in advance of the army and was enthusiastically welcomed. He proclaimed himself dictator of the kingdom.

His rapid success, meanwhile, inspired both the French emperor and the government of Turin with misgivings, and Cavour saw that the situation could only be saved by the armed participation of Piedmont in the liberation of south Italy. In the circumstances Cavour decided that Piedmont must anticipate Garibaldi, occupy Umbria and the Marches and place Italy between the red-shirts and Rome. His excuse was the pope's refusal to dismiss his foreign levies (Sept. 7). On Sept 11 a Piedmontese army crossed the frontier; and, after defeating the papal troops under the French general Lamoricière at Castelfidardo, entered Neapolitan territory on Oct. 15. In the meanwhile the red-shirts had encountered a formidable obstacle to their advance in the Neapolitan army entrenched on the Volturno under the guns of Capua. On Sept. 19 the Garibaldians began their attack on this position with their usual impetuous valour; but it was not till Oct. 2 that they succeeded in carrying the position. On the 29th Victor Emmanuel and Garibaldi met, and on Nov. 7 they entered Naples together: Garibaldi resigned his authority into the king's hands and, refusing the titles and other honours offered to him (he had asked for the Neapolitan viceroyalty for life, which the king very wisely refused), retired to his island home of Caprera.

The Piedmontese under Cialdini had begun the siege of Gaeta on Nov. 5, and on Feb. 13 the fortress surrendered, Francis and his family having departed by sea for papal territory. The citadel of Messina capitulated on the 2nd, and Civitella del Tronto, the last stronghold of the Bourbon, on March 21. On Feb. 18 the first Italian parliament met at Turin, and Victor Emmanuel was proclaimed king of Italy.

The New Government.—There were, however, other serious problems calling for immediate attention. The country had to be built up and converted from an agglomeration of scattered mediaeval principalities into a unified modern nation. The first question which arose was that of brigandage in the south, which had indeed always existed in the Neapolitan kingdom, owing to the poverty of the population, but was now organized and encouraged for political purposes by King Francis's uncle, the count of Trapani, and Mons. de Mérode, a Belgian ecclesiastic who enjoyed immense influence at the Vatican. The task of suppressing the movement took four or five years. Politically, its sole outcome was to prove the impossibility of allowing the continuance of an independent Roman state in the heart of Italy. Another of the Government's difficulties was the question of what to do with Garibaldi's volunteers, which was discussed on April 18 in one of the most dramatic sittings of the Italian parliament, when Garibaldi denounced Cavour for his treatment of the volunteers and for the cession of Nice. On April 23 they were formally reconciled in the presence of the king, but the scene of April 18 hastened Cavour's end. In May the Roman question was discussed in parliament. Cavour had often declared that in the end the capital of Italy must be Rome, for it alone of all Italian cities had an unquestioned claim to moral supremacy, and his views of a free Church in a free State were well known. But it was not given him to see this problem solved, for his health was broken by the strain of the last few years, during which practically the whole administration of the country was concentrated in his hands. He died after a short illness on June 6, 1861.

Ricasoli became prime minister, Cavour having advised the king to that effect. The financial situation was far from brilliant; the budget of 1861 showed a deficit of 344,000,000 lire, while the service of the debt was 110,000,000; deficits were met by new loans issued on unfavourable terms. Considering the state of the country and the coming war for Venice, heavy expenditure was inevitable, but good management might have rendered the situation less dangerous. Ricasoli, honest and capable as he was, failed to win popularity, and was succeeded by Rattazzi.

In June, 1862, Garibaldi went to Sicily, where, after taking counsel with his former followers, he decided on an immediate raid on Rome, and in August he crossed over to Calabria with 1,000 men. His intentions in the main were still loyal, for he desired to capture Rome for the kingdom; and he did his best to avoid the regulars tardily sent against him. On Aug. 29, 1862, however, in an engagement with a force under Pallavicini at

Aspromonte, he was seriously wounded and taken prisoner. He was shut up in the fortress of Varignano, and after endless discussions as to whether he should be tried or not, the question was settled by an amnesty. The affair made the ministry so unpopular that it was forced to resign. Farini, who succeeded, retired almost at once on account of ill-health, and Minghetti became premier, with Visconti-Venosta as minister for foreign affairs.

Negotiations were resumed with Napoleon for the evacuation of Rome by the French troops, and the two governments concluded a convention on Sept. 15, 1864, whereby France agreed to withdraw her troops from Rome, Italy undertaking not to attack it nor permit others to do so, and to transfer the capital from Turin to some other city within six months. The convention was kept secret, but the last clause leaked out and caused the bitterest feeling among the people of Turin. Demonstrations were held which were repressed with unnecessary violence, and such a storm of disapproval arose that the king for the first time used his privilege of dismissing the ministry. Under La Marmora's administration the September convention was ratified, and the capital was transferred to Florence the following year.

Venice and the War of 1866.—Meanwhile, the Venetian question was becoming more and more acute. Every Italian felt the presence of the Austrians in the lagoons as a national humiliation, and it became clear that the foreigner could only be driven from the peninsula by another war. To wage this alone Italy was still too weak, and it was necessary to look round for an ally. Napoleon was sympathetic, but he dared not brave French public opinion by another war with Austria, nor did Italy desire an alliance which would only have been bought at the price of further cessions. There remained Prussia, which was completing her preparations for the final struggle with Austria for the hegemony of Germany; and Napoleon willingly lent his aid in negotiating a Prusso-Italian alliance. After a set-back due to the Gastein convention (Aug. 14, 1865) this was actually concluded on April 8, 1866.

The outbreak of war was postponed by further diplomatic complications. On June 12 Napoleon, whose policy throughout had been obscure and contradictory, signed a secret treaty with Austria, under which Venice was to be handed over to him, to be given to Italy in the event of her making a separate peace. La Marmora, however, who believed himself bound in honour to Prussia, refused to enter into a separate arrangement. On the 16th the Prussians began hostilities, and on the 20th Italy declared war. Victor Emmanuel took the supreme command of the Italian army, and La Marmora resigned the premiership (which was assumed by Ricasoli), to become chief of the staff. An indecisive battle was fought at Custoza on June 24; bad generalship, bad organization and the jealousy between La Marmora and Della Rocca were responsible for this failure which might have been afterwards retrieved, for the Italians had plenty of fresh troops besides Cialdini's army; but nothing was done, as both the king and La Marmora believed the situation to be much worse than it actually was. On July 3 the Prussians completely defeated the Austrians at Königgrätz, and on the 5th Austria ceded Venetia to Napoleon, accepting his mediation in favour of peace. The Italian fleet, commanded by the incompetent Persano, was defeated at Lissa by the Austrian fleet under the capable Tegethoff.

On the 22nd Prussia, without consulting Italy, made an armistice with Austria, while Italy obtained an eight days' truce on condition of evacuating the Trentino, which had almost entirely fallen into the hands of Garibaldi and his volunteers. An armistice was accordingly signed at Cormons on Aug. 12; Austria handed Venetia over to Gen. Leboeuf, representing Napoleon; and on Oct. 3 peace between Austria and Italy was concluded at Vienna. On the 19th Leboeuf handed Venetia over to the Venetian representatives, and at the plebiscite held on the 21st and 22nd, 647,246 votes were returned in favour of union with Italy, only 69 against it. When this result was announced to the king by a deputation from Venice he said: "This is the finest day of my life; Italy is made, but it is not complete." Rome was still wanting.

The Occupation of Rome.—Custoza and Lissa were not Italy's only misfortunes in 1866. There had been considerable discontent in Sicily, which culminated in serious riots in Palermo, in September; it was put down owing to the energy of the mayor of the city, Marquis A. di Rudini, and the arrival of reinforcements. The Ricasoli cabinet fell over the law against the religious houses, and was succeeded by that of Rattazzi, who, with the support of the Left, was apparently more fortunate. The French regular troops were withdrawn from Rome in Dec. 1866; but the pontifical forces were largely recruited in France and commanded by officers of the imperial army, and service under the pope was considered by the French war office as equivalent to service in France. This was a violation of the letter as well as of the spirit of the September convention, and Garibaldi advocated an invasion of Roman territory. He made open preparations for a raid, but on Sept. 23, 1867, Rattazzi had him arrested and confined to Caprera. In spite of the vigilance of the warships he escaped on Oct. 14 and landed in Tuscany, whence he attempted to march on Rome at the head of his ill-armed and ill-disciplined bands. Napoleon, under pressure of the Clerical Party, had sent another expedition to Rome (Oct. 26); Rattazzi resigned and was succeeded by Menabrea. On Nov. 3 a battle took place at Mentana between 4,000 or 5,000 red-shirts and a somewhat superior force of French and pontificals. The Garibaldians, mowed down by the new French *chassepôt* rifles, fought until their last cartridges were exhausted, and retreated the next day towards the Italian frontier, leaving 800 prisoners.

The affair of Mentana caused considerable excitement throughout Europe, and Rouher, the French premier, declared in the Chamber (Dec. 5, 1867) that France could never permit the Italians to occupy Rome. This attitude of France strengthened anti-French feeling in Italy, and Bismarck was not slow to make use of it with a view to preventing Italy from taking sides with France against Prussia in the coming inevitable struggle between the two Powers.

A scandal concerning the tobacco monopoly led to the fall of Menabrea, who was succeeded in Dec. 1869 by Giovanni Lanza, with Visconti-Venosta at the Foreign Office and Q. Sella as finance minister. The latter introduced a sounder financial policy, which was maintained until the fall of the Right in 1876. Mazzini, now openly hostile to the monarchy, was seized with a perfect monomania for insurrections, and promoted various small risings, the only effect of which was to show how completely his influence was gone.

In Dec. 1869, the XXI. oecumenical council began its sittings in Rome, and on July 18, 1870, proclaimed the infallibility of the pope (*see* VATICAN COUNCIL). Two days previously Napoleon had declared war on Prussia, and immediately afterwards he withdrew his troops from Civitavecchia. On Aug. 9 Italy made a declaration of neutrality, and three weeks later Visconti-Venosta informed the powers that Italy was about to occupy Rome. On Sept. 3 the news of Sedan reached Florence, and with the fall of Napoleon's empire, the September convention ceased to have any value. The Powers having engaged to abstain from intervention in Italian affairs, Victor Emmanuel addressed a letter to Pius IX. asking him in the name of religion and peace to accept Italian protection instead of the temporal power, to which the pope replied that he would only yield to force. Cardinal Antonelli would have come to terms, but the pope decided on making a sufficient show of resistance to prove that he was yielding to force. On the 20th the Italians, under Gen. Raffaele Cadorna, began the attack, and Gen. Mazé de la Roche's division having effected a breach in the Porta Pia, the pope ordered the garrison to cease fire, the Italians poured into the Eternal City, and the garrison laid down their arms; the next day, at the pope's request, the Leonine City on the right bank was also occupied. It had been intended to leave that quarter of Rome to the pope, but by the earnest wish of the inhabitants it too was included in the Italian kingdom. At the plebiscite there were 133,681 votes for union and 1,507 against it. Thus, after a struggle of more than half a century, in spite of apparently insuperable obstacles, the liberation and the unity of Italy were accomplished. (L. V.)

1870–1902

The downfall of the temporal power was hailed throughout Italy

with great satisfaction. But in France, although the Government of National Defence had congratulated Italy, that of Thiers, which succeeded it, was less friendly. Bismarck, too, was annoyed with Italy on account of the Garibaldian expedition to assist the French and at Visconti-Venosta's plea for the integrity of French territory.

Church Settlement.—For a few weeks after the occupation of Rome relations between the Italian authorities and the Curia were marked by a conciliatory spirit. The Government laid before parliament a bill known as the Law of Papal Guarantees to regulate the position juridically. It embodied Cavour's idea of "a free Church in a free State" and various schemes previously presented, and was voted on March 21, 1871, by 185 votes to 106. The law recognized the person of the pope as sacred and intangible, and while providing for free discussions on religious matters, punished insults and outrages against the pope, according him the right to maintain the Swiss and Noble Guards, and granted him an annuity of 3,225,000 lire and the enjoyment of the Vatican and Lateran palaces and of the villa at Castel Gandolfo. The pope was given full freedom for the exercise of his spiritual ministry, while diplomats accredited to the Holy See and papal diplomats in Italy were placed on the same footing as those accredited to the Quirinal. All restrictions on the right of meeting of members of the clergy were abolished, and bishops were dispensed from swearing fealty to the king. The changed attitude of France stiffened the resistance of the papacy, and an encyclical of Pius IX. of May 15 repudiated the law of guarantees and summoned the Catholic princes to restore the temporal power. Consequently the law remained a unilateral measure, which Italy considered herself bound to respect and always respected while the papacy availed itself of those clauses which were of advantage to it.

Parliament and the Government offices were transferred to Rome in 1871. The growth of Clericalism in France engendered the belief that Italy might have to defend her newly-won unity against foreign aggression, and Gen. Ricotti, the minister of war, framed a bill for the improvement of the army. But with taxation screwed up to the extreme limit and a deficit of 212,500,000 lire, the financial situation was far from satisfactory. Sella had to bear the brunt of the unprecedented fight against bankruptcy which Italy had been waging since 1861. In the face of grave difficulties and violent popular opposition, he had succeeded in getting the grist tax on cereals (*tassa sul macinato*) voted and applied, and brought its net revenue from 25,000,000 lire to over 80,000,000. He undoubtedly saved the situation by that measure for the time being, but while in 1871 he had succeeded by rigid economies in reducing the deficit to less than 50,000,000 lire, in 1872 it had again risen to 200,000,000. He therefore proposed to make over the Treasury service to the state banks, to increase the forced currency, to increase certain taxes, and to provide for the conversion of sundry internal loans into consolidated stock at a lower rate of interest. After a long and bitter struggle he was able to carry out his programme by March 1872, thereby meeting the pressing needs of the moment and laying the foundations of a definitely balanced budget.

On April 29, 1873, the Lanza-Sella cabinet was beaten in the Chamber, but was induced to remain in office until after the debate on the extension to Rome of the law of 1866 on the religious orders, a measure carried in May. While leaving the general houses of the confraternities intact, the law abolished the legal personality of the religious orders, placed the schools and hospitals under civil administration and the churches under the secular clergy, and provided pensions for monks and nuns. The pope enjoined on the suppressed orders to reconstitute themselves under the ordinary Italian law of association. A few days after the passage of the bill Rattazzi died (June 5, 1873), and on June 23 the Lanza cabinet was defeated by a coalition of the Left under Depretis and a part of the Right under Minghetti and by Tuscan deputies led by Correnti.

Minghetti.—Minghetti now became prime minister, with Visconti-Venosta as minister of foreign affairs. In essential points the work of the preceding administration was continued. Minghetti gradually overcame the chronic deficit, and, owing to the normal increase of revenue, ended his term of office with the announcement of a surplus of some 18,000,000 lire.

Outside the all-important domain of finance, the attention of Minghetti and his colleagues was principally absorbed by strife between Church and State, army reform and railway redemption.

Particularly noteworthy were the efforts of the cabinet to strengthen and consolidate national defence. Appalled by the weakness, or rather the non-existence, of the navy, Admiral Saint-Bon addressed himself earnestly to the task of recreating the fleet, which had never recovered from the effects of the disaster of Lissa. During his three years of office he laid the foundation upon which Brin was afterwards to build up a new Italian navy. Simultaneously Gen. Ricotti-Magnani's army reform scheme was adopted by parliament on June 7, 1875.

It was fortunate for Italy that during the whole period 1869–76 the direction of her foreign policy remained in the experienced hands of Visconti-Venosta. As foreign minister of a young State which had attained unity in defiance of the most formidable religious organization in the world and in opposition to the traditional policy of France, it could but be his aim to uphold the dignity of his country while convincing European diplomacy that United Italy was an element of order and progress, and that the spiritual independence of the Roman pontiff had suffered no diminution. Thiers had consistently opposed the emperor Napoleon's pro-Italian policy. He frankly regretted the constitution of powerful homogeneous states upon the borders of France. Personal pique accentuated this feeling towards Italy and had decreased whatever inclination he might otherwise have felt to oppose the French Clerical agitation for the restoration of the temporal power, and for French interference with the Italian Religious Orders bill. Consequently relations between France and Italy became severely strained. At this juncture the emperor of Austria invited Victor Emmanuel to visit the Vienna exhibition, and the Italian Government received confidential intimation that acceptance of the invitation to Vienna would be followed by a further invitation from Berlin. Perceiving the advantage of these visits, Visconti-Venosta and Minghetti advised their sovereign to accept both the Austrian and the subsequent German invitations. The Italian monarch was accorded in both capitals (Sept. 1873) a most cordial reception, although the contemporaneous publication of La Marmora's famous pamphlet, *More Light on the Events of 1866,* prevented intercourse between the Italian ministers and Bismarck from being entirely confidential. Visconti-Venosta and Minghetti, moreover, wisely resisted the chancellor's pressure to override the Law of Guarantees and to engage in an Italian *Kulturkampf*. Nevertheless the royal journey contributed notably to the establishment of cordial relations between Italy and the Central Powers. Meanwhile Thiers had given place to Marshal Macmahon, who effected a decided improvement in Franco-Italian relations. The foreign policy of Visconti-Venosta may be said to have reinforced the international position of Italy without sacrifice of dignity.

THE RISE OF THE LEFT

Depretis.—The fall of the Right on March 18, 1876, was an event destined profoundly, and in many respects adversely, to affect the course of Italian history. Except at rare and not auspicious intervals, the Right had held office from 1849 to 1876. For years the men of the Left had worked to inoculate the electorate with suspicion of Conservative methods and with hatred of the imposts which they nevertheless knew to be indispensable to sound finance. Moreover, the redemption of the railways by the State had been fiercely opposed by the Left, although its members were for the most part convinced of the utility of the operation. When, at the beginning of March 1876, these contracts were submitted to parliament, a group of Tuscan deputies, under Cesare Correnti, joined the opposition, and on March 18 took advantage of a chance motion to place the Minghetti cabinet in a minority. Depretis, successor of Rattazzi in the leadership of the Left, was entrusted by the king with the formation of a Liberal ministry. Besides the premiership, Depretis assumed the portfolio of finance; Nicotera, an ex-Garibaldian of somewhat tarnished reputation, but a man of energetic and conservative temperament, was placed at the ministry of the interior; public works were entrusted to Zanardelli, a

Radical doctrinaire of considerable juridical attainments. Great difficulty was experienced in finding a foreign minister willing to challenge comparison with Visconti-Venosta, and the choice fell upon Melegari, Italian minister at Berne and an old friend of Mazzini.

The new ministers had long since made monarchical professions of faith, but although their patriotism and loyalty were above suspicion, they were nevertheless considered to be tinged with an almost revolutionary hue. The king alone appeared to feel no misgivings. Danger lay rather in entrusting men schooled in political conspiracy and in unscrupulous parliamentary opposition with the government of a young state still beset by enemies at home and abroad. The programme of Depretis comprised extension of the franchise, strict enforcement of the rights of the State as against the Church, maintenance of the military and naval policy inaugurated by the Conservatives, acceptance of the railway redemption contracts, consolidation of the financial equilibrium, abolition of the forced currency, and, eventually, fiscal reform.

Nicotera, minister of the interior, found himself obliged to incur the wrath of his supporters by prohibiting Radical meetings likely to endanger public order, and by enunciating administrative principles which would have befitted an inveterate conservative. He instructed the prefects strictly to prevent infraction of the law against religious orders. At the same time the cabinet, as a whole, brought in a Clerical Abuses Bill, threatening with severe punishment priests guilty of disturbing the peace of families, of opposing the laws of the State, or of fomenting disorder. Depretis, for his part, was compelled to declare impracticable the immediate abolition of the grist tax, and to frame a bill for the increase of revenue, acts which caused the secession of many supporters. The first general election under the Left (Nov. 1876) had yielded the cabinet the overwhelming majority of 421 Ministerialists against 87 Conservatives, but the very size of the majority rendered it unmanageable. The Clerical Abuses Bill provoked dissensions: Nicotera was severely affected by revelations concerning his political past, and Zanardelli refused to sanction the construction of a railway in Calabria in which Nicotera was interested. Almost the only respect in which the Left could boast a decided improvement over the administration of the Right was the energy displayed by Nicotera in combating brigandage and the mafia (*q.v.*) in Calabria and Sicily. Successes achieved in those provinces failed, however, to save Nicotera from the wrath of the Chamber, and on Dec. 14, 1877, a cabinet crisis arose over a question concerning the secrecy of telegraphic correspondence. Depretis thereupon reconstructed his administration, excluding Nicotera, Melegari and Zanardelli, giving Crispi the Ministry of the Interior, entrusting Magliani with finance, and himself assuming the direction of foreign affairs.

Although the Left had for years advocated an Italo-Prussian alliance in opposition to the Francophil tendencies of the Right, Depretis and Melegari, both of whom were imbued with French Liberal doctrines, adopted towards the republic an attitude so deferential as to arouse suspicion in Vienna and Berlin, without, however, securing a more friendly attitude on the part of France. As a precaution against an eventual French attempt to restore the temporal power, orders were hurriedly given to complete the defences of Rome, but in other respects the Italian Government maintained its subservient attitude. In the hope of inducing the European Powers to "compensate" Italy for the increase of Austrian influence on the Adriatic, Crispi undertook in the autumn of 1877, with the approval of the king, and in spite of the half-disguised opposition of Depretis, a semi-official mission to Paris, Berlin, London and Vienna; but did not achieve any important success for Italian foreign policy.

Accession of Humbert I. and Leo. XIII.—The entry of Crispi into the Depretis cabinet (Dec. 1877) placed at the ministry of the interior a strong hand and sure eye at a moment when they were about to become imperatively necessary. Crispi was the only man of truly statesmanlike calibre in the ranks of the Left. Hardly had he assumed office when the unexpected death of Victor Emmanuel II. (Jan. 9, 1878) stirred national feeling to an unprecedented depth, and placed the continuity of monarchical institutions in Italy upon trial before Europe. His disappearance snapped the chief link with the heroic period, and removed from the helm of state a ruler of large heart, great experience and civil courage, at a moment when elements of continuity were needed and vital problems of internal reorganization had still to be faced. Crispi adopted the measures necessary to ensure the tranquil accession of King Humbert with a quick energy which precluded any Radical or Republican demonstrations. Before the commotion caused by the death of Victor Emmanuel had passed away, the decease of Pius IX. (Feb. 7, 1878) placed further demands upon Crispi's sagacity and promptitude. Like Victor Emmanuel, Pius IX. had been bound up with the history of the Risorgimento, but, unlike him, had represented and embodied the anti-national, reactionary spirit. Notwithstanding the pontiff's bestowal of the apostolic benediction *in articulo mortis* upon Victor Emmanuel, the attitude of the Vatican had remained so inimical as to make it doubtful whether the conclave would be held in Rome. Crispi's energetic action and his outspoken communications to the Sacred College as to the consequences of holding the conclave abroad, induced the cardinals to hold it in Rome, the new pope, Cardinal Pecci, being elected on Feb. 20, 1878. The Italian Government assured the new pope protection during the settlement of his outstanding personal affairs, an assurance of which Leo. XIII. on the evening after his election, took full advantage. At the same time the duke of Aosta, commander of the Rome Army corps, ordered the troops to render royal honours to the pontiff should he officially appear in the capital. King Humbert addressed to the pope a letter of congratulation upon his election, and received a courteous reply. The Depretis-Crispi cabinet did not long survive the opening of the new reign. It was succeeded by that of Cairoli whose premiership was characterized by the enactment of highly dangerous financial measures, and was cut short by the attempt made upon the king's life during a royal visit to Naples in Nov. 1878, by Passanante. In spite of the courage and presence of mind of Cairoli, who received the dagger thrust intended for the king, public and parliamentary indignation found expression in a vote which compelled the ministry to resign.

Cairoli.—Though brief, Cairoli's term of office was momentous. Replying on April 9, 1878, to interpellations on the impending Congress of Berlin, the foreign minister, Count Corti, appeared free from apprehension lest Italy, isolated, might find herself face to face with a change of the balance of power in the Mediterranean, and declared that in the event of serious complications Italy would be "too much sought after rather than too much forgotten." The policy of Italy in the congress, he added, would be to support the interests of the young Balkan nations. Wrapped in this optimism, Count Corti proceeded, as first Italian delegate, to Berlin, where he had to sanction the Austrian occupation of Bosnia-Hercegovina. On July 8 the revelation of the Anglo-Ottoman treaty for the British occupation of Cyprus took the congress by surprise; and Corti returned from the German capital with "clean" but empty hands, a plight which found marked disfavour in Italian eyes, and stimulated anti-Austrian Irredentism. Ever since the war of 1866 secret revolutionary committees had been formed in the northern Italian provinces to prepare for the redemption of Trent and Trieste. For 12 years these committees had remained comparatively inactive, but in 1878 the presence of the ex-Garibaldian Cairoli at the head of the Government, and popular dissatisfaction at the spread of Austrian sway on the Adriatic, encouraged them to begin a series of noisy demonstrations. Nor could Austria ignore the Irredentist agitation, for the equivocal attitude of Cairoli and Zanardelli cast doubt upon the sincerity of their regret.

The fall of Cairoli, and the formation of a second Depretis cabinet in 1878, brought no substantial change in the attitude of the Government towards Irredentism, nor was the position improved by the return of Cairoli to power in the following July. In Bonghi's mordant phrase, the foreign policy of Italy during this period may be said to have been characterized by "enormous intellectual impotence counterbalanced by equal moral feebleness." Home affairs were scarcely better managed. Parliament had degenerated into a congeries of personal groups, whose

members were eager only to overturn cabinets in order to secure power for the leaders and official favours for themselves. Depretis, who had succeeded Cairoli in Dec. 1878, fell in July 1879, after a vote in which Cairoli and Nicotera joined the Conservative opposition. On July 12 Cairoli formed a new administration, only to resign on Nov. 24, and to reconstruct his cabinet with the help of Depretis. The administration of finance was as chaotic as the state of parliament. The 60,000,000 lire surplus announced by Seismit Doda proved to be a myth. Nevertheless Magliani, who succeeded Seismit Doda, had neither the perspicacity nor the courage to resist the abolition of the grist tax. While revenue was thus reduced no new taxes were imposed, although Depretis's scheme for building 5,000km. of new, and by no means wholly necessary, railways had been sanctioned. The unsatisfactory financial condition of the Florence, Rome and Naples municipalities necessitated State help, but the Chamber nevertheless proceeded with a light heart (Feb. 23, 1881) to sanction the issue of a foreign loan for 650,000,000 lire with a view to the abolition of the forced currency.

Tunisia.—Cairoli had declined the suggestions of Germany, Austria and Russia that Italy should seek compensation in Tunisia for the extension of Austrian sway in the Balkans, and neither he nor Count Corti had any inkling of the verbal arrangement made between Lord Salisbury and Waddington at the instance of Bismarck, that, when convenient, France should occupy Tunisia, an agreement afterwards confirmed in writing. Almost up to the moment of the French occupation of Tunisia the Italian Government believed that Great Britain, if only out of gratitude for the bearing of Italy in connection with the Dulcigno demonstration in the autumn of 1880, would prevent French acquisition of the Regency, and was ignorant of the assurance conveyed to France by Lord Granville that the Gladstone cabinet would respect the engagements of the Beaconsfield-Salisbury administration. The French Government in the meanwhile was preparing an expeditionary corps for the occupation of the Regency. In the spring of 1881, with the pretext of an attack by the Kroumir tribe on the Algerian border, the Regency was occupied, and on May 12 the bey signed the treaty of Bardo accepting French protection.

Italian indignation at the French *coup de main* was the deeper on account of the apparent duplicity of the Government of the republic, the French foreign minister, Barthélemy St. Hilaire, having on May 11 officially assured the Italian ambassador in Paris that France "had no thought of occupying Tunisia or any part of Tunisian territory, beyond some points of the Kroumir country." The whole Italian nation was filled with deep resentment at an event which was considered tantamount not only to the destruction of Italian aspirations to Tunisia, but to the ruin of the interests of the numerous Italian colony and to a constant menace against the security of the Sicilian and south Italian coasts. The conclusion of the treaty of Bardo on May 12 compelled Cairoli to sacrifice himself to popular indignation. Sella was called upon, but the dog-in-the-manger policy of Depretis, Cairoli, Nicotera and Baccarini, in conjunction with the intolerant attitude of some extreme Conservatives, proved fatal to his endeavours. Depretis then succeeded in recomposing the Cairoli cabinet without Cairoli, Mancini being placed at the Foreign Office. Public opinion was further irritated against France by the massacre of some Italian workmen at Marseille on the occasion of the return of the French expedition from Tunisia, and Depretis, in response to public feeling, found himself obliged to mobilize a part of the militia for military exercises; at the same time disorders occurred at Rome in connection with the transfer of the remains of Pius IX. from St. Peter's to the basilica of San Lorenzo.

THE TRIPLE ALLIANCE

A conviction was spreading that escape from the isolation of Italy lay in agreement with Austria and Germany. Depretis tardily recognized the need for such agreement, but he was opposed to any formal alliance, lest it might arouse French resentment, while the new Franco-Italian treaty was still unconcluded, and the foreign loan for the abolition of the forced currency had still to be floated. The Centre, a small group led by Sidney Sonnino, a young politician of unusual fibre, believed that the only sound basis for Italian policy would be a close alliance with the Central Powers and a friendly understanding with Great Britain upon Mediterranean affairs. The principal Italian public men were divided in opinion on the subject of the alliance. Peruzzi, Lanza and Bonghi pleaded for equal friendship with all powers, and especially with France; Crispi, Minghetti, Cadorna and others favoured Germany and Austria. Austria and Germany, however, scarcely reciprocated these dispositions. The Irredentist agitation had left profound traces at Berlin as well as at Vienna, and had given rise to a distrust of Depretis which nothing had yet occurred to allay. Nor, in view of the comparative weakness of Italian armaments, could eagerness to find an ally be deemed conclusive proof of the value of Italian friendship. Mancini, foreign minister, limited his efforts to the maintenance of correct diplomatic relations with the Central Powers. Danger of foreign interference in the relations between Italy and the papacy had never been so great since the Italian occupation of Rome, as when, in the summer of 1881, the disorders during the transfer of the remains of Pius IX. had lent an unwonted ring of plausibility to the papal complaint concerning the "miserable" position of the Holy See. Bismarck at that moment was anxious to obtain from the Vatican the support of German Catholics, and might well have taken the initiative of making papal independence the subject of an international conference. Friendship and alliance with Catholic Austria and powerful Germany could alone lay this spectre. The political conditions of Europe favoured the realization of Italian desires, and it was tacitly understood between Bismarck and Austria that the latter should profit by Italian resentment against France to draw Italy into the orbit of the Austro-German alliance.

A visit of King Humbert and Queen Margherita to Vienna was then arranged and took place in due state, in Oct. 1881. The reception was marked by great cordiality, and both in Germany and Austria the visit was construed as a preliminary to the adhesion of Italy to the Austro-German alliance. Count Hatzfeldt, on behalf of the German Foreign Office, informed the Italian ambassador in Berlin that whatever was done at Vienna would be regarded as having been done in the German capital. Nor did nascent irritation in France prevent the conclusion of the Franco-Italian commercial treaty which was signed at Paris on Nov. 3.

The advent to power in France of Gambetta (Nov. 9, 1881) who was believed to favour a policy of *révanche* against Germany, and of more friendly relations with Italy, convinced Bismarck of the necessity of securing Italy's adhesion to the Austro-German alliance. As usual, when dealing with weaker nations, the German chancellor resorted to intimidation. He referred to Italy as a country tottering on the verge of revolution, and opened in the German semi-official press a campaign in favour of an international guarantee for the independence of the papacy. These manoeuvres produced their effect upon Italian public opinion. At the new year's reception of deputies King Humbert aroused enthusiasm by a significant remark that Italy intended to remain "mistress in her own house"; while Mancini, in a despatch to Count de Launay, Italian ambassador in Berlin, repudiated the supposition that closer relations between Italy and Germany could be made in any way contingent upon a modification of Italian freedom of action in regard to home affairs.

The sudden fall of Gambetta (Jan. 26, 1882) having removed the fear of immediate European complications, the cabinets of Berlin and Vienna again displayed diffidence towards Italy. But the bitterness aroused by the French action in Tunisia induced Mancini to open negotiations for an Italo-Austrian alliance. The first exchange of ideas between the two Governments proved fruitless. There were difficulties owing to Kalnóky's clerical views, and the polemics in the Italian press over the failure of the Austrian emperor to return King Humbert's visit, because the pope declared that he would not receive the emperor if he came to Rome on a visit to the Quirinal. Mancini was, on the other hand, unwilling to guarantee Austria's permanent possession of Trento and Trieste. Meanwhile (May 11, 1882) the Italian parliament adopted the new Army Bill, with a special credit of 127,500,000 lire for the creation of two new army corps, and increasing the ordinary

military estimates to 200,000,000 lire yearly. Garibaldi, since the French occupation of Tunis, had ardently worked for the increase of the army, and so had the satisfaction of seeing his desire realized before his death at Caprera on June 2, 1882. Before his death, and almost contemporaneously with the passing of the Army Bill, negotiations for the alliance were renewed. Encouraged from Berlin, Kalnóky agreed to the reciprocal territorial guarantee, but declined reciprocity in support of social interests. The treaty of triple alliance was signed on May 20, 1882, five days after the promulgation of the Franco-Italian commercial treaty in Paris. It pledged the contracting parties for a period of five years to join in resisting attack upon the territory of any one of them, within the limits of its own interests; if one of the contracting Powers were menaced by a single great Power and forced to declare war on it, the others would preserve a friendly neutrality, but if the menace came from two or more Powers the *casus foederis* would arise for all. Austria and Italy also undertook to maintain the *status quo* in the East, but if this should become impossible neither of the two Powers was to occupy territories permanently or temporarily without previous agreement and adequate compensation. Kalnóky desired that both the terms of the treaty and the fact of its conclusion should remain secret, but Bismarck and Mancini hastened to hint at its existence. A revival of Irredentism after the execution of an Italian subject of Austria named Oberdan, who was alleged to have intended to murder Francis Joseph, and the cordial references to France made by Depretis at Stradella (Oct. 8, 1882), prevented the French Government from suspecting the existence of the alliance. Suspicion was not aroused until March, 1883, when Mancini practically admitted the existence of the treaty. In Italy generally this revelation was hailed with satisfaction except by the Clericals, who were enraged at the blow thus struck at the restoration of the pope's temporal power, and by the Radicals, who feared both the inevitable breach with republican France and the reinforcement of the Italian constitutional parties by intimacy with strong monarchical states such as Germany and Austria.

Nevertheless, during its first period (1882–87), the triple alliance failed to ensure cordiality between the contracting Powers. Mancini exerted himself in a hundred ways to soothe French resentment. He not only refused to join Great Britain in the Egyptian expedition, but agreed to suspend Italian consular jurisdiction in Tunis; but his efforts were worse than futile. France remained cold, while Bismarck and Kalnóky, distrustful of the radicalism of Depretis and Mancini, assumed towards their ally an attitude almost hostile. Possibly Germany and Austria may have been influenced by the secret treaty signed between Austria, Germany and Russia on March 21, 1884, whereby Italy became in the eyes of the Central Powers a negligible quantity, and was treated accordingly. Meanwhile France provided Italy with fresh cause for uneasiness by abating her hostility to Germany. Italy in consequence drew nearer to Great Britain, and at the London conference on the Egyptian financial question sided with Great Britain against Austria and Germany. On Feb. 5, 1885, Massawa was occupied. The importance of this event was not appreciated at the time, and it aroused considerable opposition in the Chamber. On June 16 the cabinet obtained so small a majority that Depretis resigned. He was asked by the king to form a new ministry, which he did, but without Mancini who was replaced by Count Robilant. Robilant followed a firmly independent policy throughout the Bulgarian crisis of 1885–86. Italy, indeed, came out of the Eastern crisis with enhanced prestige and with her relations to Austria greatly improved. As, in the spring of 1886, the moment for the renewal of the triple alliance drew near, he profited by the development of the Bulgarian crisis and the threatened Franco-Russian understanding to secure from the Central Powers "something more" than the bare territorial guarantee of the original treaty. This "something more" consisted, at least in part, of the arrangement of an Anglo-Italian naval understanding providing for common action by the British and Italian fleets in the Mediterranean in case of war. A vote of the Italian Chamber on Feb. 4, 1887 in connection with the disaster to Italian troops at Dogali, in Abyssinia, brought about the resignation of the Depretis-Robilant cabinet. The crisis dragged for three months, and before its definite solution by the formation of a Depretis-Crispi ministry, Robilant succeeded (March 17, 1887) in renewing the triple alliance on terms more favourable to Italy than those obtained in 1882. Not only did he secure concessions from Austria and Germany corresponding in some degree to the improved state of the Italian army and navy, but, in virtue of the Anglo-Italian understanding, assured the practical adhesion of Great Britain to the European policy of the Central Powers.

INTERNAL POLITICS

The period 1881–87 was marked by political and economic problems, and by the parliamentary phenomena known as *trasformismo*. On June 20, 1881, the Chamber adopted a Franchise Reform Bill, which increased the electorate from 600,000 to 2,000,000. On April 12, 1883, the forced currency was formally abolished by the resumption of Treasury payments in gold with funds obtained through a loan of £14,500,000 issued in London on May 5, 1882. On March 6, 1885, parliament finally sanctioned the conventions by which State railways were farmed out to three private companies—the Mediterranean, Adriatic and Sicilian. The conventions, concluded for a period of 60 years, but terminable by either party after 20 or 40 years, retained for the State the possession of the lines. Unfortunately, the calculation of probable railway revenue on which the conventions had been based, proved to be enormously exaggerated, and the Government's position remained so unsatisfactory as to render the resumption of the whole system by the State on the expiration of the first period of 20 years in 1905 inevitable.

Intimately bound up with the forced currency, the railway conventions and public works was the financial question in general. From 1876, when equilibrium between expenditure and revenue had first been attained, taxation yielded steady annual surpluses, in 1881 reaching the satisfactory level of 53,000,000 lire. The repeal of the grist tax on wheat, which took effect on Jan. 1, 1884, the increase of military and naval expenditure, the lack of firm financial administration, and the constant drain of not always necessary public works, opened a new and disastrous period of deficit. In their anxiety to remain in office Depretis and the finance minister, Magliani, never hesitated to mortgage the financial future of their country. No concession could be denied to deputies, or groups of deputies, whose support was indispensable to the life of the cabinet, nor, under such conditions, was it possible to place any effective check upon administrative abuses in which politicians or their electors were interested. Thus the deficit of 23,500,000 lire for the financial year 1885–86 rose to nearly 73,000,000 lire in 1887–88, and in 1888–89 attained the terrible level of 250,000,000 lire.

Nevertheless, in spite of many and serious shortcomings, the long series of Depretis administrations was marked by the adoption of some useful measures. The foundation of land tax re-assessment was laid by the introduction of a new cadastral survey. The Agricultural Inquiry brought to light vast quantities of information valuable for future agrarian legislation. In 1885 a measure embodying the principle of employers' liability for accidents to workmen was enacted. An effort to encourage the development of the mercantile marine was made in the same year. Sanitation and public hygiene received a potent impulse from the cholera epidemic of 1884, many of the unhealthiest quarters in Naples and other cities being demolished and rebuilt. The movement was strongly supported by King Humbert, whose intrepidity in visiting the most dangerous spots at Busca and Naples while the epidemic was at its height, reassuring the panic-stricken inhabitants by his presence, excited the enthusiasm of his people and the admiration of Europe.

During the accomplishment of these and other reforms the condition of parliament underwent profound change. By degrees the administrations of the Left had ceased to rely solely upon the Liberal sections of the Chamber, and had carried their most important bills with the help of the Right. This process of transformation was not exclusively the work of Depretis, but had been initiated as early as 1873, when a portion of the Right under

Minghetti had, by joining the Left, overturned the Lanza-Sella cabinet. The practical annihilation of the old Right in the elections of 1876 opened a new parliamentary era. Reduced in number to less than 100, and radically changed in spirit and composition, the Right gave way, if not to despair, at least to a despondency unsuited to an opposition party. Gradually it lost its conservative character and approached the various cabinets of the Left. When, in course of time, the extended suffrage increased the Republican and Extreme Radical elements in the Chamber, and the Liberal "Pentarchy" (composed of Crispi, Cairoli, Nicotera, Zanardelli and Baccarini) assumed an attitude of bitter hostility to Depretis, the Right, obeying the impulse of Minghetti, rallied openly to Depretis, lending him aid without which his prolonged term of office would have been impossible. The result was parliamentary chaos, baptized *trasformismo*. Depretis thus established a parliamentary system destined largely to sterilize and vitiate the political life of Italy.

IMPERIAL AFFAIRS

Egypt and Abyssinia.—Contemporaneously with the vicissitudes of home and foreign policy under the Left there grew up in Italy a marked tendency towards colonial enterprise. On Nov. 15, 1869, an Italian shipper, Rubattino, had bought the bay of Assab from Beheran, sultan of Raheita, for 47,000 lire from funds furnished by the Government. The Egyptian Government raised some objections to the occupation, but in 1880 Assab was permanently occupied. On Sept. 20, 1881 Beheran formally accepted Italian protection, and in the following February an Anglo-Italian convention established the Italian title to Assab, and in July the Chamber adopted a bill constituting Assab an Italian crown colony.

Within four weeks of the adoption of this bill the bombardment of Alexandria by the British fleet (July 11, 1882) opened an era destined profoundly to affect the colonial position of Italy. The refusal of France to co-operate with Great Britain induced Lord Granville on July 27 to invite Italy to join in restoring order in Egypt; but Mancini and Depretis, in spite of the efforts of Crispi, then in London, declined the offer. Financial considerations, lack of proper transports for an expeditionary corps, fear of displeasing France, dislike of a "policy of adventure," misplaced deference towards the ambassadorial conference in Constantinople, and unwillingness to thwart the current of Italian sentiment in favour of the Egyptian "nationalists" were the chief motives of the Italian refusal.

The occupation of Massawa (Feb. 5, 1885) was carried out with the approval of Great Britain. Partly to satisfy public opinion, whose resentment had been aroused by the massacre of some Italian explorers in that part of Africa, partly in order to profit by the favourable disposition of the British Government, and partly in the hope of remedying the error committed in 1882 by refusal to co-operate with Great Britain in Egypt, the Italian Government in Jan. 1885 despatched an expedition to occupy Massawa and Beilul, subsequently extending their zone of occupation. The extension of the Italian zone excited the suspicions of John, negus of Abyssinia, whose apprehensions were assiduously fomented by Alula, ras of Tigré, and by French and Greek adventurers. Measures, apparently successful, were taken to reassure the negus, but shortly afterwards protection accorded by Italy to enemies of Ras Alula, induced the Abyssinians to enter upon hostilities. Ras Alula took prisoners and held as hostages the members of the Salimbeni expedition, whereupon Gen. Gené pushed forward a detachment to Saati. On Jan. 25, 1887, Ras Alula attacked Saati, but was repulsed with loss. On the following day, however, the Abyssinians, 20,000 strong, succeeded in surprising, near the village of Dogali, an Italian force of 524 officers and men under Col. De Cristoforis, and overwhelmed them. The Italians, after exhausting their ammunition, were destroyed where they stood. One man only escaped; 407 men and 23 officers were killed outright, and one officer and 81 men wounded. Dead and wounded alike were horribly mutilated by order of Alula.

In Italy the disaster of Dogali produced consternation, and caused the fall of the Depretis-Robilant cabinet. The Chamber sanctioned the despatch of reinforcements. Meanwhile Crispi who, though averse from colonial adventure, desired to vindicate Italian honour, entered the Depretis cabinet as minister of the interior. In Nov. 1887, a strong expedition under Gen. di San Marzano raised the strength of the Massawa garrison to nearly 20,000 men. The British Government, desirous of preventing an Italo-Abyssinian conflict, which could but strengthen the position of the Mahdists, despatched Mr. (afterwards Sir) Gerald Portal from Massawa on Oct. 29 to mediate with the negus. The mission proved fruitless. On March 28, 1888, the negus descended from the Abyssinian high plateau in the direction of Saati, but, on April 3, sickness among his men compelled him to withdraw the Abyssinian army. He was killed on March 10, 1889, while in an expedition against the Mahdists. His death gave rise to an Abyssinian war of succession between Mangasha, natural son of John, and Menelek, king of Shoa and grandson of the Negus Sella-Selasie. Menelek, by means of Count Antonelli, resident in the Shoa country, requested Italy to execute a diversion in his favour by occupying Asmara. Antonelli obtained Menelek's signature to a treaty fixing the frontiers of the Italian colony and defining Italo-Abyssinian relations. The treaty, signed at Uccialli on May 2, 1889, arranged for regular intercourse between Italy and Abyssinia and conceded to Italy a portion of the high plateau, with the positions of Halai, Saganeiti and Asmarà. The main point of the treaty, however, lay in clause 17:—

> His Majesty the king of kings of Ethiopia *consents* to make use of the Government of His Majesty the king of Italy for the treatment of all questions concerning other Powers and Governments.

Upon this clause Italy founded her claim to a protectorate over Abyssinia. In Sept. 1889 the Treaty of Uccialli was ratified, Italy recognizing Menelek as emperor of Ethiopia, and Menelek recognizing the Italian colony. On Jan. 1, 1890, a royal decree conferred upon the colony the name of "Eritrea."

In the colony itself Gen. Baldissera, who had replaced Gen. Saletta, prepared himself to take the offensive against Mangashà and Ras Alula. The latter retreated, and Mangashà, seeing further resistance to be useless, submitted to Menelek, who conformed to article 17 of the Treaty of Uccialli by requesting Italy to represent Abyssinia at the Brussels anti-slavery conference, an act which strengthened Italian illusions as to Menelek's readiness to submit to their protectorate. But he afterwards protested against the Italian text of article 17 and to contend that the Amharic text contained no equivalent for the word *"consent,"* but merely stipulated that Abyssinia *"might"* make use of Italy in her relations with foreign powers. On Oct. 28, 1890, Count Antonelli was despatched to settle the controversy, but found agreement impossible either with regard to the frontier or the protectorate. Meanwhile the marquis di Rudinì, who had succeeded Crispi as the Italian premier, had authorized the abandonment of article 17, but was able to conclude two protocols with Great Britain (March and April, 1891) whereby the British government definitely recognized Abyssinia as within the Italian sphere of influence in return for an Italian recognition of British rights in the Upper Nile.

CRISPI

With the entry of Crispi into the Depretis cabinet as minister of the interior (April 4, 1887) an element of vigour which had long been lacking was introduced into the Government. Within four months the death of Depretis (July 29, 1887) opened for Crispi the way to the premiership. Besides assuming the presidency of the council of ministers and retaining the Ministry of the Interior, Crispi took over the portfolio of foreign affairs. One of the first questions with which he had to deal was that of conciliation between Italy and the Vatican. At the end of May the pope, in an allocution to the cardinals, had spoken of Italy in terms of unusual cordiality, and had expressed a wish for peace. Soon afterwards a pamphlet known to represent the pope's ideas, was published by Father Tosti, a close friend and confidant of the pope, and *persona grata* to the Italian Government, extolling the advantages of peace between Vatican and Quirinal. Reconciliation seemed within sight when suddenly Tosti's pamphlet was placed on the Index. On June 4, 1887, the official Vatican organ, the *Osservatore Romano*, published a letter written by Tosti to

the pope conditionally retracting the views expressed in the pamphlet. The letter had been written at the pope's request, on the understanding that it should not be published. The dream of conciliation was at an end, but the Tosti incident had served once more to illustrate the true position of the Vatican in Italy. It seemed clear that neither the influence of the regular clergy, of which the Society of Jesus is the most powerful embodiment, nor that of foreign clerical parties, which largely control the Peter's Pence fund, would ever permit renunciation of the papal claim to temporal power. Conciliation with Italy would expose the pope and his Italian *entourage* to suspicion of being unduly subject to Italian political influence—of being, in a word, more Italian than Catholic. In order to avoid this danger it was necessary to refuse all compromise, and, by perpetual reiteration of a claim incompatible with Italian territorial unity, to prove to the Church at large that the pope and the Curia were more Catholic than Italian. But such rigidity need not have been extended to the affairs of everyday contact between the Vatican and the Italian authorities, wherein, indeed, a tacit *modus vivendi* was easily attainable. The failure of the conciliation movement left profound irritation between Vatican and Quirinal.

The internal situation inherited by Crispi from Depretis was very unsatisfactory. Extravagant expenditure, and the over-speculation in building and in industrial ventures, had combined to produce a state of affairs calling for firm and radical treatment. Crispi, burdened by the premiership and by the two most important portfolios in the cabinet, was unable to exercise efficient control over all departments of State. Nevertheless his administration was by no means unfruitful. Zanardelli, minister of justice, secured in June 1888 the adoption of a new penal code, and municipal franchise was reformed by granting what was practically manhood suffrage with residential qualification. The management of finance was scarcely satisfactory, for Giolitti, who had succeeded Magliani and Perazzi at the Treasury, lacked the fibre needed to deal with the huge deficit of nearly 250,000,000 lire in 1888–89, the existence of which both Perazzi and he had recognized. The most successful feature of Crispi's term of office was his strict maintenance of order and the suppression of Radical and Irredentist agitation. So vigorous was his treatment of Irredentism that he dismissed without warning his colleague Seismit Doda, minister of finance, for having failed to protest against Irredentist speeches delivered in his presence at Udine. The general election of 1890 gave the cabinet an almost unwieldy majority, comprising four-fifths of the Chamber. But an angry outburst of Crispi's against the Right in a debate on a financial bill, precipitated a division and placed the cabinet in a minority (Jan. 31, 1891). The incident brought about the resignation of Crispi. A few days later he was succeeded in the premiership by the marquis di Rudinì, leader of the Right, who formed a coalition cabinet with Nicotera and a part of the Left.

The sudden fall of Crispi wrought a great change in the character of Italian relations with foreign powers. His policy had been characterized by cordiality towards Austria and Germany, an understanding with Great Britain, in regard to Mediterranean questions and an apparent animosity towards France. Crispi entertained in reality no *a priori* animosity towards France, but was strongly convinced that Italy must emancipate herself from the position of political dependence on her powerful neighbour which had vitiated the foreign policy of the Left. His ostentatious visit to Bismarck at Friedrichsruh, and a subsequent speech at Turin, in which he eulogized the personality of Bismarck, aroused against him a hostility on the part of the French which he was never afterwards able to allay. In such circumstances the negotiations for the new commercial treaty could but fail. The chief advantage derived by Italy from Crispi's foreign policy was the increase of confidence in her Government on the part of her allies and of Great Britain. Both Bismarck and Great Britain made it clear that if Italy were attacked by France she would not stand alone. With the instinct of a true statesman, Crispi felt the pulse of the people, divined their need for prestige, and their preference for a Government heavy-handed rather than lax. How great had been Crispi's power was seen by contrast with the policy of the Rudinì cabinet which succeeded him in Feb. 1891. Crispi's so-called "megalomania" gave place to retrenchment in home affairs and to a deferential attitude towards all foreign powers. Although inclined to be friendly to France, Rudinì did not intend to let the triple alliance lapse on its expiry in May 1892, and in fact, accepting proposals from Berlin, he renewed it in June 1891 for a period of 12 years. On the other hand he assured Russia in Oct. 1891 of the entirely defensive nature of Italian engagements under the triple alliance. At the same time he carried to a successful conclusion negotiations begun by Crispi for the renewal of commercial treaties with Austria and Germany, and concluded with Great Britain conventions for the delimitation of British and Italian spheres of influence in north-east Africa. In home affairs his administration was weak and vacillating, nor did the economies effected in naval and military expenditure and in other departments suffice to strengthen the position of the cabinet. He was defeated in the Chamber on May 5 and obliged to resign. Giolitti, a Piedmontese deputy, sometime Treasury minister in the Crispi cabinet, was entrusted with the formation of a ministry of the Left, which contrived to obtain six months' supply on account, and dissolved the Chamber.

GIOLITTI

The ensuing general election held in Nov. 1892 marked by unprecedented violence and abuse of official pressure upon the electorate, fitly ushered in what proved to be one of the most unfortunate periods of Italian history since the completion of national unity. Early in 1893 a scandal arose in connection with the management of State banks, especially of the Banca Romana, whose managing director, Tanlongo, had issued 62,500,000 lire of duplicate bank-notes. Giolitti scarcely improved matters by creating Tanlongo a member of the senate, and by denying in parliament the existence of any mismanagement. In consequence of an interpellation in the Chamber, Giolitti was compelled to arrest Tanlongo and other prominent persons, and to sanction an investigation by a parliamentary commission of seven members, into the conditions of the banks of issue. On Nov. 23 the report of the commission was read in the Chamber. It established that the two preceding cabinets had been aware of the irregularities committed by Tanlongo; that Tanlongo had heavily subsidized the press; that a number of deputies, including several ex-ministers, had received from him loans of a considerable amount; that Giolitti had deceived the Chamber about the banks of issue and was open to suspicion of having, after the arrest of Tanlongo, abstracted a number of documents from the latter's papers before placing the remainder in the hands of the judicial authorities. In spite of the gravity of the charges formulated against many prominent men, the report merely "deplored" and "disapproved" of their conduct, without proposing penal proceedings. The report, however, sealed the fate of the Giolitti cabinet, and on Nov. 24 it resigned amid general execration.

Giolitti also exhibited incompetence in the conduct of foreign and home affairs. On Aug. 16 and 18, 1893, a number of Italian workmen were massacred at Aigues-Mortes. The French authorities, under whose eyes the massacre was perpetrated, did nothing to prevent or repress it. This occurrence provoked anti-French demonstrations in many parts of Italy. The Italian foreign minister Brin, accepted as satisfactory the anodyne measures adopted by the French Government, and Giolitti removed the prefect of Rome for not having prevented an expression of popular anger. In the following December the French tribunal at Angoulême acquitted all the authors of the massacre. At home Giolitti displayed the same weakness. Symptoms of unrest in Sicily found him, as usual, unprepared and vacillating. The closing of the French market to Sicilian produce, the devastation wrought by the phylloxera and the decrease of the sulphur trade had combined to produce in Sicily a discontent of which Socialist agitators took advantage to organize the workmen and the peasants into groups known as *fasci*. Here and there the movement was based upon a bastard socialism, in other places it was made a means of municipal party warfare under the guidance of the local mafia, and in some districts it was simply popular effervescence against the local octrois

on bread and flour. As early as Jan. 1893 a conflict had occurred between the police and the populace, in which several persons were killed, an occurrence used by the agitators further to inflame the populace. Instead of maintaining a firm policy, Giolitti allowed the movement to spread until, towards the autumn of 1893, he became alarmed and drafted troops into the island. At the moment of his fall the movement assumed the aspect of an insurrection. The return of Crispi to power (Dec. 10)—a return imposed by public opinion as that of the only man capable of dealing with the desperate situation—marked the turning-point of the crisis. The *fasci* were suppressed, a state of siege was proclaimed, and the whole movement crushed in a few weeks. A simultaneous insurrection at Massa-Carrara was crushed with similar vigour. Crispi's methods aroused great outcry in the Radical press, but the severe sentences of the military courts were in time tempered by the royal prerogative of amnesty.

The financial situation further inspired serious misgivings. The State banks, already hampered by maladministration, were encumbered by huge quantities of real estate and the deficit amounted to over 150,000,000 lire. Drastic measures were required to limit expenditure and to provide new sources of revenue. Baron Sonnino, the finance minister, applied, and subsequently amended, a bill passed by the previous administration (Aug. 10, 1893) for the creation of a supreme State bank, the Bank of Italy, which was entrusted with the liquidation of the insolvent Banca Romana. The new law forbade the State banks to lend money on real estate, limited their powers of discounting bills and securities, and reduced the maximum of their paper currency. Forced currency was given to the existing notes of the banks of Italy, Naples and Sicily, while special State notes were issued to meet immediate currency needs. Various measures were prepared for increasing revenue and introducing economies, while the income-tax upon consols was increased from 13% to 20%. These proposals met with opposition so fierce as to cause a cabinet crisis, but Sonnino, who resigned office as minister of finance, returned to power as minister of the Treasury, promulgated some of his proposals by royal decree, and in spite of vehement opposition secured the ratification by the Chamber. When the Crispi cabinet fell in March 1896, Sonnino had the satisfaction of seeing revenue increased by 85,000,000 lire, outgo fall by 90,000,000 lire, the gold premium reduced from 16 to 5%, consolidated stock at 95 instead of 72, and, notwithstanding the expenditure necessitated by the Abyssinian war, financial equilibrium practically restored.

While engaged in restoring order and in supporting Sonnino's courageous struggle against bankruptcy, Crispi became the object of fierce attacks from the Radicals, Socialists and anarchists. A series of anarchist outrages led the government to frame and parliament to adopt (July 11) a Public Safety Bill for the prevention of anarchist propaganda and crime. At the end of July the trial of the persons implicated in the Banca Romana scandal led to a series of charges against Crispi by Giolitti, and the Radical leader, Cavallotti, but they proved devoid of serious foundation, and Giolitti fled to Berlin to avoid arrest for libel. At the general election of May 1895, Crispi's Government obtained a majority of nearly 200 votes. Nevertheless public confidence in the efficacy of the parliamentary system and in the honesty of politicians was seriously diminished by these unsavoury occurrences, which, in combination with the acquittal of all the defendants in the Banca Romana trial, and the abandonment of the proceedings against Giolitti, reinforced to an alarming degree the propaganda of the revolutionary parties.

WAR IN AFRICA

Eritrea.—The foreign policy of the second Crispi administration was, as before, marked by a cordial interpretation of the triple alliance, and by close accord with Great Britain. Graver than any foreign question were the complications in Eritrea. Under the arrangement concluded in 1891 by Rudinì, relations with Abyssinia had remained comparatively satisfactory. Towards the Sudan, however, the Mahdists, who had recovered from a defeat inflicted by an Italian force at Agordat in 1890, resumed operations in Dec. 1893. Col. Arimondi attacked and routed a Dervish force 10,000 strong on Dec. 21. The Italian troops, mostly native levies, numbered only 2,200 men. Gen. Baratieri, the military governor, decided to execute a *coup de main* against the dervish base at Kassala. Concentrating a little army of 2,600 men, Baratieri surprised and captured Kassala on July 17, 1894, and garrisoned the place with native levies under Italian officers. Meanwhile Menelek, with the support of France and Russia, had completed his preparations for asserting his authority as independent ruler of Ethiopia. On May 11, 1893, he denounced the Treaty of Uccialli, but the Giolitti cabinet, absorbed by the bank scandals, paid no heed to his action, and Mangashà came to terms with Menelek. In Dec. 1894, a revolt broke out, but Major Toselli with a small force marched rapidly against the rebels under Bath-Agos, whom he routed and killed at Halai. Gen. Baratieri, crossing the Mareb, advanced to Adowa, but four days later was obliged to return northwards. Mangashà thereupon took the offensive and attempted to occupy the village of Koatit in Okulé-Kusai, but was forestalled and defeated by Baratieri on Jan. 13, 1895. Mangashà was obliged to abandon his camp to Baratieri, who also secured a quantity of correspondence establishing the complicity of Menelek and Mangashà in the revolt of Bath-Agos.

After obtaining the establishment of an apostolic prefecture in Eritrea under the charge of Italian Franciscans, Baratieri expelled from the colony the French Lazarist missionaries for their alleged complicity in the Bath-Agos insurrection, and in March 1895 undertook the conquest of Tigré. Adigrat, Makallè, Adowa and Axum, the holy city of Abyssinia, were occupied and garrisoned, and during the rainy season Baratieri returned to Italy, where he was received with unbounded enthusiasm. Early in September both Mangashà and Menelek showed signs of activity, and on Sept. 20 Makonnen, ras of Harrar, who had hitherto been regarded as a friend and quasi-ally by Italy, marched with 30,000 men to join the negus. On returning to Eritrea, Baratieri pushed forward columns under Major Toselli and Gen. Arimondi as far south as Amba Alagi. Mangashà fell back before the Italians, who obtained several minor successes; but on Dec. 6 Toselli's column, 2,000 strong, was almost annihilated by the Abyssinian vanguard of 40,000 men. Toselli and all but three officers and 300 men fell at their posts after a desperate resistance. Arimondi, collecting the survivors of the Toselli column, retreated to Makallè and Adigrat. At Makallè, however, he left a small garrison in the fort, which on Jan. 7, 1896, was invested by the Abyssinian army, and on Jan. 21 the garrison, under Major Galliano, who had heroically defended the position, were permitted to march out with the honours of war. Meanwhile Baratieri received reinforcements from Italy, but remained undecided as to the best plan of campaign. The Abyssinians were nearly 100,000 strong, mostly armed with rifles and well supplied with artillery, whereas the Italians, including camp followers, numbered less than 25,000 men.

Battle of Adowa.—Baratieri's futile tactics exasperated the home government, which on Feb. 22 despatched Gen. Baldissera, with strong reinforcements, to supersede him. Baratieri, anxious probably to obtain some success before the arrival of Baldissera, called a council of war (Feb. 29) and obtained the approval of the divisional commanders for a plan of attack. During the night the army advanced towards Adowa in three divisions, under Generals Dabormida, Arimondi and Albertone, each division being between 4,000 and 5,000 strong, and a brigade 5,300 strong under Gen. Ellena remaining in reserve. All the divisions, save that of Albertone, consisted chiefly of Italian troops. Owing to a mistake concerning the topography of the country, the various units were attacked separately by overwhelming forces, and the battle—or rather, series of distinct engagements—ended in a general rout. The Italians lost 4,600 white troops and nearly 3,000 native soldiers killed and wounded, while between 2,500 and 3,000 prisoners were taken by the Abyssinians, including Gen. Albertone. Generals Arimondi and Dabormida were killed and Gen. Ellena wounded. While the Abyssinians owned to a loss of over 3,000 men, it is certain that this figure must have been greatly exceeded, some writers placing it as high as 17,000. Baratieri reached Adi-Cajè before the débris of his army. Thence he despatched telegrams to Italy throwing blame for the defeat upon his troops, a proceeding which subsequent evidence proved to be as unjustifiable as it was

unsoldierlike. He was placed under court-martial and the sentence "deplored that in such difficult circumstances the command should have been given to a general so inferior to the exigencies of the situation."

In Italy the news of the defeat of Adowa caused deep discouragement and dismay. On March 5 the Crispi cabinet resigned before an outburst of indignation which the Opposition had assiduously fomented, and five days later a new cabinet was formed by Gen. Ricotti-Magnani, who, however, made over the premiership to the marquis di Rudinì. The latter, though leader of the Right, had long been intriguing with Cavallotti, leader of the Extreme Left, to overthrow Crispi. The first act of the new cabinet was to confirm instructions given by its predecessor to Gen. Baldissera (who had succeeded Gen. Baratieri on March 2) to treat for peace with Menelek if he thought desirable. Baldissera opened negotiations with the negus through Major Salsa, and simultaneously reorganized the Italian forces. The negotiations having failed, he conducted successful operations against the dervishes and the Abyssinians, and despatched Major Nerazzini to the negus to arrange terms of peace. On Oct. 26 a provisional treaty was concluded at Addis Ababa annulling the Treaty of Uccialli; recognizing the complete independence of Ethiopia; postponing for one year the definitive delimitation of the Italo-Abyssinian boundary, but allowing the Italians meanwhile to hold the strong Mareb-Belesa-Muna line; and arranging for the release of the Italian prisoners after ratification of the treaty in exchange for an indemnity of which the amount was to be fixed by the Italian government. The treaty having been duly ratified, and an indemnity of 10,000,000 lire paid to Menelek, the Shoan prisoners were freed. Rudinì, in order to satisfy the demands of his Radical supporters, was prepared to withdraw to Massawa, but the fall of his cabinet in June 1898, enabled Ferdinando Martini and Captain Ciccodicola, who had been appointed respectively civil governor of Eritrea and minister resident at Addis Ababa, to secure Seraè and Okulé-Kusai, and the Mareb-Belesa-Muna frontier. Eritrea remained approximately the same as before the revolt of Bath-Agos, except in regard to Kassala, which was transferred to the Anglo-Egyptian authorities on Dec. 25, 1897, in pursuance of a previous Anglo-Italian convention. Under Ferdinando Martini's able administration (1898–1906) the cost of the colony to Italy was reduced and its trade and agriculture vastly improved. (*See* also ABYSSINIA: *History,* and ERITREA.)

Fortunately for Italy, the marquis Visconti-Venosta consented to assume the portfolio of foreign affairs, which had been resigned to Duke Caetani di Sermoneta, and again to place, after an interval of 20 years, his unrivalled experience at the service of his country. In Sept. 1896 he concluded with France a treaty with regard to Tunisia. During the Greco-Turkish war of 1897 Visconti-Venosta laboured to maintain the European concert, joined Great Britain in preserving Greece from the worst consequences of her folly, and lent moral and material aid in establishing an autonomous government in Crete.

Home Politics.—The home administration of the Rudinì cabinet compared unfavourably with that of foreign affairs. Bound by a secret understanding with the Radical leader Cavallotti, Rudinì was compelled to bow to Radical exigencies. He threw all the influence of the Government against Crispi, who was charged with complicity in embezzlements perpetrated by Favilla, managing director of the Bologna branch of the Bank of Naples. After being subjected to persecution for nearly two years, Crispi's character was substantially vindicated. Pressed by Cavallotti, Rudinì in March 1897 dissolved the Chamber and conducted the general election in such a way as to crush by Government pressure the partisans of Crispi, and greatly to strengthen the (Socialist, Republican and Radical) revolutionary Parties. The effect was seen in May 1898, when, in consequence of a rise in the price of bread, disturbances occurred in southern Italy. At Faenza, Piacenza, Cremona, Pavia and Milan, where subversive associations were stronger, the movement assumed the complexion of a political revolt. During May 7–9 Milan remained practically in the hands of the mob. In view of these occurrences, Rudinì authorized the proclamation of martial law at Milan, Florence, Leghorn and Naples, delegating the suppression of disorder to special military commissioners. By these means order was restored, though not without considerable loss of life at Milan and elsewhere. As in 1894, excessively severe sentences were passed by the military tribunals, but successive royal amnesties obliterated these condemnations within three years.

The Rudinì ministry underwent several metamorphoses, and fell for the fourth and last time on June 18, 1898, on account of public indignation at the result of Rudinì's home policy as exemplified in the May riots. On June 29 Rudinì was succeeded in the premiership by Gen. Luigi Pelloux. The Pelloux cabinet presented its predecessor's Public Safety Bill to parliament in Nov. 1898, but it was violently obstructed by the Socialists, Radicals and Republicans of the Extreme Left. In view of this obstruction, an effort was made to reform the standing orders of the Lower House, but parliamentary feeling ran so high that Gen. Pelloux thought it expedient to appeal to the country.

Accession of Victor Emmanuel III.—The general election of June 1900 largely increased the strength of the extreme parties, who in the new Chamber numbered nearly 100 out of a total of 508. Gen. Pelloux therefore resigned, and on June 24 a moderate Liberal cabinet was formed by the aged Saracco, president of the senate. Within five weeks of its formation King Humbert was shot by an anarchist assassin named Bresci, at Monza (July 29, 1900). His death caused an outburst of profound sorrow and indignation. Though not a great monarch, King Humbert had, by his unfailing generosity and personal courage, won the esteem and affection of his people. More than 2,500,000 lire of his civil list was yearly given for charitable purposes. Humbert was succeeded by his only son, Victor Emmanuel III. (b. Nov. 11, 1869), a liberal-minded and well-educated prince.

Foreign Affairs.—Admiral Canevaro, who had gained distinction as commander of the international forces in Crete (1896–98), assumed the direction of foreign affairs in the first period of the Pelloux administration. His diplomacy, though energetic, lacked steadiness. Soon after taking office, he completed the negotiations begun by the Rudinì administration for a new commercial treaty with France (Oct. 1898), after a breach which had lasted for more than ten years. By the despatch of a squadron to South America he obtained satisfaction for injuries inflicted 13 years previously upon an Italian subject by the United States of Colombia. Supported by Great Britain and Germany, he succeeded in preventing the invitation of a papal delegate to the Hague Peace Conference. Shortly afterwards his term of office was brought to a close by the failure of an attempt to secure for Italy a coaling station at Sanmun and a sphere of influence in China. Under his successor, the Marquis Visconti-Venosta, an Italian expedition, 2,000 strong, was despatched to China to aid in repressing the Chinese outbreak and in protecting Italian interests in the Far East (July 1900). With characteristic foresight, Visconti-Venosta promoted an exchange of views between Italy and France on the Tripolitan hinterland. Similarly, he exchanged notes with Austria with a view to the prevention of any misunderstanding of Italian and Austrian interests in Albania. Upon the fall of the Saracco cabinet (Feb. 9, 1901) Visconti-Venosta was succeeded at the Foreign Office by Prinetti. The outset of his administration was marked by Franco-Italian fêtes at Toulon (April 10–14, 1901), and by the despatch of three Italian warships to Prevesa to obtain satisfaction for damage done to Italian subjects by Turkish officials.

The Saracco administration was overthrown in Feb. 1901 in consequence of its vacillating conduct towards a dock strike at Genoa. It was succeeded by a Zanardelli cabinet, in which the portfolio of the Interior was allotted to Giolitti. Composed mainly of elements drawn from the Left, and dependent for a majority upon the support of the subversive groups of the Extreme Left, the formation of this cabinet gave the signal for a vast working-class movement, during which the Socialist Party sought to extend its political influence by means of strikes and the organization of labour leagues among agricultural labourers and artisans. During the first six months of 1901 the strikes numbered 600, and involved more than 1,000,000 workmen. (X.)

1902–1914

Industrial Unrest, 1902–07.—The strikes and other economic agitations at this time may be divided roughly into three groups: strikes in industrial centres for higher wages, shorter hours and better labour conditions generally; strikes of agricultural labourers in northern Italy for better contracts with the landlords; disturbances among the south Italian peasantry due to low wages, unemployment (particularly in Apulia), and the claims of the labourers to public land occupied illegally by the landlords, combined with local feuds and the struggle for power of the various influential families. The prime cause in most cases was the unsatisfactory economic condition of the working classes. Unfortunately these genuine grievances were taken advantage of by the Socialists for their own purposes, and strikes and disorders, in which the dregs of the population took part, were sometimes promoted without cause, and conciliation impeded by outsiders who acted from motives of personal ambition or profit. The most serious movement at this time was that of the railway servants. On Jan. 4, 1902, the employees of the Mediterranean railway advanced demands for greater fixity of tenure, more regular promotion and the recognition of their union by the companies. By the beginning of February the Government was faced by the possibility of a strike which would paralyse the whole economic life of the country. Then the Turin gas men struck, and a general sympathetic strike broke out in that city, resulting in scenes of violence lasting two days. The Government called out all the railwaymen who were army reservists, but continued to keep them at their railway work. At the same time it mediated between the companies and the employees, and in June a settlement was formally concluded.

The Socialist Party, which had grown powerful under a series of weak-kneed administrations, now began to show signs of division; the revolutionary wing, led by Enrico Ferri, the Mantuan deputy, advocating a policy of uncompromising class warfare, the *riformisti,* or moderate Socialists, led by Filippo Turati, deputy for Milan, adopting a more conciliatory attitude. Later another extreme wing was formed, constituted by the *sindicalisti,* who were opposed to all legislative parliamentary action and favoured only direct revolutionary propaganda. Strikes broke out in the district of Copparo, in the Polesine, and in Apulia, and later among the Genoa dockers, the Florence iron-workers and the Como textile workers.

In Sept. 1904 a very serious situation arose. There were disturbances at Buggeru in Sardinia, at Castelluzzo in Sicily, and at Sestri Ponente, all of them accompanied by loss of life. The Monza labour exchange then took the initiative of proclaiming a general strike throughout Italy (Sept. 15) as a protest against the Government for daring to maintain order. The strike spread to nearly all the industrial centres. At Milan it was more serious, as the movement was controlled by the extremists under Arturo Labriola; the strikers committed many acts of savage violence, especially against those workmen who refused to strike, and much property was wilfully destroyed. Riots broke out also in Genoa, Venice, Naples, Florence, Rome and Bologna. The deputies of the Extreme Left demanded an immediate convocation of parliament in order that they might present a bill forbidding the troops and police to use their arms in all conflicts between capital and labour, whatever the provocation might be. This movement caused a feeling of reaction against Socialism; for, however much sympathy there might be with the genuine grievances of the working classes, the September strikes were of a frankly revolutionary character.

Early in 1905 there was a fresh agitation among the railway servants, who were dissatisfied with the clauses concerning the personnel in the bill for the purchase of the lines by the State. They initiated a system of obstruction which hampered and delayed the traffic without altogether suspending it. On April 17 a general railway strike was ordered by the union, but owing to the action of the authorities, who for once showed energy, the traffic was carried on. The extreme parties now began to direct especial attention to propaganda in the army, with a view to destroying its cohesion and thus paralysing the action of the Government. Fortunately, however, this policy was not successful. No mutinies occurred, except a few trifling disturbances among reservists unexpectedly called back to the colours.

In June and July, 1907, there were again disturbances among the agricultural labourers of Ferrara and Rovigo, and a widespread strike organized by the *leghe* throughout those provinces caused very serious losses to all concerned. The *leghisti,* moreover, were guilty of much criminal violence; they committed one murder and established a veritable reign of terror, boycotting, beating and wounding numbers of peaceful labourers who would not join the unions, and brutally maltreating isolated policemen and soldiers. The authorities, however, by arresting a number of the more prominent leaders, succeeded in restoring order. Almost immediately afterwards another agitation broke out in various towns under the guise of anti-clericalism, in consequence of scandals, real or alleged, in certain convent schools. Unoffending priests were attacked, and even Cardinal Merry del Val was assaulted at Marino. The Socialists and the freemasons were largely responsible for the disorders.

In Oct. 1907 there was again a general strike at Milan and other cities which was rendered more serious on account of the action of the railway servants; traffic was disorganized over a large part of northern Italy, until the Government, being now owner of the railways, dismissed the ringleaders from the service. In the spring of 1908 there were serious agrarian strikes in the province of Parma, and although they ended in June with the defeat of the strikers, a vast amount of damage had been done. The failure of the strike caused the Socialists to quarrel among themselves and to accuse each other, not without reason, of dishonesty in the management of party funds. The spirit of indiscipline had begun to reach the lower classes of state employees, especially the school teachers and the postal and telegraph clerks. Fortunately, however, the Government nipped the agitation in the bud by dismissing the ringleader, Dr. Campanozzi, while attempting to redress some of the genuine grievances.

Internal Politics, 1902–09.—In parliamentary politics the most notable event in 1902 was the presentation of a divorce bill by Zanardelli's Government; this was done not because there was any real demand for it, but to please the doctrinaire anti-clericals and freemasons. But the agitation against the measure was so strong that the ministry decided to drop the bill. The financial situation continued satisfactory; a new loan at 3½% was voted by the Chamber in April 1902, and by June the whole of it had been placed in Italy. In October the rate of exchange was at par, the premium on gold had disappeared, and by the end of the year the budget showed a surplus of sixteen millions.

In Oct. 1903 Zanardelli, the premier, resigned on account of his health, and the king entrusted the formation of the cabinet to Giolitti. The new administration included Tittoni, the prefect of Naples, as foreign minister, and Luigi Luzzatti, the eminent financier, at the Treasury. Almost immediately after his appointment Tittoni accompanied the king and queen of Italy on a state visit to France and then to England, where various international questions were discussed, and the cordial reception which the royal pair met with in London and at Windsor served to dispel the small cloud which had arisen in the relations of the two countries on account of the Tripoli agreements and the language question in Malta. The weakness of the Government in dealing with the strike riots caused a feeling of profound dissatisfaction, and the so-called "experiment of liberty," conducted with the object of conciliating the extreme parties, proved a failure. In Oct. 1904, after the September strikes, the Chamber was dissolved, and at the general elections in November a ministerial majority was returned, while the deputies of the Extreme Left (Socialists, Republicans and Radicals) were reduced from 107 to 94, and a few mild Clericals elected. In spite of its majority, the Giolitti cabinet, realizing that it had lost its hold over the country, resigned in March 1905.

A cabinet was formed by Fortis, Tittoni remaining as foreign minister. A colourless administration, its most important measure was the bill for the purchase of the railways, which was voted in June 1905. Dissatisfaction caused by the *modus vivendi* with Spain, which would have wrought much injury to the Italian wine-

growers, led to demonstrations and riots, and a hostile vote in the Chamber (Dec. 17, 1905) compelled Fortis to reconstruct the ministry, the marquis di San Giuliano accepting the portfolio of foreign affairs. Even this cabinet was still-born, and a hostile vote in the Chamber on Jan. 30, 1906 brought about its fall.

Now at last, after waiting so long, Sonnino's hour had struck, and he became premier for the first time. This result was most satisfactory to all the best elements in the country, and great hopes were entertained that the advent of a rigid and honest statesman would usher in a new era of Italian parliamentary life. Unfortunately the composition of the new cabinet proved disappointing; for while such men as Guicciardini, the minister for foreign affairs, and Luzzatti, at the Treasury, commanded general approval, the choice of Sacchi as minister of justice and of Pantano as minister of agriculture and trade, both of them militant Radicals, savoured of an unholy compact between the premier and his erstwhile bitter enemies. For this combination Sonnino himself was not altogether to blame; having lost many of his most faithful followers, who, weary of waiting for office, had gone over to the enemy, he had been forced to seek support elsewhere, and thus secure at least the neutrality of the Extreme Left. The new premier's first act was to suppress all subsidies to journalists, and although this resulted in bitter attacks against him in the columns of the "reptile press" it commanded the approval of all right-thinking men. The Socialist motion in the Chamber for the immediate discussion of a bill to prevent "the massacres of the proletariat" having been rejected by an enormous majority, the 28 Socialist deputies resigned their seats; on presenting themselves for re-election their number was reduced to 25. A few days later the ministry, having received an adverse vote on a question of procedure, sent in its resignation (May 17), and Giolitti returned to power.

The change of government brought Tittoni back to the Foreign Office. The new ministry began auspiciously with the conversion of the public debt from 4% to 3¾%, to be eventually reduced to 3½%. This operation had been prepared by Luzzatti under Sonnino's leadership, and although carried out by Maiorana it was Luzzatti who deservedly reaped the honour and glory. The surplus for the year amounted to 65,000,000 lire. In November Pietro Bertolini became minister of public works; his acceptance of office under Giolitti marked a further step in the *dégringolade* of Sonnino's party, to which Bertolini had belonged. Gen. Viganò was succeeded in December by Senator Casana, the first civilian to become minister of war in Italy; the experiment of a civilian "War Lord" was not a complete success, and in April 1909 Casana retired and was succeeded by Gen. Spingardi.

Meanwhile the relations between Church and State began to show signs of change. The chief supporters of the claims of the papacy to temporal power were the clericals of France and Austria, but in the former country they had lost influence. With the rebellion of her "Eldest Daughter," the Church of Rome began to realize the folly of placing every Italian in the dilemma of being *either* a good Italian *or* a good Catholic, when the majority wished to be both. Outside Rome, relations between the clergy and the authorities were already quite cordial. In July 1903 Leo XIII. died, and Cardinal Sarto became pope under the style of Pius X. The new pope was distinctly less insistent in his claims to temporal power. At the elections for the local bodies the Catholics had already been permitted to vote, and the encyclical of June 11, 1905, practically abolished the *non expedit*. In September of that year a number of religious institutions in the Near East, formerly under the protectorate of the French Government, in view of the rupture between Church and State in France now asked to be placed under Italian protection, which was granted in Jan. 1907. Giolitti wished to conciliate the Vatican by facilitating religious education, which was desired by the majority of parents, but without offending the freemasons and other anti-clericals too much. Consequently the minister of education, Rava, elaborated a scheme based on compromise which, it was hoped, would please everyone; but in practice it did not work satisfactorily. At the general elections of March 1909, over a score of Clerical deputies were returned, men of a very mild tone who did not trouble about the temporal power and were supporters of the monarchy and anti-Socialists; where no Clerical candidate was in the field the Catholic voters plumped for the constitutional candidate against all representatives of the Extreme Left. At 5 A.M. on Dec. 28, 1908, an earthquake of appalling severity shook the whole of southern Calabria and the eastern part of Sicily, completely destroying the cities of Reggio and Messina, the smaller towns of Canitello, Scilla, Villa San Giovanni, Bagnara, Palmi, Melito, Porto Salvo and Santa Eufemia, as well as a large number of villages. At Messina the horror of the situation was heightened by a tidal wave; the number of persons killed was approximately 150,000, while the injured were beyond calculation.

Foreign Affairs, 1902–09.—In the field of foreign affairs Franco-Italian friendship was officially cemented by the visit of King Victor Emmanuel and Queen Elena in Oct. 1903 to Paris, where they received a very cordial welcome. The visit was returned in April 1904 when M. Loubet, the French president, came to Rome; this action was strongly resented by the pope, who, like his predecessor since 1870, objected to the presence of foreign Catholic rulers in Rome, and led to the final rupture between France and the Vatican. The Franco-Italian understanding had the effect of raising Italy's credit, and also served to clear up the situation in Tripolitania, which was recognized as coming within the Italian "sphere of influence."

The triple alliance was maintained and renewed in June 1902 for 12 years, but public opinion was no longer so favourably disposed towards it. Austria's petty persecutions of her Italian subjects in the *irredente* provinces, her support of the anti-Italian Slav elements on the Adriatic littoral, her active propaganda incompatible with Italian interests in the Balkans, and the anti-Italian war talk of Austrian military circles, imperilled the relations of the two allies. One of the causes of ill-feeling was the university question; the Austrian Government had persistently refused to create an Italian university for its Italian subjects. An attempt at compromise resulted in the institution of the Italian law faculty at Innsbruck, but this aroused the violent hostility of the German students and populace, who indulged in an unprovoked attack on the Italians, in Oct. 1902. Further acts of violence were committed by the Germans in 1903, which led to anti-Austrian demonstrations in Italy. Anti-Italian demonstrations occurred periodically also at Vienna and in Dalmatia. But the most serious point at issue was the Balkan question. Italian public opinion could not view without serious misgivings the active political propaganda which Austria was conducting in Albania. The two Governments frequently discussed the situation, but although they had agreed to a self-denying ordinance whereby each bound itself not to occupy any part of Albanian territory, Austria's declarations and promises were hardly borne out by the activity of her agents in the Balkans. Italy, therefore, instituted a counter-propaganda by means of schools and commercial agencies. The Macedonian troubles of 1903 again brought Austria and Italy into conflict. Acceptance by the Powers of the Mürzsteg reform programme and appointment of Austrian and Russian financial agents in Macedonia was an advantage for Austria and a set-back for Italy; but the latter scored a success in the appointment of Gen. De Giorgis as commander of the international Macedonian gendarmerie.

In Oct. 1908 came the bombshell of the Austrian annexation of Bosnia. The news caused the most widespread sensation, and public opinion in Italy was greatly agitated; Tittoni, however, in a speech at Carate Brianza (Oct. 6) declared that "Italy might await events with serenity, and that these could find her neither unprepared nor isolated," and his words were taken to mean that Italy would receive compensation to restore the balance of power upset in Austria's favour. When it was found that there was to be no direct compensation for Italy, a storm of indignation was aroused against Austria, and also against Tittoni.

With the abandonment by Austria of her military posts in the sandjak of Novipazar (Oct. 29) the danger of a "pacific penetration" of Macedonia became more remote. Austria also renounced her right to police the Montenegrin coast and to prevent Montenegro from having warships of its own in a note presented to the

Italian Foreign Office on April 12, 1909. Italy had developed some important commercial interests in Montenegro, and anything which strengthened the position of that principality was a guarantee against further Austrian encroachments. The harbour works of the Montenegrin port of Antivari, commenced in March 1905 and completed early in 1909, were an Italian concern. But the whole episode was a warning to Italy, and the result was a national movement for security. Credits for the army and navy were voted almost without a dissentient voice; new battleships were laid down, the strength of the army was increased, and the defences of the exposed eastern border were strengthened.

Sonnino and Luzzatti.—On Dec. 2, 1909, the cabinet was defeated on a point of procedure, but really by Sonnino's attacks on its Shipping Subsidies Bill, and resigned. Baron Sonnino was consequently called upon to form a cabinet, which comprised Guicciardini (foreign minister), Salandra (Treasury), and Luzzatti (agriculture). But although it enjoyed wide popular support, the cabinet had no stable majority in the Chamber, and was defeated over a new shipping bill on March 21, 1910, and resigned. Luzzatti now formed a cabinet, with the marquis di San Giuliano at the Foreign Office, Tedesco, Facta, Credaro and Sacchi in other departments. The cabinet only held office on sufferance until Giolitti saw fit to return to power, and it showed great feebleness in dealing with the agrarian strikes of the Romagna, and other internal troubles. On Dec. 21, 1910, there was a division over the extension of the franchise bill, and although the cabinet secured a majority, the Radical ministers, Credaro and Sacchi, resigned. The whole cabinet followed suit on March 18, 1911, and Giolitti was again sent for.

The Turkish War.—During the previous few years relations with Turkey had become strained owing to the restrictions placed by the Porte on Italian enterprise in Tripoli, the only part of North Africa where Italian expansion was still possible. At the same time the policy of Germany aroused the suspicion that she was contemplating action in that province. The Nationalist movement, created at the Florence congress of 1910, and directed towards awakening the country to the necessity of a more vigorous foreign policy, advocated the occupation of Tripoli. The strength of the movement was such that Giolitti himself, anxious as he was to avoid foreign complications, could not afford to disregard it.

After a series of diplomatic incidents, an ultimatum was presented to Turkey on Sept. 28, 1911, and no satisfactory answer being obtained, war was declared on the 29th. Except for the Socialists, public opinion strongly supported the Government. On Nov. 5 Italian sovereignty was extended to Tripolitania and Cyrenaica. The foreign Powers were unfriendly to Italy's African policy, and while Austria placed a veto on the extension of the campaign to the Balkans, a serious diplomatic incident arose with France over the searching by Italian cruisers of the French steamers "Carthage" and "Manouba," suspected of carrying contraband. On Oct. 15, 1912, the peace preliminaries were signed at Ouchy, and the treaty on the 18th, the sultan retaining only spiritual authority over the inhabitants of the annexed territories, while Italy was to remain in occupation of Rhodes and the Dodecanese until Turkey had withdrawn all her troops from Libya and fulfilled her other treaty undertakings.

Giolitti's proposals for the extension of the franchise (raising the electorate from three to eight million voters), payment of members, and a Government monopoly of life insurance, although not wanted by any strong section of public opinion, were voted without much opposition, as parliament did not wish to embarrass the cabinet during the war. At the Socialist congress of Reggio Emilia (June 1912) a group of leaders, including Leonida Bissolati and Ivanoe Bonomi, who approved of the Government's African policy, were expelled from the party and formed a new group called the Reformist Socialists, prepared to collaborate with the constitutional parties. The majority styled itself thenceforth the "Official" Socialist Party. In the field of labour there were strikes at the Fiat works in Turin, and among the agricultural workers of Ferrara and a general strike at Milan in the summer of 1913.

At the elections of Oct. 26–Nov. 2, 1913, under the extended franchise, the Socialist group was increased to 79. For the first time a Catholic Party presented itself to the polls, the pope having withdrawn the *non expedit*, and 33 Catholics were returned, while a number of Liberals and Democrats owed their success to Catholic support. Giolitti's position was somewhat shaken, owing to disagreement among his own followers over the question of Catholic support, and the threatened railway strike. On March 10, 1914, he resigned and was succeeded by Antonio Salandra, a Right-wing Liberal of high standing. San Giuliano remained at the Foreign Office, but Spingardi was succeeded as war minister by Gen. Grandi. The revolutionary *Sindacato ferrovieri* demanded a general increase of wages, but, owing to financial difficulties, the Government could offer an increase only to the lowest categories; the *Sindacato* threatened a strike, but eventually gave way.

On the national festival of the Statuto (June 7, 1914) riots broke out at Ancona because the authorities had forbidden the holding of an anti-militarist meeting. A general strike ensued in the town and the trouble spread to other parts of the March, to Romagna, and most of the larger cities. The movement was of a mainly revolutionary character; its leader was the anarchist Enrico Malatesta, and Benito Mussolini (*q.v.*), editor of the *Avanti*, played a prominent part in it. For a week many towns were under mob rule, until a popular reaction led by the Nationalists cleared the streets of the seditious elements and the troops and police restored order.

THE WORLD WAR

The Austrian ultimatum was presented to Serbia on July 23, 1914. Italy co-operated with Great Britain in trying to avert a catastrophe, and public opinion, although realizing that if a *casus foederis* under the terms of the triple alliance were to arise, Italy would be bound to stand by her allies, was hostile to the idea of siding with Austria. General relief was caused by Italy's declaration of neutrality on Aug. 3 which was based on (1) Austria's failure to co-operate with Italy before taking action, (2) the fact that Italy had not been given time to act in favour of peace, or to make adequate military preparations and (3) the fact that Italy was not bound by the terms of the alliance to take part in an aggressive policy. It was afterwards announced that no *casus foederis* could arise for Italy in a conflict in which Great Britain was involved.[1]

The question now was whether Italy should remain neutral to the end of the war. The Triplicists, although fairly numerous in Conservative and diplomatic circles, and in a part of the army, hardly went so far as to advocate intervention on the side of the Central Powers, for the invasion of Belgium had created a very unfavourable impression, but they advocated neutrality. The Catholics were neutralists from dislike of "atheist" France and Orthodox Russia and from sympathy with Catholic Austria. The "Official" Socialists were neutralists because they opposed all war except class-war. The Nationalists, Irredentists and some Liberals, realizing that this was the last chance for completing Italian unity and affirming Italy's position as a Great Power, favoured intervention, while the Democrats, Freemasons, Republicans and Reformist Socialists were interventionists from sympathy with France. Mussolini's little group of Syndicalists desired intervention, partly for the same reason as the Nationalists, but also in the hope that war would promote social changes. Mussolini resigned the editorship of the *Avanti* and founded a new paper, *Il Popolo d'Italia*, which supported intervention.

On Oct. 16, 1914, the marquis di San Giuliano died, and the prime minister temporarily took over the Foreign Office. On Oct. 31 the Treasury minister, Rubini, resigned on a question concerning the supply of funds for the army, and the cabinet followed suit. But Salandra himself reconstructed it by Nov. 5, and selected Sonnino as foreign minister. Owing to the troubles in Albania, the departure of Prince William of Wied and the Greek invasion of the southern districts, Italy occupied the islet of Saseno on Oct. 31, and on Dec. 26 the town and harbour of Valona. 1915 began with a serious earthquake in the Abruzzi (Jan. 13), which caused the death of 30,000 people.

[1]The treaty of 1882 stated that "the treaty was not in any case directed against England."

The Treaty of London.—Meanwhile the interventionist tendency grew stronger. Both Salandra and Sonnino were determined not to let the war end without trying to acquire at least a part of the Italian districts of Austria, and to secure a rectification of the frontiers of 1866 which left Italy open to invasion. In Dec. 1914 Italy had reminded Austria that the invasion of Serbia, by tending to destroy the balance of power in the Balkans, gave Italy a right to compensation under the terms of Article 7 of the alliance as renewed in 1887. Sonnino demanded all the Trentino, the Isonzo valley, some of the Dalmatian islands, a free hand in Albania and the formation of Trieste and north-western Istria into an independent state, Italy in return to remain neutral to the end of the war. As Austria continued to give evasive replies, Italy opened negotiations with the Entente. On April 26, 1915, the Treaty of London was concluded between Italy, Britain, France and Russia, to be completed by naval and military conventions. Italy undertook to intervene, and was promised the Trentino and the Upper Adige valley to the Brenner pass, Trieste, Gorizia-Gradisca, Istria and the Quarnero islands of Cherso and Lussin, Dalmatia to Cape Planka, Valona, full possession of Rhodes and the Dodecanese, and in Asia Minor a zone of influence and eventually a share in its partition. If an independent Albania were created, it would be under Italian control, while Italy would not oppose the cession of the northern and southern districts to Serbia and Greece if the other signatories so desired.

The poet D'Annunzio by his fiery speeches, and Mussolini by his articles, largely influenced public opinion in favour of intervention. On May 3, 1915, Italy denounced the alliance with Austria, but Prince von Bülow made a last effort to secure Italian neutrality through Giolitti, who, although informed by Salandra of Italy's engagements with the Entente, continued his neutralist activities. Salandra, knowing that if Giolitti declared his opposition, the cabinet must fall, resigned on May 13. But at once huge popular demonstrations in favour of Salandra and intervention were held all over Italy, and the king refused Salandra's resignation; Austria's final offer, no improvement on the last, was rejected.

UNITY WITH THE ALLIES

Italy Enters the War.—On May 20, 1915, the Chamber and the Senate granted the Government full powers. On the 23rd the general mobilization was ordered, and on the 24th war against Austria was declared, while diplomatic relations with Germany were broken off. Owing to the persecution of Italian subjects in Turkey and Turkish assistance to the rebels in Libya, war was declared against the Porte on Aug. 21, and against Bulgaria in September. On Dec. 1 Sonnino adhered to the London Agreement, undertaking not to conclude a separate peace. An expeditionary force was sent to Albania, where it saved the remnants of the Serbian army driven from its own country.

The initial successes of the Italian offensive were satisfactory, but did not lead to definite results. The subsequent defeats sustained in the Trentino and on the Asiago plateau (May 1916) shook the cabinet's position, and on June 10 Salandra resigned. Paolo Boselli, the veteran statesman, respected by all parties, formed a cabinet in which all shades of opinion, except the Socialists and Neutralists, were represented. Sonnino remained at the Foreign Office, while Orlando was transferred from the Ministry of Justice to that of the Interior.

On Aug. 4, 1916, after 11 days' desperate fighting, Gen. Cadorna's forces captured Gorizia. On Aug. 27 Italy declared war on Germany, owing to the assistance she had afforded to Austria and the seizure of Italian property by the Imperial Government. In April 1917, the British, Italian and French premiers concluded a convention at St. Jean de Maurienne whereby it was agreed that in a future partition of Anatolia the Smyrna area was to be assigned to Italy.

During the operations of 1916 and 1917 the Italians achieved some important successes, and above all pinned down Austria's best troops, preventing her from sending reinforcements to the West. But the protracted struggle, the fearful losses, the collapse of Russia, and the grave privations at home had accentuated the feeling of depression in Italy, to which enemy and neutralist propaganda contributed. The Socialists fomented the discontent. Claudio Treves's phrase, "next winter not a man in the trenches," the German peace offensive, the pope's allusion to "the useless carnage" and the defeatist campaign of the Giolittians began to affect public opinion and the war-weary troops. There were revolutionary riots in Turin (Aug. 1917) and signs of a diminished military spirit among certain units at the front. Cadorna had repeatedly warned the Government, and particularly the minister of the interior, Orlando, but no attention was paid to him. This state of affairs and certain military errors of Generals Cadorna, Capello, Badoglio and others resulted in the disaster of Caporetto (*q.v.*) (Oct. 23, 1917).

In spite of this serious defeat, by Nov. 22 the army had reconstituted its front on the Asiago-Grappa-Piave line, and the enemy's advance was definitely held up. British and French forces hurried to assist Italy, but did not come into action till December. Cadorna was relieved of his command and succeeded by Gen. Diaz. The Boselli cabinet resigned (Oct. 26) and on the 30th, Orlando succeeded as premier, while Sonnino remained at the Foreign Office and Nitti became Treasury minister. The army was rapidly reorganized and the losses in material made good through the enterprise of the Italian manufacturers and the technical genius of Gen. Dallolio, minister of munitions.

On Jan. 8, 1918, President Wilson published his famous Fourteen Points (*q.v.*). Those referring to Italy—"the rectification of the Italian frontiers on clearly recognized national lines," and "autonomy" for the peoples of Austria-Hungary—were of a nature to raise anxiety as to his intentions. From April 8 to 10 the congress of nationalities oppressed by Austria met in Rome, and although organized by a private committee, its delegates were received by Orlando, to whom they presented the so-called "Pact of Rome." This should have been an earnest of mutual good-will between Italy and the Yugoslavs, but it had no binding force and compromised the solution of the territorial problems involved. Meanwhile the Yugoslavs were conducting a propaganda to induce Britain and France to rescind the objectionable clauses of the London Treaty, and even proposed that, should Italy remain obdurate, the Allies and America should cut off her supplies of food and fuel, a request which was rejected. The economic situation was becoming worse, and Italy suffered restrictions and privations greater than those of any other Allied country.

In June, 1918, the Austrians launched an offensive on the Asiago-Piave front, but were driven back with heavy losses. The Italian contingent in Macedonia, commanded by Gen. Mombelli, contributed materially to the victory in the Balkans (Sept. 15–29). On Oct. 24, Diaz delivered his attack on the Austrians from Asiago to the sea, and by Nov. 3 "what had been one of the most powerful armies in the world," as the victory communiqué stated, "was annihilated." Some 600,000 prisoners, 7,000 guns and immense quantities of material were captured. The same day at Villa Giusti near Padua the armistice between the Italian and Austro-Hungarian armies was signed. The armistice came into force on Nov. 4, followed a week later by that with Germany. The whole area within the armistice line was rapidly occupied, as well as certain points beyond it for the maintenance of order. Italy's losses had amounted to well over 600,000 killed and a million seriously wounded, including 220,000 permanently disabled.

THE POST-WAR PERIOD

The Peace Conference.—On Feb. 7, 1919, the Italian Government presented a memorandum to the Peace conference, embodying and justifying its territorial claims, which corresponded to those agreed upon in London, but Fiume was also mentioned, because on Oct. 31, 1918, the national council of that town had, in the name of the Italian majority, applied for annexation to Italy. Italian opinion was unanimous in desiring a satisfactory frontier and the protection of the *Italianità* of the Italian communities on the east coast of the Adriatic, but was divided on the details of the settlement. The Nationalists demanded the Treaty of London territories, plus Fiume. The *rinunciatari* were ready to give up Dalmatia, part of Istria and the Trieste hinterland, because they wanted to conciliate the Yugoslavs and disregarded

strategic necessities, but demanded Fiume. Bissolati, minister without portfolio, wished even to renounce the Alto Adige because of its German-speaking population. In the Italian Peace delegation too, opinion was divided; while Sonnino stuck to the Treaty of London and did not insist on Fiume, Orlando demanded the latter, but was prepared to compromise on Dalmatia. The Yugoslav counterclaims extended to the old Italo-Austrian frontier and even beyond it, and this attitude aroused much indignation in Italy, the more so as, until the very eve of Austria's collapse, the Croats and Slovenes had behaved as faithful subjects of the Dual Monarchy.

The Government had many internal difficulties to contend with. In Italy itself the Socialists and Communists, now that the war régime and the censorship were relaxed, took advantage of the general weariness of the people to foment revolutionary agitation, hoping to emulate their comrades in Russia. The financial situation was serious and the budget statement for 1917–18, presented on Nov. 2, 1918, showed a deficit of 6,271 millions. Bissolati, disagreeing with his colleagues over the Alto Adige and Dalmatia, resigned. On Jan. 1, 1919, the state of war was declared at an end throughout Italy, except in the Veneto. On the 3rd, President Wilson arrived in Rome and was received with frenzied enthusiasm as the man who had contributed the most to end the war, but the ministers who discussed politics with him suspected him of little sympathy with Italian aspirations.

TERRITORIAL REDIVISION

The Adriatic Question.—The ministerial crisis initiated by Bissolati's resignation came to a head on Jan. 18, and resulted in the resignation of Nitti (who wished to prepare the way for assuming the premiership himself) and of four other ministers. The Italian peace delegation to the Paris conference, which first met on that same day, was composed of Orlando, Sonnino, Salandra, Barzilai and the ambassador, Marquis Salvago-Raggi. On Feb. 17 the debate on the Adriatic question began, but led to no result. In the meanwhile frequent incidents between Italian and Yugoslav soldiers occurred on the frontier. On April 23, Wilson published his famous appeal to the Italian people over the heads of their Government, setting forth his reasons for opposing certain claims. The message caused wide-spread astonishment as a violation of the rules of diplomacy, while in Italy it aroused great indignation. Orlando started for Rome on the 24th to consult parliament and the country, and was received with enthusiastic demonstrations. In the Chamber his policy was approved by 382 votes to 40 and found adherents even in the Socialist camp.

D'Annunzio took up the Fiume-Dalmatia question with fiery eloquence, and the Nationalists urged the Government to annex both. Orlando failed to take advantage of the anxiety of Britain and France that Italy should sign the treaty with Germany, or of Wilson's desire that she should adhere to the League Covenant, to secure advantages for his country, and on May 5 he returned to Paris without having obtained any guarantees for Italy's claims. Discussion on the Adriatic question was resumed, and various proposals for its solution were advanced, including one suggested by M. Tardieu, on which agreement would have been possible, if President Wilson had not agreed to its rejection by Yugoslavia. Orlando returned to Rome in June, and on the 19th he was beaten in the Chamber and resigned. Nitti now formed a new cabinet, with Tittoni at the Foreign Office, Schanzer at the Treasury and Gen. Albricci as war minister. On June 28 the new peace delegation, presided over by Tittoni, left for Paris, and the same day the treaty with Germany was signed by Sonnino and the Marquis Imperiali.

The internal situation grew more serious. The bread subsidy involved a huge deficit in the budget, the doles to the unemployed encouraged idleness, and the regulations hampering trade rendered production ever more difficult. The workers received high wages, but were discontented because prices were rising, while both they and the war profiteers indulged in an orgy of extravagance. Ex-neutralists helped to foment discontent. In Jan. 1919 the Partito Popolare Italiano (Catholic) was formed; it had a more definite programme and a more complete organization than the old Catholic group, and it developed rapidly under the guidance of its political secretary, the Sicilian priest, Don Luigi Sturzo. It advocated reforms of a Christian-Socialist character, including the expropriation of the landed estates for the benefit of the peasants, but with compensation to the landlords. A series of avowedly revolutionary strikes broke out in every trade, and even in the public services. A postal strike was threatened in Dec. 1918, fomented by the Socialist party, and only called off on the Government's promise of higher wages. During a Bolshevist demonstration on April 13, 1919, at Milan, a shot was fired at a patriotic *cortège*, which provoked a reaction in the crowd, and the offices of the Socialist paper *Avanti* were wrecked.

At the Peace conference, during the absence of the Italian delegation, Lloyd George and Clemenceau ignored the St. Jean de Maurienne agreement, and in accord with President Wilson decided to send Greek troops to Smyrna. Immediately after the Greek landing Italian troops occupied various points in southwest Anatolia. Italian forces co-operated with the British and the French in occupying other parts of Turkey, but the Italian view was that real peace could only be secured by a more conciliatory attitude towards the Turks. At the same time, in order to conciliate Greece, Tittoni concluded an arrangement with Venezelos in July 1919 for the delimitation of their respective spheres of military occupation, leaving the Greeks a free hand in Southern Albania.

D'Annunzio and Fiume.—Fresh troubles broke out at Fiume (*q.v.*), where on July 2–5, 1919, the antipathy of the French troops (mostly colonials) to the Italians and sympathy with the Croats, led to reprisals, in which some French and Annamite soldiers were killed or wounded. The Peace conference thereupon appointed an inter-Allied commission of inquiry, which proposed the dissolution of the Fiume national council, elections to be held under inter-Allied control, the disbanding of the Fiume volunteers, the reduction of the Italian garrison, and the importation of British or American police. These proposals were about to be carried out when on Sept. 12 D'Annunzio arrived at Fiume from Ronchi, at the head of some Italian troops, whom he had induced to follow him to save the town for Italy, and a number of volunteers. Most of the Italian troops and seamen in the town and port joined him, and he set up a government of his own. The Allied troops departed, and Nitti stigmatized the poet's conduct in the most violent terms, calling on the workmen and peasants of Italy to back him up against the *Patriotards*. But a large part of Italian opinion supported D'Annunzio, and volunteers flocked to his standard. Further and more serious general strikes and riots followed, but a reaction in public opinion was beginning to show itself, especially in the Fascist movement, under Benito Mussolini (*see* FASCISM). Nitti expressed the belief that the only remedy was to let the spirit of unrest wear itself out, regardless of the immediate danger to the country. The premier's treatment of the army caused much dissatisfaction. In his desire to restore the "Peace spirit," he failed to protect the officers from outrage and insult, and advised them to go about in mufti and disarmed when off duty: while a decree of the minister of war granted an amnesty to deserters, thereby placing them on an equal footing with those who had done their duty in the war.

On Sept. 10, 1919 the Peace treaty with Austria was signed at St. Germain-en-Laye (*see* ST. GERMAIN, TREATY OF), whereby Italy definitely acquired the frontiers assigned to her by the Treaty of London on the north and north-east, plus the Sexten valley and Tarvis, but the Adriatic question remained unsolved. On Nov. 12, Tittoni resigned from the Foreign Office and the peace delegation, and was succeeded by the eminent jurist, Vittorio Scialoja.

Industrial and Political Unrest.—In spite of, or because of, the Government's restrictive measures, prices had more than doubled. The Government had made the wheat trade a state monopoly; while it requisitioned domestic wheat at a price below the cost of production, it had to buy foreign wheat at the market price. Thus wheat-growing was discouraged at home, and bread was sold below cost, thereby increasing the deficit by six

milliards. Transport was disorganized, and although the traffic was less, the staff, for demagogic reasons, had been increased from 154,000 to 180,000, and afterwards to 240,000; the railwaymen had become more and more idle and insubordinate.

By the electoral law of Sept. 1919 the proportional system, whereby the voter voted not for a candidate but for a list, was adopted to please the Socialists and the Popolari, who, as the only two mass parties, hoped to derive benefit from it. The Socialists demanded the abolition of capital and the institution of a Soviet republic, but the extremist group proposed abstention from the polls and an armed rising. The Popolari decided to present their own candidates instead of co-operating with other parties; an extreme wing promoted strikes and disorders and differed little from the Socialists. The constitutional groups were split up and without a programme or organization. The Government was discredited and unpopular. The elections were held on Nov. 16, 1919: 156 Socialists, 101 Popolari and 30 Combatants were returned, but none of the Fascist candidates. On the opening of parliament by the king on Dec. 1 the Socialist deputies withdrew from the Chamber, and as a protest against this insult a patriotic demonstration was held outside, in which some Socialist deputies were injured. A general strike was proclaimed in consequence, and at Mantua there were serious riots.

The Socialist successes at the election resulted in further disorders. On Jan. 13, 1920, the postal employees went on strike because their demands for higher wages were not instantly complied with; volunteers replaced the strikers, in spite of official discouragement, and this broke the back of the agitation. But on the 22nd the railwaymen struck, and although volunteers enabled the management to maintain a reduced service, on the 29th Nitti came forward with concessions and undertook not to punish a single striker, in spite of explicit provisions of the regulations. The strike ended in a triumph for the revolutionists. In the spring there was a strike at the Mazzonis cotton mills in Piedmont, where the Government legitimized the arbitrary seizure of the factories by the workmen, and the railwaymen in general refused to run trains conveying soldiers or police to places where there were disorders. Nitti, finding himself unable to conduct the government in the face of the growing opposition, had resigned on March 12, 1920, but as no one else was prepared to assume office in these difficult conditions, he reconstructed his cabinet with a few changes. On April 17, the Supreme Council met at San Remo to prepare the peace with Turkey. On May 12 the cabinet, having been defeated in the Chamber, resigned, but as no other combination proved possible, Nitti again reconstructed his cabinet. The prime minister's failure to solve the Adriatic problem and the indignation aroused by the arrest of the Dalmatians and Fiumani in Rome on account of an alleged plot, made his position untenable. On June 4 he enacted a decree reducing the bread subsidy, but yielding to the threats of the Socialists, he withdrew it five days later and resigned without waiting for a vote.

Giolitti now appeared the only man capable of forming a government, and this he achieved by June 16, with Count Sforza as minister of foreign affairs. The budget statement for 1920–21, presented on June 27, 1920, showed a deficit of 14 milliards.

Troubles now broke out in Albania. An Albanian government had been formed at Tirana and the Italian garrisons were greatly reduced; in the spring of 1920 Albanian bands began to disturb the Italian troops, and on June 5 they attacked and captured some of the outposts. An attack on Valona was repulsed, but on June 24, Giolitti, alarmed by a mutiny which had broken out as a result of anarchist propaganda at Ancona, and yielding to the Socialist demands, announced that Italy would withdraw her troops from Albania and negotiate with the Tirana Government. An agreement was arrived at on Aug. 3, and on Sept. 2 the last Italian troops departed, only the islet of Saseno being retained.

At the Spa conference (July 5–16, 1920) Italy succeeded in getting her share of the German indemnity raised to 10%, and that of the Austrian, Hungarian and Bulgarian indemnities to 25%. On Aug. 6 the Tittoni-Venezelos agreement was rescinded, and on the 10th the treaty with Turkey was signed at Sèvres; by the terms of the tripartite agreement Italy obtained "economic priority" over a wide zone of Anatolia south and east of the Greek zone (Smyrna) and a concession for exploiting the Heraclea coal-fields. By a separate agreement with Greece,[1] Italy undertook to cede to the latter the Dodecanese minus Charki and Castellorizo, which together with Rhodes were to remain Italian for 15 years, and then, if Britain ceded Cyprus to Greece, a plebiscite was to decide the fate of those islands.

The Rapallo Conference.—Serious anti-Italian disorders occurred on July 11 at Spalato, where the Croat mob murdered the commander of the cruiser "Puglie" and wounded several officers and men; protest demonstrations were held at Trieste, and shots having been fired from one of the Yugoslav institutions, several of them were set on fire. At Fiume the national council resigned and D'Annunzio proclaimed the Reggenza del Carnaro, for which he drafted a curious, mystical, semi-mediaeval statute. The Yugoslavs felt that a direct understanding with Italy would be the best solution. A conference was held at Rapallo on Nov. 8, Italy being represented by Giolitti, Count Sforza, Bonomi, Gen. Badoglio and Admiral Acton; Yugoslavia by Vesnich, Trumbich, Kosta Stoyanovich and Col. Kalafatovich. On the 12th the treaty was signed. Italy waived her rights over Dalmatia, except for the town of Zara, and the following frontier was agreed upon: Mount Pec, Mount Yalovets, the watershed between the Isonzo and the Wurzen See and the Wocheiner Save, north-east slope of Mount Mezik, east slope of Mount Porzen, west slope of Mount Blegos, Zelse, Cabranska, east of Mount Trstenik, east of Griza, east of Mattuglie, frontier of the Fiume State on the Fiume-Castua road; the islands of Cherso, Lussin, Lagosta and Pelagosa were assigned to Italy, while both Powers recognized the independence of Fiume; the Italian-speaking inhabitants of the territories assigned to Yugoslavia were entitled to opt for Italian citizenship without having to leave the country, and full freedom of language, culture and religion were granted to Yugoslavs in Italian territory.

By a secret clause, which soon became public property, although Count Sforza denied its existence, Porto Baros, an integral part of the port of Fiume, was promised to Yugoslavia. D'Annunzio, however, refused to recognize the treaty, and on Dec. 23, as he refused to obey Gen. Caviglia's summons to submit, military operations were commenced. There was some fighting, but on the 30th D'Annunzio accepted the conditions imposed. Fiume was to be placed under its own town council, with a local volunteer force assisted by Italian carabinieri, until after the elections for the constituent assembly. D'Annunzio left Fiume on Jan. 18, 1921. But the elections in the spring of that year led to disorders necessitating the maintenance of Italian troops. The evacuation of Dalmatia, divided for the purpose into three zones, began in the spring of 1921.

Industrial Disturbances.—Internal troubles reached their zenith in the autumn of 1920. There were industrial, agricultural and railway strikes in various parts of the country, and in September a very serious agitation broke out in the metal trades. These industries had earned large profits during the war and were paying high wages. But the cost of production was increasing, and there were signs of a coming slump, so that it was impossible to grant the still higher wages which the workmen demanded. The men of the Romeo works in Milan adopted obstructive tactics and sabotage, and the management retorted by a lock-out on Aug. 20. Thereupon the F.I.O.M. (*Federazione italiana operai metallurgici*) ordered all the metal workers in Milan to remain in permanence at the mills without working. The Federation of Mechanical Industries then extended the lock-out to the whole of Italy on the 31st, and the workmen, many of them armed, seized a number of factories in Lombardy, Piedmont and elsewhere. Encouraged by the passive attitude of the authorities, they kidnapped owners and managers and tried to force them to run the works exclusively for the workers; armed "Red Guards" were organized, revolutionary tribunals set up and persons approaching the factories were shot at. But the workmen found themselves incapable of

[1]Denounced by Italy, Oct. 8, 1922, in consequence of Greece's inability to carry out her share of the arrangement.

running the factories unaided, and the occupation ended by becoming merely an occasion for orgies. At Turin a Nationalist student and a prison warder who happened to be passing near an "occupied" factory were brutally murdered by "Red Guards," and in many works the safes were broken open and the contents pocketed by the leaders.

On Sept. 19 Giolitti summoned the representatives of the owners and the workers to meet him in Rome, where a rise in wages and a form of workmen's control over industry, which the Government undertook to embody in a bill, was agreed upon. The factories were evacuated on the 27th and work was resumed on Oct. 4. As a practical attempt to establish Communism, the agitation had failed, but the "occupation" wrought serious injury to Italian credit at home and abroad.

THE FASCISTS

About this time agrarian troubles, provoked by Socialists and left-wing Popolari, had also broken out in various parts of Italy, notably in the Veneto, the provinces of Bergamo and Cremona, the Lazio, Tuscany and Sicily. The peasants demanded contracts which, if accepted, would have left the landlords without enough income to pay the taxes. The middle classes set themselves to organize resistance. The Agrarian Association of Bologna was particularly active, but it was the 'Fasci, now arising all over Italy, under Mussolini's leadership, which organized the national reaction. The first attempt at resistance at Bologna was on Sept. 20, when, as the result of a Communist attack on a patriotic procession, a kiosk where seditious papers were sold was destroyed. At a strike demonstration in the same city on Oct. 14, 1920, against the "white terror" in Hungary, the anarchist, Malatesta, incited the mob to violence, and a police inspector and a Guardia Regia were murdered. Small groups of Nationalists and Fascists thereupon paraded the streets; the tricolour flag appeared everywhere and the strike ceased.

The assumption of office by the Red municipal administrations offered occasion for fresh outbreaks of violence. In Bologna the Communist deputy, Bucco, secretary of the local chamber of labour, beginning to fear for his own safety, applied for police protection against the Fascists; he was spirited out of the city and after his departure a deficit of a quarter of a million was found in the accounts of the chamber of labour. On Nov. 21, 1920, the first meeting of the new Bologna town council was intended to be the occasion for an armed rising organized by the Communists. There were anti-Socialist demonstrations in the streets organized by the Nationalists and Fascists, supported by other citizens, but in the town hall, Giordani, a disabled ex-officer, was murdered and another member of the council, Colliva, seriously wounded by Communists. The Red leaders had to fly for their lives and the whole fabric of Bolshevist organization in Bologna collapsed. The town council was dissolved, while the Fascists wrecked or burned down various Socialist institutions. Throughout the Po valley the Fascists proceeded to break the tyranny of the "Red baronies"; the revolutionary *leghe* which had dominated labour in that area, were dispersed, and one Red town council after another resigned or was dissolved by the prefects, while ever-increasing masses of workers, industrial and agricultural, went over to Fascism and thus formed the basis of the Fascist labour movement.

During the last months the Maximalist Socialist party had begun to show signs of dissension. The Russian leaders demanded the absolute submission of the Italian party to the orders of Moscow and the expulsion of all Socialists tainted with the Reformist heresy. At the general congress of the party in Leghorn (Jan. 13–22) a resolution in favour of a middle tendency supported by Turati, Treves, Buozzi, Baldesi, D'Aragona and the G.C.L., who called themselves *Unitari* and were prepared to collaborate with bourgeois governments, was adopted. The Communists (represented by 18 deputies) thereupon broke away, formed a party of their own, and tried to affirm itself by a series of terrorist outrages. Bombs were thrown in Florence on Feb. 27, killing and wounding several persons, whereupon the Fascists retaliated by murdering Lavagnini, a notorious Communist railway organizer; the railwaymen and electricians went on strike and various affrays between Communists and Fascists occurred, until the troops intervened and restored order. At Empoli a number of unarmed sailors were murdered by Communists, and the Fascists, summoned from various parts of the country, inflicted severe reprisals. Similar occurrences took place at Foiano della Chiana and other places.

On March 1. in spite of Socialist obstruction, the bill for the abolition of the bread subsidy was voted by a large majority. The bill in favour of syndicalist control over industry, presented by the premier in accordance with the agreement of the preceding September, encountered much opposition in parliament and was finally dropped.

On April 7, 1920, Giolitti, owing to the insecurity of the parliamentary situation, dissolved the Chamber, and on May 15 the elections were held. Out of 535 seats (27 had been added for the new provinces) the Liberals and Democrats of various shades secured 275, the Popolari rose from 101 to 107, the Socialists fell from 156 to 122 Unitari and 16 Communists; there were in addition four Germans for the Alto Adige and five Slavs for the Venezia Giulia. The Fascists were 35 and the Nationalists 10. The Socialists and Communists were now faced by a vigorous Fascist-Nationalist group supported by sympathizers belonging to other parties. On June 11 Parliament opened, and in the debate on the speech from the throne, the Nationalist, Federzoni (*q.v.*) delivered a strong attack on Count Sforza's foreign policy. On June 26 the cabinet secured only a small majority on a vote of confidence on foreign policy and Giolitti resigned.

Bonomi formed an administration comprising members of many parties, but the Popolari were predominant and Don Sturzo ruled the cabinet with a rod of iron. A bill, demanded by the Popolari and Socialists, for the expropriation of land alleged to be inadequately cultivated, was introduced, but aroused violent opposition and never became law. Bonomi had the merit of deciding that the celebration of the ceremony for the Unknown Soldier should at last be held; it took place on Nov. 4, 1921. Two days later the Fascist congress was opened in Rome, and Fascism was definitely constituted into a political party. On the 10th the Communists and Socialists proclaimed a general strike as a protest against the presence of the Fascists in Rome; disorders ensued, in which five persons were killed and several wounded. The debate in the Chamber on the eligibility of the deserter Misiano, who had been returned for Turin and Naples, led to violent scenes, until on Dec. 20 his election was annulled. During this same month the Banco di Sconto failed, and the Government was severely blamed for not having prevented the collapse of so important an institution, whose actual condition was by no means hopeless; as was proved at the subsequent legal proceedings before the Senate, the failure caused serious prejudice to the general financial and economic situation of the country.

The Bonomi cabinet was now attacked on all sides, and when on Feb. 2, 1922, the Democrats, 16 of whom were in the Government, went over to the Opposition, Bonomi resigned. It was not until the 25th that a new Cabinet was formed by Luigi Facta. He was a thoroughly honest man, and his acceptance of office in these circumstances was proof of his patriotism, but he was not a first-class statesman. He selected Schanzer for the Foreign Office, while the other ministers were of respectable mediocrity.

In 1922 the reconquest of Tripolitania was commenced with the reoccupation of the port of Misurata at the end of January. After a series of operations lasting through 1922 and 1923 the whole colony was reoccupied. The governor in this period was Count Giuseppe Volpi, afterwards finance minister.

The Genoa economic conference was inaugurated on April 10. Facta presided with dignity, but the hardest work was accomplished by Schanzer, who often succeeded in composing differences between the British and the French and between the French and the Germans and Russians.

Further industrial troubles followed. At Naples a conflict had opened between the Red dockers' union, which wished to retain its labour monopoly, and the new Fascist dockers' union. The Red union proclaimed a strike in all the Italian ports on March 18. In spite of the Government's tendency to support the Reds, the Fascists eventually succeeded in breaking the Red

monopoly and restoring order and freedom of labour in the ports. On May 24 the funeral procession escorting the body of the war hero Enrico Toti to the cemetery in Rome was fired on by Communists in the San Lorenzo quarter. Two persons were killed and several wounded. The next day the Committee of Proletarian Defence and the Alleanza del Lavoro, a newly formed coalition of the Communist, Socialist and Republican parties and the G.C.L., ordered a general strike in Rome.

Rumours of a new cabinet crisis followed and the Socialists were divided on the question of collaborating with a bourgeois government. On July 12, 1922, Peano, the Treasury minister, issued his financial statement for 1921–22, which showed a deficit of 4,500 million lire, while experts estimated it at 6,500 million. Public opinion was seriously alarmed, but the deputies were too busy over lobby intrigue in view of the expected crisis to worry about finance. There were disorders at Cremona, provoked by the left wing Popolari led by Miglioli and the Socialists; the Fascists mobilized and wrecked several Socialist institutions and Miglioli's own law offices. The Democrats in the Chamber seized the occasion to contract an alliance with the Popolari, and on July 19 Facta was outvoted and resigned. But it proved impossible to form a new cabinet, and after various unsuccessful attempts, the old cabinet was reconstructed, with Senator Taddei, prefect of Turin, as minister of the Interior.

THE FASCIST COUP-D'ÉTAT

The General Strike.—On Aug. 1, 1922, a general strike in all Italy was called by the Alleanza del Lavoro proclaimed by Turati a "legalist" strike, because its professed object was to affirm the authority of the State against the Fascists. Work was suspended in many factories and a part of the railwaymen struck; but the Fascists and Nationalists ordered a general mobilization, and the Fascist directorate issued a manifesto calling on the public servants and the workers "to shake off the yoke of the politicians by whom they were led," and giving the Government 48 hours within which to prove that it possessed authority over its own employees and those who were attempting to destroy the nation. "On the expiry of this delay Fascism will assume full freedom to supplant the State." Serious conflicts between Fascists and Communists occurred at Milan, Ancona and other places, but the strike rapidly collapsed, and by the 5th all disturbances were over. During the strike agitation the Fascists delivered an attack on the Communist-Socialist municipality of Milan, which had for years ruled the city, bringing it to the verge of ruin and indulging in the most scandalous graft; the deficit was 375,000,000 lire, with bills for 101,000,000 lire overdue, and the richest city in Italy could obtain no credit anywhere. The Fascists and other citizens took the places of the strikers; on Aug. 3 the Fascists succeeded in getting into the town hall, and for the first time since 1914 the tricolour was raised on Palazzo Marino amid scenes of great popular enthusiasm. The Fascists withdrew on the 4th and handed over the building to the prefect's commissioner. On the 27th, after the disastrous results of the inquiry into its financial administration, the council was dissolved.

At Genoa the Fascists led a similar and equally successful operation against the port consortium, which was largely under the influence of the Red dockers' union, and extended their action against a number of Socialist, Communist and Popolare town councils and institutions, and also against the governor of Trento, Credaro, accused of being under the influence of the anti-Italian Pan-German elements of Bolzano. All these actions were of course illegal, but public opinion approved of them because it considered that the Fascists were doing what the Government should have done before.

Facta's position was daily weakening, and indeed the whole machinery of government was obviously breaking down. At the Socialist congress held on Oct. 3 the party split into two groups, the *Unitari* or collaborationists and the uncompromising *Massimalisti;* as a result of this split the G.C.L. broke off its alliance with the Socialist party and declared itself a non-political body, but many of its adherents had already gone over to Fascism. The Partito Popolare was also divided by conflicting tendencies, and the pope enjoined on the bishops and clergy to abstain from partisan political activity. The moment was now ripe for a bold Fascist move.

Although many Liberals approved of the Fascist programme, the Fascists themselves were convinced that it could not be carried out under normal parliamentary conditions. At a Fascist gathering at Udine on Sept. 29 Mussolini made an important declaration in favour of the monarchy, thereby securing the support of many non-Fascists. His hints at a revolution, however, were still regarded as figures of speech, but he was now entrusted by the party directorate with a mandate to conduct a political and even military action to bring Fascism into power. On Oct. 24 another Fascist congress was held at Naples, where 40,000 Fascists in military formation paraded the streets. In his speech at the San Carlo theatre Mussolini said that "what we have in view is the introduction into the Liberal State, which has fulfilled its functions . . . of all the forces of the new generation which has emerged from the war and the victory." In another speech he declared that "either the Government will be given to us or we shall seize it by marching on Rome."

March on Rome.—That same evening the Fascist Quadrumvirate was formed, composed of Michele Bianchi, general secretary of the party, Italo Balbo, commander of the armed *squadre,* Gen. De Bono, who had organized them, and the deputy C. M. De Vecchi, while Dino Grandi, an authority on labour problems, was entrusted with the political functions of the enterprise. The congress broke up and on the 27th Facta resigned. In the meanwhile the general mobilization of the Fascists had been ordered, and they proceeded to concentrate on Rome in four columns. Both the Fascist leaders and the Army officers were anxious to avoid any conflict between the *squadre* and the troops, and the news that martial law had been proclaimed caused deep consternation. Facta had indeed drafted and issued the decree, but the king refused to sign it as it would have meant civil war, and it was immediately withdrawn. After an unsuccessful attempt by Salandra to form a cabinet owing to Mussolini's declaration that an administration of the old parliamentary type was now impossible, the king, on Salandra's advice, sent for Mussolini. The Fascist columns began to enter Rome on the morning of Oct. 30, 1922, and the city was peacefully occupied; the only regrettable incidents were the murder of a Fascist at Valmontone by Communists, and the murder of some Communists by Fascists in the San Lorenzo quarter of Rome. Mussolini reached Rome from Milan the same day, and at once presented himself to the king, with his cabinet list already prepared, which the king at once accepted. As the presence of the *squadre* in Rome was no longer necessary, and might lead to trouble, Mussolini ordered them to depart; this they began to do on Oct. 31, after paying a tribute of honour to the tomb of the Unknown Soldier and homage to the king. By Nov. 2 all had left the capital.

The Fascist Government.—The new cabinet was composed as follows: Mussolini, premier and minister of foreign affairs and the interior; Gen. Diaz (war); Admiral Thaon di Revel (marine); Prof. Alberto de Stefani (finance); Prof. Tangorra (treasury); duke of Cesarò (post office); Federzoni (colonies); Prof. Gentile (education); De Capitani (agriculture); Carnazza (public works); Count Teofilo Rossi (industry); Cavazzoni (labour); De Vecchi (under-secretary for pensions). Although predominantly Fascist, the cabinet comprised members of all the chief groups except the anti-national parties; Rossi was a Giolittian, Cesarò a Social Democrat, Gentile[1] and De Capitani Liberals, Tangorra and Cavazzoni Popolari. Stringent orders for the cessation of all acts of violence were issued, and for the reinstatement of the town councils which had been forced by the Fascists to resign after Nov. 1. Occasional conflicts still occurred, but on the whole order was restored with surprising rapidity.

On Nov. 16 the premier informed the Chamber that he might have closed parliament and formed a purely Fascist cabinet, but that he preferred, at all events in the first phase, to form a coalition with all the national parties. He undertook to balance the budget, provide for the working classes, but not in accordance

[1]Gentile afterwards became a Fascist.

with any extravagant theories, and conduct the foreign policy of Italy with firmness and dignity. He finally asked for full powers for a year to carry out the necessary reforms, and these were granted by 275 votes to 90. The Nationalists were now absorbed.

The most urgent problem before the new Government was finance. The estimated deficit for 1922–23 was 6,500 million lire and De Stefani at once proceeded to adopt drastic economies, reorganize taxation and encourage economic activity without hindrances to production. Tangorra having died on Dec. 21 De Stefani took charge of the Treasury as well. The Ministry of the Liberated Territories and several under-secretaryships were abolished, and by the decree of Jan. 23, 1923, the Government was enabled during one year to place on the retired list all officials who were too old or otherwise incapable of fulfilling their duties, and to revise all appointments made under special war legislation since May 1915. The Guardia Regia was disbanded. The Fascist and other armed *squadre* were also disbanded, and the *Milizia Volontaria per la Sicurezza nazionale* (*see* FASCISM), composed of *ex-squadristi* and officered by ex-army officers, was created in Jan. 1923 to assist in the maintenance of order. In the administration of justice the four courts of cassation were reduced to one, and many minor courts suppressed. The railway staff, which amounted to 225,000 when the Fascists came into power, was gradually reduced to 170,000.

A large number of abuses were eliminated; the eight hours' day, which had been reduced to five or six hours of real work, was restored; railway thefts and damage to property were brought down to trifling proportions; the free passes issued to the leaders of the revolutionary *sindacato ferrovieri* and many other persons were withdrawn, discipline was re-established and bonuses for economy reintroduced. These reforms converted the railway deficit, which in 1921–22 amounted to 1,400 million lire, into a surplus of 176,000,000 lire for 1924–25. A similar transformation was effected in other services with similar results.

THE NEW NATIONALISM

Foreign Affairs.—Soon after coming into power Mussolini attended the opening of the Lausanne conference on the peace with Turkey, and there he first came into contact with his British and French colleagues. On Aug. 27, 1923, the Italian general, Tellini, president of the inter-Allied commission for the delimitation of the Graeco-Albanian frontier, and four of his staff were murdered by Epirote bands near Yannina on Greek territory, as a result of a violent campaign in the Greek press against Tellini, who was accused of unduly favouring the Albanian claims. On the 29th the Italian Government presented an ultimatum to Greece demanding immediate satisfaction and an indemnity of 50,000,000 lire. As the Greek Government rejected some of the conditions, and denied responsibility for the crime, an Italian fleet was sent to Corfu to occupy the island. The Greek commander having refused to lower the flag a few shots were fired on the fort, one of which killed or wounded a number of refugees who, unknown to the Italian admiral, were lodged in it. The island was then occupied. On Sept. 1 Greece appealed to the League of Nations Council, but as the Conference of Ambassadors had also been invested with the question, the Italian delegate to the League Council, Salandra, maintained that the conference alone was competent to deal with the matter, whereas the British delegate, Lord Robert (Viscount) Cecil, the Greek delegate, Politis, and the delegates of the small Powers insisted on the League's right to intervene. After arranging that an enquiry should be conducted by the four Great Powers, the Conference of Ambassadors finally decided that Greece should give full satisfaction, and pay the indemnity demanded. On the 13th the conference announced Greece's acceptance of its decision and Italy evacuated Corfu by the 27th.

The next important action of the Fascist Government in the field of foreign affairs was the settlement with Yugoslavia. As Mussolini had long recognized the difficulty of fully carrying out the Rapallo and Santa Margherita agreements, he had suggested, as early as Nov. 1922, to M. Ninchich, the advisability of a more complete agreement. The Santa Margherita convention was ratified on Feb. 21, 1923, and Italy proceeded to evacuate the third Dalmatian zone; but the existence of the Fiume Free State was the chief obstacle to a real understanding. Negotiations with Yugoslavia were resumed. and on Jan. 27, 1924, the various agreements were signed in Rome. By the first of these the two Powers undertook to collaborate in maintaining the conditions established by the peace treaties and to assist each other politically and diplomatically in case of a conflict. By a second convention Italy recognized Yugoslavia's full sovereignty over Porto Baros and the Delta, while Yugoslavia recognized that of Italy over Fiume; a free customs zone was also established comprising Fiume and Castua (the latter ceded to Yugoslavia). Ratifications were exchanged on Feb. 22, and subsequently a series of commercial agreements was concluded at Nettuno.

Mussolini and Parliament.—In the summer of 1923 a bill was drafted dividing the country into 15 constituencies, each voter to vote for the party list which he preferred, the party securing relatively the largest number of votes to be entitled to two-thirds of the seats in the Chamber, while the remaining third was divided among the other parties on a proportional basis. The bill encountered much opposition among the Socialists and the Popolari, and also among some sections of the Liberals, but it was admittedly only a temporary and tentative measure, and it was voted by a large majority in the Chamber in July and by the Senate in Nov. 1923. At a cabinet Council on Dec. 31 the Government renounced the full powers granted to it by parliament a year previously, and on Jan. 25, 1924, parliament was dissolved. Mussolini stated that, while recognizing the value of the elective Chamber, it must not be accorded absolute predominance over the other organs of the State—the Crown, the Senate, the Executive—all of which have their allotted functions. He rejected the idea of electoral and political alliances with other parties, but decided to include in the Government electoral list men of all parties or no party who might be counted on to render services to the country. Salandra, Orlando, De Nicola and De Nava undertook to support the Government. The Duke of Cesarò, minister of Posts and Telegraphs, disapproving of certain influential Fascists, resigned and presented an opposition list.

The Government candidates comprised 200 ex-combatants, and a number of eminent men. The Opposition competed for the 179 seats reserved for the minorities. The elections were held on April 6. In all 7,628,859 votes were recorded; of these 4,693,690 were for the Government, *i.e.*, 65·25% of the recorded votes, not including those in favour of minority candidates who had declared themselves supporters of the Government; the Government thus would have been entitled to over two-thirds of the seats independently of the new law. Ex-premier Facta did not stand but was raised to the Senate soon afterwards.

CRISES AND STABILIZATION

The Matteotti Murder.—Parliament was opened by the king on May 24, 1924. After his overwhelming victory at the polls Mussolini held out the olive branch to the Opposition parties, and everything seemed to point to a return to normal political conditions; but on June 10 the Socialist deputy Giacomo Matteotti, secretary of the Unitario group, mysteriously disappeared, and a day or two later it was discovered that he had been kidnapped in a motor-car by Dumini, Volpi and other Fascists of shady antecedents and carried off to an unknown destination. The kidnappers, suspected of complicity in attacks on other anti-Fascist leaders, were caught at once, and four prominent Fascists—Marinelli, the administrative secretary of the party; Filippelli, editor of the *Corriere italiano;* Cesare Rossi, head of the official press bureau; and Naldi, the editor of the *Nuovo Paese*—were also arrested as accomplices. The body of Matteotti was discovered on June 13 buried in a lonely spot 20km. from Rome.

The affair created a sensation, and the Opposition deputies and press seized on it to indulge in the gravest accusations against all the leading Fascists. On June 15 the Opposition deputies withdrew from the Chamber, stating that they would not return until the Matteotti mystery, and the supposed complicity of the Government in the affair, had been cleared up. The Opposition by

this "withdrawal on to the Aventine"[1] hoped to render parliamentary business impossible and to exploit the consternation aroused by the crime to upset the Fascist Government. Among the persons more directly accused was Aldo Finzi, under-secretary for the Interior; he immediately resigned, and his resignation was accepted, but when he brought libel actions against his accusers they were unable to prove their case by evidence.

The Chamber was adjourned, and on the 16th Federzoni was transferred from the Colonial ministry to that of the Interior: he immediately cleared the department of the doubtful elements who had taken advantage of their connection with it for purposes of their own. On the 30th various cabinet changes were effected.

The Opposition saw in the Matteotti affair a chance of mobilizing a part of the nation against the Government, and secured the support of many who had adhered to Fascism only as long as they had believed it to be invincible, and were ready to abandon it the moment they thought that its days were numbered. Orlando, who had been elected on the Government list, and Giolitti, who had declared himself benevolently independent, joined the Opposition, professedly on constitutional grounds, but did not withdraw from the Chamber. The "Aventine" groups on June 27 confirmed their abstention from parliamentary activity, demanded the disbanding of the Milizia nazionale, and the repression of all acts of violence by Fascists (without mentioning those committed by non-Fascists); their unofficial leader was Giovanni Amendola. The conduct of the constitutional Opposition, in allying itself with the revolutionary Socialists and the Popolari extremists, was much criticized even in non-Fascist circles. The directorate of the ex-combatants' association also assumed an attitude of veiled hostility to the Government, and as this created a sharp division within its ranks the Government dissolved the directorate and placed a temporary board in charge.

The press campaign reached an unparalleled degree of violence, Don Sturzo's *Popolo* vying with the Socialist *Avanti* and Amendola's *Mondo*, and was a direct incitement to many acts of violence committed against Fascists. Mussolini therefore decided on July 8 to call into force the decree of July 12, 1923, drafted by the Duke of Cesarò, and the prefects were ordered to apply Art. 3 of the Communal and Provincial law, whereby in the interests of public order they were empowered to confiscate issues of papers containing seditious matter or incitements to violence. This measure was afterwards completed by the royal decree of March 4, 1926. Several Liberal and Democratic organs which systematically attacked the Government were acquired by pro-Fascists, including the *Corriere della Sera*, of Milan, the *Giornale d'Italia* of Rome, and the *Mattino* of Naples. Several Opposition papers continued to exist, including the Democratic *Mondo*, the *Voce Repubblicana*, the *Avanti*, etc. An important reform was carried out in the Milizia nazionale which, in accordance with the decree of Aug. 4, swore allegiance to the king on Oct. 28.

In the field of foreign affairs a treaty was concluded with Britain whereby the Transjuba territory was ceded to Italy. There had been a previous agreement to that effect, but the British Foreign Office had raised difficulties, claiming that the question should be settled together with that of the Dodecanese; the Italian Government persuaded Ramsay MacDonald that the two questions were wholly unconnected, and the treaty was signed on July 15, 1924, Italy securing a larger area than had been at first contemplated. Ratifications were exchanged on May 1, 1925.

The Government's position had been undoubtedly shaken by the Matteotti affair, but no evidence was produced implicating any of its members in it, and Mussolini parried the attack with consummate skill. The Fascist party, except for an insignificant number of defections, rallied round him solidly, and after the first bewilderment non-party opinion continued its support of him. The country tended to calm down, in spite of occasional regrettable incidents provoked by both sides, of which the most serious was the murder of the Fascist deputy Casalini by a Communist on Sept. 12, 1924. The Chamber opened on Nov. 12, Orlando and the Communists being present, while later Giolitti's attack on the Government for its unconstitutional methods caused some surprise as coming from a statesman who while in office had proved a past-master in the art of violating the Constitution. On Dec. 20 the premier presented a bill to parliament providing for the re-establishment of the old one-member constituency system, eventually passed by 307 votes to 33, and approved by the Senate on Feb. 10, 1925. This measure divided the "Aventine," as the Democrats and Liberals were in favour of it, while the Socialists and Popolari were proportionalists. In his speech in the Chamber on Jan. 3, 1925, Mussolini reaffirmed the uncompromising policy of Fascism, rejecting all alliances, and stated that the government was determined to *Fascisitizzare* the State, and that if the Opposition did not abstain from factious violence severe repressive measures would be resorted to. These declarations induced Salandra to withdraw his support, although, like Orlando and Giolitti, he did not retire on to the "Aventine"; a part of his group (the Liberal Right) broke away and formed the pro-Fascist National Liberals. In March Roberto Farinacci was appointed general secretary of the Fascist Party, which he proceeded to reorganize, giving it a rigidly intransigent character. His speeches and articles represented the extremist attitude of Fascism.

The bill presented by the minister of war, Gen. Di Giorgio, for reorganizing the army, encountered much opposition in military circles and in the Senate. Gen. Di Giorgio therefore resigned, and Mussolini himself took charge of the War Ministry *ad interim*, with Gen. Cavallero as under-secretary; Gen. Badoglio was appointed chief of the staff and entrusted with the co-ordination of the army, navy and air force. On May 5 Admiral Thaon di Revel resigned, and Mussolini took over the Ministry of Marine and the newly created Air Ministry as well, with Admiral Sirianni and Gen. Bonzani as under-secretaries. This arrangement is regarded as leading the way to a future Ministry of National Defence. A great manifestation in honour of the king's jubilee was held on June 7, and it was generally recognized that the prestige of the monarchy had been greatly strengthened by the Fascist régime.

The decision of the Senate judicial committee, rendered on June 12, 1925, on Donati's charges against Gen. De Bono, acquitted the latter of guilt in connection with the Matteotti affair and of the other more serious accusations, only certain minor counts being declared not proven. In consequence of the success of the Fascist list at the Palermo municipal election, on May 2, 1925, Orlando resigned his seat. His withdrawal from politics made very little impression, as he had already to a very large extent lost his political influence. The findings of the prosecuting section of the Court of Appeal on the Matteotti case in Dec. 1925, while committing Dumini and four accomplices to trial for murder, excluded premeditation and exonerated members of the Government and officials from complicity. Cesare Rossi, Marinelli and Filippelli were consequently set free. The trial of the five accused men was ended on March 24, 1926, at Chieti. Dumini, Volpi and Poveromo were found guilty of non-premeditated unintentional homicide extenuated by the subnormal physical resistance of Matteotti and by other circumstances; Viola and Malacria were found not guilty. The sentence on Dumini, Volpi and Poveromo was 5 years 11 months and 20 days' penal servitude of which four years were remitted later under an amnesty and one year and nine months were already served in awaiting trial. They had therefore to serve only two months and 20 days' imprisonment.

Finance.—In the spring of 1925 financial difficulties had arisen resulting in the serious depreciation of the lira, which fell from a little over 100 to the £ to close on 150; this was partly due to the heavy excess of imports over exports in consequence of the bad harvest of 1924, but also to speculation initially promoted by certain members of the Opposition who hoped to break Fascism through a financial disaster and the consequent panic, due to the belief that the Government intended to reduce the currency to zero after the example of Germany. The premier felt that a bold Treasury policy was now necessary, requiring the services of a

[1] An allusion to the withdrawal of the Roman *plebs* on to the Aventine hill as a protest against the aristocracy. Opposition deputies did not, as was often reported in the foreign press, actually meet on the the Aventine.

practical financier. De Stefani's great task in reorganizing the fiscal system and balancing the budget was accomplished; for 1924–25 a surplus of 209 millions was announced, which eventually rose to 417 millions. In July he resigned and was replaced by Count Giuseppe Volpi, governor of Tripoli, and formerly a business man of wide experience. After enacting new regulations, which effectively restrained illicit speculation and improved the currency (the lira rose to 120 to the £) he undertook the settlement of the war debt to the U.S., which was weighing heavily on Italian finance. On Nov. 14 an agreement was concluded at Washington whereby Italy's debt, originally $2,148,000,000, was reduced to $2,042,000,000 to be spread over 62 years, which, calculating the interest at 5%, reduces the actual value of the debt to $360,000,000 (a reduction of 82%). The agreement was ratified by the U.S. Senate on April 21. A loan floated by the American banks for $100,000,000 to help the Government to stabilize the exchange was subscribed several times over, while other loans for public works and the railways were also successfully floated in New York. On Jan. 27, 1926, Volpi signed with Churchill, the British chancellor of the Exchequer, an agreement in settlement of the Italian war debt of £610,000,000, whereby Italy contracted to pay an annual sum of £4,500,000, slightly reduced at first, over a period of 62 years. The first payment of £2,000,000 was made in March 1926.

In order to bring southern Italy up to the standard of the more progressive north a series of measures were enacted for co-ordinating agricultural land reclamation, drainage, the building of roads and railways, etc., for which adequate funds were provided and a suitable civil service organization created. The wheat crop of 1925 had beaten all records, amounting to 65,000,000 quintals (the pre-war average was 49,000,000), but Mussolini was determined to spare no efforts to increase the output; all forms of encouragement to producers were adopted and various agricultural measures enacted, constituting what was known as "the battle for wheat."

POLITICAL ENTRENCHMENT

Fascist Legislation.—Of the political Fascist measures the following were the most important:—

In order to eliminate the influence of freemasonry in the administrative and political life of the country often inspired by foreign interests, a law was enacted in Dec. 1925 whereby all associations were obliged to communicate their statutes and their membership lists to the authorities, and, should secret societies continue nevertheless to exist, civil servants were forbidden to belong to them on pain of dismissal.

The law of Jan. 31, 1926, provided that Italians living abroad who committed acts calculated to promote sedition in Italy or injure Italian interests should be deprived of Italian citizenship, and in the graver cases even of their property.

By the law of Nov. 1925 the Government was empowered for one year to dismiss from the public service officials who committed overt acts against the State and existing institutions or attempted to prevent the enforcement of the laws or to frustrate its policy.

The unsatisfactory results of the system of municipal elections induced the Government to enact measures for placing the local administrations under the authority of a *Podestà* appointed by royal decree. The law of Oct. 28, 1925, provided for the appointment of a governor of Rome, assisted by an advisory council; that of Feb. 4, 1926, placed communes of less than 5,000 inhabitants under a *Podestà*, while that of Sept. 3, 1926, extended it to all communes.

The authority of the prefects was strengthened with a view to co-ordinating the various provincial services, while the advisory provincial economic councils were created (law of March 1926) to assist the prefects and the Government in all matters of an economic character. The law of Dec. 24, 1925, conferred greater power of parliamentary initiative on the prime minister and otherwise extended his authority; it also provided for the infliction of penalties for committing offences against him.

The most important measure was the law of April 3, 1926, whereby the labour corporations were recognized and invested with the right of legally representing the various categories (employers, workers, employees, professional men, landlords, peasants, experts, etc.), and all labour conflicts were referred to the labour tribunals attached to courts of appeal; strikes and lock-outs were declared illegal, and persons promoting them or participating in them were liable to penalties.

Although most of the "Aventinians" continued to remain absent from the Chamber, the groups led by Salandra and Giolitti were present, together with Orlando's followers and the Communists. The unity of the Aventiniani was gradually breaking up through internal dissensions and personal jealousy. The general internal situation continued to improve, although affrays between Fascists and anti-Fascists occurred from time to time. The most serious of these was the attack on Amendola (*q.v.*) near Montecatini, in the summer of 1925, and the outbreak in Florence on Oct. 3, when as the result of the murder of the Fascist provincial secretary Luporini by a leading freemason, the latter and two Communists were murdered by Fascists, and the shops and offices of several persons supposed to be freemasons were wrecked. In March 1926 Farinacci, who had been counsel for the defence of Dumini in the Matteotti trial, resigned from the secretaryship of the Fascist party, and was succeeded by Augusto Turati; on April 23 it decided to admit no new recruits to the party until 1927. The exclusion has been extended and is still (1928) in force.

The object of these various measures and of the general policy of the Government is to give stability and an essentially Fascist character to the State and its institutions. It is a policy similar to that of the men of the Risorgimento who succeeded in getting the then novel ideas of the unity and independence of Italy accepted by the mass of the people, who had until that time been indifferent or opposed to them.

Penal Laws.—A scheme for a new criminal code, containing many innovations, was drafted by Rocco, the minister of justice, and published on Aug. 22, 1927; the provisions of the law for the protection of the State were included in it; the penalties for the graver crimes of violence were made more severe, and penalties were established for sundry offences against morals, the practice and propaganda of birth control, etc. The draft was submitted to a committee of eminent jurists, with a view to presenting it, with their suggested amendments, to parliament. An important undertaking of the Fascist Government was the repression of ordinary crime, especially of the Mafia (*q.v.*) in Sicily, which for generations had terrorized the population of the island and had, to a large extent, enjoyed immunity owing to the impossibility of securing evidence. Mussolini entrusted the task to the prefect of Palermo, Mori, who accomplished it most successfully; numerous arrests were made, and at the three months' trial before the assizes of Termini Imerese, ending in Jan. 1928, witnesses at last gave evidence fearlessly and 147 mafiosi were condemned to severe sentences.

Representation and Organization.—In November 1927 the Fascist Grand Council drafted a new scheme for political representation, which after having been studied by the law officers of the State and the cabinet council, was submitted to parliament and became law in May 1928. In the new parliament the deputies numbered 400 instead of 535. Each of the 13 confederations and certain other recognized bodies of national importance have the right to be represented in a fixed proportion, and submit a list of their candidates for election, voted for by their own council, to the Fascist Grand Council. The latter is entitled to modify the list excluding certain names and adding others. The final list is then submitted to the electorate, which votes on it as a whole. If the list secures a majority of the votes all its members thereby become deputies. If it is rejected fresh elections will be held with competing lists, any association or organization of 5,000 voters having the right to present a list, each list including not more than three-quarters of the deputies to be elected. The lists are to be submitted to the vote; candidates securing the largest number of votes are elected; the seats reserved for minorities are distributed on a proportional basis. All male citizens over 21 years old, and those over 18 years in certain conditions are voters. The new system is

less of an election in the ordinary sense than a means to enable the citizens to express their approval or disapproval of the policy of the Government in general. It is regarded as a provisional measure, and a committee of senators and deputies will sit in permanence to follow its workings and from time to time propose such modifications as will appear desirable. The senate remains unchanged, and so also do the relations between the two chambers and between the latter, the executive and the Crown.

At a meeting of the Fascist Grand Council on Sept. 19, 1928, the powers and composition of that body were definitely laid down. Its chairman is the prime minister and its members are all the ministers and certain under-secretaries, the *Quadrumviri* of the March on Rome, the presidents of the senate and the Chamber, the commander of the *Milizia nazionale,* the general secretary and certain other high officers of the Fascist party, the president of the special tribunal, the presidents of the confederation of workers' syndicates, of the agricultural confederation and of the industrial confederation, and of various other Governmental and semi-official organizations. The prime minister can summon other persons to be temporary members of the Grand Council for special purposes. The functions of the Grand Council are to ratify the lists of candidates to parliament according to article 5 of the new electoral law, to decide on the statutes, standing orders and policy of the Fascist party, and to appoint and revoke its chief officers. It is to be consulted on all matters affecting the Constitution, including the prerogatives of the Crown, the succession to the throne, the composition and functions of the senate and the Chamber, the prerogatives and powers of the prime minister, organization, relations between Church and State, and international treaties involving territorial changes. The Grand Council is further called upon to draft and keep up to date lists of persons to be submitted to the Crown, in case of a vacancy, for the succession to the premiership, and also a list of persons whom it deems suitable to fill other vacancies in the cabinet. This scheme finally welds the Fascist party and the State into a single unit, and also provides for the continuity of the régime. At the same session of the Grand Council it was decided that the first general election under the new electoral law should be held in April 1929.

A sensation was caused on Nov. 5, 1925, when it was announced that a plot had been discovered to murder Mussolini. The Socialist ex-deputy Zaniboni, was arrested in a room in a hotel commanding the Palazzo Chigi, armed with a rifle with which, as he confessed, he intended to shoot the premier. Gen. Capello (*q.v.*), ex-commander of the II. Army, an active freemason and a bitter opponent of the Government, was arrested for complicity in the attempt. Both were eventually condemned to 30 years' imprisonment. Mussolini was greeted with enthusiastic demonstrations in consequence of his escape. Another attempt on his life was made by the Hon. Violet Gibson, a demented Irishwoman, on April 7, 1926, on the eve of his departure for Tripoli. The premier was slightly wounded in the nose, but proceeded nevertheless on his journey to visit Italy's North African colony. Miss Gibson was sent back and arrived without further incident in England in May 1927.

SUPPRESSION OF INTERNAL DISORDER

Fascist Policy.—In the field of foreign affairs a treaty with Egypt was concluded, whereby the Jarabub oasis was ceded to Italy and the bay of Sollum was ceded to Egypt. The oasis is important both as the headquarters of the Senussi sect and because its possession enables Italy to prevent the contraband of arms from Egypt to the rebel tribes. Jarabub had been promised to Italy, but Lord Milner had informed Senator Scialoja in April 1920 that, as in the case of Transjuba, the agreement would only become effective after a general settlement of all the problems before the Peace conference, thus coupling the Jarabub question with that of the Dodecanese. As we have seen, this connection was rejected by Italy, and Britain had ended by accepting the Italian view, but with the concession of independence to Egypt in 1922 negotiations had had to be renewed with that country, and were concluded on Dec. 6, 1925.

The policy of the Fascist Government to enforce the teaching of Italian in the schools of the Alto Adige, and otherwise to give an Italian character to this district inhabited by 180,000 to 200,000 Germans, aroused irritation in Germany, and the pan-German elements voiced by Held, the Bavarian premier, promoted an agitation against Italy, advocating a boycott of Italian goods, and accusing the Italian authorities of terrorizing the population. Mussolini on Feb. 6, 1926, delivered a vigorous speech in the Chamber denouncing this campaign and warning the German Government that unless it ceased Italy would not hesitate to adopt strong measures. This outburst caused widespread excitement abroad, but achieved its object, Stresemann replying in a very minor tone.

The year 1925 was proclaimed by Pope Pius XI. an *Anno Santo,* and over 1,000,000 pilgrims flocked to Rome from all parts of the world. The Italian Government and the Roman municipality collaborated with the Vatican in organizing the transport of the pilgrims and in making arrangements for their stay. Imposing ceremonies were held in St. Peter's and the other churches, undisturbed by any untoward incident. Suggestions were made from time to time for an official conciliation between the State and the Vatican, and although a solution was not reached till 1929, the question was now discussed in a far more friendly spirit than formerly, and the territorial aspirations of the Holy See were no longer stressed. In April 1928 a dispute arose in connection with a meeting in the Capitol of the *Centro nazionale,* a Catholic political organization which had adhered to Fascism; the pope reprimanded it for not having paid homage to him, and while admitting that Fascism had done much good to religion, denied that under the new régime the Church was enjoying a golden age. The Government made no reply, but shortly afterwards issued a decree dissolving the Catholic boy scouts, and providing that all such activities shall be concentrated in the Fascist *Balilla* organization. But, apart from this and other similar occasional misunderstandings, relations between the Church and the State have continued to improve, the Fascist Government attaching particular importance to conciliating the Vatican.

Two further unsuccessful attempts were made on Mussolini's life, one by the anarchist Lucetti in Rome on Sept. 11, 1926, and the other at Bologna on Oct. 31 by a youth named Zamboni; Lucetti was arrested and eventually condemned to 30 years' imprisonment, while Zamboni was lynched by the infuriated crowd. These new outrages aroused the greatest indignation throughout the country, and led to insistent demands for more rigorous measures against what was regarded as an attempt to destroy Fascist Italy. Reprisals against prominent anti-Fascist individuals and newspapers were carried out, and they all were immediately repressed; the Fascist Grand Council on Nov. 5 severely stigmatized them and proceeded to a rigorous revision of the party lists, expelling all members who were deemed unworthy. On the same day the prime minister announced a bill containing various provisions for the protection of the State, viz., the dissolution of the anti-national party organizations (Socialists, Communists and Republicans), the suppression of seditious newspapers, the application of the death penalty for attempts on the life of the king, the queen, the crown prince or the premier and for the graver forms of high treason, varying terms of imprisonment for lesser political crimes, the institution of the *confino* (relegation to a fixed place of residence) for persons of notoriously seditious activities, and for persons deriving their livelihood from usury, the illicit earnings of women, and other immoral sources, and the creation of a special tribunal of summary jurisdiction, presided over by a military judge, for trying graver political crimes. The bill, voted by the Chamber and the Senate, became law on Dec. 15. The Chamber on Nov. 9 voted that the "Aventinian" deputies who had refused to fulfil their parliamentary duties, should be deprived of their seats. There remained three small groups of opponents consisting of the followers of the ex-premiers—Salandra, Giolitti and Orlando—whose opposition, however, was very moderate. These various measures were professedly of a temporary nature, enacted to cover a period of transition from the old régime to the new Fascist State. In order to give greater unity to the conduct of the country's policy, Mussolini took over the Ministry of the Interior from Federzoni, who returned to the Colonial Ministry. On Dec. 8 the *Fascio littorio*

was declared an official emblem, thereby further identifying Fascism with the State.

During the last months of the year there had been considerable activity in the field of foreign affairs. On Sept. 30 a meeting between Mussolini and Sir Austen Chamberlain took place on a yacht off Leghorn, where the chief international problems were discussed. On Nov. 24 a treaty of commerce was concluded with Greece, and on the 27th a pact of friendship and security with Albania. This latter agreement aroused considerable agitation in Yugoslavia, where it was regarded as entrusting the protection of Albania to Italy alone, and led to violent attacks against Italy in the Yugoslav press and parliament. Subsequently (March 1927) Italy called the attention of other Powers to Yugoslavia's warlike preparations against Albania. There was also some friction with France on account of the French Government's alleged protection of the anti-Fascist organizations in France and of its support of Yugoslavia's anti-Italian policy. A treaty of conciliation and arbitration was concluded with Germany on Dec. 29, 1926.

On Nov. 6 a loan was issued for the conversion of the short-term Treasury bills into consolidated Government bonds. In Feb. 1927 the leaders of the old General Confederation of Labour declared their acceptance of the Fascist syndical régime. On April 23 the Charter of Labour was promulgated, constituting a new code of the rights and duties of employers and workers.

Two more treaties of conciliation and arbitration were concluded, with Chile (Feb. 24) and Hungary (April 5), while on March 8 Italy ratified the treaty assigning Bessarabia to Rumania; against this act Soviet Russia lodged a protest on the 19th. In China an Italian force was landed to co-operate with the British in the protection of Shanghai.

Since Mussolini's speech at Pesaro on Aug. 18, 1926, there had been a rapid revaluation in the lira from about 125 to the £ to 90. Although this improvement had many advantages, it produced certain temporary drawbacks, especially by the reduction of the profits of the export trade and a consequent increase of unemployment. Various measures were enacted for bringing down the cost of living, salaries, wages and rents, while taxes were reduced by over a milliard. But the decrease of prices was inevitably slow, and the possibility of further improvements in the currency made the business world chary of new investments. Foreign capital, however, had begun to flow into Italy, especially for hydro-electric development (1,000,000,000 lire from the U.S.A. alone), and a budget surplus for 1926–27 of 405 millions was announced. In the autumn of 1927 the Government decided that the time for the stabilization of the currency on a gold basis had arrived. The operation was carried out by an agreement between the Banca d'Italia, the Bank of England and the U.S. Federal Reserve Bank, concluded in London on Dec. 21. The Banca d'Italia, which is the sole bank of issue, secured a reserve in gold of equivalent currencies amounting to 57% of the paper circulation, and the Italian lira was declared convertible into gold at the rate of 92·46 to the £. (19 to the dollar). Stabilization had been made possible by sound finance, steady agricultural and industrial development, and the consequent confidence of the foreign financial world.

France and Yugoslavia.—Relations with Yugoslavia have undergone a series of vicissitudes. The treaty of friendship and cordial collaboration concluded on Jan. 27, 1924, for five years was followed by a commercial treaty, a consular convention and sundry other agreements in July–August of the same year concluded at Belgrade, which were duly ratified. On July 20, 1925, another series of agreements concerning the status of Italians in Dalmatia and of Yugoslavs in Fiume and other matters were signed at Nettuno. But the Yugoslav Government for a long time specifically refused to ratify them, a fact which tended to embitter relations between the two countries which the 1924 treaties had apparently placed on a more satisfactory basis. A pact of friendship and security with Albania was concluded on Nov. 27, 1926. Yugoslavia was jealous of Italian influence in Albania, where the President (in 1928, King) Ahmed Bey Zogu, who had come into power with Yugoslav help, was now friendlier to Italy than to Yugoslavia. Italy denounced to the other Powers Yugoslavia's military preparations on the Albanian frontier as a menace to that country's integrity. Yugoslavia thereupon (Nov. 7, 1927) concluded a treaty of friendship with France; although the agreement had been previously initialled and did not in itself contain any dangerous clauses, the moment chosen for its conclusion was regarded in Italy as an unfriendly act and it was interpreted in Yugoslavia as a sort of *carte blanche* given to her by France for an anti-Italian policy, which was evidently not the intention of the French Government. Italy replied by concluding a treaty of alliance with Albania on Nov. 22, 1927. This treaty caused considerable irritation in Yugoslavia, but the French Government appears to have used its influence at Belgrade in a moderating sense, and Franco-Italian relations were improved subsequently by the public declarations of Briand and Mussolini, and by the suppression by the French Government of the *Corriere degli Italiani*, the bitterest of the seditious revolutionary papers published in France. The Yugoslav Government now made an effort to ratify the Nettuno conventions, but this aroused a violent outcry in certain extremist groups, especially in Croatia and Dalmatia, where a number of outrages against Italians were committed. The Belgrade Government repressed them with energy, with the result that the quarrel assumed the aspect of a Serbo-Croat conflict rather than an international one. The conventions were presented to the Skuptchina and voted, and ratifications exchanged on Aug. 13, 1928. Rioting followed in Dalmatia but since then Italo-Yugoslav relations have become more normal.

Other treaties of friendship, conciliation and arbitration have been concluded by Italy since the advent of the Fascist Government with the following countries: Switzerland (Sept. 20, 1924); Czechoslovakia (July 5, 1924); Siam (May 9, 1926); Spain (Aug. 7, 1926); Yemen (Sept. 2, 1926); Germany (Dec. 29, 1926); Chile (Feb. 24, 1927); Hungary (April 5, 1927); Lithuania (Sept. 17, 1927); Mexico (Oct. 16, 1927); Turkey (May 30, 1928); the United States (April 19, 1928); Abyssinia (Aug. 2, 1928); Greece (Sept. 23, 1928). The treaty with Switzerland is regarded as a model of such instruments. (L. V.)

THE VATICAN STATE

The execution of a political treaty with the Holy See on Feb. 11, 1929 ended the Roman Question. The recognition by Italy of the Papal Sovereignty evoked unexampled scenes of enthusiasm in Rome, and created a sense of deep satisfaction amongst the 300,000,000 Roman Catholics throughout the world.

Formal ratification of the treaty and its two accompanying instruments by the high contracting parties had to take place within four months of the affixing of the signature to the respective documents. (A summary of the political treaty will be found at the end of the article on the PAPACY.) It will be seen therefore that the Vatican City is constituted a tiny state, with the status and immunities pertaining to independent civil sovereignty, and with certain public services placed at its disposal by the Italian government. This includes the railway station, and direct connection with other states by telegraphy, telephonic, wireless, broadcasting and postal services. The increase of papal territory is insignificant.

Marriage and Education.—The settlement of the Roman question was accompanied by concordat, which regulates the conditions of religion and of the Church in Italy.

It is stipulated that "The Italian State, wishing to restore dignity to matrimony, which is the basis of the family, in agreement with the Catholic tradition of its own people, recognizes matrimony as a sacrament regulated by canon law in its relation to civil law. Banns of marriage must appear in the parish church as well as in the town hall. Immediately after the celebration of marriage, the parish priest will explain to the married couple the civil consequences of marriage, reading the articles of the civil code concerning the rights and duties of the married.

"Cases concerning nullity of marriage and dissolution of marriages celebrated but not consummated are reserved to the ecclesiastical courts. Their sentences before becoming definitive must be brought before the Supreme Tribunal of the Segnatura, which will examine whether all the rules of canon law have been respected concerning the competence of the judge and whether the interested parties were represented before the court or judged in default."

The decision of the Supreme Tribunal of the Segnatura will be

sent to the court of appeal by the Italian State, which will enforce the sentences of the ecclesiastical authorities, ordering them to be noted in the municipal marriage registers. With regard to cases of separation, the Holy See consents to judgment being given by the Italian civil authorities.

Religious instruction will be compulsory, in the elementary schools and secondary schools, according to a programme to be established in agreement between the Holy See and Italy.

The clauses concerning Church marriages and religious instruction in the schools only apply to Roman Catholics. The marriages of non-Catholics will continue to be performed exclusively by the civil authorities, and children of non-Catholic parents are, at the request of the latter, exempted from Catholic teaching.

(The preamble to the treaty begins by re-affirming the principle contained in the first article of the constitution of the kingdom of Italy, by which the Holy Catholic Apostolic and Roman Religion is the only state religion in Italy.)

Some Implications of the Treaty.—Speculation was immediately rife after the signing of the treaty as to the question of Vatican citizenship, which at the most can only affect those who fulfil the requirements of domicile and papal service. Some writers at the time envisaged the possibility of a "double nationality." But the goodwill and mutual respect that the treaty brought to light as existing between the pope and Mussolini and their advisors, is a happy augury for the satisfactory solution of this and other problems of readjustment inherent in the historic reconciliation.

Proof of the practical goodwill of the Italian government was revealed a few days after the signing of the treaty. The Italian Government, foreseeing the travel needs that would arise when the pope ceased to be "the prisoner of the Vatican," arranged to present his holiness with a modern train similar in most respects to the royal train. (For the terms of the Financial Convention that was also signed between Italy and the Holy See on Feb. 11th, 1929, *see* PAPACY.) (X.)

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ITHACA ('Ιθάκη), vulgarly Thiaki (Θιάκη), next to Paxo the smallest of the seven Ionian islands, with an area of about 44 sq.m.; an eparchy of the nomos of Cephalonia in Greece whose population, with Cephalonia and Leucas, in 1920 was 64,215. It consists of two mountain masses, connected by a narrow isthmus of hills, W. of a wide inlet, the Gulf of Molo. The northern culminates in Anoi (2,650 ft.), the southern in Hagios Stephanos (Merovigli) (2,100 ft.). Vathy, the chief town and port of the island, lies at the northern foot of Mount Stephanos, its white-washed houses stretching for about a mile round the deep bay, to which it owes its name. As there is little arable land in Ithaca, the inhabitants are dependent on commerce for their grain supply; olive oil, wine and currants are the principal products. Goats are fed on the brushwood of the hills; and hares are exceptionally abundant. The island is divided into four districts: Vathy, Aeto (or Eagle's Cliff), Anoge (Anoi) or Upland, and Exoge (Exoi) or Outland.

The name has remained attached to the island from the earliest historical times with but little interruption of the tradition; though in Brompton's travels (12th century) and in the old Venetian maps we find it called Fale or Val de Compar, and at a later date it not infrequently appears as Little Cephalonia. This last name indicates the general character of Ithacan history in modern and in ancient times; for the fame of the island is almost solely due to the Homeric story of Odysseus, its king in the heroic age. In the *Odyssey* the island is incidentally described with picturesque topographical detail, the Homeric localities for which counterparts have been sought are Mount Neritos, Mount Neion, the harbour of Phorcys, the town and palace of Odysseus, the fountain of Arethusa, the cave of the Naiads, the stalls of the swineherd Eumaeus, the orchard of Laertes, the Raven Cliff Korax and the island Asteris, where the suitors lay in ambush for Telemachus. There are two schools of identification, one placing the town at Polis on the west coast in the northern half of the island (Leake, Gladstone, etc.), and the other at Aeto on the isthmus. The latter site, advocated by Sir William Gell, was supported by Dr. H. Schliemann, who carried on excavations in 1873 and 1878. But no amount of ingenuity can fully reconcile the descriptions in the *Odyssey* with the actual topography. Accordingly W. Dörpfeld has suggested that the Homeric Ithaca must be identified with Leucas (Santa Maura, *q.v.*). He deals ingeniously with the Homeric topography and suggests that the name may have been transferred as a result of migration and interprets the valuable and surprising results of his excavations in accordance with his theories of "Achaean" archaeology. Leucas fits Homeric descriptions better than Ithaca; but many scholars refuse to discuss the *Odyssey* as if it were a guide-book, or to look, in the author, for close familiarity with the Ionian islands.

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ITHACA, a city of New York, U.S.A., at the southern end

of Cayuga Lake; the county seat of Tompkins county. It is served by the Lackawanna and the Lehigh Valley railways and by lake steamers. The population in 1925 was 18,948. The city spreads up from a level valley over heights to the south, east and west. It is surrounded by the romantic scenery of the Finger Lake region, and there are picturesque gorges, cascades and water-falls within the city limits. Cornell university (*q.v.*) occupies a beautiful campus of 1,500 acres. On the edge of the city is Buttermilk Falls State park; and the State parks embracing Taughannock Falls (215ft. high) and Enfield Falls are respectively 9m. N. and 7m. S.W. Ithaca is a farming centre, a distribution point for coal from the Pennsylvania mines; and has various manufactures (including firearms, typewriters, adding machines, electric clocks) valued in 1925 at $6.910.811. Ithaca was settled about 1789; named by Simeon De Witt in 1806; incorporated as a village in 1821; and chartered as a city in 1888. At Buttermilk Falls stood the principal village of the Tutelo Indians (Coreorgonel), destroyed by Sullivan's army in 1779.

ITINERARIUM, a term applied to the extant descriptions of the ancient Roman roads and routes of traffic, with the stations and distances (Lat. *iter,* road). Earlier than these, and therefore to be treated as an original source, are the silver cups found at Vicarello, on the lake of Bracciano (*q.v.*), which belong to the time of Trajan, and give the stations from Gades (Cadiz) to Rome overland through Spain, southern Gaul and Italy. There are a few inscriptions which give shorter stretches; but for the rest, we are dependent on the written itineraries. According to one view, all the sources we have are derived from a lost official map; one descendant of this is the *Antonine Itinerary,* a somewhat unskilful excerpt from it of the stations and distances along the various roads of the Roman empire; while from another map (also lost) are derived the *Ravenna Itinerary* and the *Tabula Peutingeriana.* Another view (Miller's) is that the maps arose out of the itineraries, which were kept at the main posting centres, and brought up to date from information given by travellers. Thus, he would hold, the *Antonine Itinerary* is made up from material collected from these itineraries and from travellers in various parts of the world. It belongs to the time of Diocletian, but is of private origin.

The *Tabula Peutingeriana* is a 12th century copy of Castorius' map of the world (4th century), which was intended to be rolled, and was also unofficial. From it is derived the *Ravenna Itinerary.*

The *Itinerarium Hierosolymitanum,* made by an unknown pilgrim in A.D. 333, records the stations and distances from Bordeaux overland to Jerusalem and back by Valona and Rome to Milan. The *Itinerarium Maritimum* (generally, but wrongly regarded as the second part of the *Itinerarium Antonini*) is independent.

See R. Miller, *Itineraria Romana* (Stuttgart, 1916); and for Roman Britain, T. Codrington, *Roman Roads in Britain;* O. G. S. Crawford in *Antiquity,* i. 195 (1927).

ITIUS PORTUS, the name given by Caesar to the chief harbour which he used when embarking for his second expedition to Britain in 54 B.C. It was certainly near Cape Grisnez (*Promuntorium Itium*), but the exact site has been disputed. Many have assumed that Caesar used the port for his first expedition, but the name does not appear at all in that connection and it is generally agreed that he first embarked at Boulogne, and the same view was widely held about the second. But T. Rice Holmes in the *Classical Review* (May 1909) gave strong reasons for preferring Wissant, 4 m. E. of Grisnez.

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ITO, HIROBUMI, PRINCE (1841–1909), Japanese statesman, was born in 1841, being the son of Ito Jūzō, and (like his father) began life as a retainer of the lord of Choshu, one of the most powerful nobles of Japan. Choshu, in common with many of his fellow Daimyos, was bitterly opposed to the rule of the shôgun or tycoon, and when this rule resulted in the conclusion of the treaty with Commodore M. C. Perry in 1854, the smouldering discontent broke out into open hostility against both parties to the compact. In these views Ito cordially agreed with his chieftain, and was sent on a secret mission to Yedo to report to his lord on the doings of the government. This visit caused Ito to turn his attention seriously to the study of the British and of other military systems. As a result he persuaded Choshu to remodel his army, and to exchange the bows and arrows of his men for guns and rifles.

But Ito felt that real knowledge of foreigners must be sought in Europe, and with the connivance of Choshu he and Inouye with three other young nobles, determined to risk their lives by committing the then capital offence of visiting a foreign country and went to London for a year to study English methods, but then events in Japan recalled them to their country. The treaties lately concluded by the shôgun with foreign powers conceded the right to navigate the strait of Shimonoseki, leading to the Inland Sea. On the northern shores of this strait lay the feudal state ruled over by Prince Choshu, who refused to recognize the clause opening the strait, and erected batteries on the shore, from which he opened fire on all ships which attempted to force the passage. The shôgun having declared himself unable to enforce the provision, the treaty powers determined to take the matter into their own hands.

Ito, who knew better than Prince Choshu the disproportion between the fighting powers of Europe and Japan, memorialized the cabinets, begging that hostilities should be suspended until he had used his influence with Choshu in the interests of peace. With this object Ito hurried back to Japan. But Choshu refused to give way, and suffered the consequences of his obstinacy in the destruction of his batteries and in the infliction of a heavy fine. Ito's part in these negotiations aroused the animosity of the more reactionary of his fellow-clansmen, who made repeated attempts to assassinate him. In 1868 Ito was made governor of Hiogo, and in 1869 vice-minister of finance. In 1871 he accompanied Iwakura on a mission to Europe, which, though diplomatically a failure, resulted in the enlistment of European advisers on military, naval and educational systems.

After his return to Japan Ito served in several cabinets as head of the bureau of engineering and mines, and in 1886 he became prime minister, a post which, when he resigned in 1901, he had held four times. In 1882 he was sent on a mission to Europe to study the various forms of constitutional government; on this occasion he attended the coronation of the tsar Alexander III. On his return to Japan he was entrusted with the drafting of a constitution. In 1890 he reaped the fruits of his labours, and nine years later he witnessed the abrogation of the old treaties, and the conclusion of conventions which placed Japan on terms of equality with the European states. In the work of reform in Japan Ito played a leading part. He was able to meet Li Hung-chang at the end of the Chinese and Japanese War (1895) as the representative of Japan, and the conclusion of the Anglo-Japanese Alliance in 1902 testified to his triumphant success in raising Japan to the first rank among civilized powers.

After the Russo-Japanese War (1905) Ito was appointed resident general in Korea, and increased Japanese influence in that country. He retired from this post in July 1909, and became president of the privy council in Japan. But on Oct. 26, when on a visit to Harbin, he was shot dead by a Korean assassin.

He is to be distinguished from Admiral Yuko Ito (b. 1843).

ITONAMAN, a small group of tribes of South American Indians, supposed on meagre evidence to constitute an independent linguistic stock. The stock gets its name from the Itonamas, the best known tribe of the group, which occupies a small area in north-eastern Bolivia along the Itonama river (a tributary of the Guapore) from its mouth up as far as the large lake of the same name in lat. 14° S. The Itonamas are a sedentary, agricultural folk, good canoemen and makers of excellent cotton textiles.

See A. D'Orbigny, *L'Homme Américain* (Paris, 1839); A. Landi, "Appunti sulle condizioni," etc. (*Arch. per Antropologia e Etnologia,* vol. xxxvi., pp. 219-228).

ITRI, a town of Campania, Italy, province of Rome, 4 m. by rail from Formia. Pop. (1921) 5,393. The town is 690 ft. above sea-level, in the mountains which the Via Appia traverses between Fondi and Formia. Interesting remains of the ancient road are preserved in Itri itself; and there are many remains of

ancient buildings near it. The place was once noted for brigandage.

ITUCALÉAN, a small group of tribes of South American Indians, supposed on very insufficient evidence to constitute an independent linguistic stock. The Itucalés, or Uarinas lived in north-eastern Peru on the Chambira river, a northern tributary of the Marañon between the Tigre and the Pastaza. Little or nothing is known of them.

See F. de Figueroa, *Relacion de las Misiones . . . en el País de los Maynas* (Col. de Libros y Documentos referentes a la Historia de America), vol. i. (Madrid, 1904).

ITURBIDE, AUGUSTIN DE (1783–1824), emperor of Mexico from May, 1822 to March, 1823, was born on Sept. 27, 1783, at Valladolid, now Morelia, in Mexico. He joined the provincial regiment of his native city in 1797. In 1810 Hidalgo offered him a flattering post in his revolutionary army, but he refused and joined the royalists. In Dec. 1813, Itúrbide, now a colonel, and Gen. Llano defeated Morelos, the successor of Hidalgo, in the battle of Valladolid, thereby dealing a crushing blow to the revolt. In consideration of his services, the government placed him in command of the military district of Guanajuato and Michoacán, but in 1816 grave charges of extortion and violence led to his recall.

In 1820, when Ferdinand VII. of Spain was compelled to acknowledge once more the Constitution of 1812, Itúrbide became associated with the conservatives in Mexico in a revolutionary movement. Itúrbide issued Feb. 24, 1821, the famous *Plan de Iguala* for a Mexican empire. His plan conciliated all classes of society as Hidalgo's had never done. The military chieftains Santa Anna, Nicolás Bravo and Vicente Filisola supported him. In March 1821, Veracruz acknowledged his leadership, Valladolid was captured in May, and in June, Querétaro. In July the viceroy was withdrawn and on Aug. 24, 1821, Gen. Juan O'Donojú, the new representative of the king, seeing the futility of struggle, signed the treaty of Córdoba that gave Mexico her independence. In September Itúrbide entered the City of Mexico; in Feb. 1822, the Spanish *Cortes* refused to sanction the treaty of Córdoba; and on May 19, Congress proclaimed Itúrbide Augustín I. of Mexico. His régime proved arbitrary and extravagant, and in Dec. 1822, Santa Anna issued a *pronunciamiento* against him.

On March 19, 1823, Itúrbide abdicated, and on May 11, sailed for Leghorn, Italy. Congress declared all matters appertaining to the election, coronation and administration of the late emperor null and void. In Dec. 1823, Itúrbide moved to London; in Feb. 1824, he offered his services to the Mexican Congress; and on May 11, ignorant of a decree of death awaiting his reappearance in Mexico, sailed from England, landing near Soto la Marina on July 15. He was recognized, captured and shot, by order of the State of Tamaulipas, at Padilla, on July 19, 1824. In 1838 Congress ordered his remains removed to Mexico City where they lie in the cathedral with those of Hidalgo and other leaders.

See *Statement of Some of the Principal Events in the Public Life of Augustín de Itúrbide,* written by himself (Eng. trans., 1824); also W. S. Robertson, *Rise of the Spanish-American Republics* (New York, 1918). (W. B. P.)

ITZA, an American-Indian people of Mayan stock, inhabiting the country around Lake Peten in northern Guatemala. Chichen-Itza, among the most wonderful of the ruined cities of Yucatan, was the capital of the Itzas. Thence, according to tradition they removed, on the breaking up of the Mayan kingdom in 1420, to an island in the lake and built another city. In 1697, the Spaniards destroyed the city and temples, and a library of sacred books, written in hieroglyphics on bark fibre.

ITZEHOE, a town in the Prussian province of Schleswig-Holstein, on the Stör, 32 m. N.W. of Hamburg and 15 m. N. of Glückstadt. Pop. (1925) 19,619. Itzehoe, the oldest town in Holstein, had as its nucleus a castle, built in 809. In 1201 the town was destroyed, but it was restored in 1224. Lübeck rights were granted to the new town in 1238, and to the old town in 1303. It passed to Prussia in 1867, with the duchy of Schleswig-Holstein. Ancient buildings include the church of St. Laurence (12th century), and a convent founded in 1256. Manufactures include machinery, tobacco, fishing-nets, soap, cement and beer. Iron founding, shipbuilding and wool-spinning are carried on.

IUKA, the county seat of Tishomingo county, Mississippi, U.S.A., *c.* 25 m. S.E. of Corinth, N.E. corner of the State and 8 m. S. of the Tennessee river. Pop. (1910) 1,221; (1920) 1,306. In the American Civil War, a Confederate force under Gen. Sterling Price occupied the town on Sept. 14, 1862, driving out a small Union garrison; and on Sept. 19, a partial engagement took place between Price and a Federal column in which the Confederate losses were 700 and the Union 790. Price, whose line of retreat was threatened by superior forces under Gen. Grant, withdrew from Iuka on the morning of Sept. 20.

IULUS, in Roman legend: (*a*) the eldest son of Ascanius and grandson of Aeneas, founder of the Julian gens (*gens Iulia*), deprived of his kingdom of Latium by his younger brother Silvius (Dion. Halic. i. 70); (*b*) another name for Ascanius.

IUTURNA, previously Diuturna, "the lasting," Latin divinity, a personification of the never-failing springs. Her original home was on the river Numicius near Lavinium, where there was a spring called after her, supposed to possess healing qualities (whence the old Roman derivation from *iuvare,* "to help"). Her worship was early transferred to Rome, localized by the Lacus Iuturnae near the Temple of Vesta, at which Castor and Pollux, after announcing the victory of Lake Regillus, were said to have washed the sweat from their horses. At the end of the First Punic War, Lutatius Catullus erected a temple in her honour on the Campus Martius, subsequently restored by Augustus. Iuturna was associated with two festivals: the Iuturnalia on Jan. 11, probably a dedication festival of a temple built by Augustus, and celebrated by the college of the *fontani,* workmen employed in the construction and maintenance of aqueducts and fountains; and the Volcanalia on Aug. 23, at which sacrifice was offered to Volcanus, the nymphs and Iuturna, as protectors against outbreaks of fire. In Virgil, Iuturna appears as the sister of Turnus (probably owing to the partial similarity of the names), on whom Jupiter, to console her for the loss of her chastity, bestowed immortality and the control of all the lakes and rivers of Latium. For the statement that she was the wife of Janus and mother of Fontus (or Fons), the god of fountains, Arnobius (*Adv. gentes* iii. 29) is alone responsible.

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IVAN VI. (1740–1764), emperor of Russia, was the son of Prince Antony Ulrich of Brunswick, and the princess Anna Leopoldovna of Mecklenburg, and great-nephew of the empress Anne, who adopted him and declared him her successor on Oct. 5, 1740, when he was only eight weeks old. On the death of Anne (Oct. 17) he was proclaimed emperor, and on the following day Biren, duke of Courland, was appointed regent. On the fall of Biren (Nov. 8, 1740), the regency passed to the baby tsar's mother, though the government was in the hands of the vice-chancellor, Andrei Osterman. A *coup d'état* placed the tsarevna Elizabeth on the throne (Dec. 6, 1741), and Ivan and his family were imprisoned in the fortress of Dünamünde (Dec. 13, 1742). In June 1744 they were transferred to Kholmogory on the White Sea, where Ivan, seeing nobody but his gaoler, remained for the next twelve years. He was then secretly transferred to the fortress of Schlüsselburg (1756), where even the commandant of the fortress was left in ignorance of his identity. In the few weeks' reign of Peter III. his condition was improved, but later instructions were given to chain him up. On the accession of Catherine orders were given that the prisoner was not to be delivered alive into any one's hands, even if his deliverers produced the empress's own sign-manual authorizing his release. By this time, twenty years of solitary confinement had disturbed Ivan's mental equilibrium, though he does not seem to have been actually insane. A sub-lieutenant of the garrison, Vasily Mirovich, learned his identity, and formed a plan for freeing and proclaiming him emperor. At midnight on July 5, 1764, Mirovich won over some of the garrison, arrested the commandant, Berednikov, and demanded the delivery of Ivan, who there and then was murdered by his gaolers in obedience to their instructions.

See R. Nisbet Bain, *The Pupils of Peter the Great* (London, 1897); M. Semevsky, *Ivan VI. Antonovich* (Rus.) (St. Petersburg, 1866); A. Brückner, *The Emperor Ivan VI. and his Family* (Rus.) (Moscow, 1874); V. A. Bilbasov, *Geschichte Catherine II.* (vol. ii., Berlin, 1891–93).

IVAN IV., called "the Terrible" (1530–1584), tsar of Muscovy, was the son of Vasily [Basil] III. Ivanovich, grand duke of Muscovy, by his second wife, Helena Glinska. Born on Aug. 25, 1530, he was proclaimed grand duke on the death of his father (1533), and took the government into his own hands in 1544, being then 14 years old. Ivan IV. had a neurotic strain in his character. His father died when he was three, his mother when he was only seven, and he grew up in a brutal and degrading environment where he learnt to hold human life and human dignity in contempt. He was maltreated by the leading boyars whom successive revolutions placed at the head of affairs, and he conceived an inextinguishable hatred of their whole order and a liking for the merchant class, their natural enemies. He threw to his dogs the last of his boyar tyrants, and announced his intention of assuming the title of tsar, a title which his father and grandfather had not dared to assume. On Jan. 16, 1547, he was crowned the first Russian tsar by the metropolitan of Moscow; on Feb. 3 in the same year he selected as his wife from among the virgins gathered from all parts of Russia for his inspection, Anastasia Zakharina-Koshkina, the scion of an ancient and noble family better known by its later name of Romanov.

Hitherto, by his own showing, the private life of the young tsar had been abominable, but in 1550 he summoned a *Zemsky Sobor* or national assembly, the first of its kind, to which he made public confession of the sins of his youth, and at the same time promised that the realm of Russia (for whose dilapidation he blamed the boyar regents) should henceforth be governed justly and mercifully. In 1551 the tsar submitted to a synod of prelates a hundred questions as to the best mode of remedying existing evils, for which reason the decrees of this synod are generally called *stoglav* or *centuria*. At this time Ivan deliberately broke with his disreputable past and surrounded himself with good men of lowly origin. The chief of these were Alexis Adashev and the monk Sylvester, men of obscure origin, and the best Muscovites of their day. The period of their administration coincides with the most glorious period of Ivan's reign—the period of the conquest of Kazan and Astrakhan.

In 1551 one of the factions of Kazan offered the whole khanate to the young tsar, and on Aug. 20, 1552 he began the siege with an army of 150,000 men and 50 guns. On Oct. 2 the fortress, which had been heroically defended, was taken by assault. The conquest of Kazan was the first territorial conquest from the Tatars, before whom Muscovy had humbled herself for generations; at Kazan Asia, in the name of Mohammed, had fought behind its last trench against Christian Europe marshalled beneath the banner of the tsar of Muscovy. For the first time the Volga became a Russian river. Nothing could now retard the natural advance of the young Russian state towards the east and the south-east. In 1554 Astrakhan fell almost without a blow. By 1560 all the Finnic and Tatar tribes between the Oka and the Kama had become Russian subjects. Ivan was also the first tsar who dared to attack the Crimea. In 1555 he sent Ivan Sheremetev against Perekop, and Sheremetev routed the Tatars in a great two days' battle at Sudbishenska. Some of Ivan's advisers, including both Sylvester and Adashev, now advised him to make an end of the Crimean khanate, as he had already made an end of the khanates of Kazan and Astrakhan. But Ivan recognized the difficulties involved. He coveted Livonia, which was comparatively near at hand and promised him a seaboard and direct communication with western Europe. Ivan IV. desired to raise Muscovy to the level of her neighbours. He proposed immigration into his tsardom of master-workmen and skilled artificers. But his neighbours combined to thwart him. Charles V. dispersed 123 skilled Germans whom Ivan's agent had collected and brought to Lübeck for shipment to a Baltic port. Therefore, when Sweden, Poland and Denmark were contesting the possession of Livonia, Ivan intervened in 1558. He captured Narva, Dorpat and a dozen smaller fortresses; then, in 1560, Livonia placed herself beneath the protection of Poland, and King Sigismund II. warned Ivan off.

Ivan now entered upon the second and evil portion of his reign. As early as 1553 he had ceased to trust Sylvester and Adashev, owing to their backwardness in supporting the claims of his infant son to the throne while he himself lay at the point of death. On his recovery he overlooked their ambiguous conduct, and they continued to direct affairs for six years longer. Then the dispute about the Crimea arose, and Ivan began to distrust their intelligence as well as their loyalty. In 1560 both of them disappeared from the scene, Sylvester into a monastery at his own request, while Adashev died the same year, in honourable exile as a general in Livonia. The death of his wife Anastasia and his son Demetrius, and the desertion of his one bosom friend Prince Kurbsky, about the same time, seem to have infuriated Ivan against God and man. During the next ten years (1560–1570) terrible and horrible things happened in Muscovy. The tsar imagined that every man's hand was against him. On Dec. 3, 1564 he quitted Moscow with his whole family. On Jan. 3, 1565, he declared his intention to abdicate. The common people, whom he had always favoured at the expense of the boyars implored him to come back on his own terms. He consented to do so, but entrenched himself within a peculiar institution, the *oprichina* or "separate estate." Certain towns and districts all over Russia were separated from the rest of the realm, and their revenues were assigned to the maintenance of the tsar's new court and household, which was to consist of 1,000 carefully selected boyars and lower dignitaries, with their families and suites, in the midst of whom Ivan henceforth lived exclusively. The *duma*, or council, still attended to the administration; the old boyars still retained their ancient offices and dignities. But the tsar had cut himself off from all communication with them except on extraordinary occasions. The *oprichniki* trampled with impunity upon every one beyond the charmed circle. Their first victim was Philip, the saintly metropolitan of Moscow, who was strangled for condemning the *oprichina* as an unchristian institution, and refusing to bless the tsar (1569). Ivan had stopped at Tver, to murder St. Philip, while on his way to destroy the second wealthiest city in his tsardom—Great Novgorod. A delator of infamous character, one Peter, had accused the authorities of the city to the tsar of conspiracy; Ivan, without even confronting the Novgorodians with their accuser, proceeded at the end of 1569 to punish them. After ravaging the land he entered the city on Jan. 8, 1570, and for the next five weeks, day after day, massacred batches of every class of the population. Every monastery, church, manor-house, warehouse and farm within a circuit of 100 m. was plundered and left roofless, all goods were pillaged, all cattle destroyed. Not till Feb. 13 were the miserable remnants of the population permitted to rebuild their houses.

An intermittent and desultory war, with Sweden and Poland simultaneously, for the possession of Livonia and Estonia, went on from 1560 to 1582. Ivan's generals bore down their enemies by sheer numbers, capturing scores of fortresses and towns. But in the end the superior military efficiency of the Swedes and Poles invariably prevailed. Ivan had as his chief antagonist Stephen Báthory, one of the greatest captains of the age. The West was too strong for him. By the peace of Zapoli (Jan. 15, 1582) he surrendered Livonia with Polotsk to Báthory, and by the truce of Ilyusa he at the same time abandoned Ingria to the Swedes. The Baltic seaboard was lost to Muscovy for another century and a half. In his latter years Ivan cultivated friendly relations with England; he wished to marry Mary Hastings, one of Elizabeth's ladies, though his fifth wife, Martha Nagaya, was still alive. Towards the end of his life Ivan acquired Siberia, which was first subdued by the Cossack hetman Ermak or Yermak in 1581.

In November 1580 Ivan in a fit of ungovernable fury struck his eldest surviving son Ivan, whom he passionately loved, a blow which proved fatal. In an agony of remorse, he would now have abdicated, but the boyars absolutely refused his abdication. Three years later, on March 18, 1584, he died. During the last moments of his life he assumed the hood of the strictest order of

hermits, and died as the monk Jonah.

Ivan IV. possessed extraordinary political foresight. He anticipated the ideals of Peter the Great, but the resources for their realization were lacking. His brutal and vicious manners prepared the way for the horrors of "the Great Anarchy." Personally, Ivan was tall and well-made, with high shoulders and a broad chest. His face had a sinister, troubled expression, but an enigmatical smile played perpetually around his lips. He was the best educated and the hardest worked man of his age. His memory was astonishing, his energy indefatigable. As far as possible he saw to everything personally, and never sent away a petitioner of the lower orders.

See S. M. Solov'ev, *History of Russia* (Rus.) vol. v. (St. Petersburg, 1895); A. Brückner, *Geschichte Russlands bis zum Ende des 18ten Jahrhunderts* (Gotha, 1896); E. Tikhomirov, *The first Tsar of Moscovy, Ivan IV.* (Rus.) (Moscow, 1888); L. G. T. Tidander, *Kriget mellan Sverige och Ryssland åren 1555–1557* (Vesterås, 1888); P. Pierling, *Un Arbitrage pontifical au XVIe siècle entre la Pologne et la Russie* (Bruxelles, 1890); V. V. Novodvorsky, *The Struggle for Livonia, 1570–1582* (Rus.) (St. Petersburg, 1904); K. Waliszewski, *Ivan le terrible* (Paris, 1904); R. N. Bain, *Slavonic Europe*, ch. 5 (Cambridge, 1907). (R. N. B.; X.)

IVAN V.[1] (1666–1696), tsar of Russia, was the son of Tsar Alexius Mikhailovich and his first consort Miloslavzkoya. Physically and mentally deficient, Ivan was the mere tool of the party in Muscovy who would have kept the children of the tsar Alexis, by his second consort Natalia Naruishkina, from the throne. In 1682 the party of progress, headed by Artamon Matvyeev and the tsaritsa Natalia, passed Ivan over and placed his half-brother, the vigorous and promising little tsarevich Peter, on the throne. On May 23, however, the Naruishkin faction was overthrown by the *stryeltsi* (musketeers), secretly worked upon by Ivan's half-sister Sophia, and Ivan was associated as tsar with Peter. Three days later he was proclaimed "first tsar," in order still further to depress the Naruishkins, and place the government in the hands of Sophia exclusively. In 1689 the name of Ivan was used as a pretext by Sophia in her attempt to oust Peter from the throne altogether. During the reign of his colleague Peter, Ivan V. took no part whatever in affairs, but devoted himself to religious exercises. On Jan. 9, 1684, he married Praskovia Saltuikova, who bore him five daughters, one of whom, Anne, ultimately became empress. He died on Jan. 29, 1696.

See R. Nisbet Bain, *The First Romanovs* (London, 1905); M. P. Pogodin, *The First Seventeen Years of the Life of Peter the Great* (Rus.) (Moscow, 1875).

IVAN III. (1440–1505), grand duke of Muscovy, son of Vasily (Basil) Vasilievich the Blind, grand duke of Moscow, and Maria Yaroslavovna, was born in 1440. He was co-regent with his father during the latter years of his life, and succeeded him in 1462. Ivan III.'s first enterprise was a war with the republic of Novgorod, which, alarmed at the growing dominance of Muscovy, had sought the protection of Casimir IV., king of Poland, an alliance regarded at Moscow as an act of apostasy from orthodoxy. Ivan took the field against Novgorod in 1470; during the summer of 1471, the Novgorodians sued for peace, which they obtained on engaging to abandon for ever the Polish alliance, ceding a considerable portion of their northern colonies, and paying a war indemnity of 15,500 roubles. Ivan sought continually a pretext for destroying Novgorod altogether; he found his opportunity in 1477. In that year the ambassadors of Novgorod addressed him in public audience as "Gosudar" (sovereign) instead of "Gospodin" ("Sir") as heretofore. Ivan siezed upon this as a recognition of his sovereignty, and when the Novgorodians repudiated their ambassadors, he marched against them. Deserted by Casimir IV., and surrounded on every side by the Muscovite armies, which included a Tatar contingent, the republic recognized Ivan as autocrat, and surrendered (January 14, 1478) all her prerogatives and possessions (the latter including the whole of northern Russia from Lapland to the Urals) into his hands. Subsequent revolts (1479–1488) were punished by the removal *en masse* of the richest and most ancient families of Novgorod to Moscow, Vyatka and other central Russian cities. Novgorod, as an independent state, ceased to exist. The rival republic of Pskov purchased the continuance of its political existence by assisting Ivan against its ancient enemy. The other principalities were virtually absorbed, by conquest, purchase or marriage contract—Yaroslavl in 1463, Rostov in 1474, Tver in 1485.

Ivan's refusal to share his conquests with his brothers, and his interference in their inherited principalities, involved him in several wars, from which, though the princes were assisted by Lithuania, he emerged victorious. Ivan's last will decreeing that the domains of all his kinsfolk, after their deaths, should pass directly to the reigning grand duke instead of reverting to the princes' heirs, destroyed these semi-independent princedoms. Ivan determined to annex part of Lithuania, now governed by his son-in-law Alexander, who was compelled in 1499 to take up arms against his father-in-law. The Lithuanians were routed at Vedrosha (July 14, 1500), and in 1503 Alexander purchased peace by ceding to Ivan, Chernigov, Starodub, Novgorod-Syeversk and sixteen other towns.

In the reign of Ivan III. Muscovy rejected the Tatar yoke. In 1480 Ivan refused to pay the customary tribute to the grand Khan Ahmed. All through the autumn the Russian and Tatar hosts confronted each other on opposite sides of the Ugra, till Nov. 11, when Ahmed retired into the steppe. In the following year the grand khan, while preparing a second expedition against Moscow, was suddenly attacked, routed and slain by Ivak, the khan of the Nogai Tatars, whereupon the Golden Horde suddenly fell to pieces. In 1487 Ivan reduced the khanate of Kazan (one of the offshoots of the Horde) to the condition of a vassal-state, though in his later years it broke away from his suzerainty. With the other Mohammedan powers, the khan of the Crimea and the sultan of Turkey, Ivan's relations were pacific and even amicable. The Crimean khan, Mengli Girai, helped him against Lithuania, and facilitated the opening of diplomatic intercourse between Moscow and Constantinople, where the first Russian embassy appeared in 1495.

The character of the government of Muscovy under Ivan III. took on an autocratic form. This was due to the natural consequence of the hegemony of Moscow over the other Russian lands, and to the simultaneous growth of new and exotic principles falling upon a soil already prepared for them. After the fall of Constantinople, orthodox canonists were inclined to regard the Muscovite grand dukes as the successors of the Byzantine emperors. After the death of his first consort, Maria of Tver (1467), Ivan III. wedded the Catholic Zoe Paleologa (better known by her orthodox name of Sophia), daughter of Thomas, despot of the Morea, who claimed the throne of Constantinople as the nearest relative of the last Greek emperor. Through her influence the ceremonious etiquette of Constantinople with the imperial double-headed eagle was adopted by the court of Moscow. The old patriarchal systems of government vanished. The boyars were no longer consulted on affairs of state. The sovereign became sacrosanct, while the boyars were reduced to the level of slaves absolutely dependent on the will of the sovereign. The boyars naturally resented so insulting a revolution, and struggled against it, at first with some success. But Sophia prevailed in the end, and her son Vasily was ultimately crowned co-regent with his father (April 14, 1502). The first Russian "Law Book," or code, was compiled by the scribe Gusev in Ivan's reign. The grand duke invited many foreign masters and artificers to settle in Muscovy, the most noted of whom was the Italian Ridolfo di Fioravante, nicknamed Aristotle, who built the cathedrals of the Assumption (Uspenski) and of Saint Michael or the Holy Archangels in the Kremlin.

See P. Pierling, *Mariage d'un tsar au Vatican, Ivan III. et Sophie Paléologue* (Paris, 1891); E. I. Kashprovsky, *The Struggle of Ivan III. with Sigismund I.* (Rus.) (Nizhni, 1899); S. M. Solov'ev, *History of Russia* (Rus.), vol. v. (St. Petersburg, 1895).

IVAN I., called *Kalita*, or Money-Bag (d. 1341), grand duke of Vladimir, was first *sobiratel*, or "gatherer" of the scattered Russian lands, thereby laying the foundations of the future

[1] Ivan V., if we count from the first grand duke of that name, as most Russian historians do; Ivan II., if, with the minority, we reckon from Ivan the Terrible as the first Russian tsar.

autocracy as a national institution. He adopted a policy of complete subserviency to the khan of the Golden Horde, who, in return for a liberal and punctual tribute, permitted him to aggrandize himself at the expense of the lesser grand dukes. Moscow and Tver were the first to fall. The latter Ivan received from the hand of the khan, after devastating it with a host of 50,000 Tatars (1327). When Alexander of Tver fled to Pskov, Ivan procured his banishment by the aid of the metropolitan, Theognost, who threatened Pskov with an interdict. In 1330 Ivan extended his influence over Rostov by the drastic methods of blackmail and hanging. But he threatened the republic of Great Novgorod in vain. In 1340 Ivan assisted the khan to ravage the domains of Prince Ivan of Smolensk, who had refused to pay the customary tribute to the Horde. Ivan's own domains remained free from Tatar incursions, and therefore attracted immigrants and their wealth from surrounding principalities. Ivan was a niggard, keeping an exact account of every village or piece of plate that his moneybags acquired, whence his nickname. During his reign the metropolitan see was transferred from Vladimir to Moscow, which gave Muscovy the pre-eminence over all the other Russian states. The Metropolitan Peter built the first stone cathedral of Moscow, and his successor, Theognost, followed suit with three more stone churches. Simultaneously Ivan substituted stone walls for the ancient wooden ones of the Kremlin, or citadel, which made Moscow a still safer place of refuge.

See S. M. Soloviev, *History of Russia* (Rus.), vol. iii. (St. Petersburg, 1895); Polezhaev, *The Principality of Moscow in the first half of the 14th Century* (Rus.) (St. Petersburg, 1878).

IVAN II. (1326–1359), grand duke of Vladimir, a younger son of Ivan Kalita, succeeded his elder brother Simeon as grand duke in 1353, despite the competition of Prince Constantine of Suzdal, the Khan Hanibek preferring to bestow the *yarluik*, or letter of investiture, upon Ivan rather than upon Constantine. At first the principalities of Suzdal, Ryazan and the republic of Novgorod refused to recognize him as grand duke, and waged war with him till 1354. The surrounding principalities paid little attention to Moscow, and Ivan was ruled to a great extent by the *tuisyatsky*, or chiliarch, Alexis Khvost, and, after his murder by the jealous boyars in 1357, by Bishop Alexis. Ivan, by his last will, divided his dominions among his children.

See Dmitry Ilovaisky, *History of Russia* (Rus.), vol. ii. (Moscow, 1876–94).

IVANOVO-VOZNESENSK, (1) a province of the Russian S.F.S.R., drained by the Volga and its tributary the Unzha. It lies in the *taiga* or pine forest area, and is thickly forested north of the Volga and east of the Unzha, but in the south-western district the forest remains in patches only. Rye and oats are the main crops, with potatoes, grasses, flax, wheat, barley and buckwheat in much smaller quantities. Sheep, cattle, horses and pigs are reared. A network of electric stations working on the abundant peat fuel of the district is planned, and the town of Ivanovo-Voznesensk is supplied from an electric plant at Teikovo, near Lake Rubsk, on the railway to Moscow via Aleksandrov.

(2) A town, the administrative centre of the province, linked by branch lines with the Moscow to Nizhni-Novgorod and the Moscow to Yaroslavl railways, and also to Kineshma on the Volga river. It has important cotton and linen factories, equipped with up-to-date machinery, and iron and chemical works connected with its textile industries. Its population is increasing rapidly and was 110,728 in 1926. Originally it consisted of two villages —Ivanovo, dating from the 16th century, and Voznesensk, of more recent date—united into a town in 1861. Its cathedral and the church of the Intercession of the Virgin were formerly associated with an important monastery founded in 1579 and abandoned in 1754.

IVARR BEINLAUSI (d. 873), son of Ragnar Lothbrok, the great Viking chieftain, is known in English and Continental annals as Inuaer, Ingwar or Hingwar. He was one of the Danish leaders in the Sheppey expedition of 855 and was perhaps present at the siege of York in 867. The chief incident in his life was his share in the martyrdom of St. Edmund in 870. He seems to have been the leader of the Danes on that occasion, and by this act he probably gained the epithet "crudelissimus" by which he is usually described. It is probable that he is to be identified with Imhar, king of the Norsemen of all Ireland and Britain, who was active in Ireland between the years 852 and 873, the year of his death.

IVEAGH, EDWARD CECIL GUINNESS, 1ST EARL of (1847–1927), was born on Nov. 10, 1847, the son of Sir Benjamin Guinness, first baronet. He was educated at Trinity college, Dublin, and after some experience of the business became chairman of the famous Guinness brewery. He retired from the management in 1889, marking his retirement by a gift of £250,000 for the housing of the poor in Dublin and in London. A little later he provided another £250,000 for the clearing of an insanitary area in Dublin and the erection of workmen's dwellings. His other great benefactions included £250,000 to the Lister Institute of Preventive Medicine in London for bacteriological research. Last of all he rescued Ken Wood, north of Hampstead Heath, for the benefit of Londoners by purchasing the remaining portion of the estate in 1925 and arranging that Ken Wood with its collection of pictures and the 76 acres on which it stood should become public property. From 1905 onwards when he purchased Elveden Hall, Suffolk, most of his time was spent in England, but he never lost touch with his native city, of which he was a constant benefactor, and he did not allow his Unionist principles to interfere with his civic patriotism. Guinness received a barony in 1891, a viscounty in 1905 and an earldom in 1919. He died in London on Oct. 7, 1927.

He was succeeded by his son, Rupert Viscount Elveden, M.P. (b. 1874), whose wife (née Lady Gwendolen Onslow) entered Parliament as member for Southend in 1927.

IVES, FREDERIC EUGENE (1856–), American inventor, was born on Feb. 17, 1856, on a farm in Litchfield, Connecticut. He was apprenticed as a printer on the Litchfield *Inquirer*, 1869. He diligently studied photography and it was in those early days he first dreamed of a quick and popular photo-mechanical process of illustration. So expert a photographer had he become at 19 that he was placed in charge of the Cornell university photographic laboratory. Here he developed a new "swell gelatine" line process by which beautiful illustrations were produced for the undergraduate periodical. At Cornell in 1878 Ives invented the first process called "half-tone." Although the results were identical with those of to-day, the process was different. The method now in universal use he invented in 1885–86 in Philadelphia, where, in Feb. 1881, he had begun the first commercial production of half-tone printing plates (by his first method). In 1881 Ives made the world's first set of trichromatic half-tone process printing plates. Among his other important inventions are the half-tone photogravure (anticipating rotogravure); the modern short-tube single-objective binocular microscope; the photochromoscope, a device for optically reproducing objects in both full modelling and perfect colour; also photographs and motion pictures in natural colours. Specimens of his early prints are preserved in the Smithsonian Institution. Frederic E. Ives is the father of Herbert E. Ives, the outstanding engineer in the development of television and the transmission of pictures by wire. (W. T. I.)

IVIZA, IBIZA or IVIÇA, an island in the Mediterranean sea, belonging to Spain, and forming part of the archipelago known as the Balearic islands (*q.v.*). Pop. (1920) 24,476; area 228 sq.m. Iviza lies 50 m. S.W. of Majorca and about 60 m. from Cape San Martin on the coast of Spain. Its greatest length from north-east to south-west is about 25 m. and its greatest breadth about 13 m. The hilly parts which culminate in the Pico de Atalayasa (1,560 ft.), are richly wooded. Oil, corn and fruits (of which the most important are the fig, prickly pear, almond and carob-bean) are the principal products; hemp and flax are also grown. Fruit, salt, charcoal, lead and stockings of native manufacture are exported. The imports are rice, flour, sugar, woollen goods and cotton. The capital of the island, and, indeed, the only town of much importance—for the population is remarkably scattered—is Iviza or La Ciudad (6,751), a fortified town on the south-east coast, possessing a good harbour, a 13th-century Gothic

collegiate church and an ancient castle. Iviza was the see of a bishop from 1782 to 1851.

South of Iviza lies the smaller and more irregular island of Formentera (pop., 1920, 2,508; area, 37 sq.m.). With Iviza it agrees both in general appearance and in the character of its products, but it is altogether destitute of streams. Goats and sheep are found in the mountains, and the coasts are greatly frequented by flamingoes. Iviza and Formentera are the principal islands of the lesser or western Balearic group, formerly known as the Pityusae or Pine islands.

IVO OF CHARTRES, SAINT (Yvo, Yves) (*c.* 1040–1116), bishop of Chartres, was born of a noble family near Beauvais, and was educated in Paris and at Bec under Lanfranc. About 1080 he became prior of the canons of St. Quentin in Beauvais and ten years later bishop of Chartres in place of Geoffrey who had been deposed for simony. As bishop he incurred the hostility of Philip I. who wished to leave his wife and marry the Countess Bertrada of Anjou. In the Investiture struggle his policy was one of moderation. His importance as a canonist is apparent from his *Decretum* and his *Panormia,* both composed before 1096. His 288 letters throw much light on the political, religious and liturgical questions of his day. In addition to these works, which together with the sermons are printed in Migne's *Patrol. Lat.*, vols. 161 and 162, Ivo wrote an unprinted commentary on the Psalms and a collection of canons, *Tripartita.* His feast is celebrated on May 20.

See A. Sieber, *Bischof Ivo von Chartres* (Königsberg, 1895); F. Fournier, "Les Collections canoniques attribuées à Yves de Chartres" in *Bibliothèque de l'école des Chartres* (vols. 57 and 58, 1896) and "Yves de Chartres et le droit canonique" in *Rev. des questions historiques* (vol. 57, 1898), and F. P. Bliemelzrieder, *Zu den Schriften Ivo von Chartres* (1917).

IVORY, SIR JAMES (1765–1842), Scottish mathematician, was born in Dundee in 1765. In 1779 he entered the University of St. Andrews, distinguishing himself especially in mathematics. From 1804–16, he occupied a chair of mathematics at the Royal Military College, Marlow (now Sandhurst). He contributed many memoirs to the *Philosophical Transactions,* the most important being one in 1809 giving a theorem on the attraction due to a homogeneous ellipsoid, which is now known as Ivory's Theorem. Ivory received the Copley medal in 1814, was elected F.R.S. in 1815, and was connected with several other scientific societies. He died in London on Sept. 21, 1842.

IVORY, strictly speaking a term confined to the material represented by the tusk of the elephant, and for commercial purposes almost entirely to that of the male elephant. In Africa both the male and female elephant produce good-sized tusks; in the Indian variety the female is much less bountifully provided, and in Ceylon perhaps not more than 1% of either sex have any tusks at all. Ivory is in substance very dense, the pores close and compact and filled with a gelatinous solution which contributes to the beautiful polish which may be given to it and makes it easy to work. It may be placed between bone and horn; more fibrous than bone and therefore less easily torn or splintered. For a scientific definition it would be difficult to find a better one than that given by Sir Richard Owen. He says: "The name ivory is now restricted to that modification of dentine or tooth substance which in transverse sections or fractures shows lines of different colours, or striae, proceeding in the arc of a circle and forming by their decussations minute curvilinear lozenge-shaped spaces." These spaces are formed by an immense number of exceedingly minute tubes placed very close together, radiating outwards in all directions. It is to this arrangement of structure that ivory owes its fine grain and almost perfect elasticity, and the peculiar marking resembling the engine-turning on the case of a watch, by which many people are guided in distinguishing it from celluloid or other imitations. Elephants' tusks are the upper incisor teeth of the animal, which, starting in earliest youth from a semi-solid vascular pulp, grow during the whole of its existence, gathering phosphates and other earthy matters and becoming hardened as in the formation of teeth generally. The tusk is built up in layers, the inside layer being the last produced. A large proportion is embedded in the bone sockets of the skull, and is hollow for some distance up in a conical form, the hollow becoming less and less as it is prolonged into a narrow channel which runs along as a thread or as it is sometimes called, nerve, towards the point of the tooth. The outer layer, or bark, is enamel of similar density to the central part. Besides the elephant's tooth or tusk we recognize as ivory, for commercial purposes, the teeth of the hippopotamus, walrus, narwhal, cachalot or sperm-whale and of some animals of the wild boar class, such as the wart-hog of South Africa. Practically, however, amongst these the hippo and walrus tusks are the only ones of importance for large work, though boars' tusks come to the sale-rooms in considerable quantities from India and Africa.

Sources of Ivory.—Generally speaking, the supply of ivory imported into Europe comes from Africa; some is Asiatic, but much that is shipped from India is really African, coming by way of Zanzibar and Mozambique to Bombay. A certain amount is furnished by the vast stores of remains of prehistoric animals still existing throughout Russia, principally in Siberia in the neighbourhood of the Lena and other rivers discharging into the Arctic ocean. The mammoth and mastodon seem at one time to have been common over the whole surface of the globe. In England tusks have been dug up—for instance at Dungeness—as long as 12ft. and weighing 200 lb. The Siberian deposits have been worked now for nearly two centuries. The store appears to be as inexhaustible as a coalfield. Some think that a day may come when the spread of civilization may cause the utter disappearance of the elephant in Africa, and that it will be to these deposits that we may have to turn as the only source of animal ivory. Of late years in England the use of mammoth ivory has shown signs of decline. Little or none passed through the London sale-rooms after 1900. Before that, parcels of 10 to 20 tons were not uncommon. Not all of it is good; perhaps about half of what comes to England is so, the rest rotten; specimens, however, are found as perfect and in as fine condition as if recently killed, instead of having lain hidden and preserved for thousands of years in the icy ground. There is a considerable literature (*see* Shooting) on the subject of big-game hunting which includes that of the elephant, hippopotamus and smaller tusk-bearing animals. Elephants until comparatively recent times roamed over the whole of Africa from the northern deserts to the Cape of Good Hope. They are still abundant in Central Africa and Uganda, but civilization has gradually driven them farther and farther into the wilds and impenetrable forests of the interior.

The quality of ivory varies according to the districts whence it is obtained, the soft variety of the eastern parts of the continent being the most esteemed. When in perfect condition African ivory should be, if recently cut, of a warm, transparent, mellow tint, with as little as possible appearance of grain or mottling. Asiatic ivory is of a denser white, more open in texture and softer to work. But it is apt to turn yellow sooner, and is not so easy to polish. Unlike bone, ivory requires no preparation, but is fit for immediate working. That from the neighbourhood of Cameroon is very good, then ranks the ivory from Loango, Congo, Gabun and Ambriz; next the Gold Coast, Sierra Leone and Cape Coast Castle. That of French Sudan is nearly always "ringy," and some of the Ambriz variety also. We may call Zanzibar and Mozambique varieties soft; Angola and Ambriz all hard. Ambriz ivory was at one time much esteemed, but there is comparatively little now. Siam ivory is rarely if ever soft. Abyssinian has its soft side, but Egypt is practically the only place where both descriptions are largely distributed. A drawback to Abyssinian ivory is a prevalence of a rather thick bark. Egyptian is liable to be cracked, from the extreme variations of temperature; more so formerly than now, since better methods of packing and transit are used. Ivory is extremely sensitive to sudden extremes of temperature; for this reason billiard balls should be kept where the temperature is fairly equable.

The market terms by which descriptions of ivory are distinguished are liable to mislead. As is often the case they most generally refer to ports of shipment rather than to places of origin. For instance, "Malta" ivory is a well-understood term,

yet there are no ivory-producing animals in that island.

Tusks should be regular and tapering in shape, not very curved or twisted, for economy in cutting; the coat fine, thin, clear and transparent. The substance of ivory is so elastic and flexible that excellent riding-whips have been cut longitudinally from whole tusks. The size to which tusks grow and are brought to market depends on race rather than on size of elephants. The latter run largest in equatorial Africa. Asiatic bull elephant tusks seldom exceed 50 lb. in weight, though lengths of 9ft. and up to 150 lb. in weight are not entirely unknown. Record lengths for African tusks are the one presented to George V., when prince of Wales, on his marriage (1893), measuring 8ft. 7½in. and weighing 165 lb., and the pair of tusks which were brought to the Zanzibar market by natives in 1898, weighing together over 450 lb. One of the latter is now in the Natural History Museum at South Kensington; the other is in Messrs. Rodgers & Co.'s collection at Sheffield. For length the longest known are those belonging to Messrs. Rowland Ward, Piccadilly, which measure 11ft. and 11ft. 5in. respectively, with a combined weight of 293 lb. Osteodentine, resulting from the effects of injuries from spearheads or bullets, is sometimes found in tusks. This formation, resembling stalactites, grows with the tusk, the bullets or iron remaining embedded without trace of their entry.

Hard and Soft Ivory.—The most important commercial distinction of the qualities of ivory is that of the *hard* and *soft* varieties. The terms are difficult to define exactly. Generally speaking, hard or bright ivory is distinctly harder to cut with the saw or other tools. It is, as it were, glassy and transparent. Soft contains more moisture, stands differences of climate and temperature better and does not crack so easily. The expert is guided by the shape of the tooth, by the colour and quality of the bark or skin, and by the transparency when cut, or even before, as at the point of the tooth. Roughly, a line might be drawn almost centrally down the map of Africa, on the west of which the hard quality prevails, on the east the soft. In choosing ivory—for example for knife-handles—people rather like to see a pretty grain, strongly marked; but the finest quality in the hard variety, which is generally used for them, is the closest and freest from grain. The curved or canine teeth of the hippopotamus are valuable and come in considerable quantities to the European markets. Owen describes this variety as "an extremely dense, compact kind of dentine, partially defended on the outside by a thin layer of enamel as hard as porcelain; so hard as to strike fire with steel." By reason of this hardness it is not at all liked by the turner and ivory workers, and before being touched by them the enamel has to be removed by acid, or sometimes by heating and sudden cooling when it can be scaled off. The texture is slightly curdled, mottled or damasked. Hippo ivory was at one time largely used for artificial teeth, but now mostly for umbrella and stick handles; whole (in their natural form) for fancy door-handles and the like. In the trade the term is not "riverhorse" but "seahorse" teeth. Walrus ivory is less dense and coarser than hippo, but of fine quality—what there is of it—for the oval centre which has more the character of coarse bone unfortunately extends a long way up. At one time a large supply came to the market, but of late years there has been an increasing scarcity, the animals having been almost exterminated by the ruthless persecution to which they have been subjected in their principal haunts in the northern seas. It is little esteemed now, though our ancestors thought highly of it. Comparatively large slabs are to be found in mediaeval sculpture of the 11th and 12th centuries, and the grips of most oriental swords, ancient and modern, are made from it. The ivory from the single tusk or horn of the narwhal is not of much commercial value except as an ornament or curiosity. Some horns attain a length of 8 to 10ft., 4in. thick at the base. It is dense in substance and of a fair colour, but owing to the central cavity there is little of it fit for anything larger than napkin-rings.

Ivory in Commerce.—Almost the whole of the importation of ivory to Europe was until recent years confined to London, the principal distributing mart of the world. But the opening up of the Congo trade placed the port of Antwerp in a position which has equalled that of London. Other important markets are Liverpool and Hamburg; and Germany, France and Portugal have colonial possessions in Africa, from which it is imported. America is a considerable importer for its own requirements. Every pair of tusks that comes to the market represents a dead elephant, but not necessarily by any means a slain or even a recently killed one, as is popularly supposed. By far the greater proportion is the result of stores accumulated by natives, a good part coming from animals which have died a natural death. Not 20% is *live* ivory or recently killed; the remainder is known in the trade as *dead* ivory.

The British supplies of ivory have greatly fallen since the '90s. In 1827 the London market received 3,000 cwt.; in 1850, 8,000 cwt. In 1890 British imports increased to 14,349 cwt., but since then there has been decline to 10,911 cwt. in 1895; 9,889 cwt. in 1900; 5,095 cwt. in 1927. The price has greatly risen in consequence, the British imports of all grades of ivory in 1927 averaging as much as £66 per cwt.; while £154 was paid for East India billiard ball pieces. If we allow say 30 lb. per pair of tusks, each cwt. imported represents nearly four elephants, and we must expect supplies further to decline.

The leading London sales are held quarterly in Mincing lane, a very interesting and wonderful display of tusks and ivory of all kinds being laid out previously for inspection in the great warehouses known as the "Ivory Floor" in the London docks. The quarterly Liverpool sales follow the London ones, with a short interval.

Industrial Applications.—The important part which ivory plays in the industrial arts not only for decorative, but also for domestic applications is hardly sufficiently recognized. Nothing is wasted of this valuable product. Hundreds of sacks full of cuttings and shavings, and scraps returned by manufacturers after they have used what they require for their particular trade, come to the mart. The dust is used for polishing, and in the preparation of India ink, and even for food in the form of ivory jelly. The scraps come in for inlaying and for the numberless purposes in which ivory is used for small domestic and decorative objects. India, which has been called the backbone of the trade, takes enormous quantities of the rings left in the turning of billiard-balls, which serve as women's bangles, or for making small toys and models, and in other characteristic Indian work. Without endeavouring to enumerate all the applications, a glance may be cast at the most important of those which consume the largest quantity. Chief among these is the manufacture of billiard-balls, of cutlery handles, of piano-keys and of brushware

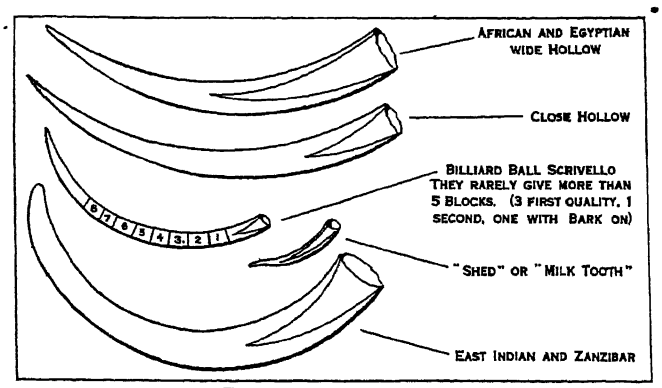


FIG. 1.—TYPES OF TUSKS

and toilet articles. Billiard-balls demand the highest quality of ivory; for the best balls the soft description is employed, though recently, through the competition of bonzoline and similar substitutes, the hard has been more used in order that the weight may be assimilated to that of the artificial kind. Therefore the most valuable tusks of all are those adapted for the billiard-ball trade. The term used is "scrivelloes," and is applied to teeth proper for the purpose, weighing not over about 7 lb. The division of the tusk into smaller pieces for subsequent manufacture, in order to avoid waste, is a matter of importance.

The accompanying diagrams (figs. 1 and 2) show the method; the cuts are made radiating from an imaginary centre of the curve of the tusk. In after processes the various trades have their own particular methods for making the most of the material. In making a billiard-ball of the English size the first thing to be done is to rough out, from the cylindrical section, a sphere about $2\frac{1}{8}$in. in diameter, which will eventually be $2\frac{1}{16}$ or sometimes for

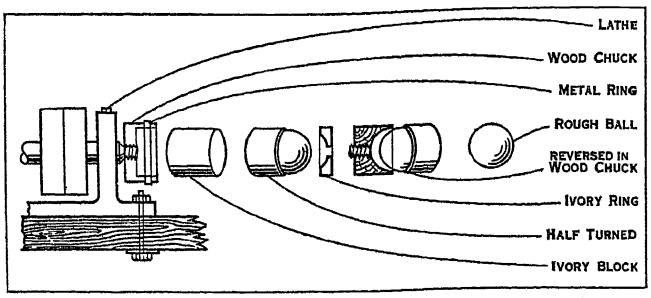


FIG. 2.—TURNING BILLIARD-BALLS FROM IVORY BLOCKS

professional players a little larger. One hemisphere—as shown in the diagrams (fig. 2)—is first turned, and the resulting ring detached with a parting tool. The diameter is accurately taken and the subsequent removals taken off in other directions. The ball is then fixed in a wooden chuck, the half cylinder reversed, and the operation repeated for the other hemisphere. It is now left five years to season and then turned dead true. The rounder and straighter the tusk selected for ball-making the better. Evidently, if the tusk is oval and the ball the size of the least diameter, its sides which come nearer to the bark or rind will be coarser and of a different density from those portions further removed from this outer skin. The matching of billiard-balls is important, for extreme accuracy in weight is essential. It is usual to bleach them, as the purchaser—or at any rate the distributing intermediary—likes to have them of a dead white. But this is a mistake, for bleaching with chemicals takes out the gelatine to some extent, alters the quality and affects the density; it also makes them more liable to crack, and they are not nearly so nice-looking. On an average three balls of fine quality are got out of a tooth. The stock of more than one great manufacturer surpasses at times 30,000 in number.

The ivory for piano-keys is delivered to the trade in the shape of what are known as heads and tails, the former for the parts which come under the fingers, the latter for that running up between the black keys. The two are joined afterwards on the keyboard with extreme accuracy. Piano-keys are bleached, but organists for some reason or other prefer unbleached keys. The soft variety is mostly used for high-class work and preferably of the Egyptian type.

The great centres of the ivory industry for the ordinary objects of common domestic use are in Great Britain: for cutlery handles Sheffield; for billiard-balls and piano-keys London. For cutlery a large firm uses an average of some 20 tons of ivory annually, mostly of the hard variety. But for billiard-balls and piano-keys America is now a large producer, and a considerable quantity is made in France and Germany. Dieppe has long been famous for the numberless little ornaments and useful articles such as statuettes, crucifixes, little book-covers, paper-cutters, combs, serviette-rings and *articles de Paris* generally. And St. Claude in the Jura, and Geislingen in Württemberg, and Erbach in Hesse, Germany, are amongst the most important centres of the industry. India and China supply the multitude of toys, models, chess and draughtsmen, puzzles, work-box fittings and other curiosities.

Vegetable Ivory, Etc.—Some allusion may be made to vegetable ivory and artificial substitutes. The plants yielding the vegetable ivory of commerce represent two or more species of an anomalous genus of palms, and are known to botanists as *Phytelephas*. They are natives of tropical South America, occurring chiefly on the banks of the river Magdalena, Colombia, always found in damp localities, not only, however, on the lower coast region as in Darien, but also at a considerable elevation above the sea. They are mostly found in separate groves, not mixed with other trees or shrubs. The plant is severally known as the "tagua" by the Indians on the banks of the Magdalena, as the "anta" on the coasts of Darien, and as the "pullipunta" and "homero" in Peru. It is stemless or short-stemmed, and crowned with from 12 to 20 very long pinnatifid leaves. The plants are dioecious, the males forming higher, more erect and robust trunks than the females. The male inflorescence is in the form of a simple, fleshy, cylindrical spadix covered with flowers; the female flowers are also in a single spadix, which, however, is shorter than in the male. The fruit consists of a conglomerated head composed of six or seven drupes, each containing from six to nine seeds, and the whole being enclosed in a walled woody covering forming altogether a globular head as large as that of a man. A single plant sometimes bears at the same time from six to eight of these large heads of fruit, each weighing from 20 to 25 lb. In its very young state the seed contains a clear insipid fluid, which travellers take advantage of to allay thirst. As it gets older this fluid becomes milky and of a sweet taste, and it gradually continues to change both in taste and consistence until it becomes so hard as to make it valuable as a substitute for animal ivory. In their young and fresh state the fruits are eaten with avidity by bears, hogs and other animals. The seeds, or nuts as they are usually called when fully ripe and hard, are used by the American Indians for making small ornamental articles and toys. They are imported into Britain in considerable quantities, frequently under the name of "Corozo" nuts, a name by which the fruits of some species of *Attalea* (another palm with hard ivory-like seeds) are known in Central America—their uses being chiefly for small articles of turnery.

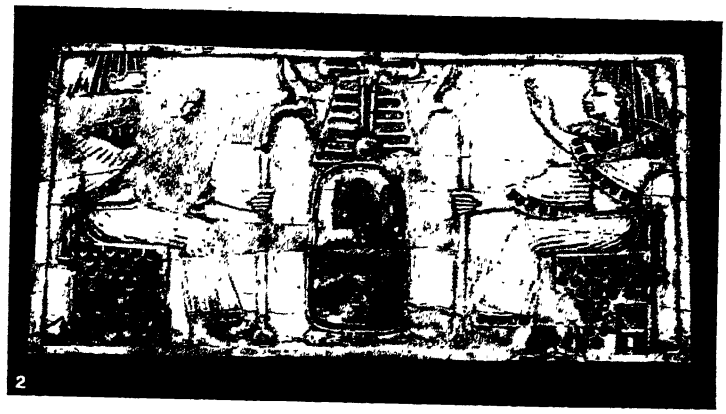
Many artificial compounds have, from time to time, been tried as substitutes for ivory; amongst them potatoes treated with sulphuric acid. Celluloid is familiar to us nowadays. In the form of bonzoline, into which it is said to enter, it is used largely for billiard-balls; and a new French substitute—a casein made from milk, called galalith—has begun to be much used for piano-keys in the cheaper sorts of instrument. Odontolite is mammoth ivory, which through lapse of time and from surroundings becomes converted into a substance known as fossil or blue ivory, and is used occasionally in jewellery as turquoise, which it very much resembles. It results from the tusks of antediluvian mammoths buried in the earth for thousands of years, during which time under certain conditions the ivory becomes slowly penetrated with the metallic salts which give it the peculiar vivid blue colour of turquoise.

IVORY BILL or **IVORY-BILLED WOODPECKER** (*Campephilus principalis*), the largest North American woodpecker, reaches a length of 20 in. Formerly extending north to Illinois, Indiana and North Carolina, the ivory bill is now very rare everywhere and is almost confined to cypress swamps in a few isolated portions of Florida. The white beak and large size are diagnostic. The plumage is black, with the secondaries and shorter primaries white, and a pair of white stripes down the back. The long crest is scarlet in the male, black in the female. The call is "a sharp, penny trumpet-like *yap-yap*." The heads were used for ornaments by the Indians.

IVORY BLACK, a high grade carbonaceous black sometimes prepared by carbonizing ivory turnings and cuttings, but more often made by the calcination of bone, only the best grades of product being selected. It should have a deep black, velvety tint. It is largely composed of mineral matter, from 65 to 84% being calcium phosphate with some calcium carbonate. Ivory black is used by copper-plate printers in preparing their inks, and also to a decreasing extent as a decolourizing agent.

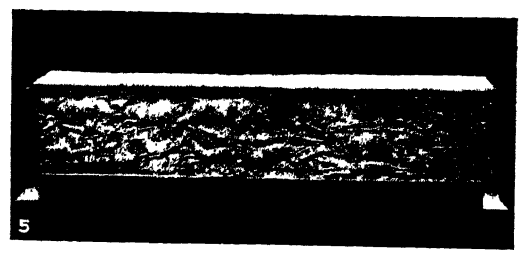
IVORY CARVING. The use of ivory as a material peculiarly adapted for sculpture and decoration has been universal in the history of civilization. In order to treat the subject adequately and give the relative importance of the art in different countries, the following division is made: (1) History, covering various periods and countries, (2) Chinese, (3) Japanese, (4) North American. For ivory carving technique *see* SCULPTURE: *Technique*.


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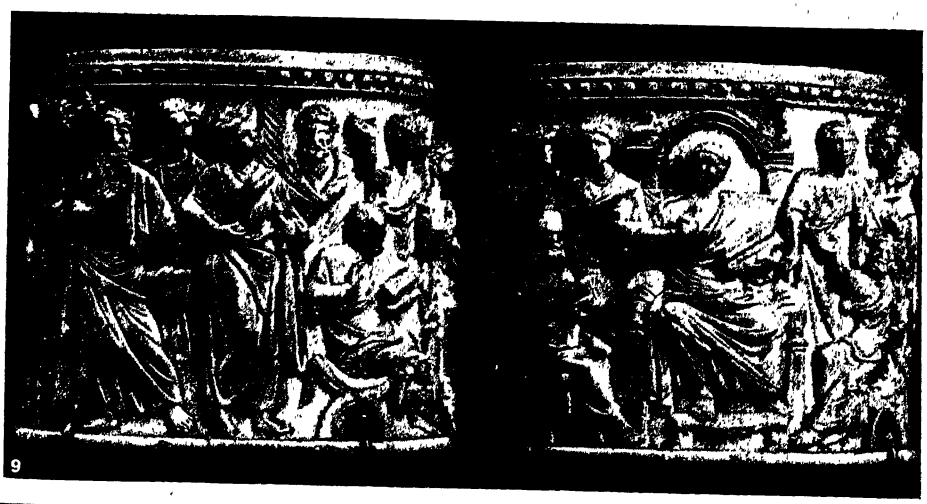

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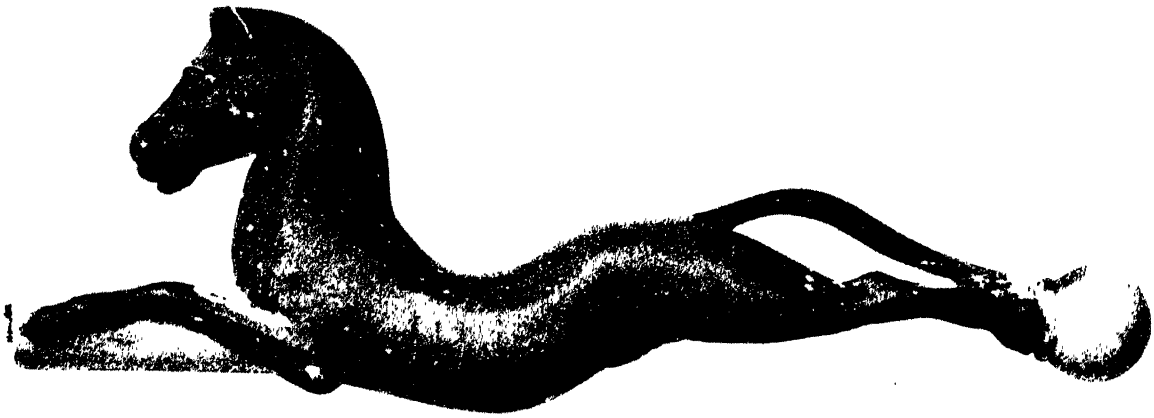

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BY COURTESY OF (1, 2, 4, 5, 6, 7) THE TRUSTEES OF THE BRITISH MUSEUM, (3) THE DIRECTOR OF THE MUSEE DES ANTIQUITES NATIONALES, (9) THE KAISER-FRIEDRICH MUSEUM, (10) THE DIRECTOR OF THE VICTORIA AND ALBERT MUSEUM; PHOTOGRAPH, (8) J. C. BURRILL

PALAEOLITHIC, EGYPTIAN, EARLY CHRISTIAN AND MOHAMMEDAN IVORIES

1. Figure of a King from Abydos, Egyptian, 1st dynasty, *c.* 3400 B.C.; one of the earliest examples of Egyptian ivory carvings. In the British Museum. 2. Relief, from Nimrud, Assyria, 9th to 7th century B.C. 3. Head of a girl from Brassempouy, Landes, France, Palaeolithic period, now in the Piette Collection, St. Germain-en-laye. 4. Mammoth tusk, from Montastruc, France, Palaeolithic period. In the British Museum. 5. Gaming box from Enkomi, Cyprus; Aegean ivory, dating from 14th to 11th century B.C. 6 and 7. Chesspieces from the Isle of Lewis, Scotland; front, queen; back, king. Probably of Scandinavian origin. 8. "Horn of Ulphus," Mohammedan, now in York Minster, one of the finest of the horns with hunting scenes. 9. Early Christian pyxis (a small box, usually of cylindrical shape), with Christ and the Apostles; 4th century, now at Berlin. 10. Hispano-Moresque box, 969–970 A.D., showing a mixture of Moorish and Northern influence. In the Victoria and Albert Museum

IVORY CARVING





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BY COURTESY OF THE METROPOLITAN MUSEUM OF ART, NEW YORK

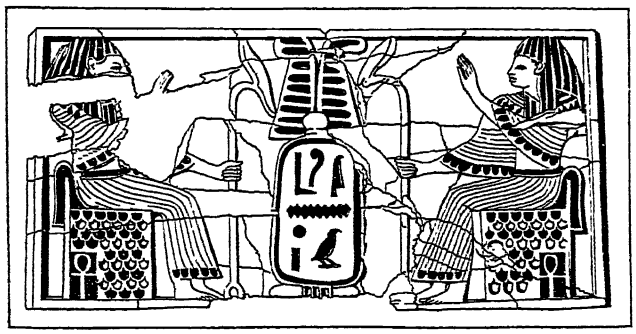
TWO EGYPTIAN IVORIES

1. Whip handle in the form of a running horse, late 18th dynasty 1375–1350 B.C. Carnarvon collection

2. Figure of a gazelle, Thebes, late 18th dynasty. The base is painted to depict a desert crag with flowers. Carnarvon collection

HISTORY

It is probable that ivory carving has a long and continuous history, extending from the Palaeolithic period to the present day, but even so there are gaps and it is rather a question of a succession of groups than of an unbroken historical development. The question of the supply of the raw material perhaps partially accounts for the apparently barren periods, though it must also be remembered that we can only judge by the existing work and it may only be chance which has preserved these particular examples and not others. But there are historical grounds for these long periods of inactivity. In Europe the ivory carver was dependent on more or less remote countries for his material and it is easy to see that in the 7th and 8th centuries the Mohammedan conquests must have interfered to some extent with the traffic between Nubia (one of the great distributing centres) and Egypt, and so through Syria and Cyprus with Europe. By what route the vast quantities of tusks necessary to furnish the raw material for the huge output of the Carolingian and Gothic periods arrived in Europe it is difficult to say. Communication with the East was probably furnished by the navies of Cyprus but there appears to be no record of the port at which the ivories were landed. In western and northern Europe, chiefly during the Romanesque period, walrus tooth (or morse ivory) was largely used in place of elephant tusk, probably owing to the fact that it was more easily obtainable; more rarely whale's bone was employed. Ordinary bone was also used, notably in the Coptic period and again later, at the end of the 14th century, in northern Italy. Ivory uncoloured, as we generally see it now, does not seem to have appealed to the ancient or mediaeval imagination and the carvings were in most cases originally lavishly coloured and gilded and frequently enriched with jewels and pastes. At certain times, notably in the Carolingian period in Western Europe and in the Byzantine empire, ivory-carving reached an importance not perhaps warranted by its intrinsic merits. The very considerable influence exercised on Romanesque sculpture by Byzantine art was probably largely derived through carved ivories. Illuminated manuscripts were in their turn a fertile source of inspiration for carved ivories especially of the Byzantine and Carolingian periods. Textiles, too, furnish numerous prototypes for the Coptic bone-carvings and for the beasts and mythological monsters found on Byzantine and Mohammedan carvings. The connection between carved ivories and metalwork is frequently very close, as in the case of silver caskets of the Byzantine period at Anagni and Cracow.



FROM LAYARD, "THE MONUMENTS OF NINEVEH" (JOHN MURRAY)

IVORY CARVING. PANEL AND CARTOUCHE FROM EXCAVATIONS MADE BY LAYARD ABOUT 1840 ON THE SUPPOSED SITE OF NINEVEH

After the 12th century with the widespread development of monumental sculpture ivory-carving ceases to have the same historical significance, though charming and extremely accomplished work was produced both during the Gothic and subsequent periods.

ANCIENT HISTORY

Carvings of the Palaeolithic Period.—Carvings in ivory, bone and horn are so numerous in certain periods of the stone age that one of these, the Aurignacian, has been called the ivory period. Most of the carvings have been found in southern France, in the Dordogne and Arriège districts, though a few come from the Riviera and Germany. The earlier examples usually take the form of nude female figures, the aesthetic worth of which is usually almost negligible, but a small head of a girl found at Brassempouy (Landes) has real artistic value. The animal carvings belong almost entirely to the succeeding Magdalenian period; these are frequently of extraordinary merit. The material is usually reindeer horn or more rarely mammoth ivory; among the objects in the latter is a tusk in two parts carved in the round with reindeer, found at Montastruc, Bruniquel (now in the British Museum). In reindeer horn is a magnificent dagger handle from Laugerie Basse (now in the museum at St. Germain) with a figure of a kneeling reindeer, a fine example of the utilization of the natural form of the material. Though no hard and fast demarcation can be made, engraving is probably rather posterior to carving in the round. The engravings usually represent animals, often rendered in a masterly manner and combined to form scenes, but occasionally human figures are represented in a rudimentary and animal-like form.

Egyptian Ivories.—Ivory and bone were worked from a very early period in Egypt, the supply of the raw material being easily obtained from Ethiopia and possibly Asia Minor. A large number of combs, hairpins and other utensils dating from the Predynastic and Early Dynastic period have been found at Nagada and other sites, and a very fine handle carved with hunting and other scenes found at Gebel-el-arak is now in the Louvre. To the same period belong some at any rate of an extensive series of nude female figures, probably of amuletic significance, carved in varying degrees of crudity. A considerable number of ivory figures of men and women, some in embroidered robes, were found by Mr. Quibell at Hierakonpolis, many of which show considerable aesthetic feeling, but among the masterpieces of early Egyptian carving are two statuettes, both found at Abydos: one, a king belonging to the First Dynasty (now in the British Museum) wearing the crown of Upper Egypt and a richly embroidered robe; the second, now at Cairo, representing the King Khufu (Fourth Dynasty), the builder of the Great Pyramid. The later work, though frequently of very fine quality, is usually more purely decorative in intention, being largely used for handles, spoons, inlays for caskets and furniture. (*See* EGYPT: *Ancient Art and Archaeology*.)



BY COURTESY OF THE VICTORIA AND ALBERT MUSEUM

IVORY SCULPTURE. LEAF OF ROMAN DIPTYCH REPRESENTING A BACCHANTE

Babylonian and Assyrian Ivories.—Though only a few examples have been found up to the present there is every reason to believe that ivory was carved in Babylonia from a period at least as early as in Egypt. The later work of about the 9th to the 7th centuries B.C. is, however, represented in the British Museum by an unrivalled series of ivories from Nimrud many of which show strong Egyptian influence; these were frequently inlaid with gold and lapis-lazuli, a method of decoration which is found elsewhere as for example at Mycenae and throughout the Aegean. Apparently contemporary with these are a series of fragments, chiefly heads, more purely indigenous in type. Both groups show an admixture of other influence and it has been plausibly suggested that the carvers were Phoenicians.

Aegean, Etruscan, Greek and Roman Ivories.—Among the earliest Aegean carvings that have any considerable aesthetic value are the small ivory figures of acrobats found in Crete at Knossos, now in the museum at Candia. These must be rated

beside the masterpieces of Minoan art and may be dated about the 16th century B.C. The celebrated figure of the snake goddess, now at Boston, has also been ascribed to the same period. A considerable number of ivories of very fine workmanship, now in the British Museum, which may be assigned to a date between the 14th and the 11th centuries have been found at Enkomi, in the island of Cyprus. They include a gaming box carved on the sides in low relief with hunting scenes, and two mirror handles with combats between human beings and monsters. Ivories similar in style and of about the same period have been found in Greece at Sparta and Mycenae (both groups being now in the museum at Athens). It has been suggested that one of the centres of production was perhaps Cyprus, but it is much more probable that they were made in Syria or possibly on the south coast of Asia Minor. In any case the main influence is Asiatic in derivation.

To a period between the 9th and the 6th centuries B.C. belong extensive groups of carvings which seem to derive from the same cultural source as the earlier ivories. These groups, which show close analogies of style both among themselves and with the Nimrud carvings, have been found on various sites—at Ephesus, Rhodes, Sparta and in Italy and Spain. The dominating style is Asiatic but in some cases there are traces of Egyptian influence. The ivories from Sparta, now in the Museum at Athens, were excavated in the sanctuary of Artemis Orthia and date mainly from the 8th and 7th centuries; they show traces of Ionic influence and were possibly worked locally. Among them are fibula-plaques carved in relief, figures of animals carved in the round, statuettes and a fine relief with a warship, this last inlaid with amber.

The carvings from Ephesus, now in the museum at Constantinople, were found in the temple of Artemis and date from about the same period. They consist chiefly of statuettes, the costume of which shows Asiatic (perhaps Hittite) influence, and some finely conceived animal figures.

The earliest ivories found in Etruscan tombs in Italy belong to about the same period and present many difficulties as to origin. Some of the finest examples were found in the Barberini Tomb at Praeneste south of Rome; these included a tazza on a high foot, and three arms and hands the use of which is not clear; all are decorated with bands of centaurs, griffins and animals in procession. It has been suggested, with considerable likelihood, that these are importations from Cyprus, probably of Phoenician workmanship, but even if they are native Etruscan imitations the motives are derived from an oriental source. Slightly later in date is a box found at Chiusi in northern Etruria, now in the Museo Archeologico at Florence.

It is remarkable that no ivories of importance belonging to the earlier classical period of Greek art have survived, though we know from documentary evidence that they existed. To the Graeco-Roman period should probably be assigned a very beautiful head found in the Roman theatre at Vienne (Isère) now in the Musée Archéologique of that town. A fine head of a goddess, together with fragments of arms in the Vatican, probably belongs to the same period, but it may serve to give an idea of the chryselephantine statuary of Greece known to us only from the descriptions of classical writers. A number of smaller ivories of the Roman period have survived, among them being a small figure of a tragic actor (in the Dutuit collection in Paris) and a statuette of a hunchback (in the British Museum), but they are mostly objects for domestic use.

IVORIES OF THE CHRISTIAN ERA

The ivory carvings of the earlier centuries of the Christian era show a close continuity in style with those of the preceding period, and much of the finest work, such as the well-known Symmachorum-Nicomachorum diptych in the Victoria and Albert and Cluny museums, may be called either late pagan or early Christian. The classification and provenance of ivories made between the 4th and the 7th centuries is one of the most difficult problems of Christian archaeology and to specify definitely the place of origin of individual examples is almost impossible. Intercourse between the great centres of Mediterranean civilization was so close that very similar cultural conditions existed in cities so far apart as Antioch, Constantinople, Alexandria and Rome. This culture represents a fusion of the plastic and naturalistic ideals of classic art with the abstract and colouristic principles of the East. Christianity was oriental in conception and while for its own purposes it took over many of the artistic forms of Paganism it was largely influenced by the ideals of the Aramaic art of the countries adjacent to Palestine. A number of the earliest ivories with definitely Christian subjects are frequently associated with Antioch, though we have no one carving which can with certainty be ascribed to the school. Such celebrated carvings as the Brescia reliquary, a very fine pyxis at Berlin, and the diptych or book-cover with scenes from the New Testament in Milan cathedral, the first two of which may be assigned to the late 4th or early 5th centuries have been included in this group. The Milan book-cover has also been made the centre of a group of ivories which have recently been ascribed by several American scholars to Provence on the ground of their relationship with the Early Christian sarcophagi found in Southern France.

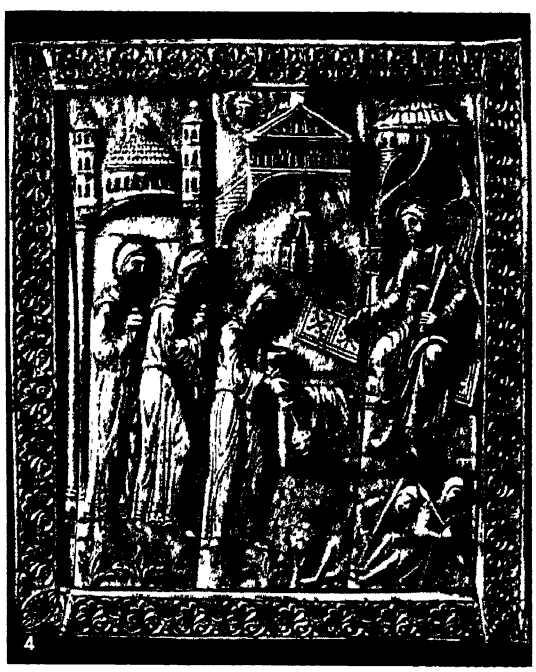
Other important carvings which have also been associated alternatively with Syria and with various western centres are the lovely reliefs of the Maries at the Sepulchre in the Trivulzio Collection at Milan and the Ascension of Munich. From the early centuries of the present era Alexandria was the seat of a flourishing school of bone carvers who produced small reliefs, probably for the decoration of articles of furniture, carved with figures taken from classical mythology, similar to those employed on contemporary woven fabrics. To the same centre should probably be ascribed the important reliefs with Bacchus, a warrior and other figures, now on the pulpit at Aix-la-Chapelle, and a number of diptychs which show strong traces of Hellenistic influence, such as the diptych of a Muse and a Poet at Monza. A very individualistic series of carvings, dating from the 6th century, closely connected with Alexandria in iconography, are the reliefs (mainly distributed between the museums at Milan and South Kensington) which may be associated with the celebrated ivory chair of St. Mark formerly at Grado.

Another ivory chair (now at Ravenna) usually, though for no very definite reason, called the throne of Maximianus, has been assigned alternatively to both Antioch and Alexandria. With these carvings may be grouped several book-covers and a number of other ivories. Another group, dating in the main from the 6th century, for which a Palestinian origin is usually claimed, though recently an American scholar has brought forward evidence connecting it with Alexandria, may be centred round a book-cover in the museum at Ravenna, formerly at Murano. This group includes panels scattered among various collections and a number of pyxides. Both in iconography and style this group is purely oriental in derivation.

The art of the capital itself was, we may assume, very eclectic, and though there is no definite evidence several ivories, including the supremely fine relief of St. Michael in the British Museum, have been assigned to Constantinople. It is also possible that most of the consular diptychs were produced there, though there is also evidence connecting them with Alexandria. A very large proportion of the ivory-carvings of this period were in the form of diptychs. In their simplest form these consisted of two leaves, the insides hollowed out and coated with wax on which a message could be scratched with the sharp end and effaced with the blunt end of a stylus. The unprepared ivory could also be used for receiving ink. Diptychs of an elaborate and purely ceremonial character, carved on the outside, were apparently used as presents to commemorate marriages or other family or official events; but the greater number that have been preserved are associated with consuls of Rome or Constantinople and were made for the purpose of notifying, to the emperor, or others, the sender's appointment to the consulate. These were more or less richly decorated according to the rank of the recipient, elaborate composite examples, such as the Barberini diptych in the Louvre, having been probably made for the Emperor.

These ceremonial diptychs date from the 4th or the beginning





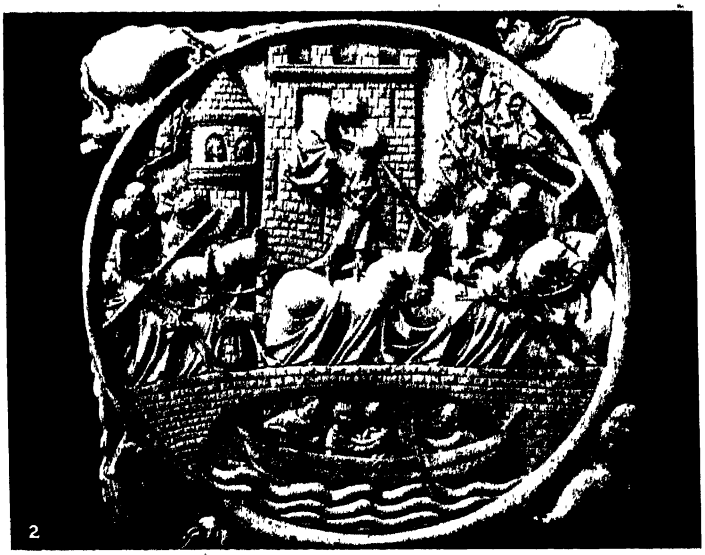
BY COURTESY OF (1) THE TRUSTEES OF THE BRITISH MUSEUM, (2, 3) THE DIRECTOR OF THE VICTORIA AND ALBERT MUSEUM, (4) GEORGE BLUMENTHAL, (6) BAYERISCHES NATIONAL MUSEUM; PHOTOGRAPH, (5) ALINARI

EUROPEAN IVORIES, EARLY CHRISTIAN TO GOTHIC PERIOD

1. Gothic triptych, the Crucifixion and the Coronation of the Virgin. English, 14th century, now at the British Museum
2. Relief, the Adoration of the Magi. English, 12th century, now at South Kensington, England
3. Relief, the Descent from the Cross. Spanish, 11th century, now at South Kensington, England
4. The Holy Women coming to the tomb of Christ; a plaque in walrus ivory, of the school of Cologne, second half of the 12th century. This was probably originally a book-cover. It was formerly in the Stroganoff Collection, Rome, and now belongs to Mr. George Blumenthal, New York
5. Early Christian pastoral throne, so-called chair of Maximianus, Archbishop (546–52), adorned with reliefs in ivory, at the Cathedral of Ravenna. Its origin has been assigned both to Antioch and to Alexandria. It was brought to Ravenna in 1001 as a present from the doge to the emperor Otto III.
6. The Marys at the Sepulchre, part of a diptych. 4th or 5th century, possibly of Syrian origin, now in the National Museum, Munich

IVORY CARVING



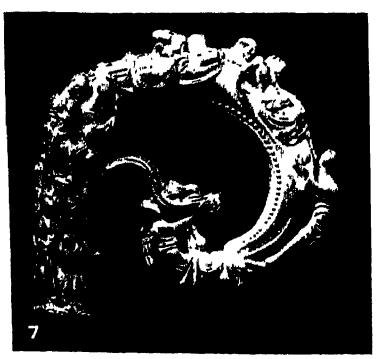
















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MEDIAEVAL AND MODERN IVORIES

1. Statuette of Virgin and Child, by Giovanni Pisano. Sacristy of the Cathedral at Pisa (*c.* 1250–1320). 2. Mirror Case, "An Elopement" (sometimes called "Lancelot and Guinevere"), French, Gothic period, 14th century. 3. Statuette, "Death and the Maiden," German, 16th century. 4. Figure from "The Descent from the Cross," late 13th century. In the Louvre. 5. Tankard, by Strauss, German Renaissance. 6. Statuette, Nessus and Deïanira, ascribed to Mathias Rauchmiller (1645–1686) or Jacob Auer, German. 7. Crozier with scenes from the Gospels, English, late 11th or 12th century. 8. Relief, the Death of Cleopatra. 9. Madonna, by Eric Gill, contemporary

of the 5th century and between 60 and 70 are known to be in existence (in whole or in part); of these, about 50 are consular, the series ending with the year 541 when the office was abolished by Justinian. The diptychs in great part owe their preservation to the fact that at a later period they were frequently transformed into book-covers. Diptychs with Christian subjects are rare, though there is a fine 5th century example at South Kensington, with six of the miracles of Christ, which is allied in style with some of the earlier pagan examples. By the 5th century a liturgical use of diptychs seems to have been established in the church; names of those for whom prayers were asked were inscribed on the insides of the leaves and solemnly recited during the mass. With the end of the 6th century there is an almost complete blank for nearly two centuries in the history of ivory-carving in the eastern empire as well as in the west.

Byzantine Ivories.—The iconoclasts during the disputes of the 8th and early 9th centuries strove to substitute a secular and purely ornamental style for the religious and representational art of the monastic party and it is to this fact that we owe the group of caskets with subjects largely drawn from classical mythology or with zoömorphic decoration. The dating of these caskets has been much discussed but it is probable that the earliest and finest, such as the casket from Veroli now at South Kensington, were produced during the iconoclastic period, though it seems likely that those of rougher workmanship are rather later in date while others again are apparently western imitations. Similar caskets with sacred subjects, usually the story of Adam and Eve, as for instance the example at Cleveland, appear from their style to date from the 11th or 12th century. The main period of Byzantine ivory-carving begins with the cessation of the iconoclastic disputes in 842 and it is probably to the period between the 10th century and the sack of Constantinople in 1204 that most of the surviving ivories belong, though it is not impossible that some should be ascribed to the succeeding centuries.



IVORY SCULPTURE IN BRITISH MUSEUM. LEAF OF DIPTYCH REPRESENTING ARCHANGEL

Ivory-carving occupies an exceptional place in Byzantine art of this period, there being practically no monumental sculpture in existence, but the difficulty of dating the ivories is greatly increased by this fact. Almost the only ivory the date of which can be fixed with any certainty by external evidence is the fine relief, in the Bibliothèque Nationale, Paris, of Christ crowning the Emperor Romanus and his wife Eudocia; this may be dated about 945, to which period should be assigned such a masterpiece as the Harbaville triptych in the Louvre. Only slightly later probably is the magnificent relief of the Virgin and Child now at Cleveland, formerly in the Stroganoff collection. An early group apparently is that in which the figures are sharply cut in high relief and show the same tightly curling hair as on the caskets. The finer carvings such as these show an austere beauty of conception and a refinement and careful precision of finish that is a legacy of the classical tradition, but the minor work suffers from a monotony of design and a carelessness of execution which become very tedious.

Mohammedan Ivories.—A group of ivories, the dating and origin of which are very uncertain, are the oliphants or horns. Some of the earliest of these perhaps go back to the iconoclastic period and some, for example the horn in the cathedral of St. Veit at Prague, which has representations of scenes in the Hippodrome, may have been made in Constantinople. But the greater number are carved with hunting scenes or zoömorphic decoration, and while some of these are probably western copies, most of them are apparently of Syrian or Mesopotamian origin, the animals and monsters with which they are ornamented being similar to those common on Asiatic textiles. One of the finest of the horns with hunting scenes is in the minster at York.

Another series of ivories, the ornament of which is derived from oriental sources, is a group of caskets carved, as their inscriptions show, in the 10th century for the court of the caliphs of Cordova, one of the most important artistic centres in Europe at this period. The compositions of figures, animals and birds carved among foliage scrolls seem to derive from Mesopotamia. With the same country have been associated a rather later series of caskets painted with interlacing scrolls, foliage and figures of birds, animals and men; it is, however, more probable that they were produced in Sicily by Arab artists.

Carolingian and Romanesque Ivories.—Ivory-carving occupies an unusually important position in the history of the artistic revival during the 9th and 10th centuries under the Carolingian emperors, for monumental sculpture of the period is almost non-existent in Western Europe during the period between the expiring classical tradition and the Romanesque revival of the latter part of the 11th century. It is usual to include with the carvings produced within the empire of Charlemagne's successors those done in western Germany under the Ottonian emperors (936–1002), as both belong to a common stylistic origin. These ivories have recently been divided into three main groups. The earliest of these, known as the Ada group from its relationship to a manuscript of the Gospels at Trèves illuminated for the Abbess Ada, sister of Charlemagne, about A.D. 800, has been located in various centres in the middle Rhine and Moselle districts. Most of the carvings of this group are closely based on early Christian models.

The second or Liuthard group is associated with an ivory relief on the binding of a psalter in the Bibliothèque Nationale at Paris written by Liuthard for Charles the Bald not long after 870. This group has been localized in the Amiens or Rheims districts and should probably in any case be ascribed to the north-east of France. The style appears to have been influenced by some such manuscript as the celebrated Utrecht psalter, the figures being characterized by the same rather slender proportions and energetic action. Some of the carvings of this group, such as the fine book-cover in the National Library at Munich, have points of resemblance with the Byzantine caskets of the Veroli type mentioned above and as many of the reliefs may be assigned to the second half of the 9th century they have an important bearing on the dating of the caskets. A casket at Berlin obviously modelled on a Byzantine prototype is dated by Dr. Goldschmidt about 900.

A number of ivories belonging to the third group can be associated with the district of Metz from an early period, as for instance the reliefs on the cover of the sacramentary of Drogo, bishop of Metz, from 826 to 855, now in the Bibliothèque Nationale at Paris. The carving is usually in lower relief and the forms heavier than those of the Liuthard group. There are of course a number of other ivories mostly of a date rather late in the period which do not fall into either of these groups. The district of the lower Rhine, and Cologne in particular, was one of the chief centres of Romanesque ivory-carving in the 12th century. Among the ivories produced in this district is an important series of large reliefs in walrus tusk probably part of an altar-piece with scenes from the Life of Christ, two of which are in the collection of Mr. Blumenthal at New York and the remainder at South Kensington. Ivories for secular use, practically non-existent during the Carolingian period, reappear principally in the form of gaming pieces. The draughtsmen are usually of Rhenish origin, but chess-pieces appear to have been made in France as well as in the North, and some of the most famous, found in the island of Lewis off Scotland, are probably of Scandinavian, or possibly of British, origin.

A number of carvings of very high artistic quality were produced in England in the 11th century, and one very distinctive

group may be associated with the famous Winchester school of illumination. The well-known whale's bone relief at South Kensington with the Adoration of the Magi, has been ascribed alternatively to northern France or Belgium, but the balance of evidence is certainly in favour of an English origin. To England may also be ascribed a crozier head and a number of tau crosses of exceptional beauty at South Kensington and the British



BY COURTESY OF THE VICTORIA AND ALBERT MUSEUM

MEDIAEVAL IVORY CARVING, MIRROR CASE, ILLUSTRATING THE STORMING OF THE CASTLE OF LOVE

Museum, decorated with figure subjects and foliage scrolls. In Italy ivory-carvings of the Romanesque revival take a different form, derived closely in style and iconography from the Early Christian and Byzantine tradition. The famous ivory "paliotto" at Salerno forms the centre of a large group of carvings being based on an Early Christian model.

Spanish ivories of the 11th and 12th centuries, on the other hand, show a mixture of Moorish and Northern influence. They are closely allied to the contemporary manuscripts and seem to have been produced mainly in the north in Castile and Leon, one of the most famous, the shrine of San Millan de le Cogolla, being still preserved in the cathedral of that name. Others are in the Madrid museum, in the cathedral at Leon and at South Kensington.

THE MIDDLE AGES

Gothic Ivories.—From the great period of French Gothic monumental sculpture—the first half of the 13th century—there exist only a few isolated examples of ivory-carving, some of the most notable being a group of statuettes of the Virgin and Child and the magnificent crucifix at Herlufsholm in Denmark. But to the last half of the century must be ascribed some of the finest examples of Gothic ivory-carving, among them the groups of the Coronation of the Virgin and the Descent from the Cross in the Louvre. To the end of the same century belong a number of diptychs and triptychs with scenes from the Passion which may be associated with a very fine diptych at South Kensington, said to have come from Soissons. Another series belonging to the 14th century is a group of polyptychs in the form of small domestic altarpieces or tabernacles usually with statuettes of the Virgin and Child under a canopy with, on the wings, scenes from the New Testament. A third group of carvings, formerly described as English, is distinguished by bands of "roses" dividing the subjects; these reliefs show greater variety both in individual types and iconography than is found in the crowded scenes of another group of diptychs with scenes from the Infancy and Passion, mostly dating from the second half of the century.

Besides these main groups there are a host of small diptychs and plaquettes with one or more scenes on each leaf. Apart from the long sequence of statuettes of the Virgin and Child, which extends from the early 13th century to the end of the period, the best of which are of almost incomparable loveliness, there are comparatively few figures or groups and, though there is documentary evidence that crucifixes were made in great numbers, they have perished almost without exception. Ivory was a favourite material for pastoral staves and great ingenuity is shown in fitting in two subjects, generally the Virgin and Child with angels and the Crucifixion, back to back in the volute. Large altarpieces were also made, though no complete example has survived; these were composed of groups carved in high relief usually with scenes from the Passion, in architectural settings apparently mounted on coloured backgrounds of metal, wood or marble. The fine relief of the Maries at the Sepulchre at South Kensington is a good example of one of these groups.

There is a great increase at this period of ivories for domestic and civil use; caskets, mirror cases, combs, writing tablets were made in great quantities for export as well as for use at home. On these were usually depicted charming little scenes of love-making, or episodes drawn from the popular romances of the period, one of the finest examples of the mirror cases being that with a story of an elopement (sometimes called Lancelot and Guinevere) now at Liverpool. The reputation of ivory-carving of the Gothic period has suffered from the superabundance of the material, the great majority of the minor carvings being little better than tradework. After the middle of the 14th century there is a rapid decline in the quality of the work and the ivories produced, chiefly in northern France and Belgium, during the 15th and early 16th centuries are of little artistic importance. These consist mainly of Paxes, *mementi mori* and small objects of devotion.

The rare ivories which can be ascribed to Germany in the 14th century are such close imitations of French work that they are hardly worthy of special mention. The case of England is rather different, in that not many carvings have survived but these are very individual and usually of fine quality, less elegant but more monumental in character than contemporary French examples. Work such as the well-known diptych of Christ and the Virgin and Child or the statuette of the Virgin and Child at South Kensington, or the two triptychs associated with Bishop Grandisson, in the British Museum, show that work of real beauty was produced outside France.

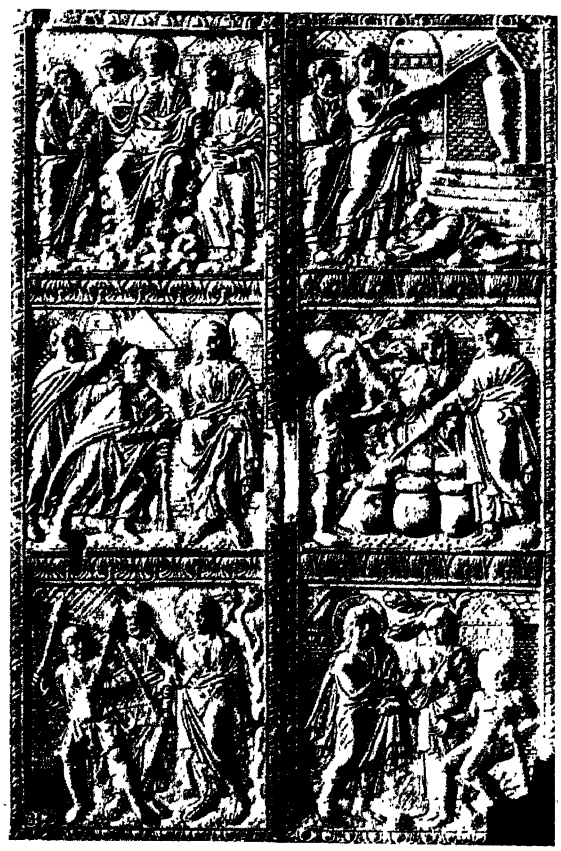
Of Italian ivory-carving of the 14th century the lovely statuette of the Virgin and Child by Giovanni Pisano in the cathedral at Pisa and a few crucifix figures, notably the fine fragment at South Kensington, are among the few survivors. The Embriachi family and their assistants produced at the end of the 14th and during the earlier part of the 15th centuries in northern Italy a quantity of caskets, triptychs and some large altarpieces in which narrow strips of bone, placed side by side, are associated with mounts of intarsia of coloured woods and ivory. This work has no great artistic value, though it has at times a sumptuous decorative effect.

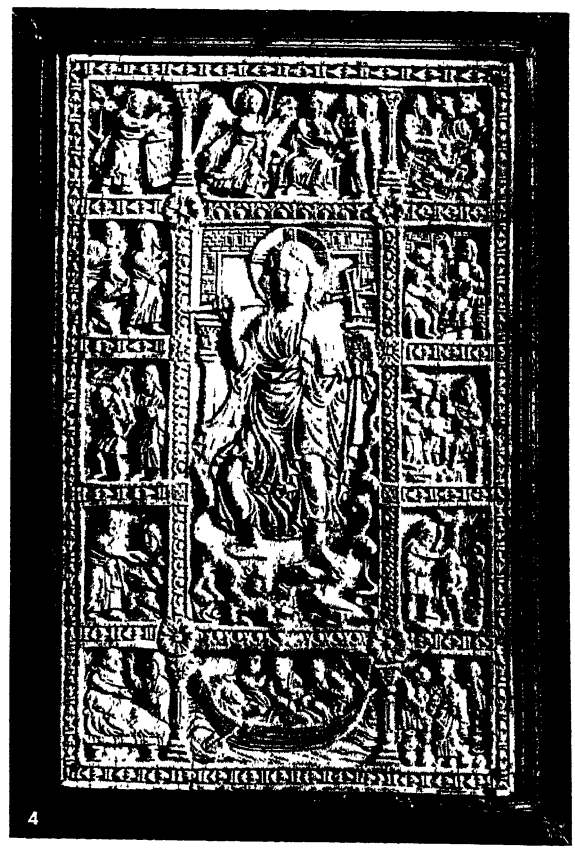
RENAISSANCE AND LATER IVORIES

Only a few scattered examples of 16th century work remain, such as the fine figure of St. Mary Magdalene in the Metropolitan Museum at New York or the Virgin and Child statuette in the Louvre, both French in origin, or again the very individual German statuette of Death and the Maiden at Munich. In the 17th and 18th centuries Germany and Flanders appear in the forefront as centres of ivory-carving and the finest work of the period still remains in German and Austrian museums. For the first time ivory-carving ceases to be anonymous, we have a few carvings signed by definite artists and there is evidence that sculptors such as the Italianized Fleming François Duquesnoy (Il Fiammingo), Algardi and Leonard Kern, among others, worked in ivory. The influence of Rubens is very apparent in much of the carving of the period, especially in the large tankards with Bacchanalian groups and there are records that his pupil, Lucas







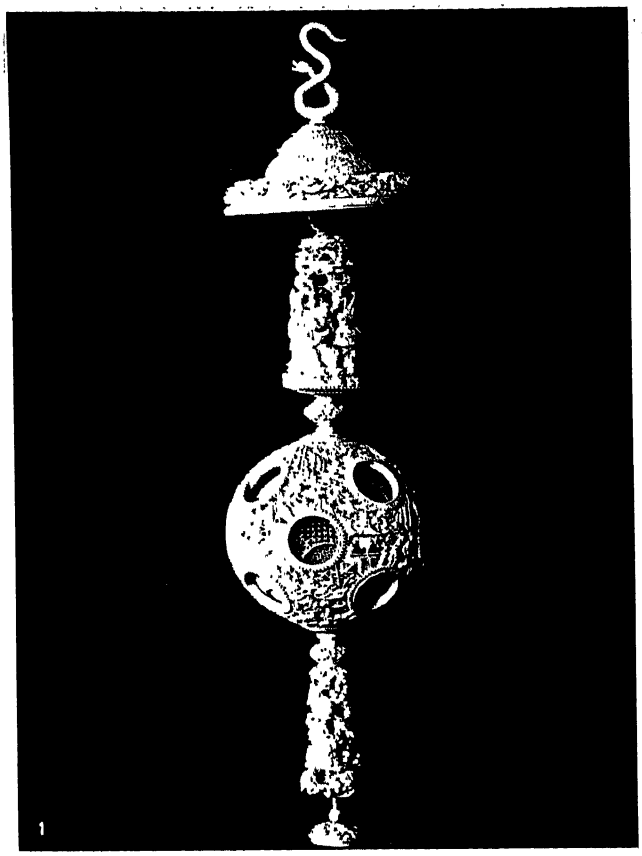


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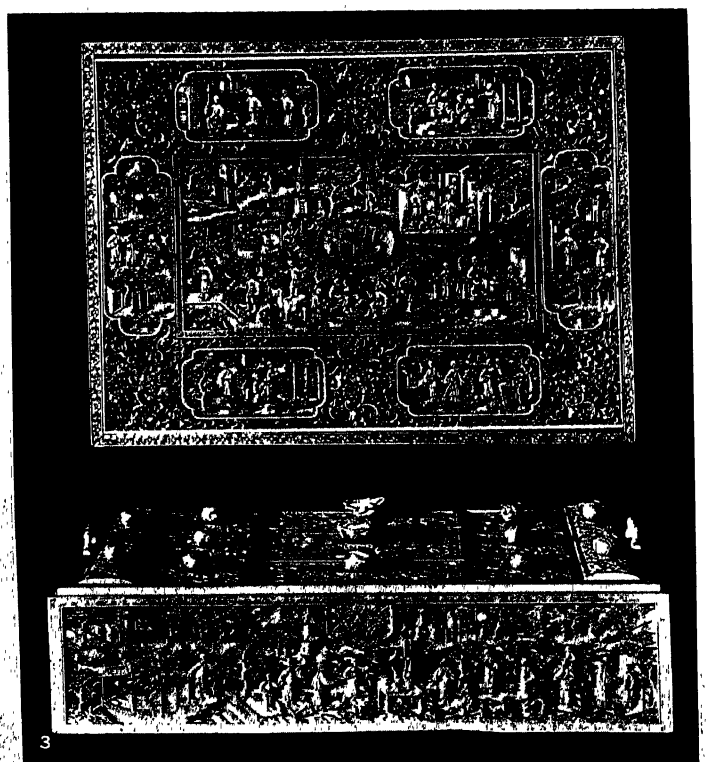
CAROLINGIAN, ROMANESQUE AND GOTHIC IVORIES

1. Gothic diptych from Soissons Cathedral, showing scenes from the Passion; *c.* 1300. 2. The front book-cover of *Cod. lat. 4452*, Bayerische Staats-Bibliothek, showing the Crucifixion. This book belonged to Henry II., Holy Roman Emperor (1002–24). Romanesque era. 3. Diptych, 5th century, South Kensington. 4. Relief on cover of *Ms. Douce 176*, Bodleian Library, Oxford

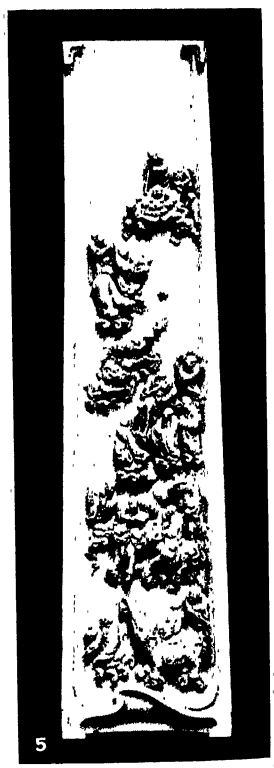
IVORY CARVING











BY COURTESY OF THE DIRECTOR OF THE VICTORIA AND ALBERT MUSEUM

FIVE CHINESE IVORIES

1. Ivory pendant, with many concentric balls one inside the other
2. Ivory brush holder (*pi-tung*). Brushstands are carved out of the central portion of the tusk
3. Ivory box and lid
4. Ivory figure with a child
5. Ivory arm-rest for writers; under side

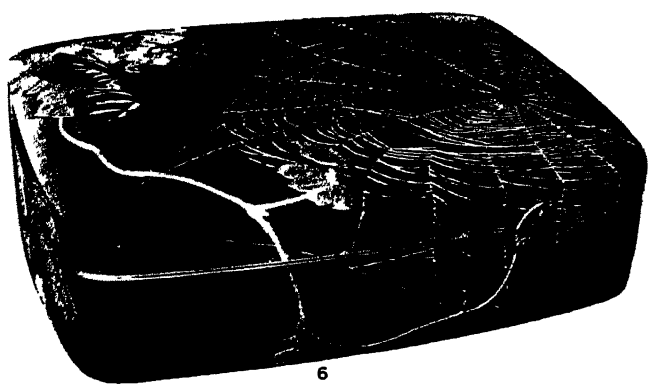












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BY COURTESY OF JIRO HARADA, AND THE IMPERIAL HOUSEHOLD MUSEUM OF JAPAN

IVORY CARVINGS OF JAPAN

1 and 2. Ivory foot-rules, stained pink, carved and coloured, dating from 8th century A.D. In the Imperial Treasure-house, Shosoin, at Nara

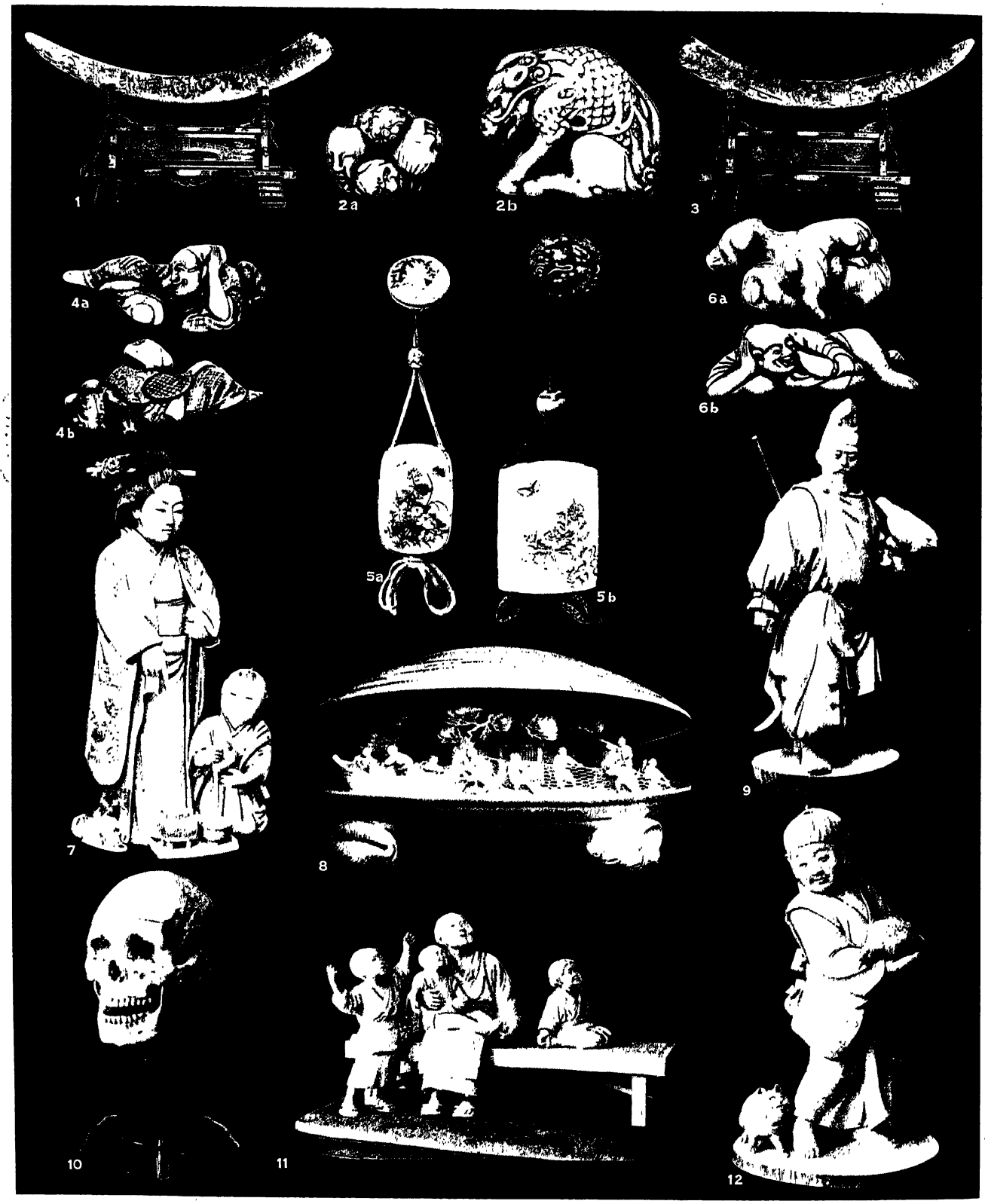
3. Ivory plectrum, stained pink, carved and coloured. The plectrum is used for the playing of the *Samisen* and other plucked string instruments. It dates from the 8th century A.D. In the Imperial Treasure-house, Shosoin, at Nara

4. Reverse of fig. 3

5. Ivory *netsuke* helmet, by Shinshisai

6. Paulownia box, inlaid with ivory and shells, by Asahi Gyokuzan (1842–*c.* 1900)

IVORY CARVING



BY COURTESY OF (1, 3, 8, 9) JIRO HARADA, (2, 4, 5, 6, 7, 10, 11, 12) JIRO HARADA, AND THE IMPERIAL HOUSEHOLD MUSEUM, TOKYO, JAPAN

JAPANESE IVORY ORNAMENTS AND WORKS OF ART

1 and 3. Carved ivory tusk, by Nomura Tomekichi. 2a. Ivory *netsuke* (ornamental piece fastened by cords to purse or *inro*), masks by Mitsushige (18th–19th c.). 2b. Ivory *netsuke, kirin,* unsigned. 4a and b. Ivory *netsuke,* by Yoshinaga (19th c.). 5a. Ivory *inro* (medicine case), inlaid with mother-of-pearl and coral, with *netsuke* similarly inlaid, by Shibayama (18th–19th c.). 5b. Ivory *inro,* carved with peony and butterfly; Ivory *netsuke,* with the signs of the zodiac, by Dōshōsai (19th c.). 6a. Ivory *netsuke,* by Rantei (18th c.). 6b. Ivory *netsuke,* by Yoshimasa (17th c.). 7. Ivory carving, by Soma Senrei, modern. 8. Fishermen with net, by Ikeda Shoten. 9. Falconer, by Ishikawa Mitsuaki, modern. 10. Skull, by Asahi Gyokuzan, (1842–c. 1900). 11. "Watching fireworks," by Ōno Hōfū, modern. 12. Boy with a fowl, by Asahi Meido, modern

Faidherbe, did a number of carvings from his master's designs. Two other Flemish carvers were famous for their bacchanalian groups of children, Gerhard van Opstal and Il Fiammingo mentioned above.

In Germany Christoph Angermair, who in the first half of the 17th century made the celebrated coin cabinet at Munich, was succeeded by a number of artists who produced a vast amount of work which, though frequently exhibiting high technical ability, shows little originality either in subject or treatment. The statuettes and groups of naked gods and goddesses, which form an appreciable proportion of the carvings, are mainly inspired by the antique or from the work of Late Renaissance and Baroque sculptors such as Giovanni Bologna and Bernini. The work of Ignaz Elhafen (born before 1685, died before 1725), one of the ablest sculptors of the period, is best seen at Munich; other characteristic works in the same manner are an elaborate group of bacchanals at Vienna ascribed to Mathias Rauchmiller (1645–1686) and a fine group of Nessus and Deijanira at Munich ascribed to Rauchmiller or Jacob Auer, a South German working in the first half of the 18th century. Statuettes of saints, Christ at the Column and Crucifixion groups were also popular as well as reliefs with scenes from the New Testament; and it is to the 17th, and more especially to the 18th century, that we owe the figures of Christ on the Cross, which appear to have been carved all over Europe and examples of which exist in nearly every collection.

A characteristic feature of the period is the development of interest in portraiture from the large equestrian groups ascribed to Steinle (died 1727) at Vienna to the small portrait medallions by Jean Cavalier and Le Marchand (1674–1726). A peculiarly German type of work of the 18th century is the association of ivory with wood, the principal exponents of which were Simon Troger, Veit Grauppensberg and others. Another group which must be mentioned is that of turned ivories produced mostly in the neighbourhood of Nurnberg by the Zick family. Other artists who excelled in this ingenious form of craftsmanship were M. Heider, Spengler and others.

In Italy ivory-carving follows similar lines as in Germany but almost the only artist whose work remains to us in any quantity (mostly at Munich) is Antonio Leoni who, in the first half of the 18th century, produced reliefs and statuettes in style very akin to that of Elhafen. In Scandinavia Magnus Berg (1666–1739) is responsible for an enormous output of rather uninteresting carvings, mainly reliefs with allegorical and mythological subjects.

The still surviving branch of the industry established at Dieppe in the 17th century, chiefly for the production of crucifixes and objects of devotion, is of relatively small artistic importance. Spain and Portugal too produced little original work of importance and, though the amount is considerable, the work turned out in the Portuguese colonies, chiefly Goa, is on an even lower level.

The Nineteenth and Twentieth Centuries.—In the early 19th century the interest in portraiture and the classical revival both find ingenious expression in the work of Benjamin Cheverton (1794–1876) who made with the partial aid of a machine reduced copies of marble busts, statuettes and reliefs. During the later part of the century, especially in Belgium, many sculptors interested themselves in ivory-carving, frequently associating it with other materials but this phase hardly calls for lengthy notice. In recent years there has been a distinct revival and some good work, chiefly for ecclesiastical use, has been produced.

Forgeries.—Another less praiseworthy phase of modern ivory-carving must be noticed, that of forgeries. Few materials lend themselves to such successful imitation and it is not beyond the power of a clever craftsman to so patinate, rub and colour the ivory as to make it almost indistinguishable from a genuinely old carving. The crackle of genuine age is rather more difficult to simulate and a regular network of cracks across the grain may raise suspicions, though even these are not always justified, natural crackle being very variable. The forger fortunately usually gives himself away in details of iconography and a general feeling of style; but the detection of both these points is a question of experience and long familiarity with and actual handling of genuine work. (*See* also IVORY-CARVING: *Chinese;* IVORY-CARVING: *Japanese;* IVORY-CARVING: *North American.*)

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(M. H. L.)

CHINESE

History.—Ivory has always been an important medium of expression for Chinese carvers, and many exquisite examples of their work have come down to us, though their names are rarely known. Chinese ivory carvers have generally had a greater appreciation of the intrinsic value of the material for their work than the carvers of Japan. An abundant supply and close intimacy with this material have doubtless helped to foster this appreciation among Chinese carvers, whereas the paucity of the supply and something in the Japanese character which was happier when carving wood, together with differences in certain phases of their culture, have prevented the higher development of ivory carving in Japan, though some excellent works have been produced. The former existence of elephants on Chinese soil is authenticated by linguistic, pictographic, historical, as well as archaeological evi-

dence. The *Tso Chwan* (548 B.C.) records that the elephant has tusks which lead to its destruction owing to their use as gifts, and there are also a number of other references showing that ivory was taken as tax and brought as tribute to China and was greatly valued in early times. It came next to jade and was used as a mark of luxury for various purposes. Even articles such as pins for scratching the head, and the tips of bows, were made of elephant ivory in early Chinese antiquity. A 3rd century B.C. minister of State, Mong Ch'ang-Kün, famous for his extravagance, possessed an ivory bed, which he presented to the prince of Ch'u. Ivory was used for personal ornament from time immemorial, and as early as the Ch'u dynasty (1122–247 B.C.) chopsticks were made of it and it was used to decorate the principal parts of some of the emperor's chariots. Later it became fashionable as a decoration on the palanquins of important officials. Narrow memorandum tablets or *hu* of ivory, originally used at court by princes and high officials, later a mere symbol of rank and an indispensable accessory to ceremonial dress, were articles of great importance. Examples of ornamental ivory carving with angular, spiral, geometrical and floral designs, dating back to the Ch'u period, have come down to us.

In time the demand for ivory outgrew the native supply and large quantities of tusks had to be imported from Siam, Burma and India, which were described as long and large, and from Annan, which were small and short, as well as a variety yielding a red powder when cut by a saw which was pronounced to be of excellent quality. As early as the 12th century the Chinese knew that African ivory was the best. From the early 14th century at least the ivory from a slain elephant was esteemed the best; that taken not too long after natural death came next, while tusks discovered long after the elephant's death were least esteemed because the ivory was dull and opaque, and irregularly speckled.

Uses.—The Chinese cultured classes had always appreciated articles made of ivory, and ivory carving received imperial attention. In 1263 a bureau for carving in ivory and rhinoceros horn was established with some 150 craftsmen and an official in charge, and couches, tables and chairs, various implements, and ornaments for girdles inlaid with ivory and horn were made for the imperial household. In 1680 the emperor K'ang Hsi established *Tsao pan chu,* or imperial ateliers covering 27 branches of industry, including one for ivory carving, within the palace at Peking, and practical craftsmen from all over the empire were here brought together to produce fine work. They were in existence for over 100 years, turning out large numbers of excellent works bearing the stamp of the artistic fervour of the age. Authentic pieces from this imperial ivory carving atelier may be hard to identify, but many which exist in museums and private collections may reasonably be credited to it by reason of their superior workmanship which often reveals a marvellous quality of technical skill and harmonious beauty.

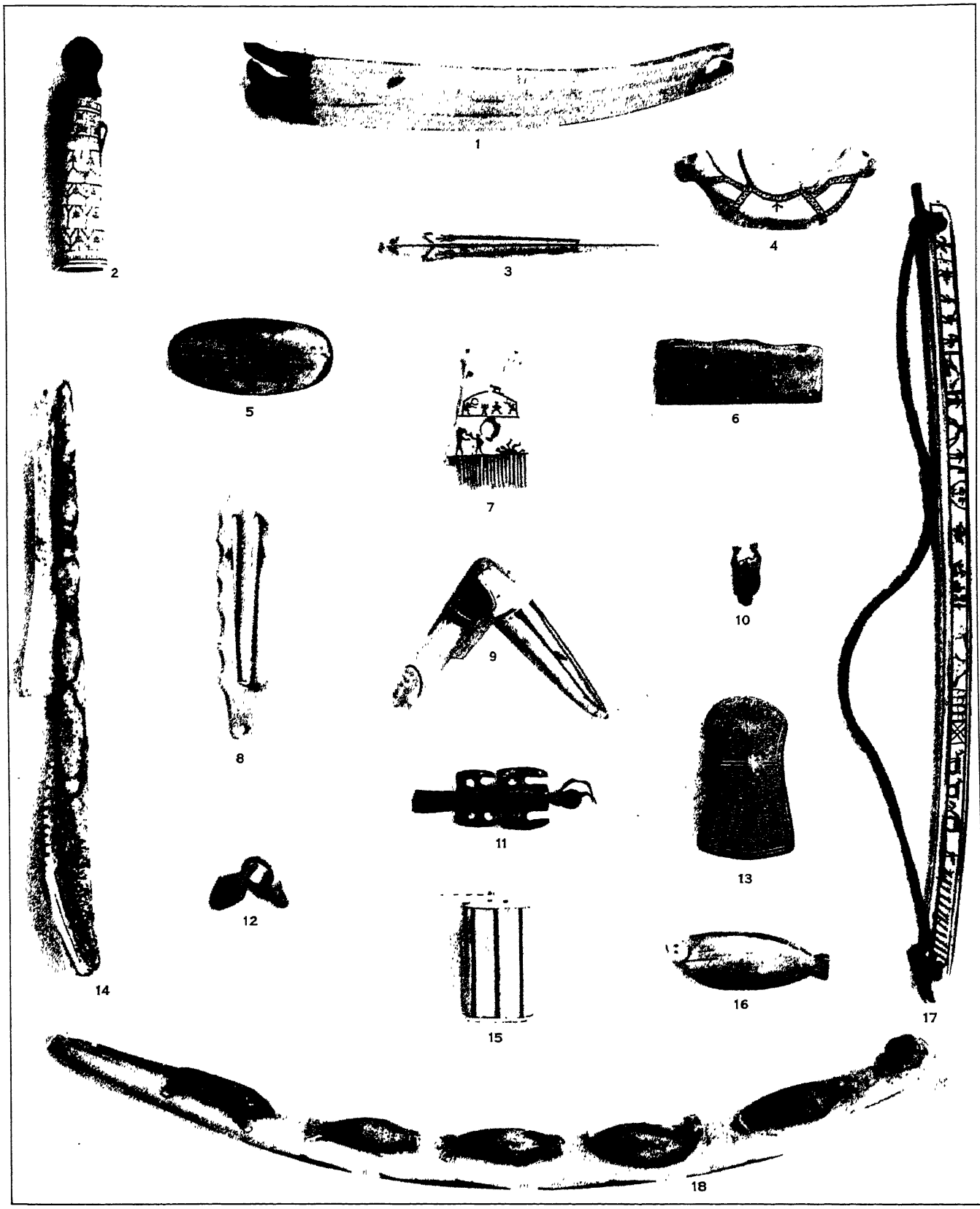
Great ingenuity is often displayed in the delicate workmanship of such an article as a fan, which may be made of finely cut plaited ivory threads, overlaid with carved flowers and birds, held by firmer pieces, likewise of carved ivory, having exquisitely carved and incised designs, which form the rim and the handle. Even more wonderful in their technical achievement as ivory carvings are the concentric spheres made in Canton as early as the 14th century and known as "devil's work balls," which are still being produced there. Endless patience and toil are needed to produce such concentric balls, carved one within the other, each having the most delicate patterns in pierced work. Models of palaces with carved roofs and intricate screens, peopled by tiny figures, and surrounded by trees and walls, all of ivory, were also a speciality of Canton; but most of them are known for their technical rather than their aesthetic triumphs as ivory carvings. Chinese ivory carving, however, is by no means wholly represented by these minutely and elaborately carved works, though for more than a century China has catered to foreign taste in producing this line of work. Excellent pieces of high artistic value are often found among carved religious and philosophic figures, especially those of *Kwan-yin,* Goddess of Mercy, with her graceful form and flowing robes, and of the Arhats, with their beatific expressions. Fine artistic work is also to be found in some of the brush-holders (*pi tung*), which are often covered with a landscape in relief enlivened by figures; and in the arm-rests likewise designed for the scholar's table, and in snuff bottles which are often dyed and then carved so as to bring out the unstained ivory beneath—a technique known in Japan under the name of *bachiru,* where examples of it are to be seen among the 8th century relics now preserved in the imperial treasure-house, Shōsōin. Works of no common talent are also frequently found among girdle pendants, covers for cricket-gourds, and ivory plaques in relief used as insets on carved wood or lacquered screens and cabinets. Other articles for which the Chinese have used ivory as a favourite material as ornament, in various degrees of elaborateness, are the handle and sheath of the writing brush, trays, cages for crickets and birds, implements for opium smoking, toilet articles such as combs, small boxes, and pieces for various games. The Chinese, in the course of their history, have utilized the ivory of the elephant, the mammoth, the walrus and the narwhal, the last three having been used as substitutes for the first. Ivory carving in one form or another is still an important industry in Canton, Peking, Shanghai, Amoy and Suchow, large numbers of carvings being produced for the foreign market.

See B. Laufer, *Ivory in China* (1922); S. W. Bushell, *Chinese Art* (2 vols., 1919–21).

JAPANESE

History.—In the Shōsōin (imperial treasure-house at Nara) collection, which consists mainly, if not entirely, of objects dating from the 8th century A.D., still housed in the original wooden structure, there are a number of ivories carved in the style known as *bachiru.* The name implies the method of decorating an ivory object in which an article with a finished surface is generally dyed or stained, and then designs are carved on it, the unstained parts, wherever the carving is deep, being either left plain or treated with other colours, producing a very beautiful and decorative effect. In some articles the carving is done on unstained ivory and colours are applied to the designs carved. In that unique collection there are several ivory foot-measures in blue and bright red, an ivory plectrum of bright red colour for the *biwa* (a stringed musical instrument), a large number of bright red and blue ivory *go* (a game resembling chess) pieces, a few ivory knife-hilts and several ivory scabbards, etc., which are all decorated in the *bachiru* style with minute carvings of birds, animals, flowers, etc., the colours still retaining their original freshness. Not only those so decorated, but a number of plain ivory pieces of sceptres, combs, flutes and foot-measures, are also found in that collection. Though ivory must have been imported into Japan, it was used extensively with horn, bone and wood in minute inlaid works, such as decorated *go* boards, arm rests, musical instruments, and various small boxes preserved in that treasure-house belonging to the imperial household of Japan.

For nearly ten centuries after the Tempyo period (708–781), to which most of the articles mentioned above belong, nothing is known about ivory carving in Japan, there being left practically no examples worthy of note from an artistic standpoint. It was Yoshimura Shuzan of Osaka who first began in the Kyoho era (1716–36) carving ivory *netsuke* (ornamental pieces fastened to the cords attached to a tobacco pouch, purse or *inro; i.e.,* medicine case) which became very popular among the people. Of course, the wooden *netsuke* was already known to have been been used with a bunch of keys in the Ashikaga period (1394–1573) and with *inro,* when they came to be a great fashion in the Tensho era (1573–92). However, Shuzan seems to have popularized them in ivory, and he was followed by many artists who carved mostly *netsuke* and rarely *okimono,* or ornaments for the alcove, in ivory as well as in wood. Among the ivory carvers who worked under the Tokugawa régime, which came to an end in 1867 after continuing for about two and a half centuries, are Shibayama Senzo, who is known to have devised a method of inlay in the An-ei era (1772–81), using corals, ivory, horns, etc.; Garan of Osaka, who was fond of carving birds, animals and insects for *netsuke* at about the same time; Izumiya Tomotada of Kyoto, who is known to have excelled in the Ten-

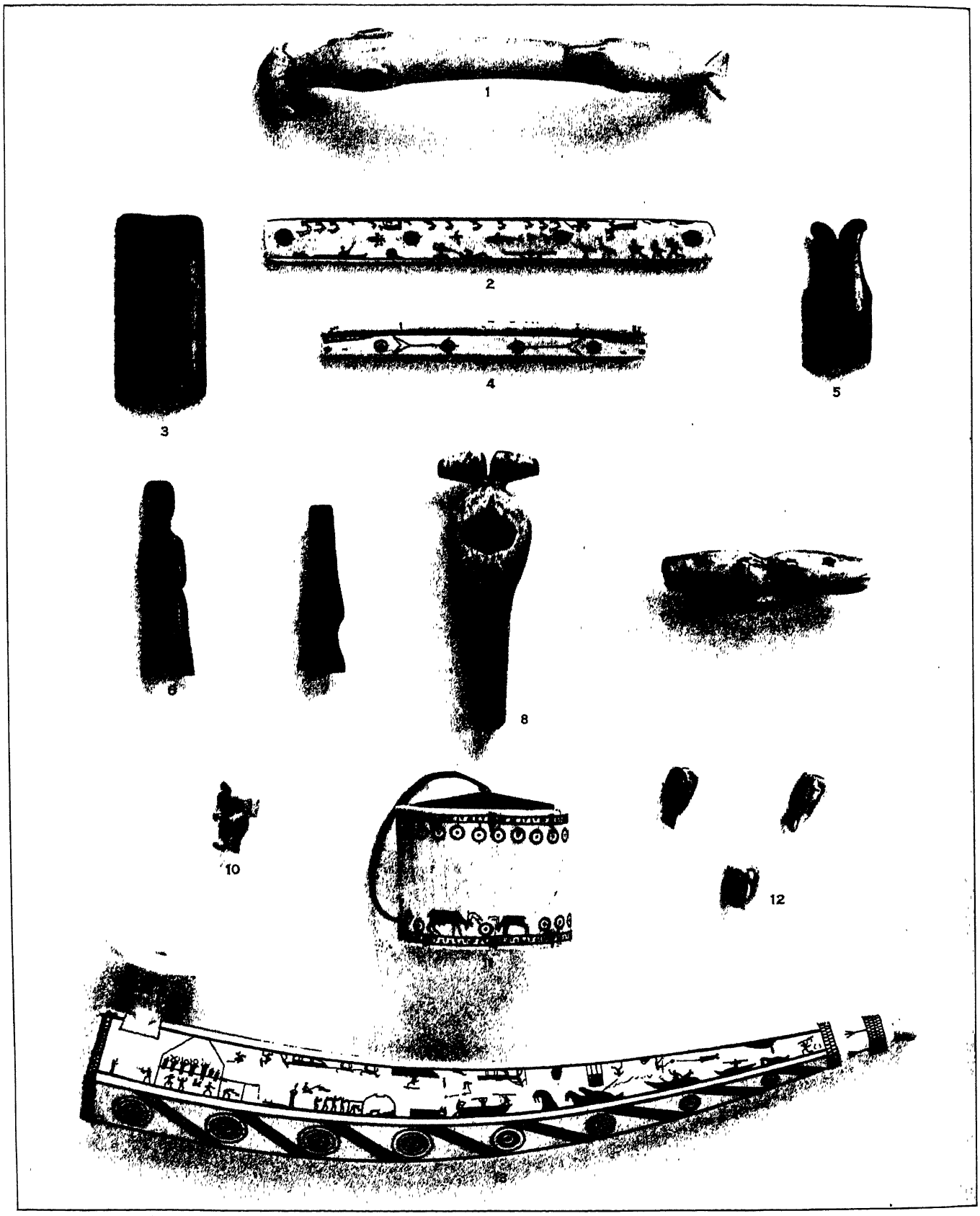


BY COURTESY OF THE NATIONAL MUSEUM OF CANADA

IVORY CARVING OF NORTH AMERICA

1. Scratcher for imitating the clawing of seals on ice. 2. Snuff-box. 3. Bodkin. 4. Mouth-piece of a bow drill. 5 & 6. Archer's wrist guards. 7. Comb. 8. Thimble-holder. 9. Needle-case and thimble-holder. 10. Mythical animal resembling a frog. 11. Needle-case with flanges representing polar bears. 12. Unbroken links representing seal-heads. 13. Handle of a skin scraper. 14. Mesh-gauge with seals carved in relief. 15. Match-box with sliding lid. 16. Fish. 17. Handle of a bow drill. 18. Pipe with walruses and an otter in high relief

IVORY CARVING



BY COURTESY OF THE NATIONAL MUSEUM OF CANADA

IVORY CARVING OF NORTH AMERICA

1. Bucket handle, carved at one end to represent a whale, at the other a monstrous bear attacking a whale. 2. Bucket handle. 3. Archer's wrist guard. 4. Ornament for a bucket. 5. Archer's wrist guard. 6. "Human" needle-case. 7. "Winged" needle-case. 8. Arrow-straightener, surmounted with caribou heads. 9. Toggle for dragging seals, in the shape of two polar bear heads. 10. Figurine of a man carrying a pack. 11. Engraved box with wooden base and lid. 12. Ear-pendants. 13. Pipe with both geometric and realistic engraving

mei era (1781–89) in *netsuke* of cows and oxen in realistic carving; Tametada of Owari, an expert relief carver; Tomotane of Kyoto, whose favourite subjects for *netsuke* were warriors, angels, insects and animals; Hōshin of Kyoto, skilled in carving palaces and landscapes in half-opened shells and miniature figures in buildings; Masanao of Kyoto, who generally drew his subjects from hermits, animals, birds and insects, especially frogs in the act of jumping; Masatoshi, also of the Temmei era, who was an expert *netsuke* carver, being fond of figures, demons and masks for his subjects; Nakayama Yamatome of Yedo, skilled in minute carving, such as 53 stages of the Tokaido road, or portraits of 36 famous poets, on a single small piece; Noriaki, who was well-known in the Kwansei era (1789–1801) for figures and animal subjects; Miyasaka Hakuryu of Kyoto, who excelled in carving tigers, monkeys and dragons; Genryosai Minkoku, whose favourite subjects were grotesque hermits, animals and fishes; Ranko of Izumo, who left good works in a variety of subjects, such as figures, animals, birds, flowers and attempted landscapes on *netsuke;* and such others as Masaharu, Rantei, Yoshimasa, Yoshinaga, Shokyusai, Mitsushige, Tadachika, Ikkosai Tōun, Rakuwosai, Masakazu, Shinshisai, Tomachika, Gyokuyosai, and his pupil Ozaki Kokusai, some of whom have left masterpieces in ivory *netsuke* and other carvings.

Scope.—Immediately after the Restoration of 1868, ivory objects found their way abroad, having attracted the attention of foreign collectors. So great was the foreign demand for the ivory carvings that they became quite an item in the Japanese export for some time. It was a great encouragement to the carvers, as their native patrons were becoming scarce, and the call for *netsuke* in Japan came to an end when the cigarette drove away tobacco pouches. However, the demand was for a greater and cheaper production, rather than for a high quality of work, and the standard of the craft deteriorated in consequence. Nevertheless, there were a number of masters who did produce works of high merit. Among them Asahi Gyokuzan and Ishikawa Mitsuaki stand pre-eminent. The former made his reputation in wonderfully minute and realistic carving of skulls in ivory and in intricate and beautiful inlaid works, while the latter produced excellent figure ornaments as well as exquisite low relief in ivory. Among other well-known ivory carvers of more recent times mention may be made of Shimamura Toshiáki, Asahi Meidō, Sōma Senrei, Kaneda Kenjiro, Nishino Kōgyoku, Otani Mitsutoshi and Ōno Hōfū, whose works have been much admired.

Designs in ivory *netsuke* are manifold, embracing almost every imaginary subject. However, the striking feature was the rounded corners, avoiding sharp edges, so as not to scratch the *inro,* which is generally in lacquer of costly decoration. Influences of contemporary artists like Hokusai and of such comic styles of painting as Otsu-ye are shown in the choice and treatment of the subject. Taoists and, later, *genre* figures commonly supplied the motives, and various animals, especially those in the 12 signs of the zodiac, were treated in all moods and attitudes.

Uses.—Apart from the *netsuke* and ornaments for the alcove, ivory has been used extensively as an ornamental piece for the *kakemono,* the mounted hanging paintings that can be rolled up when not in use. For plectra for *shamisen* (popular three-stringed musical instruments) ivory has been invaluable. Moreover it has long occupied a dignified position as an important accessory to the *cha-no-yu* (ceremonial tea) utensils. The lid of the tea caddy (*cha-ire*) is almost exclusively made of ivory, the bottom being lined with gold foil. It is generally in a simple but graceful form, having a knob in the centre with concentric circular lines or relief as ornaments. However, the portion of the tusk with black stains or flaws is often chosen for making a lid, care being taken to let such a flaw appear as an ornament or "scenery," as it is called, which often constitutes a striking feature in the ware. Tea scoops also are sometimes made of ivory, though most commonly they are made of bamboo by bending the flattened end of it to scoop out pulverized tea leaves from the caddy in preparing the tea.

It is for *kakemono, shamisen* plectra, tea caddy lids and tea scoops, though these are not of very great artistic value, that ivory is chiefly used in Japan at the present time, since *netsuke* are almost entirely out of fashion. One still sees in shop windows ivory carvings of wide variety, and there are some skilled carvers in ivory producing works of unquestionable merit, but it cannot be denied that most of them cater for the taste of Europeans and Americans, and that the true refined taste of the Japanese rarely admits an ivory carving to the *tokonoma.*

See A. Brockhaus, *Netsuke-Versuch einer Geschichte der Japanischen Schnitzkunst* (Leipzig, 1905). (J. Har.)

NORTH AMERICAN

To the primitive North American Indian unacquainted with metals except the soft copper found in a pure state in certain isolated places, the gleaming ivory teeth of the animals he hunted always possessed a special attraction. The tooth of the beaver made him an efficient knife or graving tool, the tooth of the bear an admirable fish-lure. Often he attached rows of teeth to his clothing, partly to show his success in hunting, partly also because he found pleasure in their sheen. But there are three animals, the walrus, the narwhal and the elephant, gifted by nature with a larger share of ivory than the rest. and it so happened that in North America two of these animals were available only in the Arctic and sub-Arctic regions where the timber that supplies so many of man's needs was either scarce or lacking. The third animal, the elephant, was extinct in every part of America, but its tusks were easily accessible in certain parts of Alaska, although rare and usually deeply buried elsewhere. Consequently it was among the Eskimo tribes inhabiting the Arctic and sub-Arctic regions that the art of carving ivory for both utilitarian and aesthetic purposes attained its highest development.

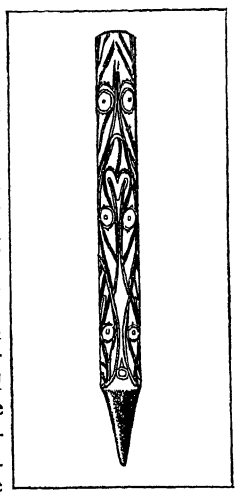
The ivory in commonest use is walrus ivory, which is densest in structure and easiest to secure. Narwhal tusks are twisted and hollow, which renders them unsuited for engraving or carving, although they served the old Eskimos of Hudson bay for harpoon shafts and other implements. Mammoth ivory is almost as dense as walrus ivory, and hollow only towards the base. Fossilization, *i.e.,* darkening through long contact with minerals in the soil, gives a variety of soft, deep colours greatly appreciated by curio collectors; hence traders often immerse white ivory in boiling coffee and other liquids to give its surface a spurious fossilization.

Our earliest specimens of Eskimo carving seem to come from the Bering sea region. They are not numerous, and are scattered through several museums, their antiquity unrecognized because they were purchased from ignorant Eskimos and not excavated by trained archaeologists. We may distinguish them by two criteria, deepness of colour (a very unsafe guide) and the style of ornamentation; sometimes we may add a third, the shapes of the specimens, which often differ from the later Eskimo types. There is carving in the round, apparently,—heads of seals and other realistic figures very similar and perhaps not inferior to anything we find in more recent Eskimo remains; but still more abundant are finely etched geometric patterns covering surfaces even of utilitarian objects such as snow-goggles and harpoon foreshafts that in later periods seldom carried any ornamentation. The artists of this ancient school, unlike their successors, disliked straight lines, preferring the graceful curves, scrolls and concentric circles that are so characteristic of Maori and Melanesian art. Unlike the Melanesians, however, they did not allow their ornamentation to run riot, but subordinated it in conformity with the shape and purpose of the object so as to produce a natural balance. The freehand drawing on the more carefully worked specimens is admirable; many of the concentric circles with incised dots are so accurate that they seem hardly traceable without compasses (fig. 1).

The period at which this remarkable art flourished is as obscure as its origin. It surely dates back at least 1,000 years, but how much more than this we cannot guess.

The curtain then closes for a period on the early history of the Arctic. When it opens again, some ten centuries ago, we find the Eskimos occupying the whole coast line from Bering sea to Labrador and Greenland. Ivory-carving flourished in both the west and the east, but the finest specimens come from the west.

Even the most everyday objects, such as needle-cases, toggles for the dog-harness and harpoon-heads, underwent ornamentation or were given a decorative form. There are ornaments made of two unbroken links each carrying a representation of an animal's head, sometimes slightly conventionalized but often quite realistic. The needle-case with thimble-holder attached that is shown in Pl. IX., fig. 9 dates from post-European times, but it also has been carved from one unbroken section of a walrus tusk.



BY COURTESY OF THE NATIONAL MUSEUM OF CANADA

FIG. 1.—EXAMPLE OF FREEHAND, ESKIMO CARVING

The Eskimo needle-case is a hollow cylinder of bone or ivory that contains a sealskin thong carrying the bone or copper needles. The ivory carvers of ancient days could not remain content with a plain undecorated tube, but for some reason not as yet understood, expanded it into what has been called the "winged" form (Pl. X., fig. 7), which they engraved with their characteristic geometric designs. Winged needle-cases have been found in old ruins from Alaska to the Labrador peninsula, so that the type was established at least 1,000 years ago. In Alaska the artists let their fancy play with the different elements of this conventional form. Sometimes they developed the ends of the needle-case, sometimes the flanges or wings and the hardly perceptible knobs below them. Since all their sculpture (as opposed to their engraving) tended towards realism, these elements became elaborated into animal forms, as in Pl. IX., fig. 11. Attached to the sealskin thong that passed through the tube there was always a toggle of some kind to assist in drawing the needles in and out, and it may be that the round, button-like toggle, fitting on top of a "winged" needle-case, suggested the human figure. At all events, we have actually secured from quite early sites many needle-cases in human form,—always female, for though men were the ivory carvers, the women performed all the sewing. In some specimens the head is hollow, as in Pl. X., fig. 6; in others it is solid and separate from the trunk, serving as the button for the sealskin thong.

Animal heads, usually carved on tools connected with the chase, are nevertheless much commoner than human figures in these old remains. The implement in the form of two polar bear heads joined together (Pl. X., fig. 9) is a toggle for dragging home seals. The ears of the bears show admirable workmanship, and the eyes are skilfully represented by plugs of dark-coloured antler. Possibly the holes marking the nostrils were originally plugged in the same way. The heads would be almost identical if the artist had not fancifully depicted one bear with teeth and one without. This specimen is particularly interesting because of the wide deep groove on the underside, which still reveals the stone age method of its formation. The workman first drilled a series of holes, side by side, then broke away the intervening walls.

From a somewhat later period, the early iron age, comes the arrow-straightener shown in Pl. X., fig. 8, which is surmounted with the heads of what appear to be caribou. Here again the artist has used plugs of dark ivory to represent the eyes and nostrils, but for the somewhat misplaced ears he contented himself with a conventional design, an engraved dot and circle. This pattern, so widely spread over the globe, appears fairly frequently in Alaska, even from the earliest times. (*See* Pl. X., fig. 11, an ivory box with wooden base and lid; Pl. IX., fig. 2, a snuff box and Pl. IX., fig. 13, handle of a skin-scraper, all from vicinity of Norton sound.)

The Russian explorations of the Chukchee peninsula in the middle and latter half of the 17th century caused a steady stream of iron to flow across Bering strait. The possession of iron tools immediately brought about a striking development in ivory work, particularly in Alaska. Older implements and ornaments appeared in new forms, as the skin-scraper of Pl. IX., fig. 13, the thimble-holder of Pl. IX., fig. 7, the mouthpiece of the bow drill in Pl. IX., fig. 4 and the delicate little ear pendants with their concentric circles and holes for suspending glass beads (Pl. X., fig. 12). With more efficient tools the artist could give freer rein to his imagination, and for the first time, apparently, we find carvings in the round, or in high relief, arranged to compose a scene. To this post-iron period belongs the Alaskan bucket handle of Pl. X., fig. 1, where a polar bear is seizing a fish. The Labrador peninsula has produced some remarkable carved ivory tusks in the past, probably recent, that illustrate the same artistic growth.

Far more striking, however, than either of these developments was the sudden emergence of realistic engravings in Alaska, and the birth, nearly full-grown, of a picture-writing, that has often been compared by writers too apt to forget its modernity with the scenes painted by palaeolithic man on the walls of French and Spanish caves, and the drawings made on rocks by the Bushmen in South Africa. Actually very little realistic engraving seems to occur before the Eskimos had direct or indirect contact with Europeans, and for some time after this contact realistic designs contested the field with the older geometric patterns without gaining the supremacy (compare the designs on the two archer's wrist-guards in Pl. X., figs. 3 & 5). In museum collections the oldest pipes (which were first introduced from Siberia about the same time as iron) seem to be carved in relief, and engraved either with geometric designs or with realistic figures of animals arranged without any relation to each other except a purely spatial one (Pl. IX., fig. 18). It was not until the 19th century indeed that picture-writing became firmly established and succeeded in relegating the older geometric engraving to the background; and even then it failed to gain a foothold in the Eskimo area except Alaska.

From about 1750 onward picture-writing in Alaska overshadowed the older engraving of geometric patterns, but by no means superseded it. Nor did it seriously affect the carving of detached figures, or of figures in high or low relief. A few specimens from the last 150 years may be illustrated to compare with the earlier art forms. Pl. IX., fig. 1 shows a graceful tool that was used by hunters to simulate the scratching of seals on the ice; it dates from about the beginning of European contact, although the claws have been relashed with sinew in modern times. Pl. IX., fig. 14, from the early 19th century perhaps, is a gauge for regulating the mesh of the sealing net; besides the seals carved on its upper surface there is some crude picture-writing on the under side. Pl. IX., figs. 3 & 16; Pl. X., fig. 4 are productions from the second half of the 19th century; Pl. IX., fig. 3 a needle for lacing skins together; Pl. X., fig. 4 an ornament, probably for a bucket; Pl. IX., fig. 16, a fish.

It is too early yet to foresee what will result from the commercialization of Eskimo ivory-carving during the last 50 years. Already it has produced in Alaska professional carvers who earn their livelihood by supplying the demands of the curio trade. Undoubtedly these modern artists possess as much skill as their ancestors (*see* Pl X., fig. 10, from Hudson bay, a cleverly balanced statuette of a man carrying a pack, and Pl. IX., fig. 10, from Alaska, which represents a mythical monster); but they have failed to apply their skill to the production of objects that are acceptable to the civilized world at large. (*See* also SCULPTURE; SCULPTURE TECHNIQUE; NORTH AMERICAN INDIAN.)

(D. J.)

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IVORY COAST (*Côte d'Ivoire*), a French West African colony, bounded south by the Gulf of Guinea, west by Liberia and French Guinea, north by the colonies of French Soudan and of the Upper Volta, east by the Gold Coast. Its area is 315,000 square kilometres, the population is about 725,000 (density 5·45 per sq. kilometre), of which 1,200 are Europeans. The most densely populated regions are the Baoule and the lagoons.

Physical Features.—The coast-line extends from 7° 30′ to 3° 7′ W. and has a length of 380 m. It forms an arc of a circle of which the convexity turns slightly to the north; neither bay nor promontory breaks the regularity of its outline. The shore is low, bordered in its eastern half with lagoons, and difficult of

access on account of the submarine bar of sand which stretches along nearly the whole of the coast, and also because of the heavy surf caused by the great Atlantic billows. The principal lagoons, going west to east, are those of Grand Lahou, Grand Bassam or Ebrié and Assini. The coast plains extend inland about 40 m. Beyond the ground rises in steep slopes to a general level of over 1,000 ft., the plateau being traversed in several directions by hills rising 2,000 ft. and over, and cut by valleys with a general south-eastern trend. In the north-east, in the district of Kong (*q.v.*), the country becomes mountainous. Mt. Kommono attaining a height of 4,757 ft. In the north-west, by the Liberian frontier, the mountains in the Gon region rise over 6,000 ft. Starting from the Liberian frontier, the chief rivers are the Cavalla (or Kavalli), the San Pedro, the Sassandra (240 m. long), the Bandama (225 m.), formed by the White and the Red Bandama, the Komoe (360 m.). All these streams are interrupted by rapids as they descend from the highlands to the plain and are unnavigable by steamers save for a few miles from their mouths. The rivers named all drain to the Gulf of Guinea; the rivers in the extreme north of the colony belong to the Niger system. The climate is in general very hot and unhealthy, the rainfall being very heavy. In some parts of the plateau healthier conditions prevail. The fauna and flora are similar to those of the Gold Coast and Liberia. Primeval forest extends from the coast plains to about 8° N., covering nearly 112,000 sq. kilometres.

Inhabitants.—The coast districts are inhabited by Negro tribes allied on the one hand to the Kru (*q.v.*) and on the other to the people of Ashanti (*q.v.*). The Assinis are of Ashanti origin, and chiefly of the Ochin and Agni tribes. The Mandés, Malinkés, Diulas, Mandingans, inhabit the north; they form nearly a quarter of the population. Inland live the Sienuf (Senoufos), a very primitive people. The Baulé, 340,000, who occupy the central part of the colony, are of Agni-Ashanti origin. The bulk of the inhabitants are fetish worshippers; only several Mandé groups are Muslim. In general the coast tribes are peaceful. The traders are chiefly Fanti, Sierra Leonians, Senegalese and Mandingos.

Towns.—The chief towns on the coast are Grand and Little Bassam, Jackville and Assini in the east and Grand Lahou, Sassandra and Tabu in the west. Grand and Little Bassam are built on the strip of sand which separates the Grand Bassam or Ebrié lagoon from the sea. This lagoon forms a commodious harbour, once the bar has been crossed. Grand Bassam is situated at the point where the lagoon and the river Komoe enter the sea and there is a minimum depth of 12 ft. of water over the bar. The town (pop. 7,000, including about 100 Europeans) is the seat of the customs administration and of the judicial department, and is the largest centre for the trade of the colony. A wharf equipped with cranes extends beyond the surf line. Little Bassam, renamed by the French Port Bouet, possesses an advantage over the other ports on the coast, as at this point there is no bar. Abijean (Abidjan) (5,300 inhabitants), on the north side of the lagoon opposite Port Bouet, is the starting-point of a railway. On the northern shore of the Bassam lagoon, and 19 m. from Grand Bassam, is the capital of the colony, the native name Adjame having been changed into Bingerville, in honour of Captain L. G. Binger. The town (750 inhabitants) is built on a hill and is fairly healthy.

In the interior are several towns, though none of any size numerically. The best known are Koroko, Kong and Bona, entrepôts for the trade of the middle Niger, and Bontuku, on the caravan route to Sokoto and the meeting-place of the merchants from Kong and Timbuktu, engaged in the kola-nut trade with Ashanti and the Gold Coast. Bontuku is peopled largely by Wongara and Hausa, and most of the inhabitants, who number some 3,000, are Muslim.

Agriculture and Trade.—The natives cultivate maize, plantains, bananas, pineapples, limes, pepper, cotton, etc., and live on the products of their gardens, with occasional help from fishing and hunting. They also weave cloth, make pottery and smelt iron. Europeans introduced the cultivation of coffee, which gives good results, and of cocoa, which grows well between the oil-palms. The export of coffee reaches 187 tons, that of cocoa 9,800 tons, that of cotton 800 tons. The forests are rich in palm-tree products and mahogany, which constitute the chief articles of export. The exploitation of the forests began in 1905, with 13,000 tons; to-day it reaches 119,000 tons, of which 96,000 tons are of cabinet-woods, 11,000 tons of palm-kernels and 8,000 tons of palm-oil have been exported.

In 1927 the trade of the Ivory Coast reached 428,772,000 francs (imports 193,305,000, exports 233,467,000). In the imports the share of France is 104 millions; then come Great Britain (37) and the United States (16); in the exports the share of France is 131 millions, then come Germany (30) and Great Britain (23).

Communications.—The railway from Abidjean serves the east central part of the colony and passes through Bouaké and Katiola and reaches Tarife (488 kilometres); it will be prolonged to Bobo Dioulasso. The line is of metre gauge. The cutting of two canals, whereby communication is effected by lagoon between Assini and Grand Lahou via Bassam, followed the construction of the railway.

Besides the wharf of Grand Bassam, another wharf is being built at Port Bouet, a bridge over the Ebrié lagoon will link it to Abidjean and to the railway. But the Ivory Coast needs a safe deep-water harbour, built either at the mouth of the Comoé or at that of the Sassandra. Grand and Little Bassam are in regular communication by steamer with Bordeaux, Marseilles, Liverpool, Antwerp and Hamburg. Grand Bassam is connected with Europe by submarine cable via Dakar. Telegraph lines connect the coast with all the principal stations in the interior, with the Gold Coast and with the other French colonies in West Africa.

Administration.—The colony is under the general superintendence of the government general of French West Africa. At the head of the local administration is a lieutenant-governor, who is assisted by a council on which nominated unofficial members have seats. To a large extent the native forms of government are maintained under European administrators responsible for the preservation of order, the colony for this purpose being divided into a number of "circles," each with its local government. The colony has a separate budget and is self-supporting. Revenue is derived chiefly from customs receipts and a capitation tax instituted in 1901 and levied on all persons over ten years old.

See *La Côte d'Ivoire* (published by the general government of West Africa, 1906); Gaston Joseph, La *Côte d'Ivoire* (1917).

HISTORY

The Ivory Coast is stated to have been visited by Dieppe merchants in the 14th century, and was made known by the Portuguese discoveries towards the end of the 15th century. It was thereafter frequented by traders for ivory, slaves, and other commodities. There was a French settlement at Assini, 1700–04, and a French factory was maintained at Grand Bassam from 1700 to 1707. In the early part of the 19th century several French traders had established themselves along the coast. In 1830 Admiral (then Commandant) Bouët-Willaumez (1808-71) began a series of surveys and expeditions which yielded valuable results. In 1842 he obtained from the native chiefs cessions of territory at Assini and Grand Bassam to France, and the towns named were occupied in 1843. From that time French influence gradually extended along the coast except during a period of temporary withdrawal (1872–83). Between 1887 and 1889 Captain Louis Gustave Binger traversed the whole region between the coast and the Niger, visited Bontuku and the Kong country, and signed protectorate treaties with the chiefs. In 1892 Captain Binger made further explorations in the interior of the Ivory Coast, and in 1893 he was appointed the first governor of the colony on its erection into an administration distinct from that of Senegal. Among other famous explorers who helped to make known the hinterland was Colonel (then Captain) Marchand. The boundary of the colony on the west was settled by Franco-Liberian agreements of 1892 and subsequent dates; that on the east by the Anglo-French agreements of 1893 and 1898. The northern boundary was fixed in 1899 on the division of the middle Niger territories among the other French West African colonies. The systematic development of the colony,

the opening up of the hinterland, and the exploitation of its economic resources date from the appointment of Captain Binger as governor, a post he held for over three years. Since 1902 the colony has been an autonomous unit, under a lieutenant-governor, of the French West African governorship general. A noteworthy stage in the opening up of the country was the building of a railway from the coast. This line had reached Buake (193 m.) in 1913 and after the World War was continued northward towards the Niger.

In the older books of travel are often found the alternative names for this region, Tooth Coast (*Côte des Dents*) or Kwa-Kwa Coast, and, less frequently, the Coast of the Five and Six Stripes (alluding to a kind of cotton fabric in favour with the natives).

See F. J. Clozel, *Dix ans à la Côte d'Ivoire* (1906); R. Villamur and Richaud, *Notre colonie de la Côte d'Ivoire* (1903). These two volumes deal with the history, geography, zoology, and economic condition of the Ivory Coast. Michellet and Clement, *La Côte d'Ivoire*, describe the administrative and land systems, etc.; another volume also called *La Côte d'Ivoire* (1908) is an official monograph on the colony. For ethnology *see* F. J. Clozel and R. Villamur, *Coutumes indigènes de la Côte d'Ivoire* (1902); R. Villamur and Delafosse, *Les Coutumes Agni*. Of books of travel *see* L. G. Binger, *Du Niger au Golfe de Guinée par Kong* (1892); Captain d'Ollone, *Mission Hostains-d'Ollone 1898–1900* (1901); R. Antonetti, "La Côte d'Ivoire" in *La Géographie* (1922).

IVREA, a town and episcopal see of Piedmont (anc. *Eporedia*), Italy, province of Turin, 38 m. north-north-east from the city of Turin by rail and 27 m. direct, 770 ft. above sea-level, on the Dora Baltea at the point where it leaves the mountains. Pop. (1921) 5,614 (town), 11,770 (commune). The cathedral was built between 973 and 1002, but nothing is left of this period save the ambulatory round the choir and the two bell-towers. The fine campanile of S. Stefano belongs to 1029–1042. The hill above the town is crowned by the imposing Castello delle Quattro Torri (1358).

The ancient Eporedia, at the junction of roads from Augusta Taurinorum and Vercellae, at the point where the road to Augusta Praetoria enters the narrow valley of the Duria (Dora Baltea), was a military position of the Salassi who inhabited the whole upper valley of the Duria. The importance of the gold-mines of the district led to its seizure by the Romans in 143 B.C. The centre of the mining industry seems to have been Victumulae (*see* TICINUM), until in 100 B.C. a colony of Roman citizens was founded at Eporedia itself; but prosperity was only assured when the Salassi were finally defeated in 25 B.C. and Augusta Praetoria founded. There are remains of a theatre of the time of the Antonines and the Ponte Vecchio rests on Roman foundations.

In the middle ages Ivrea was the capital of a Lombard duchy, and later of a marquisate; both Berengar II. (950) and Arduin (1002) became kings of Italy for a short period. Later it submitted to the marquises of Monferrato, and in the middle of the 14th century passed to the house of Savoy. The surrounding district is known as the Canavese.

IVRY, BATTLE OF (1590). The battle of Ivry (Eure, France) was fought between the Huguenots under Henry IV. of France and the Catholics under the duke of Mayenne on March 14, 1590. On Aug. 1, 1589 Henry III. was assassinated, and Henry IV., of Navarre, ascended the French throne, and at the battle of Arques, won by him on Sept. 28, 1589, he, through his energy, gallantry and resourcefulness, established himself as the national hero. The next year the duke of Mayenne laid siege to Melun, but fell back on the approach of Henry. No sooner had the king withdrawn than he was recalled to confront Mayenne who, reinforced by the Spaniards, had returned. The two forces, the duke's numbering about 13,000 and the king's somewhat less, met on the plain of Ivry. The following brief account of the battle which then took place will give some idea of the desultory tactics in vogue at this date.

Henry first drew up his army, prayed and then adjusted his helmet on the crest of which floated three white plumes. Before lowering his visor he said to his companions: "I will conquer or die. Keep well your ranks, and if the heat of the battle compels you to leave them, always rally, it is the one thing to remember in war. This you should do by the three pear-trees you see yonder on my right. If you lose your banners and your standards do not, however, lose sight of my white plume, for you will always find it on the road of honour and pointing towards victory." Colonel Schomberg, a captain of mercenaries, rode up to the king and demanded that his men should be paid. Henry in a rage rebuked him, and then throwing his arms about him kissed him, whereupon Schomberg with tears in his eyes replied, "Oh! Sire, in giving me back the honour you took from me you take away my life." The charge was sounded, and *"Schomberg part comme un trait; fond sur l'ennemi comme un lion furieux, et meurt les armes à la main,"* (Schomberg sped forward like an arrow, hurled himself like a furious lion on the enemy, and died sword in hand). With shouts of *"Vive le Roi!"* battalions and squadrons followed him. The two sides clinched, and for several hours attacks were made and repulsed without any decided advantage being gained. A page bearing a white plume in his helmet being killed, a panic seized upon some of Henry's squadrons. At the moment he was busily engaged in a hand to hand fight, lost to sight in a mêlée. Cutting his way out, his white plumes were once again seen, whereupon his soldiers wild with joy charged forward, and the enemy was routed. A pursuit to the bridge of Ivry then followed, at which most of the foreign troops in Mayenne's pay were butchered, the French and Swiss alone receiving quarter.

The prestige won at Ivry was Henry's true gain and victory. He was accepted by France, and then as an act of political wisdom, in July 1593, he became a Catholic, and two years later brought about the collapse of all opposition.

See A. Poirson, *Histoire du régne de Henry IV., 1862–1867;* P. F. Willett, *Henry of Navarre; The Cambridge Modern History,* vol. iii., 1904. (J. F. C. F.)

IVRY-SUR-SEINE, a suburb of Paris, in the department of Seine, arrondissement of Sceaux, near the left bank of the Seine, 6 kilometres from Notre Dame cathedral. Pop. (1925) 41,192. It manufactures organs, earthenware, rubber and chocolates, and has engineering works, and oil-works, its trade being facilitated by a port on the Seine.

IVY, the collective designation of certain species and varieties of *Hedera,* a member of the family Araliaceae. There are fifty species of ivy recorded in modern books, but they may be reduced to two, or at the most, three. The European ivy, *Hedera Helix,* is a plant subject to infinite variety in the forms and colours of its leaves, but the tendency of which is always to a three- to five-lobed form when climbing and a regular ovate form of leaf when producing flower and fruit. The African ivy, *H. canariensis,* often regarded as a variety of *H. Helix* and known as the Irish ivy, is a native of North Africa and the adjacent islands. It is the common large-leaved climbing ivy, and also varies, but in a less degree than *H. Helix,* from which its leaves differ in their larger size, rich deep green colour, and a prevailing tendency to a five-lobed outline. When in fruit the leaves are usually three-lobed, but they are sometimes entire and broadly ovate. The Asiatic ivy, *H. colchica,* now considered to be a form of *H. Helix,* has ovate, obscurely three-lobed leaves of a coriaceous texture and a deep green colour; in the tree or fruiting form the leaves are narrower than in the climbing form, and without any trace of lobes. Distinctive characters are also to be found in the appendages of the pedicels and calyx, *H. Helix* having six-rayed stellate hairs, *H. canariensis* fifteen-rayed hairs and *H. colchica* yellowish two-lobed scales.

The Australian ivy, *H. australiana,* is a small glabrous shrub with pinnate leaves. It is a native of Queensland, and is practically unknown in cultivation.

It is important to note the difference of characters of the same species of ivy in its two conditions of climbing and fruiting. The first stage of growth, which we will suppose to be from the seed, is essentially scandent, and the leaves are lobed more or less. This stage is accompanied with a plentiful production of the claspers or modified roots by means of which the plant becomes attached and obtains support. When it has reached the summit of the tree or tower, the stems, being no longer able to maintain a perpendicular attitude, fall over and become horizontal or pendent.

Coincidently with this change they cease to produce claspers, and the leaves are strikingly modified in form, being now narrower and less lobed than on the ascending stems. In due time this tree-like growth produces terminal umbels of greenish flowers, which have the parts in fives, with the styles united into a very short one. These flowers are succeeded by smooth black or yellow berries, containing two to five seeds. The yellow-berried ivy is met with



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IVY (HEDERA HELIX)

A. Branch with flowers
B. Fruits
C. Combining ivy with adventitious roots

in northern India and in Italy, but in northern Europe it is known only as a curiosity of the garden, where, if sufficiently sheltered and nourished, it becomes an exceedingly beautiful and fruitful tree.

A question of practical importance is the relation of the plant to its means of support. A moderate growth of ivy is not injurious to trees; still the tendency is from the first inimical to the prosperity of the tree, and at a certain stage it becomes deadly. Therefore the growth of ivy on trees should be kept within reasonable bounds, more especially in the case of trees that are of special value for their beauty, history, or the quality of their timber. In regard to buildings clothed with ivy, there is nothing to be feared so long as the plant does not penetrate the substance of the wall by means of any fissure. Should it thrust its way in, the natural and continuous expansion of its several parts will necessarily hasten the decay of the edifice. But a fair growth of ivy on sound walls that afford no entrance beyond the superficial attachment of the claspers is, without any exception whatever, beneficial. It promotes dryness and warmth, reduces to a minimum the corrosive action of the atmosphere, and is altogether as conservative as it is beautiful.

Many varieties are cultivated in gardens and to grow these is an extremely simple matter, as they will thrive in a poor soil and endure a considerable depth of shade, so that they may with advantage be planted under trees. The common Irish ivy is often to be seen clothing the ground beneath large yew trees where grass would not live, and it is occasionally planted in graveyards in London to form an imitation of grass turf, for which purpose it is admirably suited.

The ivy, though long cultivated in mild, moist districts, is, on the whole, a scarce plant on the American continent. In the northern United States and southern Canada the winters are not more severe than the ivy can endure, but the summers are too hot and dry. In districts where native ferns abound the ivy will usually thrive, and the varieties of *Hedera Helix* should have the preference. But in the drier districts ivies should be planted on the north side of buildings, and encouraged with water and careful training for three or four years. A strong light is detrimental to the growth of ivy, but there are no hardy plants that may be compared with it for variety and beauty that will endure shade equally well.

The North American poison ivy (poison oak), *Rhus Toxicodendron* (Anacardiaceae), is a climber with three-foliolate leaves, which are very attractive in their autumn colour.

The ground ivy, *Nepeta hederacea* (family Labiatae), is a small creeping plant with rounded crenate leaves and small blue-purple flowers, occurring in hedges and thickets in Great Britain and widely in North America.

IWAKURA, TOMOMI, PRINCE (1835–1883), Japanese statesman, was born in Kyoto. He was one of the court nobles (*kuge*) of Japan, and he traced his descent to the emperor Murakami (A.D. 947–967). He took a leading part in the complications preceding the fall of the Tokugawa *shōgunate*, and was obliged to fly from Kyoto accompanied by his coadjutor, Prince Sanjō. They took refuge with the *Daimyō* of Chōshū, and, while there, established relations which contributed greatly to the ultimate union of the two great fiefs, Satsuma and Chōshū, for the work of the Restoration. From 1867 until the day of his death Iwakura was one of the most prominent figures on the political stage. In 1871 he proceeded to America and Europe at the head of an embassy of some fifty persons, to explain to foreign governments existing conditions in Japan, and to prepare for negotiating new treaties consistent with her sovereign rights. Little success attended the mission. Returning to Japan in 1873, Iwakura found the cabinet divided as to the manner of dealing with Korea. He advocated peace, and his influence carried the day.

IWASAKI, KOYATA, 2ND BARON (1879–), Japanese philanthropist, was born in 1879, and succeeded to the barony in 1909. Educated at the Imperial university of Tōkyō and at Cambridge, England, he became president of the banking department of the Mitsubishi company. His vast wealth was largely expended in experiments and benefactions. He instituted a research farm in the north of Japan for stock raising. His visit to England convinced him of the educational value of public libraries and when the library of G. E. Morrison, for many years *The Times* (London) correspondent in Peking, came into the market, Baron Iwasaki bought it for the students of Japan. He added to it the bulk of his own collection and in addition to buying a site and erecting a building to contain it, he allotted a sum of money annually to the institution for the purpose of keeping it up to date by the purchase of new books. The library is called the *Tōyō Bunko* (Oriental library) and is situated in Kamifujimae Chō in Hongō, Tōkyō.

I.W.W.: *see* INDUSTRIAL WORKERS OF THE WORLD.

IXION, in Greek legend, son of Phlegyas, king of the Lapithae in Thessaly (or of Ares), and husband of Dia. Having treacherously murdered his wife's father Deïoneus he could find none to purify him until Zeus did so and admitted him as a guest to Olympus. Ixion abused his pardon by trying to seduce Hera; but the goddess substituted for herself a cloud, by which he became the father of the Centaurs. Zeus bound him on a fiery wheel, which rolls unceasingly through the air or (according to the later version) in the underworld (Pindar, *Pythia*, ii. 21; Ovid, *Metam.* iv. 461; Virgil, *Aeneid*, vi. 601). A plausible but by no means certain explanation connects the story with the not uncommon practice of carrying a blazing revolving wheel through fields which needed the heat of the sun, the legend being invented to explain the custom (*see* Mannhardt, *Wald- und Feldkulte*, ii. 1905, p. 83). *See* Roscher's *Lexikon*, *s.v.*

IXTACCIHUATL (ēsh-tăk-sē-wătl) or **IZTACCIHUATL** ("white woman"), a lofty volcano, 10m. N. of Popocatepetl and about 40m. S.S.E. of the City of Mexico, forming part of the short spur called the Sierra Nevada. According to Angelo Heilprin (1853–1907) its elevation is 16,960ft.; other authorities make it much less. Its apparent height is dwarfed somewhat by its elongated summit, and the large area covered. It has three sum-

mits of different heights standing on a north and south line, the central one being the largest and highest, and all three rising above the permanent snow-line. As seen from the City of Mexico the three summits have the appearance of a shrouded human figure, hence the poetic Aztec appellation of "white woman" and the unsentimental Spanish designation *La mujer gorda* ("the fat woman"). The ascent is difficult and perilous, and is rarely accomplished.

Heilprin says that the mountain is largely composed of trachytic rocks, and that it is older than Popocatepetl. It has no crater and no trace of lingering volcanic heat. It is surmised that its crater, if it ever had one, has been filled in and its cone worn away by erosion through long periods of time.

IXTLILXOCHITL II. (*c.* 1500–1550), chief of the Texcucans, one of the most civilized tribes of ancient Mexico. He became an enemy of Montezuma, emperor of Mexico, because Montezuma aided his brother in the struggle for leadership which followed upon the death of their father, Netzahualpilli. When the Spaniards under Cortés arrived Ixtlilxochitl offered his services against Montezuma and Cortés in turn aided him in becoming king of Texcuca. Ixtlilxochitl remained faithful to the Spaniards to the last and accompanied Cortés on many expeditions, but in the end he lost the favour of his own subjects whom he had really helped to conquer.

IYRCAE (ĭ-ür'kī), an ancient nation on the north-east trade route described by Herodotus (iv.22) beyond the Thyssagetae (*q.v.*), somewhere about the upper basins of the Tobol and the Irtysh. They were distinguished by their mode of hunting, climbing a tree to survey their game, and then pursuing it with trained horses and dogs. They were almost certainly the ancestors of the modern Magyars, also called Jugra.

IZARD (*Rupicapra pyrenaica*), the chamois of the Pyrenees, differing from the typical Alpine form (*see* CHAMOIS) in its reddish colour and smaller size. The name is also spelt "isard."

IZBARTA or SPARTA (anc. *Baris*), a town in Asia Minor, well situated on the edge of a fertile plain at the foot of Aghlasun Dagh. It was once the capital of the Emirate of Hamid. It suffered severely from an earthquake in 1889. It has been an important centre of Greek influence in Anatolia. It is connected by rail with Smyrna and Egerdir. Pop. (1927) 44,663.

IZHEVSK, the administrative centre of the Votyak Autonomous Area of the R.S.F.S.R. on the Izh river, a tributary of the Kama river, in lat. 56° 52′ N. and long. 53° 14′ E. Pop. (1926) 63,088. Its steel foundries and ammunition works were established in 1807, but have increased rapidly in importance in the last few years. Other industries include brewing, brick making, flour-milling and saw-milling.

IZU-NO-SHICHI-TO, the seven (*shichi*) islands (*to*) of Izu, included in the empire of Japan. They stretch in a southerly direction from a point near the mouth of Tokyo bay, and lie between 33° and 34° 48′ N. and between 139° and 140° E. Their names, beginning from the north, are Izu-no-Oshima, To-shima, Nii-shima, Kozu-shima, Miyake-shima and Hachijo-shima. There are some islets in their immediate vicinity. Izu-no-Oshima, an island 10 m. long and 5½ m. wide, is 15 m. from the nearest point of the Izu promontory. It is known to western cartographers as Vries island, a name derived from that of Captain Martin Gerritsz de Vries, a Dutch navigator, who is supposed to have discovered the island in 1643. But the group was known to the Japanese from a remote period, and was used as a convict settlement from the 12th century. Izu-no-Oshima is remarkable for its smoking volcano, Mihara-yama (2,461 ft.).

IZVOLSKY, ALEXANDER PETROVICH (1856–1919), Russian statesman, was born at Moscow on March 17, 1856, of an ancient Polish family long settled in Russia. He graduated at the Imperial Lyceum of St. Petersburg (Leningrad) with the highest honours attainable, and entered the diplomatic service. He held appointments at Bucharest, Washington and at the Vatican, where he was charged with the resumption of relations between the tsar's government and the Holy See.

Izvolsky married Countess Toll, a friend of the dowager Empress Maria Feodorovna, to whose influence he owed much of his professional success. His next posts, as minister plenipotentiary, were in Belgrade, Munich and Tokyo. From the Japanese capital he warned Lamsdorff, his chief, of what was brewing for Russia in the Far East, but without effect; his attempts to compose the differences by arranging the Marquis Ito's mission to Europe (1902) and obtaining moderate Japanese proposals (1904) were also thwarted. Before hostilities broke out Izvolsky was transferred to Copenhagen (1903). In 1906 he succeeded Count Lamsdorff as minister of foreign affairs, a post which he held until 1910. From 1910 to 1917 Izvolsky was Russian Ambassador in France. After the revolution he died in Paris Aug. 16, 1919.

As foreign minister Izvolsky has no claims to real greatness. He was a clever diplomatist—according to King Edward VII., the cleverest in Russia—with a very definite and circumscribed aim which he pursued with unflagging energy, an endless variety of means and untiring perseverance. When he became foreign secretary, France and Russia were but nominally allies, each one speculating on the intentions of the other; and the cardinal principle of his policy was to convert that alliance into an effective reality. This he did with occidental thoroughness. Hence he strove to draw Britain, Italy, Turkey, Bulgaria and Rumania into the Entente. Accepting as an axiom the inevitability of a great European war, the principal belligerents being France and Germany in the west, and Russia and Austria in the east, he came to the conclusion that between those future enemies there might be episodic arrangements and temporary makeshifts, but no complete settlement except by war.

Izvolsky's first success was the liquidation of the war with Japan, which he accomplished with remarkable foresight, breadth of view, thoroughness and moral courage. The next and more difficult task, the final elimination of the causes of Anglo-Russian rivalry, was begun by the arrangement with Britain about Persia, Afghanistan and Tibet (1907). This reconciliation definitely baffled Aehrenthal's scheme which the Russian tsaritza favoured—of a renewal of the Three-Kaiser Alliance.

Soon after this Izvolsky sounded Vienna unofficially as to how Austria would view an attempt by Russia to obtain the freedom of the Straits. Aehrenthal, then minister of foreign affairs, who was still on relatively friendly terms with Izvolsky, replied unofficially that no objection would be raised if Russia agreed to the annexation of Bosnia and Hercegovina. This question and answer were, however, followed by a marked coolness in the mutual relations of the two empires, and the matter dropped. The two states came together again when charged by Europe to draft and execute a scheme for the reform of justice in Macedonia. But Austria secretly obtained from Turkey a railway concession in the sanjak of Novi Bazar. In St. Petersburg, London and Belgrade the news aroused intense indignation. But after King Edward's visit to Reval (June 1908), Izvolsky informed Aehrenthal that Russia had no objection to the Sanjak Railway if Austria would assent to an Adria Railway for Serbia. At the same time he proposed that the tsardom should obtain the freedom of the Straits and Austria promulgate the annexation of Bosnia and Hercegovina. Izvolsky and Aehrenthal then met at Buchlau, the Moravian residence of Count Berchtold (Sept. 15, 1908), and agreed to this arrangement. Izvolsky held that he made the proviso that the two points be referred to a European Conference, while Aehrenthal asserted that he announced the annexation as impending. Both were probably right. A few days later the annexation was proclaimed, whereas Russia was kept out of her *quid pro quo* owing to British-French opposition.

The resulting personal and national tension almost brought war within sight, but Russia being unprepared, it was staved off. Izvolsky attempted to draw Italy into the orbit of the Allies; but in spite of this Russia and Germany seemed for a while to become friends again, and during the Tsar's sojourn in Germany Izvolsky was relieved of his office and sent to Paris as ambassador, remaining, however, the real head of his country's policy until the outbreak of the World War, for which his enemies often held him responsible. But the hyperbole is unjustified. His policy, like that of Aehrenthal, was a sequence of cruel illusions for which the peoples had to pay.

J This letter was not differentiated from I until comparatively modern times. It was the custom in mediaeval mss. to lengthen the letter I when it was in a prominent position, notably when it was initial. As initial I usually had consonantal force, the lengthened form came definitely to be regarded as representing the consonant and the shortened form the vowel in whatever position they occurred. The process of differentiation began about the 14th cent. but was not complete till the 17th. For certain purposes, an alphabetical series for example, the letters I and J are not even yet regarded as distinct, the enumeration passing generally from I to K.

The original consonantal sound represented by the letter was the semi-vowel or spirant *i* (the sound of *y* in the word *yacht*). This passed into *dy* and later into the sound *dž* which the letter represents to-day. This sound was already established in the language in words of Romance origin in which it was represented by *g* (*e.g.*, in words such as *gesture, ginger*), and these words retain their spelling. J represents the same sound (*dž*) in all positions.

The minuscule form *j* is the lengthened form, retaining the dot, of minuscule *i*.

JA'ALIN, the largest, most widely distributed and most loosely knit main group of the Arabs of the Sudan. The term is used generally of most of the northern riverain tribes and in a more restricted sense of a large group comprising the Sa'adab, Nifi'at, Kiti'āb and other tribes. They claim to be of the Koreish tribe and even trace descent from Abbas, uncle of the prophet. They are of Arab origin, but now of very mixed blood. According to tradition they emigrated to Nubia in the 12th century. They are a proud religious people, formerly notorious as slave dealers.

See H. A. MacMichael, *History of the Arabs of the Sudan* (1922).

JABIRU, an American stork, *Mycteria americana*, found from Mexico to the Argentine. It stands between 4 and 5 ft. in height, with a massive bill and white plumage. The head and neck are bare, and black and red in colour. The Old World genera *Xenorhynchus* and *Ephippiorhynchus* are nearly allied to the true jabiru, but the head and neck are feathered. Less closely related are the adjutant birds (*q.v.*).



THE COMMON BRAZILIAN JABIRU

JABLOCHKOV, PAUL (1847–1894), Russian electrical engineer and inventor, was born at Serdobsk, in the government of Saratov, on Sept. 14, 1847, and educated at St. Petersburg. He devoted himself to research on electric lighting by arc lamps and in 1876 he brought out the Jablochkov "candles," which consisted of two carbon parallel rods, separated by a non-conducting partition. His system was gradually superseded (*see* LIGHTING and ARTIFICIAL ILLUMINATION). Jablochkov died in poverty in Russia on March 19, 1894.

JABLONEC NAD NISOU, a manufacturing town in north-eastern Bohemia noted for the famous Gablonz ware, and a centre for the glass industry and the preparation of cheap jewellery and imitation stones. Apart from this it has important textile factories and is an administrative centre. Pop. (1926) 26,929.

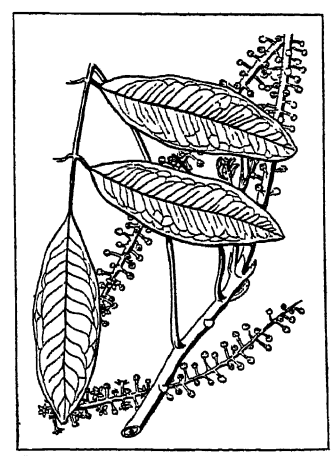
JABLONSKI, DANIEL ERNST (1660–1741), German theologian, was born at Nassenhuben, near Danzig, on Nov. 20, 1660, the son of a Moravian pastor. He studied at Frankfort-on-Oder and Oxford, became a preacher at Magdeburg in 1683, and then from 1686 to 1691 he was head of the Moravian college at Lissa. He was appointed court preacher at Königsberg in 1691 by the elector of Brandenburg, Frederick III., and had considerable influence in court circles. In 1693 he became court preacher at Berlin and in 1699 he was consecrated a bishop of the Moravian Church. Jablonski worked hard for union between the Lutherans and the Calvinists; the courts of Berlin, Hanover, Brunswick and Gotha were interested in his scheme, and his principal supporter was Leibnitz. His idea appears to have been to form a general union between the German, the English and the Swiss Protestants. In spite of the failure of negotiations, Jablonski and Leibnitz, however, did not cease to believe in their purpose. Jablonski was one of the founders of the Berlin Academy of Sciences, of which he was president in 1733. He died on May 25, 1741.

Jablonski's son, Paul Ernst Jablonski (1693–1757), was professor of theology and philosophy at Frankfort-on-Oder.

Correspondence between Jablonski and Leibnitz was published at Leipzig in 1747 and at Dorpat in 1899. *See* H. Dalton, *Daniel Ernst Jablonski* (1903).

JABORANDI, a name in Brazil and South America generally given to a number of plants, all of which possess sialogogue and sudorific properties. In the year 1875 a drug was introduced under this name, its botanical source being then unknown. *Pilocarpus pennatifolius*, a member of the family Rutaceae, the plant from which it is obtained, is a slightly branched shrub about 10 ft. high, growing in Paraguay and eastern Brazil.

The leaves are the part of the plant most commonly imported. The active principle is called *pilocarpine*. It is a liquid alkaloid, slightly soluble in water, and very soluble in alcohol, ether and chloroform. It strongly rotates the plane of polarization to the right, and forms crystalline salts of which the nitrate is that chiefly used in medicine. The formula of the alkaloid is $C_{11}H_{16}N_2O_2$. Certain other alkaloids are present in the leaves. They have been named *jaborine, jaboridine and pilocarpidine*. The first of these is the most important. It is possibly derived from pilocarpine, and has the formula $C_{22}H_{32}N_4O_4$. Jaborine resembles atropine pharmacologically, and is antagonistic to pilocarpine. The various preparations of jaborandi leaves are therefore undesirable for therapeutic purposes, and only the nitrate of pilocarpine itself should be used.



JABORANDI (PILOCARPUS PENNATIFOLIUS). BRANCH WITH RACEMES OF FLOWERS. THE DRUG IS OBTAINED FROM LEAVES AND YOUNG SHOOTS. NATIVE OF BRAZIL

The action of this powerful alkaloid closely resembles that of physostigmine, but pilocarpine exerts its greatest power on the secretions. It has no external action. When taken by the mouth the drug is rapidly absorbed and stimulates the secretions of the alimentary tract, though not of the liver. The action on the salivary glands is the most marked. The great flow of saliva is due to an action of the drug, on the terminations of the nerves of salivary secretion. The gland cells themselves are unaffected. The nerves are so violently excited that direct stimulation of them by electricity adds nothing to the rate of salivary flow. The action is antagonized by atropine, which paralyses the nerve terminals. About $\frac{1}{100}$ of a grain of atropine antagonizes half a grain of pilocarpine. The circulation is depressed by the drug, the pulse being slowed and the blood pressure falling. Its dangerous action is upon the bronchial secretion, which is greatly increased. Pilocarpine is also the most powerful diaphoretic known.

One dose may cause the flow of nearly a pint of sweat in an hour.

JACA, a city of northern Spain, in the province of Huesca, 114 m. N. by W. of Saragossa, on the left bank of the river Aragon, and among the southern slopes of the Pyrenees, 2,380 ft. above the sea. Pop. (1920), 5,526. The origin of the city is unknown. The Jaccetani ('Ιάκκητανοί) are mentioned as one of the most celebrated of the numerous small tribes inhabiting the basin of the Ebro by Strabo. They are probably identical with the Lacetani of Livy (xxi. 60, 61) and Caesar (*B.C.* i. 60). Early in the 8th century Jaca fell into the possession of the Moors, by whose writers it is referred to under the name of Dyaka as one of the chief places in the province of Sarkosta (Saragossa). It was reconquered before the time of Ramiro I. of Aragon (1035–1063), who gave it the title of "city," and in 1063 held a council within its walls. During the Peninsular War Jaca surrendered to the French in 1809, and was recaptured in 1814. Jaca is an episcopal see, and was formerly the capital of the Aragonese county of Sobrarbe. Its massive Gothic cathedral dates at least from the 11th century, and possibly from the 9th.

JACAMAR, the Brazilian name of birds forming the family *Galbulidae,* with zygodactylous or pair-toed feet, and glossy white eggs. They are all rather small birds, the largest known being little over 10in. in length, with long sharp bills, and the plumage with golden or bronze reflections. With the exception of *Galbula melanogenia,* which is found also in Central America, all the jacamars inhabit tropical South America east of the Andes, *G. ruficauda,* however, extending its range to the islands of Trinidad and Tobago. They are seen sitting motionless on trees, whence they dart at any passing insect and, catching it on the wing, return to their perch.

JAÇANA, the Brazilian name of certain wading birds of the family *Parridae* which seem to be connected with the *Limicolae.* The most obvious characteristic of the jaçanas is the extraordinary length of their toes and claws, whereby they are enabled to walk with ease over water-lilies and other aquatic plants. The genus *Parra* inhabits South America; *Metopidius,* hardly differing from it, has representatives in Africa, Madagascar and India; *Hydralector* belongs to the north Australian region; and *Hydrophasianus,* the most extravagant form of the whole, is found in India and China. The *Parridae* lay very peculiar eggs of a rich olive-brown colour, in most cases closely marked with dark lines.

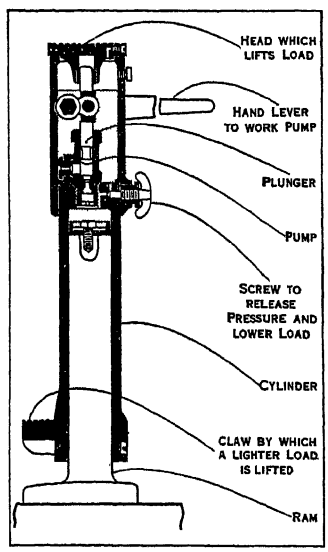
JÁCANA or **ÁCANA** (native West Indian name), a very common timber-tree (*Lucuma multiflora,* family Sapotaceae) of the West Indies. The tree grows to a height of 75 to 90 feet and gives straight logs of very durable timber. The wood is hard, very fine-grained, light-coloured and very heavy, and used in construction work where great strength is required; formerly used for cane-mill rolls. It is being used in afforestation work in Porto Rico.

JACARÉ, a Brazilian name for the spectacled cayman (*Caiman sclerops*) of tropical America. The *jacaré tinga* is the smaller *C. trigonatus.* (*See* CROCODILE, CAYMAN.)

JACK, a word with a great variety of meanings and applications. In the *History of the Monastery of St. Augustine* at Canterbury, 1414, Jack is given as a form of John—"*pro Johanne Jankin sive Jacke*" (*see* E. W. B. Nicholson, *The Pedigree of Jack and other Allied Names,* 1892). "Jack" was early used as a general term for any man of the common people. The *New English Dictionary* quotes from the *Coventry Mysteries,* 1450: "And I wole kepe the feet this tyde Thow ther come both Iakke and Gylle." Jack or Jack Tar for a sailor seems to date from the 17th century, and such uses as steeple-jack, "jack of all trades," etc. may be noted. It is a further extension of this that gives the name to the knave in a pack of cards, and also to various animals, as jack-snipe, jack-rabbit; it is also used as a general name for pike.

The word "jack" is applied to mechanical devices and other objects smaller than the ordinary, or to appliances which take the place of manual labour. In the first class are the small object bowl in the game of bowls and jack rafters, those rafters in a building shorter than the main rafters. The jack as a ship's flag is always a smaller flag than the ensign. The jack is flown on a staff on the bowsprit of a vessel. In the British navy the jack is a small Union flag. (The Union flag should not be styled a Union Jack except when it is flown as a jack.) (*See* FLAG.)

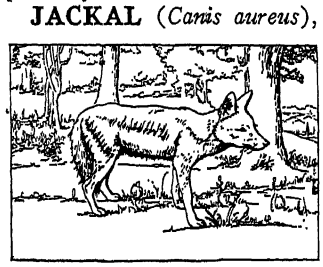
A more common use of "jack" is for various mechanical and other devices used as substitutes for men or boys. Thus the origin of the boot-jack and the meat-jack is explained. The *New English Dictionary* finds a transitional sense in the use of the name "jack" for mechanical figures which strike the hours on a bell of a clock. Such a figure in the clock of St. Lawrence Church at Reading is called a jack in the parish accounts for 1498–99. There are many different applications of "jack" to certain levers and other parts of textile machinery; the principal mechanical application of the word, however, is to a portable hand-worked appliance for raising weights from below. Jacks' range in power from a few hundred weights to 500 tons; the simple type is a crow-bar pivoted in an upright frame, giving a direct and rapid lift. To this simple pivoted lever have been added a screw turned by a tommy-bar, ratchet devices, pinion and rack, etc., for increasing power or rapidity of action; and special forms have been evolved for use with motor cars, tram-cars, cable-drums, locomotives, railway and tram rails, ships, bridges, etc.



HYDRAULIC JACK. BY WORKING THE LEVER, WATER IS PUMPED FROM TANK INTO SPACE ABOVE THE RAM

In most European languages the word "jack" in various forms appears for a short upper outer garment, particularly in the shape of a sleeveless (quilted) leather jerkin, sometimes with plates or rings of iron sewn to it. It was the common coat of defence of infantry in the middle ages. It was probably from some resemblance to the leather coat that the well-known leather vessels for holding liquor or for drinking were known as jacks. These drinking vessels, which are often of great size, were not described as black jacks till the 16th century, though known as jacks much earlier. About 1700 a jack of a different form, like an ordinary drinking mug with a tapering cylindrical body, often mounted in silver, came into vogue. The jack-boot, the heavy riding boot with long flap covering the knee and part of the thigh, and worn by troopers first during the 17th century, was so called probably from association with the leather jack or jerkin.

JACKAL (*Canis aureus*), a wolf-like wild member of the dog family inhabiting eastern Europe and southern Asia. The name is also applied to a number of allied species. Jackals resemble wolves and dogs in their dentition, the round eye-pupils, the period of gestation, and to a large extent also in habits. The European species grows to a height of 15in. at the shoulders, and to a length of about 2ft., exclusive of its bushy tail. The fur is greyish-yellow, darker on the back and lighter beneath. The range of the common jackal extends from Dalmatia to India. In Senegal this species is replaced by *C. anthus,* while in Egypt occurs the larger *C. lupaster,* known as the Egyptian wolf. Nearly allied to the last is the Indian wolf (*C. pallipes*). Several other African species exist. Jackals are nocturnal, concealing themselves until dusk in jungles and other lurking places, and then sallying forth in packs to visit farmyards, villages, and towns in search of food. This consists for the most part of the smaller mammals and poultry, although the association in packs enables



BY COURTESY OF THE NEW YORK ZOOLOGICAL SOCIETY

THE COMMON JACKAL (C. AUREUS)

these marauders to hunt down antelopes and sheep. When unable to obtain living prey, they feed on carrion and refuse of all kinds, and are thus useful in removing putrescent matter from the streets. They also follow lions and tigers in order to finish the carcase after the larger animal has eaten its fill. The cry of the jackal is even more appalling than that of the hyena. Like the fox, it has an offensive odour, due to the secretion of a gland at the base of the tail.

JACK BY THE HEDGE: *see* GARLIC MUSTARD.

JACKDAW or DAW, one of the smallest species of the genus *Corvus* (*see* CROW), and a well-known inhabitant of Europe, *C. monedula*. It associates with the rook during a great part of the year; but almost invariably chooses holes for its nest of sticks, sometimes even breeding in rabbit burrows. Nearly every church-tower and castle is occupied by daws. Their industry in collecting materials for their nests is marvellous. In some cases the stack of loose sticks piled up by daws in a tower has been known to form a structure 12 ft. in height. The style of architecture practised by the daw thus brings it more than the rook into contact with man, and its familiarity is increased by the boldness of its disposition which, though tempered by cunning, is hardly surpassed among birds. Its pilferings are not to be denied, though its services to the agriculturist are great, for in the destruction of injurious insects it is hardly inferior to the rook, and it has the useful habit of ridding sheep of some of their parasites.



BY COURTESY OF BRITISH INSTRUCTIONAL FILMS, LTD.

ENGLISH JACKDAW

The daw displays a glossy black plumage in the adult, varied by grey ear-coverts, and nape and sides of the neck. Examples from the east of Europe and western Asia have these parts much lighter. Further to the eastward occurs the *C. dauuricus*, which has much of the lower parts of the body white also. Japan and northern China are inhabited by a form (*C. neglectus*) wanting the grey nape. The daws are sometimes placed in a genus (*Monedula*) of their own.

JACK-IN-THE-PULPIT (*Arisaema triphyllum*), a North American plant of the arum family (Araceae), called also Indian turnip, bog-onion, brown-dragon and starchwort, native to wet woods and thickets from Nova Scotia to Minnesota and southward to Florida and Texas. It is a stoutish perennial, 1 to 2½ ft. high, rising from an acrid corm and usually bearing two long-stalked, three-parted, dull green leaves, which overshadow the conspicuous green- and purple-striped flowering spathe that rises on a separate stalk between them. The flowering spathe curves in a broad canopy-like portion over the top of a club-shaped spadix, 2 to 3 in. long, near the base of which, concealed within the enclosing spathe, are borne the minute flowers, the staminate and pistillate commonly though not always found on different plants. Fertilization is aided by small insects, especially gnats of the genus *Mycetophila*. The fruit, a handsome cluster of brilliant red berries, ripens in late summer. This interesting aroid, in many respects a North American counterpart of the British cuckoo-pint (*q.v.*), is one of the best-known late spring wild flowers of the eastern United States and Canada. The exceedingly pungent, starchy corm, which is made edible by boiling, was formerly used for food by the Iroquois and other American Indians. (*See* ARACEAE; GREEN DRAGON.)

JACK-O'-LANTERN: *see* IGNIS FATUUS.

JACKS, LAWRENCE PEARSALL (1860–), British Unitarian divine, was born in Nottingham. He studied at London University, and at Göttingen and Harvard. In 1887 he became assistant to Stopford Brooke, at Bedford chapel, London, and in 1889 he married Brooke's daughter, Olive Cecilia. He was subsequently minister of Unitarian churches in Liverpool and Birmingham. In 1902, on the foundation of *The Hibbert Journal*, Jacks was appointed first editor. In the following year he became instructor in philosophy at Manchester college, Oxford, and in 1915 was chosen principal of that college. Jacks wrote *Life and Letters of Stopford Brooke* (1917); *All Men are Ghosts* (1913); *From the Human End* (1916); *From Authority to Freedom* (1920); *Legends of Smokeover* (1921); *The Challenge of Life* (1924); *The Faith of a Worker* (1925); *Heroes of Smokeover* (1926).

JACKSON, ANDREW (1767–1845), American soldier and statesman, 7th president of the United States, was born on March 15, 1767, at the Waxhaw settlement in Lancaster county, S.C. (some scholars hold the theory that the place of his birth was just across the border in Union county, N.C.), whither his parents had immigrated from Carrickfergus, Ireland, in 1765. Young Andrew was wild, quick tempered and independent, with little disposition to be studious. His few years of formal education were interrupted by the call for soldiers to resist the British invasion, an appeal most in keeping with his spirit. At the age of 13 he participated in the battle of Hanging Rock (Aug. 1, 1780) and in the following year he and his next older brother joined their neighbours in trying to capture a body of British troops at Waxhaw church. The attempt failed and the boys were taken prisoners. Upon refusing to black the officer's boots, Andrew received a sabre blow which left him marked for life and established within him a lifelong dislike for Great Britain. In 1784 he took up the study of law at Salisbury, N.C., was admitted to the bar there in 1787, and began to practise at Martinsville, Guilford county, N.C. In 1788, having been appointed prosecuting attorney of the western district of North Carolina (now the State of Tennessee), he removed to Nashville, the seat of justice of that district. In 1791 he married Mrs. Rachel Robards (*née* Donelson), having heard that her husband had obtained a divorce through the legislature of Virginia. The legislative act, however, had only authorized the court to determine whether or not there were sufficient grounds for a divorce and to grant or withhold it accordingly. It was more than two years before the divorce was actually granted, and only on the basis of the fact that Jackson and Mrs. Robards were then living together. On receiving this information, Jackson had the marriage ceremony performed a second time.

In 1796 Jackson assisted in framing the Constitution of Tennessee. From Dec. 1796 to March 1797 he represented that State in the Federal House of Representatives, where he distinguished himself as an irreconcilable opponent of President Washington. In 1797 he was elected a U.S. senator; but he resigned in the following year. He was judge of the supreme court of Tennessee from 1798 to 1804. In 1804–05 he contracted a friendship with Aaron Burr; and at the latter's trial in 1807 Jackson was one of his conspicuous champions. Up to the time of his nomination for the presidency, the biographer of Jackson finds nothing to record but military exploits in which he displayed perseverance, energy and skill of a very high order, and a succession of personal acts in which he showed himself violent, quarrelsome and astonishingly indiscreet. His combative disposition led him into numerous personal difficulties. In 1795 he fought a duel with Col. Waitstill Avery (1745–1821), an opposing counsel, over some angry words uttered in a court room; but both, it appears, intentionally, fired wild. In 1806 in another duel, after a long and bitter quarrel, he killed Charles Dickinson, and himself received a wound from which he never fully recovered. In 1813 he exchanged shots with Thomas Hart Benton and his brother Jesse in a Nashville tavern, and received a second wound. Jackson and Thomas H. Benton were later reconciled.

In 1813–14 he commanded in the campaign against the Creek Indians in Georgia and Alabama, defeated them (at Talladega, on Nov. 9, 1813, and at Tohopeka, on March 29, 1814), and thus first attracted public notice. In May 1814 he was commissioned as major-general in the regular army to serve against the British; in November he captured Pensacola, Fla., then owned by Spain, but used by the British as a base of operations; and on Jan. 8, 1815, he inflicted a severe defeat on the enemy before New Orleans. (*See* NEW ORLEANS, BATTLE OF.) During his stay in New Orleans he proclaimed martial law, and carried out his measures with unrelenting sternness, banishing from the town a judge who attempted resistance. When civil law was

restored, Jackson was fined $1,000 for contempt of court; in 1844 Congress ordered the fine with interest ($2,700) to be repaid. In 1818 Jackson received the command against the Seminoles. His conduct in following them up into the Spanish territory of Florida, in seizing Pensacola, and in arresting and executing two British subjects, Alexander Arbuthnot and Robert Ambrister, gave rise to much hostile comment in the cabinet and in Congress; but the negotiations for the purchase of Florida put an end to the diplomatic difficulty. In 1821 Jackson was military governor of the Territory of Florida, and there again he came into collision with the civil authority. From this, as from previous troubles, John Quincy Adams, then secretary of State, extricated him.

In July 1822 the general assembly of Tennessee nominated Jackson for president; and in 1823 he was elected to the U.S. Senate, from which he resigned in 1825. The rival candidates for the office of president in the campaign of 1824 were Jackson, John Quincy Adams, W. H. Crawford and Henry Clay. Jackson obtained the largest number of votes (99) in the electoral college (Adams receiving 84, Crawford 41 and Clay 37); but no one had an absolute majority, and it thus became the duty of the House of Representatives to choose one of the three highest candidates. At the election by the House (Feb. 9, 1825) Adams was chosen, receiving the votes of 13 States, while Jackson received the votes of 7 and Crawford the votes of 4. Jackson, however, was recognized by the abler politicians as the coming man. Martin Van Buren and others, going into opposition under his banner, waged from the first a relentless and factious war on the administration. Jackson, when told that he had been cheated in the matter of the presidency, became possessed with the idea that the people had been deprived of their choice by a conspiracy. The charge was freely made then and afterwards (though, it is now believed, without justification) that Clay had supported Adams and by influencing his followers in the House had been instrumental in securing his election, as the result of a bargain by which Adams had agreed to pay him for his support by appointing him secretary of State.

There was great significance in the election of Jackson in 1828. The frontiers of the nation had expanded well beyond the Alleghenies. A new generation was growing up under new economic and social conditions. They despised Old World traditions and ways as represented by Hamiltonian nationalism; and they accepted the Jeffersonian dogmas, not only as maxims, but as social forces—the causes of the material prosperity of the country. By this generation, therefore, Jackson, the first president from the New West, was recognized as a man after their own heart. They liked him because he was vigorous, brusque, uncouth, relentless, straightforward and open. They made him president in 1828, and he fulfilled all their expectations. He had 178 votes in the electoral college against 83 given for Adams. Though the work of redistribution of offices began almost at his inauguration, it is yet an incorrect account of the matter to say that Jackson corrupted the civil service. His administration is rather the date at which a system of democracy, organized by the use of patronage, was introduced into the Federal arena by Van Buren. It was at this time that the Democratic or Republican Party divided, largely along personal lines, into Jacksonian Democrats and National Republicans, the latter led by such men as Henry Clay and J. Q. Adams. The administration itself had two factions in it from the first, the faction of Van Buren, the secretary of State in 1829–31, and that of Calhoun, vice-president in 1829–32. The refusal of the wives of the cabinet and of Mrs. Calhoun to accord social recognition to Mrs. J. H. Eaton brought about a rupture, and in April 1831 the whole cabinet was reorganized. Van Buren, a widower, sided with the president in this affair and grew in his favour. Jackson in the meantime had learned that Calhoun, as secretary of War, had wished to censure him for his actions during the Seminole War in Florida in 1818, and henceforth he regarded the South Carolina statesman as his enemy. The relations between Jackson and his cabinet were unlike those existing under his predecessors. Having a military point of view, he was inclined to look upon the cabinet members as inferior officers, and when in need of advice he usually consulted a group of personal friends, who came to be called the "kitchen cabinet." The principal members of this clique were William B. Lewis, Amos Kendall, Isaac Hill and Duff Green, the last named being editor of the *United States Telegraph,* the organ of the administration.

In 1832 Jackson was re-elected by a large majority over Henry Clay, his chief opponent. The battle raged mainly around the re-charter of the Bank of the United States. It is probable that Jackson's advisers in 1828 had told him, though erroneously, that the bank had worked against him, and then were not able to control him. The first message of his first presidency had contained a severe reflection on the bank; and in the very height of this second campaign (July 1832) he vetoed the re-charter, which had been passed in the session of 1831–32. Jackson interpreted his re-election as an approval by the people of his war on the bank, and he pushed it with energy. In Sept. 1833 he ordered the public deposits in the bank to be transferred to selected local banks, and entered upon the "experiment" whether these could not act as fiscal agents for the Government, and whether the desire to get the deposits would not induce the local banks to adopt sound rules of currency. During the next session the Senate passed a resolution condemning his conduct. Jackson protested, and after a hard struggle, in which Jackson's friends were led by Senator Thomas Hart Benton, the resolution was ordered to be expunged from the record, on Jan. 16, 1837.

In 1832, when the State of South Carolina attempted to "nullify" the tariff laws, Jackson at once took steps to enforce the authority of the Federal Government, ordering two war vessels to Charleston and placing troops within convenient distance. He also issued a proclamation warning the people of South Carolina against the consequences of their conduct. In the troubles between Georgia and the Cherokee Indians, however, he took a different stand by refusing to enforce a decision of the Supreme Court favourable to the Indians. (*See* NULLIFICATION; GEORGIA: *History.*)

Jackson was very successful in collecting old claims against various European nations for spoliations inflicted under Napoleon's continental system, especially the French spoliation claims, with reference to which he acted with aggressiveness and firmness. Aiming at a currency to consist largely of specie, he caused the payment of these claims to be received and imported in specie as far as possible; and in 1836 he ordered land-agents to receive for land nothing but specie. About the same time a law passed Congress for distributing among the States some $35,000,000 balance belonging to the United States, the public debt having all been paid. The 80 banks of deposit in which it was lying had regarded this sum almost as a permanent loan, and had inflated credit on the basis of it. The necessary calling in of their loans in order to meet the drafts in favour of the States, combining with the breach of the overstrained credit between America and Europe and the decline in the price of cotton, brought about the "panic" of 1837 which prostrated the whole financial, industrial and commercial system of the country for six or seven years. The crash came just as Jackson was leaving office; the whole burden fell on his successor, Van Buren.

In the 18th century the influences at work in the American Colonies developed democratic notions. In fact, the circumstances were those which create equality of wealth and condition, as far as civilized men ever can be equal. The Revolutionary War was attended by a grand outburst of political dogmatism of the democratic type. A class of men were produced who believed in very broad dogmas of popular power and rights. There were a few rich men, but they were almost ashamed to differ from their neighbours and, in some known cases, they affected democracy in order to win popularity. After the 19th century began, the class of rich men rapidly increased. It was an industrial and commercial class greatly interested in the tariff, and deeply interested also in the then current form of issue banking. The Southern planters were rich but were agriculturists and remained philosophically Democrats. Jackson came upon the political stage when a wealthy class first existed and at a time when certain

political leaders were first expressing alarm at the increase of the "money power" as a growing peril to democracy. He was a man poor from birth, uneducated, a leader of the middle-class democracy, prejudiced and marked by strong personal feelings in all his beliefs and disbeliefs. Because of these qualities, the educated and moneyed classes of that day believed him not to be in the class from which a president should be chosen. This opposition caused him to believe that the Bank of the United States was leading the money power against him. In turn Jackson felt that he was the champion of the masses of democracy and the common people. The opposite party, led by Clay, Adams, Biddle and others, had schemes for banks and tariffs, enterprises which were open to criticism. Men like Thomas H. Benton, Edward Livingston, Amos Kendall and the Southern statesmen, found in these issues material for strong attacks on the Whigs. The great mass of voters felt the issue as Jackson's managers stated it. That meant that the masses recognized Jackson as their champion. Therefore, his personality and name became a power on the side opposed to banks, currency, corporations and other forms of the new growing power of capital.

That Jackson was a typical man of his generation is certain. He represented the spirit and temper of the free American of that day, and it was a part of his way of thinking and acting that he put his whole life and interest into the conflict. He accomplished several things of great importance in the history of the nation; he gave the common people an opportunity to participate in the government; his stand against South Carolina nullification crushed excessive State rights and established the contrary doctrine in fact and in the political orthodoxy of the Democrats; he destroyed the great bank. The way in which Jackson accomplished these things was such that it cost the country ten years of the severest liquidation, and left conflicting traditions of public policy in the Democratic Party. After he left Washington, Jackson disagreed with many of his most intimate old friends, and turned his interest to the cause of slavery, which he thought to be attacked and in danger.

Jackson is perhaps the only president of whom it may be said that he went out of office far more popular than he was when he entered. When he went into office he had no political opinions, only some popular notions. He left his party strong, perfectly organized and enthusiastic on a platform of low expenditure, payment of the debt, no expenditure for public improvement or for glory or display in any form and low taxes. His name still remained a spell to conjure with, and the politicians sought to obtain the assistance of his approval for their schemes; but in general his last years were quiet and uneventful. He died at his residence near Nashville, Tenn., on June 8, 1845.

BIBLIOGRAPHY.—The most authoritative biography of Jackson is that by J. S. Bassett (1911, rev. ed., 1916). Of the early biographies, that by J. H. Eaton (Philadelphia, 1824) is a history of Jackson's early military exploits, written for political purposes. Amos Kendall's *Life* (1843) is incomplete, extending only to 1814. James Parton's elaborate work (1860) is still useful. Parton prepared a shorter biography for the Great Commanders Series (1893), which emphasizes Jackson's military career. W. G. Sumner's *Andrew Jackson* in the American Statesmen Series (1882; rev., 1899) is a judicious work combining the leading facts of Jackson's life with a history of his times. W. G. Brown wrote an appreciative sketch (1900) for the Riverside Biographical Series. Other works are A. C. Buell, *History of Andrew Jackson* (1904), marred by numerous errors; A. C. Colyar, *The Life and Times of Andrew Jackson* (Nashville, 1904); E. O. Rowland, *Andrew Jackson's Campaign against the British* (1926). The history and politics of the period are treated in C. H. Peck, *The Jacksonian Epoch* (1899); Wm. MacDonald, *Jacksonian Democracy* (1907); F. A. Ogg, *The Reign of Andrew Jackson* (1919); C. G. Bowers, *The Party Battles of the Jackson Period* (1922). *See* also J. S. Bassett, ed., *Correspondence of Andrew Jackson* (1926–28) which are publications No. 371–373 of the Carnegie Institution of Washington.

JACKSON, CHARLES THOMAS (1805–1880), American geologist, was born in Plymouth, Mass., June 21, 1805. He graduated from Harvard in 1829 and studied for two years in Paris. He was appointed State geologist of Maine in 1836, of Rhode Island in 1839, and of New Hampshire in 1840. He surveyed the public lands in the Lake Superior region in 1847, where he discovered copper and iron. He established a laboratory in Boston in 1836 for research in analytical chemistry where, as early as 1842, he experimented with the anaesthetic qualities of sulphuric ether. He died in Somerville, Mass., Aug. 28, 1880. He wrote *The Final Report of Geology and Mineralogy for the State of New Hampshire* (1834), and *The Manual of Etherization* (1861).

For the part he played in the discovery of ether, *see* "Ether Discovery—A Consideration of the Claims made by W. T. G. Morton, Horace Wells and C. T. Jackson"—A Report before the 32nd Congress, 2nd ses., 1853.

JACKSON, CYRIL (1746–1819), dean of Christ Church, Oxford, was born in Yorkshire, and educated at Westminster and Oxford. From 1771 to 1776 he was sub-preceptor to the two eldest sons of George III. He then took holy orders, and after holding (1779–83) the preachership at Lincoln's Inn, became dean of Christ Church. In this position he showed a genius for government, and maintained a strict discipline. He had a large share in the framing of the "Public Examinations Statute" (1802) and always encouraged his pupils to compete for scholarships. In 1799 he refused the offer of the bishopric of Oxford, and in 1800 the primacy of Ireland, preferring to remain at his college, where many afterwards famous men studied under him, including Canning and Sir Robert Peel, whom he is reported to have advised to "work like a tiger." Jackson resigned his deanery in 1809, and retired to Felpham, near Bognor, where he died on Aug. 31, 1819.

JACKSON, FREDERICK GEORGE (1860–), British Arctic explorer, was educated at Denstone college and Edinburgh university. His first voyage in Arctic waters was on a whaling-cruise in 1886–87, and in 1893 he made a sledge-journey of 3,000 miles across the frozen *tundra* of Siberia between the Ob and the Pechora. On his return, he was given the command of the Jackson-Harmsworth Arctic expedition (1894–97), which was to explore Franz Josef Land. He received a knighthood of the first class of the Danish Royal Order of St. Olaf in 1898. He obtained the rank of Captain during the Boer War. He also travelled across the Australian deserts. During the World War he served in the East Surrey Regiment, and after being invalided home was for some time in command of the Southwark recruiting district. In 1919 he was in charge of Russian prison camps in Hanover and Westphalia.

He wrote *The Great Frozen Land* (1895), describing his first Arctic journey; and *A Thousand Days in the Arctic* (1899), describing the 1894–97 expedition, and many articles in scientific journals.

JACKSON, HELEN MARIA (1831–1885), American poet and novelist, who wrote under the initials "H. H." (Helen Hunt), was born in Amherst (Mass.) Oct. 18, 1831, the daughter of Prof. Nathan Welby Fiske. A girl of unusual versatility and vivacity, she was educated at the Ipswich Female Seminary and at a private school in New York. In Oct. 1852 she married Captain (afterwards Major) Edward Bissell Hunt (1822–63), of the U.S. corps of engineers. The sudden deaths of her husband and two sons within a period of about ten years caused her at first to feel that her life was ended, and then to turn to writing. In 1870 she published a little volume of meditative *Verses*, which was praised by Emerson in the preface to his *Parnassus* (1874). In 1875 she married William S. Jackson, a banker, of Colorado Springs.

Although she became a prolific writer of prose and verse, including juvenile tales, books of travel, household hints and novels, she is remembered primarily for her efforts on behalf of the red men. *A Century of Dishonor* (1881) was an arraignment of the treatment of the Indians by the United States, written after careful research in the Astor library. Later she was appointed special commissioner with Abbot Kinney to investigate the conditions and needs of the Mission Indians in California. Feeling that she had accomplished little, she conceived the idea of setting forth the evils in a novel, *Ramona* (1884). The injustices she portrayed did, as she intended, "move people's hearts." Nevertheless the book has been admired chiefly because of its romantic picture of the old patriarchal life in California. Mrs. Jackson died in San Francisco Aug. 12, 1885.

See "Helen Jackson ('H. H.')" in T. W. Higginson's *Contemporaries* (1899); G. W. James, *Through Ramona's Country* (1908); and C. C. Davis and W. A. Alderson, *The True Story of "Ramona"* (1914).

JACKSON, HENRY (1839–1921), English classical scholar, was born at Sheffield on March 12, 1839. He was educated at Cheltenham college and Trinity college, Cambridge, where he was elected fellow in 1864. From 1875 to 1906 he was praelector in ancient philosophy, acting virtually as an unofficial university reader in that subject and taking charge of candidates for that section of the second part of the classical tripos. He published an edition of Aristotle's *Ethics*, Book V. (1879), many papers dealing with ancient philosophy, and a book *About Edwin Drood* (1911). Probably his greatest contribution to learning was his study of Plato's "later theory of ideas" published in a series of articles in the *Journal of Philology*, in which he expounded a view that Plato continually reviewed the comparatively crude ideas of his earlier dialogues, and even after the *Republic* saw reason to criticise his own theories and alter them substantially.

But the personal qualities of the man counted far more than anything he published. He was a modern incarnation of the Platonic Socrates, with the same extraordinary gift of inducing his pupils to think out problems for themselves by questions apparently simple but leading to depths beyond the pupil's imagination. His sympathy, his untiring energy, and his readiness to help, invoked the love and admiration of generations of Cambridge men. As an administrator of university affairs and an educational reformer he took a prominent place and was actively concerned in the commission which dealt with Trinity college, Dublin. He was appointed Regius professor of Greek at Cambridge in 1906, and elected vice-master of Trinity college in 1914. His distinction was officially recognized in 1908 by the grant of the Order of Merit. He died at Bournemouth on Sept. 25, 1921.

See R. St. John Parry, *Henry Jackson* (1926).

JACKSON, JOHN HUGHLINGS (1834–1911), English neurologist, was born at Green Hammerton, Yorkshire. In 1862 he became physician to the London Hospital and to the National Hospital for the Paralysed and Epileptic. Jackson utilized the ophthalmoscope in diagnosing brain disease (1863), studied aphasia, described unilateral convulsions (Jacksonian epilepsy), and in the Croonian lectures for 1884 on the evolution and dissolution of the nervous system originated the doctrine of "levels" in the evolution of the nervous system. He did much to advance the notion of cerebral localization. A full list of his papers is given in the *London Hospital Gazette* for 1895. Jackson died on Oct. 7, 1911.

JACKSON, SIR THOMAS GRAHAM, BART. (1835–1924), English architect, was born in London on Dec. 21, 1835, the son of a solicitor, and educated at Oxford, where he became a fellow of Wadham. He worked in the office of Sir George Gilbert Scott for three years, but was not very deeply influenced by the Gothic tradition of Scott. Upon Oxford he has left an especial impress by his additions to Brasenose, Lincoln and Balliol. For Cambridge he designed important university buildings, including the Law library and school, the Archaeological museum, and the Physiological laboratories. Less bound there than at Oxford to the precedent of an existing design, his work, mostly of a late English Renaissance character, shows facility and invention. Jackson was architect to many great English schools. The interior of the chapel at Giggleswick school, Yorks., is an example of that treatment of colour—in marble and mosaic—upon which he relied so much as a complement to his architectural design. He was a member, and in 1896 master, of the Art Workers' Guild. Jackson made a special study of the architecture of Ragusa, Dalmatia, Istria and the Adriatic coast. The Dalmatians sought his help, as an authority on their traditional type of Romanesque building, in the restoration of the Campanile at Zara which he completed in 1882. He was elected A.R.A. in 1892, and R.A. in 1896, and was created a baronet in 1913. He was the author of several books on architectural subjects. He died on Nov. 7, 1924.

JACKSON, THOMAS JONATHAN (1824–1863), American general, commonly known as "Stonewall Jackson," was born at Clarksburg, Virginia (now West Virginia), on Jan. 21, 1824. His father died leaving his family almost penniless, and the son, called early to help in the support of his mother, had few opportunities for education, but by industry and application he obtained in 1842 a nomination to the United States military academy at West Point, from which in 1846 he received a commission as second-lieutenant of artillery. Joining his regiment in Mexico, with which country the United States was then at war, he served there with distinction and was, after a few years of peace service, appointed, in 1851, professor of artillery tactics and natural philosophy at the Virginia military institute. At this institution he remained for ten years until, in April 1861, on the outbreak of the Civil War, he offered his services to his State and was ordered to bring his cadets to Richmond.

Jackson was appointed colonel of Virginia volunteers and sent to command at Harper's Ferry, the northern outpost of the Shenandoah valley which was to be the scene of his most famous exploits. When, in July 1861, the first Federal invasion of Virginia began he was in command of the 1st Brigade of Johnston's force in the valley, which moved thence to unite on the field of Bull Run with Beauregard's command, in time to meet the advance of the Federal army under McDowell. The impetuosity of the first Federal attack brought some confusion into the Confederate ranks, and in a crisis of the battle a neighbouring brigadier, Gen. Bee, rode up to Jackson with the cry "General, they are beating us back." "Then, sir," came the quick reply, "we will give them the bayonet." Encouraged by this answer Bee galloped back to his men shouting, "Look, there is Jackson standing like a stone wall. Rally behind the Virginians." The Federal attack was utterly repulsed, the nickname Stonewall rang through Virginia and was thenceforth and forever attached to Jackson's name.

A long pause followed the first battle of Bull Run, while the North, aroused to the extent of its task, was preparing an adequate army. In the first months of 1862 that army under the command of McClellan was ready for action. Jackson was then in command of a small force in the Shenandoah valley. Unknown to the Confederates McClellan was preparing to move his main army by sea to the Yorktown peninsula, in order to attack the Confederate capital, Richmond. Some of the Federal troops in the valley were ordered to join McClellan for this movement, and Jackson, learning of these withdrawals, believed he could strike an effective blow at Winchester, and advanced with barely 3,000 men. He had been misinformed of the Federal strength, and was met on March 23, at Kernstown, with 7,000 men. He was repulsed, but his bold manoeuvre caused his strength to be exaggerated in Washington, and, a great part of McClellan's force being at sea, created a sense of alarm which greatly influenced future events.

In the third week of April McClellan had completed his landing and was opposed in the Yorktown peninsula by an army of less than half the Federal strength. Three other Federal armies were converging on Richmond, from the north and west, watched by Confederate detachments, each much weaker than its opponents. In this crisis Robert E. Lee, who had been called to Richmond to be chief military adviser to the Confederate president, saw that the only hope of saving Richmond lay in keeping the converging Federals at a distance, and it was to Jackson he turned. On April 21 he wrote suggesting he should unite the Confederate detachments to fall on Banks, who commanded the Federal forces in the valley. Jackson needed but a hint, but before Banks could be struck with safety it was necessary to check the advance of the Federal troops from the west, which would threaten Jackson's rear and communications. Therefore on May 8 he drove them back into the mountains of western Virginia, and turned with 17,000 on Banks, whose force, weakened by the withdrawals, was some 10,000 strong.

In mid-May McClellan was in sight of the spires of Richmond, and the general expectation in the North was that the war would soon be over. Suddenly, on May 23, Jackson, while feinting at Strasburg, advanced down the North Fork and overwhelmed Kenly. Banks retreating was caught up ten days later, defeated at Winchester, and driven back on the Potomac. At once there was alarm and confusion at Washington, the reinforcements to McClellan were stopped, and President Abraham Lincoln himself intervened to protect Washington and direct the

attempts to intercept Jackson. By rapid marching Jackson escaped to the southern end of the valley. Then striking right and left at his pursuers he drove back their advanced guards at Cross Keys on June 8, and at Port Republic next day. He left the valley having completely deranged the Federal campaign, for McClellan in front of Richmond being deprived of his expected reinforcements hesitated to attack. Thus Jackson's skill and courage had enabled 17,500 men to neutralize the action of 175,000.

BATTLES OF THE "SEVEN DAYS"

Meanwhile, on May 31 and June 1, Johnston had attacked McClellan in the battle of Fair Oaks (Seven Pines) and fell wounded, Lee succeeding to the command of the Confederate army in Virginia. Lee first openly reinforced Jackson with some 7,000 men from Richmond in order to create a fresh alarm of a Confederate advance on Washington, and then brought him by road and rail towards Richmond to envelop the right flank of McClellan's army. Thus, on June 26, began the battles of the "Seven Days." Jackson was late at his first rendezvous, and some of his movements during the battle, notably at White Oak Swamp on June 30, were slow. This apparent dilatoriness in one notorious for bold, quick and decisive movement has by many been ascribed to physical exhaustion, but it seems more probable that it was due to the fact that Jackson was without experience of handling in a great battle, in combination with other troops, so large a force as he then commanded, and was without an adequate and experienced staff.

Though the "Seven Days" did not bring all the results Lee hoped, McClellan was driven back to the James river, and Jackson was then dispatched by Lee to the Rapidan to make head against the Federal forces which, recovering from his previous blows, were now commanded by Gen. Pope. When McClellan's evacuation of the peninsula was well advanced Lee joined Jackson, and Pope fell back before them behind the Rappahannock. Lee now decided on a bold manoeuvre. Detaching Jackson with nearly half his force to move by a wide encircling movement upon Pope's rear, he followed with the remainder. Jackson came down upon Pope's advanced base at Manassas Junction, dispersing Federal detachments and destroying quantities of stores. This done he struck at a Federal column which moved along his front ignorant of his presence, and so, on Aug. 28, brought on the second battle of Bull Run, in which Pope was utterly defeated.

Lee then crossed the Potomac, invaded Maryland, and then detached Jackson to capture Harper's Ferry, which was held by a Federal garrison of 11,000 men. Beginning the attack on Sept. 13, Jackson compelled the place to surrender on Sept. 15, only to learn that McClellan, who had become aware of the division of Lee's forces, was advancing to attack the Confederates on the Antietam. By prompt movement Jackson reached the field in time to avert a disaster to the Confederate arms, and Lee having repulsed McClellan's attack was able to retire without molestation over the Potomac. The campaign ended with the Federals as far from Richmond as they had been at the beginning of the year, a result due to the military genius of two men, Lee and Jackson.

Jackson was now recognized as Lee's right arm. He was promoted lieutenant-general and given command of the 2nd Army Corps of the army of northern Virginia. In the winter of 1862 he, in command of that corps, awaited on the Rappahannock the next Federal move, which came on Dec. 13. Burnside, now in command of the army of the Potomac, attacked the Confederates at Fredericksburg. In that battle Jackson was in command of the Confederate right, where his task was easy. The injudicious attack was easily and severely repulsed.

It took the Federals some time to recover from the disaster of Fredericksburg, and it was not until April 1863 that Hooker, Burnside's successor, initiated the next campaign by an attempt to turn the Confederate position on the Rappahannock. Hooker had some 120,000 opposed to Lee's 60,000, and when his turning movement had been well advanced on May 1, he was confident of victory. Lee, leaving a detachment to oppose the Federals on the Rappahannock, moved his main body, including Jackson's corps, to meet Hooker's threatened envelopment, which was developing in the woods of Chancellorsville. On the night of May 1–2 Lee and Jackson planned one of the boldest strokes in the history of war. Whilst Lee kept barely 10,000 men to demonstrate against Hooker's front, he sent Jackson with his whole corps to move secretly round Hooker's right. The enveloper was to be enveloped. This manoeuvre was completely successful; on the evening of May 2, Jackson had his whole corps in position; and his attack rolled up the flank of the unsuspecting Federals. In the moment of victory Jackson, who had ridden forward to organize the pursuit, was shot down in the dusk by his own men, and mortally wounded. "I should have wished," wrote Lee to him, "for the good of the country to be disabled in your stead." The loss of Jackson was fatal to the Confederate cause. Never again was Lee, without one who at once grasped what was in his mind and executed brilliantly his plans, able to attempt those bold manoeuvres which had enabled victory to be won against greatly superior numbers. Jackson was a tactician and a leader of men of the first order. He was never called upon to command large forces independently, but his valley campaign remains a classic example of what a small force can achieve when led by a man who understands the value of resolution, secrecy and mobility in war. In the major operations he was the ideal lieutenant to one who was a real master of the art of war. (F. B. M.)

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JACKSON, WILLIAM (1730–1803), English musician, was born at Exeter on May 29, 1730. He published many works during his lifetime, the most famous of which were *Twelve Songs* (1755), which deserved their great popularity. But he is remembered only for his *Te Deum* (Jackson in F), which was a popular favourite in Church music for over a century. He died at Exeter, where he passed the greater part of his life, on July 5, 1803.

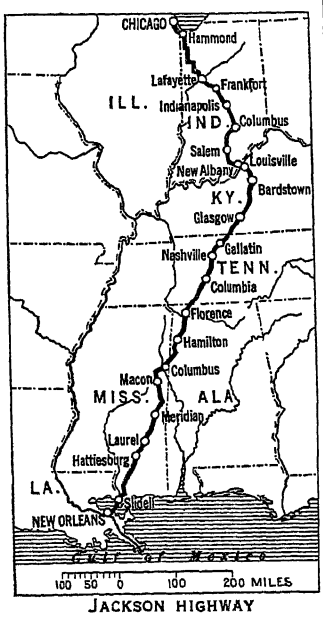
JACKSON, a city of Michigan, U.S.A., 75m. W. of Detroit, on the Grand river; county seat of Jackson county. It is on Federal highways 12 and 127; has a municipal airport of 166ac. (Reynolds field); and is served by the Cincinnati Northern, the Grand Trunk, the Michigan Central, and the New York Central railways, two electric railways, and motor coach and freight lines in every direction. The population was 48,374 in 1920 (87% native white) and was estimated by the census bureau at 63,700 in 1928. Jackson is in the heart of a beautiful and productive agricultural region. There are 40 lakes in the county, well stocked with fish, and the summer resorts are numerous. The county fair grounds and the Michigan State prison (established 1839) are within the city, and a short distance to the north are large State farms, operated largely by convict labour. The assessed valuation of property in 1927 was $84,877,353. Since 1915 the city has had a commission-manager form of government. Jackson has a large shipping and distributing trade. The Michigan Central has extensive shops here, and the city's manufactures are numerous and diversified, with an output in 1925 valued at $62,268,047. Bank clearings in 1926 amounted to $90,800,000. Among the 250 or more factories is one of the largest plants in the country making automobile and tractor wheels. The site of Jackson was a favourite camping-ground of the Indians, and it was visited as early as 1812 by two soldiers of Harrison's army corps. Permanent settlement began in 1829. A town was laid out in 1829, made the county seat, and named after Andrew Jackson, then President. For a few years it was called Jacksonburg. It was chartered as a city in 1857. "Under the oaks of Jackson," at a State convention on July 6, 1854, the Republican party was organized and named.

JACKSON, the capital city of Mississippi, U.S.A., on the west bank of the Pearl river, 45m. E. of Vicksburg; the county seat of Hinds county. It is on Federal highways 49, 51 and 80, has a municipal airport, and is served by the Gulf, Mobile and Northern, the Illinois Central, and the New Orleans Great Northern railways. The population was 22,817 in 1920 (43% negroes)

and was estimated locally at 43,500 in 1928. The city has a large trade in cotton and other agricultural products, and its manufacturing industries (including cotton-seed oil mills, iron foundries, woodworking plants and a variety of others) had an output in 1925 valued at $9,681,740. The State capitol, finished in 1903, is a fine building. In the old capitol (built in 1839) Jefferson Davis made his last speech (1884), and it was the scene of the secession convention (1861) and of the "Black and Tan Convention" (1868). Jackson is the seat of the State penitentiary, the State hospital for the insane, and the State institutions for the deaf and the blind; of Millsaps college (Methodist Episcopal, 1890) and Belhaven college (Presbyterian, 1894). In 1821 the site was designated as the seat of the State Government, and in 1822 the town was laid out and named after Andrew Jackson. It was chartered as a city in 1840. During the Civil War it was in the theatre of active campaigning. On May 14, 1863, the Confederates, under Johnston, were driven out by Sherman and McPherson. After the fall of Vicksburg, Johnston concentrated his forces here, where he was attacked by Sherman on July 9. Sherman's army entered the city on July 17, 1863, and remained five days, burning a large part of it. In the decade 1900–10 the population of the city increased from 7,816 to 21,262. A commission form of government was adopted in 1912.

JACKSON, a city of southern Ohio, U.S.A., about 70m. S.E. of Columbus; the county seat of Jackson county. It is served by the Baltimore and Ohio, the Detroit, Toledo and Ironton, and the Hocking Valley railways. The population in 1920 was 5,842 (97% native white) and was estimated locally at 7,000 in 1928. Jackson is in the heart of the natural gas belt and is surrounded by a coal and iron mining region. It has iron furnaces, foundry and machine shops, railroad shops and several other manufacturing industries. The city was founded about 1817 and incorporated in 1847.

JACKSON, a city of western Tennessee, U.S.A., on the Forked Deer river, 85m. N.E. of Memphis; the county seat of Madison county. It is on Federal highway 70, and is served by the Gulf, Mobile and Northern, the Illinois Central, the Mobile and Ohio, and the Nashville, Chattanooga and St. Louis railways. The population was 18,860 in 1920 (33% negroes) and was estimated locally at 25,000 in 1928. Jackson has a large wholesale trade; is a shipping point for cotton (of which 21,360 bales were ginned in the county in 1926), corn, fruits and other agricultural products, and has railroad repair shops and numerous other manufacturing industries, with an output in 1925 valued at $7,012,544. It is the seat of Union university; a State agricultural experiment station; and Lane college for negroes, founded in 1880 by the Colored Methodist Episcopal Church, which was organized in Jackson and has its publishing offices here. Jackson was settled about 1820, incorporated as a town in 1823, chartered as a city in 1854 and in 1907 adopted a new charter establishing local prohibition. In 1862, after Gen. Grant's advance into Tennessee, it became an important base of operations for the Federal army, and from October of that year was Grant's headquarters.



JACKSON HIGHWAY

JACKSON HIGHWAY, an American thoroughfare beginning at Chicago, Ill., and ending at New Orleans, La. It is 1,060 m. in length and is mostly paved from Chicago to Florence, Tenn., where it crosses the Tennessee river at Muscle Shoals, the site of the great dam of that name. It passes Indianapolis, Nashville, Columbus, Macon, Meridian, Hattiesburg and Slidell and enters New Orleans over the concrete bridge at Lake Pontchartrain.

JACKSONVILLE, a city of north-eastern Florida, U.S.A., on the St. John's river, 27m. above the Government jetties at the mouth; a port of entry and the county seat of Duval county. It is on Federal highways 1, 17 and 90; has a fully equipped municipal airport, and is served by the Atlantic Coast Line, the Florida East Coast, the Seaboard Air Line, the Southern and the Jacksonville Terminal railways, and by seven coastwise steamship lines and four operating to foreign ports. The population in 1925 (State census) was 135,886, of whom 50,335 were negroes, and was estimated locally at 145,000 in 1928. Jacksonville is an attractive city, in a charming setting of thickly wooded country and romantic river scenery. It is an important commercial centre. The commerce of the port in 1927 amounted to 4,608,882 tons, valued at $778,481,803. Exports to foreign countries (chiefly naval stores and lumber) accounted for $18,068,446; imports (chiefly coffee, crude oil, gasolene [petrol] and chemicals) for $27,186,578; but the bulk of the traffic consists of domestic receipts and shipments, among which oils, automobiles, canned foods, lumber, naval stores and oranges are conspicuous. The city has a large wholesale and jobbing trade. Its manufacturing industries are many (472 in 1928) and varied, with an output in 1927 valued at $142,000,000. The assessed valuation of property was $99,004,820. The first settlement was made in 1816. A town was laid out in 1822 and named after Andrew Jackson, and in 1832 it was incorporated. During the Civil War Jacksonville was thrice occupied by Federal troops. In 1888 there was an epidemic of yellow fever; and on May 3, 1901, 150 blocks, nearly the whole of the business section, were destroyed by fire, involving a loss of over $15,000,000. In 1850 the population was 1,045, and by 1880 it had reached only 7,650; but between 1880 and 1900 it increased 272%, and in the next 20 years 222%.

JACKSONVILLE, one of the oldest and most beautiful cities of Illinois, U.S.A., on Mauvaiseterre creek, 90m. N. of Saint Louis; the county seat of Morgan county. It is on Federal highway 36, and is served by the Burlington, the Chicago and Alton, the Jacksonville and Havana, and the Wabash railways. The population was 15,713 in 1920 (86% native white), and was estimated locally at 18,000 in 1928. The distinctive manufactures are Ferris wheels and steel bridges. There are also railroad shops, woollen and planing mills and other factories. The aggregate output in 1925 was valued at $7,039,464. Jacksonville is the seat of Illinois college (Presbyterian), founded in 1829 through the efforts of the Rev. John Millot Ellis (1793–1855), of the American Home Missionary Society, and of the "Yale Band," seven young graduates of Yale who were devoting themselves to promoting higher education in the growing West; the Illinois Women's college (Methodist Episcopal) chartered in 1847; a State hospital for the insane, opened in 1851; the State school for the deaf (established in 1839, opened 1845), the first charitable institution of the State; and the State school for the blind (1849). Jacksonville was laid out as the county seat in 1825, and named after Andrew Jackson. It was chartered as a city in 1867.

JACOB was the son of Isaac and Rebecca, the grandson of Abraham, and the traditional ancestor of the people of Israel. He is represented as the twin brother of Esau, the ancestor of Edom, and the two are representatives of two grades of social order, Jacob being a pastoral nomad, and Esau the typical Bedawin hunter and raider. Whilst Esau is actually the elder, Jacob by a double artifice (Gen. xxv. 28–34 and xxvii.) obtains the rights and privileges of seniority. He then goes to the Aramaean tribe from which his ancestry had sprung, and on the way receives a special revelation from God at Bethel. He marries two of his cousins, Leah and Rachel, and after serving Laban seven years for each of them, and an additional six years during which he amasses a large property in small cattle, he returns to Palestine. He receives a second revelation at Peniel, meets and is reconciled to Esau, and settles in Canaan. Twelve sons are born to him, six by Leah, and two each by Rachel and the female slaves of his wives. The story of his later years belongs rather to the life of Joseph, and it was as a result of the latter's success in Egypt that Jacob and his sons migrated thither in time of famine and took up their residence on the north-eastern border

—the land of Goshen. Here Jacob ultimately died and was buried in Palestine.

These narratives are full of much valuable evidence regarding marriage customs, pastoral life and duties, popular beliefs and traditions, and are evidently typical of what was currently retailed. Their historical value has been variously estimated. The *name* existed long before the traditional date of Jacob, and the Egyptian phonetic equivalent of Jacob-el (*cf.* Isra-el, Ishma-el) appears to be the name of a district of central Palestine (or possibly east of Jordan) about 1500 B.C. But the stories in their present form are very much later. The close relation between Jacob and Aramaeans confirms the view that some of the tribes of Israel were partly of Aramaean origin; his entrance into Palestine from beyond the Jordan is parallel to Joshua's invasion at the head of the Israelites; and his previous journey from the south finds independent support in traditions of another distinct movement from this quarter. Consequently, it would appear that these extremely elevated and richly developed narratives of Jacob-Israel embody, among a number of other features, a recollection of two distinct traditions of migration which became fused among the Israelites. *See* further GENESIS; JEWS.

(S. A. C.; T. H. R.)

JACOB, JOHN (1812–1858), Indian soldier and administrator, born on Jan. 11, 1812, was educated at Addiscombe, and entered the Bombay artillery in 1828. As commandant of the Sind Horse and political superintendent of Upper Sind he imposed peace on the Sind frontier, reducing the tribes as much by his commanding personality as by his military measures. In 1853 he warned the government of India of the danger which came to a head in the Indian Mutiny; but he was only rebuked by Lord Dalhousie for his pains. He died of brain fever, brought on by excessive heat and overwork. The town of Jacobabad is named after him.

See A. I. Shand, *General John Jacob* (1900).

JACOBA or **JACQUELINE** (1401–1436), countess of Holland, was the only daughter and heiress of William, duke of Bavaria and count of Holland, Zeeland and Hainaut. She was married as a child to John, duke of Touraine, second son of Charles VI., king of France, who on the death of his elder brother Louis became dauphin. John of Touraine died in April 1417, and two months afterwards Jacoba lost her father. Acknowledged as sovereign in Holland and Zeeland, Jacoba was opposed by her uncle John of Bavaria, bishop of Liége. She had the support of the Hook faction in Holland. Meanwhile she had been married in 1418 by her uncle, John the Fearless, duke of Burgundy, to her cousin John IV., duke of Brabant. By the mediation of John the Fearless, a treaty of partition was concluded in 1419 between Jacoba and John of Bavaria; but it was merely a truce, and the contest between uncle and niece soon began again and continued with varying success.

In 1420 Jacoba fled to England; and there, declaring that her marriage with John of Brabant was illegal, she contracted a marriage with Humphrey, duke of Gloucester, in 1422. Two years later Jacoba, with Humphrey, invaded Holland, where she was now opposed by her former husband, John of Brabant, John of Bavaria having died of poison. In 1425 Humphrey deserted his wife, who sought refuge with her cousin, Philip V., duke of Burgundy, to whom she had to submit, and she was imprisoned in the castle of Ghent. John of Brabant now mortgaged the two counties of Holland and Zeeland to Philip, who assumed their protectorate. Jacoba, however, escaped from prison in disguise, and for three years struggled gallantly to maintain herself in Holland against the united efforts of Philip of Burgundy and John of Brabant, and met at first with success. The death of the weak John of Brabant (April 1427) freed the countess from her quondam husband; but nevertheless the pope pronounced Jacoba's marriage with Humphrey illegal, and Philip, putting out his full strength, broke down all opposition.

By a treaty, made in July 1428, Jacoba was left nominally countess, but Philip was to administer the government of Holland, Zeeland and Hainaut, and was declared heir in case Jacoba should die without children. Two years later Philip mortgaged Holland and Zeeland to the Borselen family, of which Francis, lord of Borselen, was the head. Jacoba now made her last effort. In 1432 she secretly married Francis of Borselen, and endeavoured to foment a rising in Holland against the Burgundian rule. Philip invaded the country, however, and threw Borselen into prison. Only on condition that Jacoba abdicated her three countships in his favour would he allow her liberty and recognize her marriage with Borselen. She submitted in April 1432, retained her title of duchess in Bavaria, and lived on her husband's estates in retirement. She died on Oct. 6, 1436, leaving no children.

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(G. E.)

JACOBABAD, a town of British India, the administrative headquarters of the Upper Sind frontier district in Bombay with a station on the Quetta branch of the North-western railway, 37 m. from the junction at Ruk, on the main line. Pop. (1921), 10,583. It is famous as having consistently the highest temperature in India. During the month of June the thermometer ranges between 120° and 127° F. The town was founded on the site of the village of Khanghar in 1847 by General John Jacob, for many years commandant of the Sind Horse, who died here in 1858. The town is the centre of a thriving grain trade and a headquarters of caravans from Central Asia. It is watered by two canals. An annual horse show is held in January.

JACOB BEN ASHER (1280–1340), codifier of Jewish law, was born in Germany and died in Toledo. A son of Asher ben Yeḥiel (*q.v.*), Jacob helped to restore the legal casuistry overthrown by Maimonides (*q.v.*). Jacob ben Asher is known as the Ba'al ha-ṭurim (literally "Master of the Rows") from his chief work, the four *Ṭurim* or Rows (the title is derived from the four *Ṭurim* or rows of jewels in the High Priest's breastplate).

See Graetz, *History of the Jews* (Eng. trans.), vol. iv. ch. iii.; Weiss, *Dor dor we-dorashav*, v. 118–123.

JACOBEAN STYLE, in architecture, that style of early English Renaissance (*see* RENAISSANCE ARCHITECTURE) which followed the Elizabethan (*see* ELIZABETHAN STYLE) and is generally contemporary with the reign of James I. (1603–1625). It is characterized by a combination of late Perpendicular Gothic motives with a great use of crude and misunderstood classic detail, in which the influence of Flanders is strong. The Tudor pointed arch is common and in interior work there is considerable simple, Tudor panelling and an occasional use of perpendicular vaulting forms. Doorways, fireplaces and the like, are usually framed with classic forms, and both outside and in, there is a wide use of gaines (*q.v.*), pilasters, S-scrolls and that type of pierced, flat ornament known as strap work. This style, despite its name, is found over a longer period of time than the strict limits above stated, thus Wollaton Hall, Nottinghamshire (1580) can rightly be termed Jacobean, and traces of the same style are found in the colleges of Oxford and Cambridge up to the beginning of the 18th century.

JACOBI, ABRAHAM (1830–1919), German-American physician, was born at Hartum, Westphalia (Germany), on May 6, 1830, and educated at the Gymnasium of Minden and the Universities of Griefswald, Göttingen and Bonn (M.D., 1851). Because he participated in the German revolutionary movement he was imprisoned, 1851–53, in Berlin and Cologne for "high treason." Upon his release he came to the United States and began practice in New York city. In 1860 he became professor of children's diseases at the New York Medical college, holding the first chair in the subject founded in the United States. From 1865–70 he was professor of children's diseases in the medical department of New York university, and from 1870 to 1903 in the College of Physicians and Surgeons of Columbia university, becoming professor emeritus in 1903. He was physician to the German hospital, beginning in 1857, to Mount Sinai, 1860–83, to Bellevue Babies Orthopaedic, beginning 1874, to Roosevelt hospital, beginning 1898, and consulting physician to many others and to the New York city department of health. He established the first special clinic for diseases of children in the country in

New York city in 1862 and later established many others. He taught and wrote on his specialty for more than half a century, is ranked among the foremost authorities on the diseases of children, and is considered the founder of pediatrics in America. He died at Bolton Landing, N.Y., on July 10, 1919.

His more important books were *Dentition and Its Derangements* (1862); *Infant Diet* (1872); *The Value of Life* (1879); Cold Pack and Anaemia (1880); *Treatise on Diptheria* (1880); *Intestinal Diseases of Infancy and Childhood* (1887); *Pathology of the Thymus Gland* (1889); *Therapeutics of Infancy and Childhood* (1896). His many scientific articles, miscellaneous writings and addresses are found in the eight volumes of *Collectanea Jacobi*, W. G. Robinson, ed. (1909).

See F. H. Garrison, "Abraham Jacobi," *Annals of Medical History*, vol. ii. (1919).

JACOBI, FRIEDRICH HEINRICH (1743–1819), German philosopher, was born at Düsseldorf on Jan. 25, 1743. He was educated at Geneva for a commercial career, but in 1770 gave up the management of his father's business, and became a member of the council for the duchies of Jülich and Berg, where he distinguished himself by his ability in financial affairs, and his zeal in social reform. Jacobi's interest in literary and philosophic matters led him to found with C. M. Wieland a new literary journal, *Der Teutsche Mercur*, in which some of his early economic essays were published. Here too appeared in part his *Edward Allwills Briefsammlung* (1776), a combination of romance and speculation. This was followed in 1779 by *Woldemar*, a philosophic novel. A conversation with Lessing in 1780, in which Lessing avowed that he knew no philosophy, save Spinozism, led him to study Spinoza's works. This resulted in his *Briefe über die Lehre Spinozas* (1785; 2nd ed., 1789) in which he strenuously objected to Spinoza's method of demonstration in Philosophy, and drew upon himself the enmity of the Berlin clique, led by Moses Mendelssohn. In his work, *David Hume über den Glauben, oder Idealismus und Realismus* (1787), Jacobi identified faith or belief with the immediacy of experience, and critically examined the subjective idealism of Kant.

On the outbreak of the war with France he moved to Holstein, and in 1801 published his important *Über das Unternehmen des Kriticismus, die Vernunft zu Verstande zu bringen.* During the same period the accusation of atheism brought against Fichte at Jena led to the publication of Jacobi's *Letter to Fichte* (1799), in which he made more precise the relation of his own philosophic principles to theology, and set forth his efforts to establish theism. Jacobi received a call to Munich in connection with the new academy of sciences in 1804, and from 1807 to 1812 was president of the academy. In 1811 appeared his last philosophic work, *Von den göttlichen Dingen*, directed against Schelling. Jacobi died on March 10, 1819.

The philosophy of Jacobi is an attempt to define the spheres of reason and of faith. For him, reason is purely elaborative, its results never transcending the material supplied to it by the senses. But besides the things of the senses spiritual things are involved in our experience, and to these the exact method of scientific understanding cannot be applied without ending, as Spinoza does, in atheism and fatalism. Spiritual things are known only in an immediacy of experience; even God is found by finding ourselves in Him, and certainly, freedom as self-activity can be apprehended only by intuition. This appreciation of the richness of experience made Jacobi one of the chief champions of the *Gefühlsphilosophie* movement.

The best introduction to Jacobi's philosophy is the preface to vol. 2 of the *Works*, 6 vols. Leipzig (1812–20), and Appendix 7 to the *Letters on Spinoza's Theory*. Jacobi's *Auserlesener Briefwechsel* has been edited by F. Roth in 2 vols. (1825–27). *See* also J. Kuhn, *Jacobi und die Philosophie seiner Zeit* (1834); F. Deycks, *F. H. Jacobi im Verhältnis zu seinen Zeitgenossen* (1848); H. Düntzer, *Freundesbilder aus Goethes Leben* (1853); E. Zirngiebl, *F. H. Jacobis Leben, Dichten, und Denken* (1867); F. Harms, *Über die Lehre von F. H. Jacobi* (1876); L. Lévy-Bruhl, *La Philosophie de Jacobi* (1894), and H. W. Crawford, *The Philosophy of Jacobi* (New York, 1905).

JACOBI, JOHANN GEORG (1740–1814), German poet, elder brother of F. H. Jacobi (*q.v.*), was born at Düsseldorf on Sept. 2, 1740. He was professor of philosophy at Halle (1766–69), then, through the influence of his friend Gleim, prebendary at Halberstadt (1769–74), editor of the *Iris* at Düsseldorf (1774–76), and professor of literature at Freiburg-im-Breisgau (1784–1814). He died at Freiburg on Jan. 4, 1814. He wrote many charming lyrics and sonnets. In addition to the earlier *Iris*, to which Goethe, his brother F. H. Jacobi, Gleim and other poets contributed, he published from 1803–13, another periodical, also called *Iris*, in which Klopstock, Herder, Jean Paul, Voss and the brothers Stolberg also collaborated.

Jacobi's *Sämtliche Werke* were published in 1774 (Halberstadt, 3 vols.). Other editions appeared at Zürich in 1807–13 and 1825. See *Ungedruckte Briefe von und an Johann Georg Jacobi* (Strassburg, 1874); Longo, *Laurence Sterne und Johann Georg Jacobi* (Vienna, 1898).

JACOBI, KARL GUSTAV JACOB (1804–1851), German mathematician, was born at Potsdam, of Jewish parentage, on Dec. 10, 1904. He studied at Berlin University, where he obtained the degree of doctor of philosophy in 1825, his thesis being an analytical discussion of the theory of fractions. In 1827 he became extraordinary and in 1827 ordinary professor of mathematics at Königsberg, and this chair he filled until 1842. He investigated elliptic functions and produced in 1829 his important treatise *Fundamenta nova theoriae functionum ellipticarum*. He also made notable researches on differential equations, and applied his analysis to various dynamical problems. He introduced the theory of the last multiplier, which is fully treated in his *Vorlesungen über Dynamik*, edited by R. F. A. Clebsch (Berlin, 1866). Jacobi advanced the theory of configurations of rotating liquid masses by showing that the ellipsoids which are now known as Jacobi's ellipsoids should be figures of equilibrium. He was one of the early founders of the theory of determinants, and he invented the functional determinant formed of the n^2 differential coefficients of n given functions of n independent variables, which now bears his name (Jacobian), and which has played an important part in many analytical investigations (*see* ALGEBRAIC FORMS). Valuable also are his papers on Abelian transcendents, and his investigations in the theory of numbers, which supplement the labours of Gauss. He left a vast store of manuscript, portions of which have been published at intervals in Grelle's Journal. He died in Berlin on Feb. 18, 1851.

His *Gesammelte Werke* were published by the Berlin Academy (1881–91). *See* Königsberger, *Karl Gustav Jacob Jacobi* (1904).

JACOBI, MARY PUTNAM (1842–1906), American pioneer woman physician and wife of Abraham Jacobi (*q.v.*), was born at London, England, on Aug. 31, 1842, the daughter of George P. Putnam, American publisher. She was educated at home, studied anatomy with a private instructor, and gained admission, as its first woman student, to the New York College of Pharmacy, at which she graduated in 1862. She then attended the Women's Medical college in Philadelphia and was admitted to practice in 1864. After a year she went to Paris and studied in hospitals for 18 months before she gained entrance to the École de Médicine, as its first woman student, the influence of the Minister of Education being necessary to persuade the school to break its precedent. She graduated with the highest honours of her class. On returning to New York city she entered practice and also lectured on therapeutics at the newly established Medical College for Women of the New York infirmary. When the post-graduate school was founded in 1881 she became professor of children's diseases. She attained note as a writer on medical topics and gave many addresses before learned societies. She died in New York city, on June 10, 1906.

Her chief publications were: *The Question of Rest for Women during Menstruation* (1877); *Hysteria and Other Essays* (1880); *Prophylaxis of Insanity* (1881); *Physiological Notes on Primary Education* (1889); *Common Sense Applied to Woman Suffrage* (1894); *Stories and Sketches* (1907). See *Life and Letters of Mary Putnam Jacobi*, Ruth Putnam, ed. (1925), which also contains a bibliography of her publications.

JACOBINS, THE, the most famous of the political clubs of the French Revolution. It originated in the Club Breton, established at Versailles shortly after the opening of the States General in 1789. At first composed of deputies from Brittany, it was soon joined by others from various parts of France, among its early members being Mirabeau and Robespierre. After Oct. 6 the club followed the National Assembly to Paris, where it rented the refec-

tory of the monastery of the Jacobins in the Rue St. Honoré, near the seat of the Assembly. The name "Jacobins," given in France to the Dominicans, because their first house in Paris was in the Rue St. Jacques, was first applied to the club in ridicule. The title assumed by the club itself, after the promulgation of the constitution of 1791, was *Société des amis de la constitution séants aux Jacobins à Paris,* which was changed on Sept. 21, 1792, after the fall of the monarchy, to *Société des Jacobins, amis de la liberté et de l'égalité.*

Once transferred to Paris, the club underwent rapid modifications. The first step was the admission as members or associates of others besides deputies. On Feb. 8, 1790, the society was formally constituted by the adoption of the rules drawn up by Barnave. The objects of the club were defined as (1) to discuss in advance questions to be decided by the National Assembly; (2) to work for the establishment and strengthening of the constitution; (3) to correspond with other societies of the same kind. The club was to have a president, elected every month, four secretaries, a treasurer and committees elected to superintend the correspondence and the administration of the club's affairs.

Any member who showed that his principles were contrary to the constitution and the rights of man was to be expelled, a rule which later on facilitated the "purification" of the society by the expulsion of its more moderate elements. The 7th article provided for the admission of other similar societies as associates.

This last provision was of far-reaching importance. By Aug. 10, 1790 there were already one hundred and fifty-two affiliated clubs, and at the close of 1791 the Jacobins had a network of branches all over France. It was this widespread yet highly centralized organization that gave to the Jacobin Club its formidable power.

At the outset the Jacobin Club was not distinguished by extreme political views. The high subscription confined its membership tp men of substance, and to the last the central society in Paris was composed almost entirely of professional men, such as Robespierre, or well-to-do *bourgeois,* like Santerre. Other elements, however, were present. Besides Louis Philippe, duc de Chartres (afterwards king of the French), liberal aristocrats of the type of the duc d'Aiguillon, and the *bourgeois* who formed the mass of the members, the club contained such figures as "Père" Michel Gérard, a peasant proprietor from Brittany, whose rough common sense was admired as the oracle of popular wisdom, and whose countryman's waistcoat and plaited hair were to become the model for the Jacobin fashion. The provincial branches, although more democratic, were usually led by members of the middle classes. The club took no official part in the insurrections of June 20 and Aug. 10, 1792, and only formally recognized the republic on Sept. 21. But the character and extent of its influence cannot be gauged by its official acts alone, and long before it emerged as the principal focus of the Terror, its character had been profoundly changed by the secessions of its more moderate elements, some to found the Club of 1789, some in 1791 to found the club of the Feuillants scoffed at by their former friends as the *club monarchique.*

From the date of the admission of the general public to its sittings (Oct. 14, 1791), the constituency to which the club was responsible, and from which it derived its power, was the Paris mob; the *sans-culottes*—decayed lackeys, cosmopolitan ne'er-do-weels and starving workpeople—who crowded its tribunes. To this audience, and not primarily to the members of the club, the speeches of the orators were addressed and by its verdict they were judged. As the chaos in the body politic grew, and with it the appalling material misery, the mob, no longer satisfied with the platitudes of the *philosophes,* began to clamour for the blood of the "traitors" in office by whose corrupt machinations the millennium was delayed, and only those orators were listened to who pandered to its suspicions. Hence the elimination of the moderate elements from the club; hence the ascendancy of Marat, and finally of Robespierre, the secret of whose power was that they really shared the suspicions of the populace, to which they gave a voice and which they did not shrink from translating into action. After the fall of the monarchy Robespierre was in effect the Jacobin Club; for to the tribunes he was the oracle of political wisdom, and by his standard all others were judged.[1] With his fall the Jacobins too came to an end.

SECRET OF THEIR STRENGTH

Not the least singular thing about the Jacobins is the slender material basis on which their power rested. France groaned under their tyranny: yet it was reckoned by competent observers that, at the height of the Terror, the Jacobins could not command a force of more than 3,000 men in Paris. The secret of their strength was this: in the midst of the general disorganization, they alone were organized. The Girondin government was urged to meet organization by organization, force by force; and it is clear from the daily reports of the police agents that even a moderate display of energy would have saved the National Convention from the humiliation of being dominated by a club, and the French Revolution from the blot of the Terror. But the Girondins were too convinced of the ultimate triumph of their own persuasive eloquence, to act. In the session of April 30, 1793 a proposal was made to move the Convention to Versailles out of reach of the Jacobins, but the motion was not carried, and the Girondins remained to become the victims of the Jacobins.

The Jacobin Club was closed after the fall of Robespierre on the 9th of Thermidor of the year III., and some of its members were executed. An attempt was made to re-open the club, which was joined by many of the enemies of the Thermidorians, but on the 21st of Brumaire, year III. (Nov. 11, 1794), it was definitely closed. Its members and their sympathizers were scattered among the cafés, where a ruthless war of sticks and chairs was waged against them by the young "aristocrats" known as the *jeunesse dorée.* Nevertheless the "Jacobins" survived, in a somewhat subterranean fashion, emerging again in the club of the Panthéon, founded on Nov. 25, 1795, and suppressed in the following February (*see* BABEUF; FRANÇOIS NOEL). The last attempt to reorganize them was the foundation of the *Réunion d'amis de l'égalité et de la liberté,* in July 1799, which had its headquarters in the *Salle du Manège* of the Tuileries, and was thus known as the *Club du Manège.* It was patronized by Barras, and some two hundred and fifty members of the two councils of the legislature were enrolled as members, including many notable ex-Jacobins. But public opinion was now preponderatingly moderate or royalist, and the club was violently attacked. It was suppressed in August, after barely a month's existence. Its members revenged themselves on the Directory by supporting Napoleon Bonaparte.

Long before the suppression of the Jacobin Club the name of "Jacobins" had been popularly applied to all promulgators of extreme revolutionary opinions. In this sense the word passed beyond the borders of France and long survived the Revolution. Canning's paper, *The Anti-Jacobin,* directed against the English Radicals, consecrated its use in England; and in the correspondence of Metternich and other leaders of the repressive policy which followed the second fall of Napoleon, "Jacobin" is the term commonly applied to anyone with Liberal tendencies, not excepting the emperor Alexander I. of Russia.

See F. A. Aulard, *La société des Jacobins, Recueil de documents* (1889, etc.), where a critical bibliography will be found. This collection does not contain all the printed sources—notably the official Journal of the Club is omitted—but these sources, when not included, are indicated. The documents published are furnished with valuable explanatory notes. *See* also W. A. Schmidt, *Tableaux de la révolution française* (Leipzig, 1867–70), notably for the reports of the secret police, which throw much light on the actual working of the Jacobin propaganda, and Albert Mathiez, *Études robespierrstes* and other works. (W. A. P.)

JACOBITE CHURCH. The name of "Jacobites" is first found in a synodal decree of Nicaea A.D. 787, and was invented by hostile Greeks for the Syrian monophysite Church as founded, or rather restored, by Jacob or James Baradaeus, who was ordained its bishop A.D. 541 or 543. James was born a little before A.D. 500

[1] In the published reports only the speeches of members are given, not the interruptions from the tribunes. But see the report (May 18, 1793) of Dutard to Garat on a meeting of the Jacobins (Schmidt, *Tableaux* ii. 242).

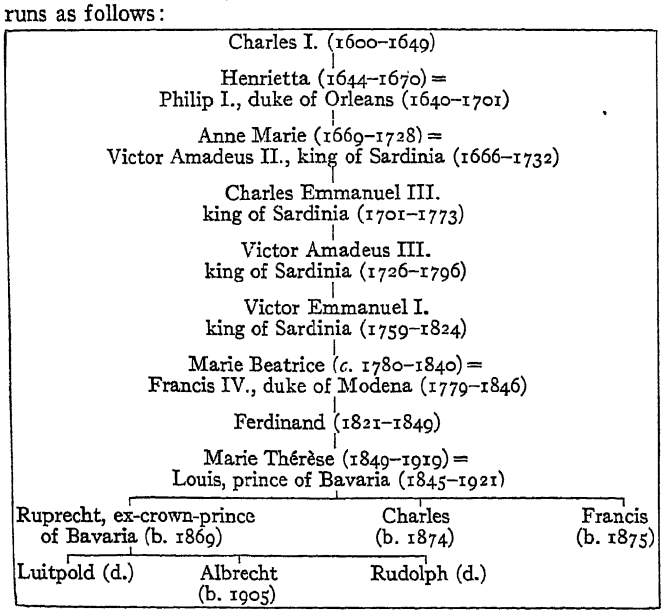
at Tella or Tela, 55 m. east of Edessa, of a priestly family, and entered the convent of Phesilta on Mount Isla. About 528 he went with a fellow-monk Sergius to Constantinople to plead the cause of his co-religionists with the empress Theodora, and lived there fifteen years. Justinian during those years imprisoned, deprived or exiled most of the monophysite clergy of Syria, Mesopotamia, Cilicia, Cappadocia, and the adjacent regions. Once ordained bishop of Edessa, with the connivance of Theodora, James, disguised as a ragged beggar, traversed these regions preaching, and ordained many thousands of clergy. He died in 578. In the middle ages there were 150 Jacobite archbishops and bishops under a patriarch, but in 1842, the Jacobites in all Turkey had dwindled to about 100,000 souls.

See A. J. Maclean, art. "Syrian Christians" in Hastings' *Encyclopaedia of Religion and Ethics*, vol. xii. pp. 172 ff., with many ref., G. P. Badger, *The Nestorians*, 1852; O. H. Parry, *Six Months in a Syrian Monastery*, 1895; R. Duval, *La litérature syriaque*, 1899; F. C. Burkitt, *Early Eastern Christianity*, 1904.

JACOBITES, the name given after the revolution of 1688 to the adherents, first of the exiled English king James II., then of his descendants, and after the extinction of the latter in 1807, of the descendants of Charles I., *i.e.*, of the exiled house of Stuart (Lat. *Jacobus*, James).

The history of the Jacobites, culminating in the risings of 1715 and 1745, is part of the general history of England, and especially of Scotland; there were also many Jacobites in Ireland. They were recruited largely, but not solely, from among the Roman Catholics, and the Protestants among them were often identical with the Non-Jurors. Owing to a variety of causes Jacobitism began to lose ground after the accession of George I.; and the suppression of the revolt of 1715 and the total failure of "the '45" marked its end as a serious political force. But as a sentiment it remained for some time longer. In 1750, during a strike of coal workers at Elswick, James III. was proclaimed king; and in Manchester a Jacobite rendezvous known as "John Shaw's Club" lasted from 1735 to 1892; North Wales was another Jacobite centre. Jacobite traditions also lingered among the great families of the Scottish Highlands. Until the accession of King Edward VII. finger-bowls were not placed upon the royal dinner-table, because in former times those who secretly sympathized with the Jacobites were in the habit of drinking to the king *over the water*. Sentimental Jacobitism was practically extinguished during the World War by the fact that the "rightful king" was Prince Ruprecht of Bavaria.

Upon the death of Henry Stuart, Cardinal York, the last of James II.'s descendants, in 1807, the rightful occupant of the British throne according to legitimist principles was to be found among the descendants of Henrietta, daughter of Charles I., who married Philip I., duke of Orleans. The table of succession runs as follows:



See James Hogg, *The Jacobite Relics of Scotland* (Edinburgh, 1819–21); *Historical Papers relating to the Jacobite Period*, edited by J. Allardyce (Aberdeen, 1895–96); F. W. Head, *The Fallen Stuarts* (1901); de Ruvigny, *The Jacobite Peerage* (Edinburgh, 1904). The chief collections of Jacobite poems are: Charles Mackay's *Jacobite Songs and Ballads of Scotland, 1688–1746, with Appendix of Modern Jacobite Songs* (1861); *English Jacobite Ballads*, edited by A. B. Grosart from the Towneley manuscripts (1877); and G. S. Macquoid's *Jacobite Songs and Ballads* (1888).

JACOB OF EDESSA, who ranks with Barhebraeus as the most distinguished for scholarship among Syriac writers, was born at 'Ēn-dēbhā in the province of Antioch, probably about A.D. 640. He spent nine years in revising and emending the Peshitta version of the Old Testament by the help of the various Greek versions. He died on June 5, 708. In doctrine Jacob was undoubtedly Monophysite.

His works include a Monophysite revision of the Old Testament; commentaries and scholia on the sacred books; many contributions to the Syrian liturgy; an Enchiridion, a tract on philosophical terms; a Syriac grammar; and a version of the homilies of Severus.

See Assemani, *Bibliotheca orientalis;* and Wright, *Catalogue of Syriac MSS. in the British Museum.*

JACOB OF SĔRŪGH (451–521), Syriac author, was born at Kurtam, a village on the Euphrates to the west of Ḥarrān, and was probably educated at Edessa. He wrote a series of metrical homilies (ed. P. Bedjan, Paris, 1905 *seq.*). Ordained to the priesthood, he became episcopal visitor of Haurā, in Sĕrūgh, not far from his birthplace. In 519, at the age of 68, Jacob was made bishop of Baṭnān, another town in the district of Sĕrūgh, but only lived till November 521.

According to Barhebraeus (*Chron. Eccles.* i. 191) Jacob employed 70 amanuenses and wrote in all 760 metrical homilies, besides expositions, letters and hymns of different sorts. Of Jacob's prose works, the most interesting are his letters, which show his attachment to the Monophysite doctrine which was then struggling for supremacy in the Syrian churches, and particularly at Edessa, over the opposite teaching of Nestorius.

See Wright, *Short History of Syrian Literature.*

JACOBS, CHRISTIAN FRIEDRICH WILHELM (1764–1847), German classical scholar, was born at Gotha on Oct. 6, 1764, and died there on March 30, 1847. He was a notable teacher and publicist, but his great work was an edition of the Greek Anthology, with copious notes, in 13 volumes (1798–1814), supplemented by a revised text from the Codex Palatinus (1814–17). He published also notes on Horace, Stobaeus, Euripides, Athenaeus and the *Iliaca* of Tzetzes; translations of Aelian (*History of Animals*); miscellaneous essays on classical subjects.

See E. F. Wüstemann, *Friderici Jacobsii laudatio* (Gotha, 1848); C. Bursian, *Geschichte der classischen Philologie in Deutschland* (1883); and the appreciative article by C. Regel in *Allgemeine deutsche Biographie.*

JACOBS' CAVERN, a cavern in latitude 36° 35′ N., 2 m. E. of Pineville, McDonald county, Mo., named after its discoverer, E. H. Jacobs, of Bentonville, Ark. It was scientifically explored by him, in company with Professors Charles Peabody and Warren K. Moorehead, in 1903. This small cave is hardly more than a rock-shelter, and is entirely in the "St. Joe Limestone" of the sub-carboniferous age. The ash surface of its floor was staked off into square metres, and the substance carefully removed in order. Each stalactite, stalagmite and pilaster was measured, numbered. and removed in sections. Six human skeletons were found buried in the ashes. Seven-tenths of a cubic metre of animal bones were found: deer, bear, wolf, raccoon, opossum, beaver, buffalo, elk, turkey, woodchuck, tortoise and hog; all contemporary with man's occupancy. Three stone metates, one stone axe, one celt and 15 hammer-stones were found. The cavern was peculiarly rich in flint knives and projectile points. The rude type of the implements, the absence of fine pottery, and the peculiarities of the human remains, indicate a race of occupants more ancient than the "mound-builders."

JACOBSEN, JENS PETER (1847–85), Danish writer, was born at Thisted, Jutland, on April 7, 1847. In 1870, although he was secretly writing verses already, Jacobsen adopted botany as a profession. He was sent by a scientific body in Copenhagen

to report on the flora of the islands of Anholt and Laesö. He translated into Danish *The Origin of Species* and *The Descent of Man*. Jacobsen contracted tuberculosis, and was obliged to give up scientific work. Under the influence of Georg Brandes he then began his great historical romance of *Marie Grubbe*, completed in 1876. In 1879 he was too ill to write at all; but in 1880 he finished his second novel, *Niels Lyhne*. In 1882 he published a volume of six short stories, entitled *Mogens*. He died at Thisted on April 30, 1885. In 1886 his posthumous fragments were collected. It was early recognized that Jacobsen was the greatest artist in prose that Denmark has produced. He has been compared with Flaubert, with De Quincey, with Pater; but these parallelisms merely express a sense of the intense individuality of his style, and of his untiring pursuit of beauty in colour, form and melody.

His *Samlede Skrifter* appeared in two volumes in 1888; in 1899 his letters (*Breve*) were edited by Edvard Brandes. In 1896 an English translation of part of the former was published under the title of *Siren Voices: Niels Lyhne*, by Miss E. F. L. Robertson.

See also G. Brandes in *Samlede Skrifter* (vol. 3, 1900).

JACOB'S WELL, the scene of the conversation between Jesus and the "woman of Samaria" narrated in the Fourth Gospel, is described as being in the neighbourhood of an otherwise unmentioned "city called Sychar." From the time of Eusebius this city has been identified with Sychem or Shechem (modern Nablus), and the well is still in existence 1½m. E. of the town, at the foot of Mt. Gerizim. When Robinson visited it in 1838 it was 105ft. deep, but it is now much shallower and often dry.

JACOBUS, the name of a British gold coin issued in the reign of James I. and called after him, Jacobus being Latin for James. It was of the value of 25 shillings.

JACOBUS DE VORAGINE (*c.* 1230–*c.* 1298), Italian chronicler, archbishop of Genoa, was born at Varazze, near Genoa, and joined the Dominicans in 1244. He was provincial of Lombardy from 1267 till 1286, and represented his own province at the councils of Lucca (1288) and Ferrara (1290). In 1288 Nicholas IV. empowered him to absolve the people of Genoa for their offence in aiding the Sicilians against Charles II. Early in 1292 Jacobus was consecrated archbishop of Genoa where he distinguished himself by his efforts to appease the civil discords of Genoa. He died in 1298 or 1299, and was buried in the Dominican church at Genoa.

His chief works are the *Chronicon januense* and the *Golden Legend* or *Lombardica hystoria*. The former, partly printed in Muratori (*Scriptores Rer. Ital.* ix. 6), deals with the history of Genoa from its earliest days to the time of the writer himself. The latter, one of the most popular religious works of the middle ages, is a collection of the legendary lives of the greater saints, ornamented with much curious information.

See Potthast, *Bibliotheca, hist. med. aevi.*, 13th ed. (Berlin, 1896), U. Chevalier, *Répertoire des sources hist. Bio.-bibl.* (1905), and F. L. Mannucci, *La Cronaca di Jacops da Varagine* (Genoa, 1904).

JACOPONE DA TODI (JACOBUS DE BENEDICTIS) (*c.* 1230–1306), Italian Franciscan poet, was born of noble family at Todi. He practised as an advocate in his native town and acquired considerable wealth, but on the death of his wife about 1268 became a Franciscan. On account of his satire on Benedict VIII., who was not well disposed towards the Spirituals with whom Jacopone sympathized, he was imprisoned from 1298–1303. On his release he lived at Collazzone where he died, Dec. 25, 1306.

Jacopone's poems, which were written chiefly in the Umbrian dialect, and are a curious mixture of coarseness and tenderness, early acquired great popularity. They relate his inner experiences and reflect his profound piety, his missionary zeal, his Franciscan devotion to love and to poverty, and his mystical but practical bent. The best edition is that of 1490, recently reprinted (1923) with preface by G. Papini. The short spiritual prose treatises were edited by Parenti at Modena (1832) and by Gigli at Rome (1843).

See Ozanam, *Les Poètes Franciscains* (1852); Tobler's *Life* in *Zeitsch. für romanische Philol.* ii. (1878); D'Ancona in *Studi della Letteratura Italiana dei primi secoli* (1884), and in *Biblioteca Umbrai* (1914); Gehart, *L'Italie Mystique* (1890); Macdonnell, *Sons of Francis* (1902); Brugnole, *Fra Jacopone da Todi* (Assisi, 1907); E. Underhill, *Jacopone da Todi* (1919); and N. Sapegno, *Frate Jacopone* (1923).

JACOTOT, JOSEPH (1770–1840), French educationist, author of the method of "emancipation intellectuelle," was born at Dijon on March 4, 1770. He was educated at the university of Dijon, where in his nineteenth year he was chosen professor of Latin. In 1788 he organized a federation of the youth of Dijon for the defence of the principles of the Revolution; and in 1792 served in the Belgian campaign. On the institution of the central schools at Dijon he was appointed to the chair of the "method of sciences," where he made his first experiments in educational method. On the central schools being replaced by other educational institutions, Jacotot occupied successively the chairs of mathematics and of Roman law until the overthrow of the empire. After the second restoration he had to leave France. He went to Brussels, and in 1818 he was nominated by the Government teacher of the French language at the university of Louvain, where he perfected into a system the educational principles which he had already practised with success in France. His method was based on three principles: (1) all men have equal intelligence; (2) every man has received from God the faculty of being able to instruct himself; (3) everything is in everything. As regards (1) he maintained that it is only in the will to use their intelligence that men differ; and his own process, depending on (3), was to give any one learning a language for the first time a short passage of a few lines, and to encourage the pupil to study, first the words, then the letters, then the grammar, then the meaning, until a single paragraph became the occasion for learning an entire literature. After the revolution of 1830 Jacotot returned to France. He died at Paris on July 30, 1840.

His system was described by him in *Enseignement universel, langue maternelle* (Louvain and Dijon, 1823)—which passed through several editions—and in various other works; and he also advocated his views in the *Journal de l'émancipation intellectuelle*. For a complete list of his works and fuller details regarding his career, *see* A. Guillard, *Biographie de J. Jacotot* (1860).

JACQUARD, JOSEPH MARIE (1752–1834), French inventor, was born at Lyons on July 7, 1752. In 1793 he took part in the unsuccessful defence of Lyons against the troops of the Convention; but afterwards served in their ranks on the Rhône and Loire. He then worked in a Lyons factory, and employed his spare time in constructing his improved loom, of which he had conceived the idea several years previously. In 1801 he exhibited his invention at the industrial exhibition at Paris; and in 1803 he was summoned to Paris and attached to the Conservatoire des Arts et Métiers. A loom by Jacques de Vaucanson (1709–82), deposited there, suggested various improvements in his own, which he gradually perfected to its final state. Although his invention was fiercely opposed by the silk-weavers, who feared that its introduction, owing to the saving of labour, would deprive them of their livelihood, its advantages secured its general adoption, and by 1812 there were 11,000 Jacquard looms in use in France. The loom was declared public property in 1806, and Jacquard was rewarded with a pension and a royalty on each machine. He died at Oullins (Rhône) on Aug. 7, 1834, and six years later a statue was erected to him at Lyons (*see* WEAVING).

JACQUARD LOOM: *see* WEAVING.

JACQUELINE OF HAINAULT: *see* JACOBA.

JACQUERIE, THE, an insurrection of the French peasantry which broke out in the Ile de France and about Beauvais at the end of May 1358. The hardships endured by the peasants in the Hundred Years' War and their hatred for the nobles who oppressed them were the principal causes which led to the rising, though the immediate occasion was an affray which took place at the village of Saint-Leu between "brigands" (militia infantry armoured in brigandines) and country-folk. The latter having got the upper hand united with the inhabitants of the neighbouring villages and placed Guillaume Karle at their head. They destroyed numerous châteaux in the valleys of the Oise, the Brèche and the Thérain, where they subjected the whole countryside to fire and sword, committing the most terrible atrocities. Charles the Bad, king of Navarre, crushed the rebellion at the battle of Mello, and the nobles then took violent reprisals upon the peasants, massacring them in great numbers.

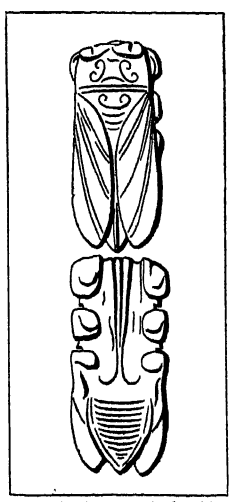
See Simeon Luce, *Histoire de la Jacquerie* (1859 and 1895). (J.V.)

JACTITATION, in English law, the maliciously boasting or giving out by one party that he or she is married to the other. In such a case, in order to prevent the common reputation of their marriage that might ensue, the procedure is by suit of jactitation of marriage, in which the petitioner alleges that the respondent boasts that he or she is married to the petitioner, and prays a declaration of nullity and a decree putting the respondent to perpetual silence thereafter.

JADE or **JAHDE,** a deep bay and estuary of the North Sea, belonging to Oldenburg. The bay, which was for the most part made by storm-floods in the 13th and 16th centuries, measures 70 sq.m., and has communication with the open sea by a fairway, 1½ m. wide, which never freezes, and with the tide gives access to the largest vessels. On the west side of the entrance to the bay is the port of Wilhelmshaven. A stream, about 14 m. long, also known as the Jade, enters the head of the bay.

JADE, a name applied to certain minerals of compact texture and colour varying from nearly white to dark green which have been used from prehistoric times in the manufacture of weapons, utensils and ornaments. The name is often restricted to two minerals, jadeite and nephrite. The word jade is derived (through Fr. *le jade,* for *l'ejade)* from Span. *ijada* (Lat. *ilia*), the loins, this mineral having been known to the Spanish conquerors of Mexico and Peru under the name of *piedra de ijada* or *yjada* (colic stone). The superstitions of the Mexicans regarding the stone were perpetuated in the Old World. When powdered and mixed with water it was supposed a powerful remedy for all kinds of internal disorders, to strengthen the frame and prevent fatigue, to prolong life and if taken in sufficient quantities just before death to prevent decomposition.

Jadeite is essentially a silicate of aluminium and sodium but generally contains small quantities of iron, calcium and magnesium. In the variety called chloromelanite, the iron amounts to 10%. In chemical composition and crystalline characters jadeite belongs to the pyroxene group of minerals and its chemical formula is therefore written $NaAlSi_2O_6$. It occurs very rarely in distinct crystals, though two small specimens were obtained from the Heber Reginald Brooke Collection of sufficient size to allow of morphological and optical investigation. Its hardness is 7 and specific gravity 3·33; it fuses in the blowpipe flame.



BY COURTESY OF THE FIELD MUSEUM OF NATURAL HISTORY

NATURALISTIC CICADA, UPPER AND LOWER SIDES, PLACED ON THE TONGUE OF THE DEAD AS AN EMBLEM OF RESURRECTION. CHINA, HAN PERIOD

Nephrite is a silicate of calcium and magnesium, generally having a little iron replacing the magnesium. It belongs to the amphibole group of minerals and is identical in composition with actinolite and tremolite of that species, which have the formula $CaMg_3(SiO_3)_4$. Its hardness is 6 and specific gravity 3·0, and it has a lower melting point than jadeite.

Both jadeite and nephrite are very tough, owing to the way in which the constituent fibres interlace. This toughness is very well illustrated in the case of nephrite by the fact that a pressure of 50 tons was required to crush certain cubical pieces of one inch size: large pieces can often only be broken by heating and then rapidly cooling by immersion in water. Suitably cut jade possesses the property of emitting a very clear musical tone when struck and of maintaining the vibrations for a comparatively long time. This has led to its use in the manufacture of bells and sounding plates and tubes. The colours which are very varied passing from black through brown to green and white are chiefly due to iron oxides and silicates and to some extent to chromium. Because of similarity in external appearance a number of minerals are often confused with jade and among these are included saussurite, bowenite, californite and verdite.

The Chinese value jade above all precious stones, as is indicated by the following quotation from T'ang Jung-tso in a discourse on jade: "The magic powers of heaven and earth are ever combined to form perfect results: so the pure essences of hill and water become solidified into precious jade." The Chinese word *yu* and the Japanese equivalents represent not only jade and gems in general, but signify the five cardinal virtues, charity, modesty, courage, justice and wisdom.

In spite of its toughness jade is worked into complicated forms and elaborately carved. This is done principally in China, where most beautiful specimens have been found. On many prehistoric sites in Europe, as in the Swiss lake-dwellings, celts and other carved objects both in nephrite and jadeite have been found; and as no kind of jade had until recent years been discovered *in situ* in any European locality, it was believed that either the raw material or the worked objects must have been brought by some of the early inhabitants from a jade locality probably in the East. The discovery of native jade in Europe was, therefore, very important—nephrite was found in Silesia and jadeite in the Alps, whilst pebbles of jade were found in Austria and north Germany—and proved that the jade implements were not of exotic origin.

Jadeite is found in several places in upper Burma, notably in the Mogaung district and in the Kachin hills. The export trade to China, which absorbs practically the whole of the output, is exceedingly valuable and is worth nearly as much as the produce of the ruby mines. Jadeite is found in Tibet and in China in the provinces of Shensi and Yunnan.

Nephrite occurs in New Zealand, particularly in the South island, in New California, in Siberia at Batugol, Lake Baikal, in Alaska and many places in China. The Chinese derive their main supply from places near the southern boundary of Eastern Turkestan, especially from the valleys of the rivers Karakash and Yarkand and the Kuen Lun range of mountains.

See H. Fischer, *Nephrit und Jadeit* (Stuttgart, 1880); H. R. Brooke, *Investigation and Studies in Jade* (privately printed, New York, 1906); G. F. H. Smith, *Gem-stones* (London, 1926).

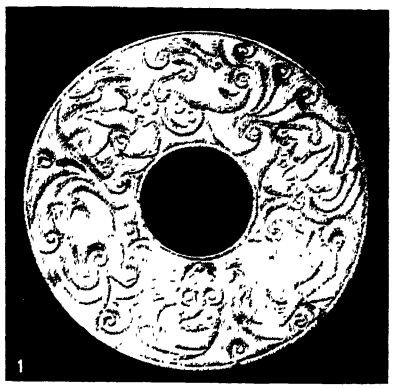
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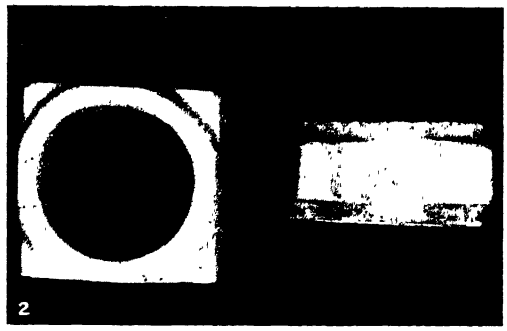
JADE AND OTHER HARD STONE CARVINGS.

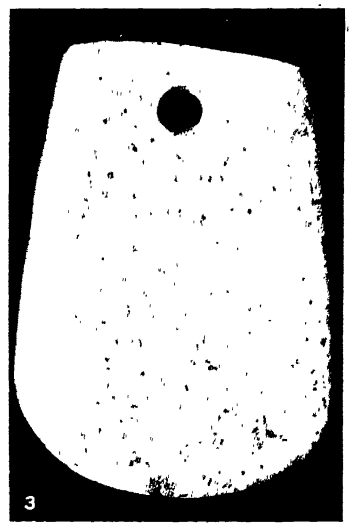
There are three minerals that are called jade: (1) Nephrite, known since earliest times; (2) Jadeite, described in 1868 by A. Damour, the famous French mineralogist, as new. The stone was of pure white with a faint purple tint. Jadeite is also often the finest jade; it is almost emerald green; (3) Chloromelanite, a dark green, almost black material. Analyses of these three minerals are given below. Although the most intensive investigations have been carried on concerning the origin and uses of Jade from the earliest times, it was not until 1868 that Damour found that nephrite contained lime and magnesia, whereas jadeite and chloromelanite contained alumina and soda.

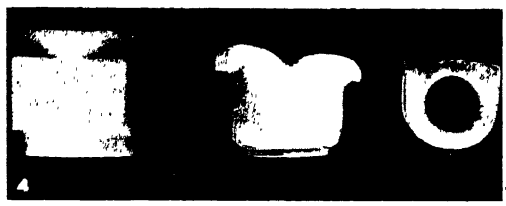
Structure.—The structure of jadeite is either granular or fibrous, the former being more characteristic. It may be studied to the best advantage in such thin, translucent, highly polished objects as bowls, cups or plates. On holding such a specimen against a light each crystal composing it often stands out quite sharply, owing to the fact that the light strikes the surface and cleavages of each crystal at a different angle, thus giving to each a slightly different appearance. The individual grains are sometimes prismatic in shape, and sometimes equidimensional, with diameters up to 3 mm. in exceptional cases.

The structure of nephrite is characteristically fibrous, and of such a fine grain that the individual fibres are but rarely visible except under the microscope. The fibres in this aggregate are arranged in various ways: parallel to one another over considerable areas; in tufted or fan-shaped groups; or curved, twisted, interlocked and felted in most intricate fashion. The coarser visible structure is due to groups of these fine fibres, and is dependent on their internal arrangement. A sinewy or horn-like appearance is extremely common, being visible on both rough and polished surfaces. It seems to be due to the groupings of the fibres into tufted or fan-shaped bundles, sometimes of considerable size, and separated from each other by indistinct parting surfaces which are often curved into irregular forms.

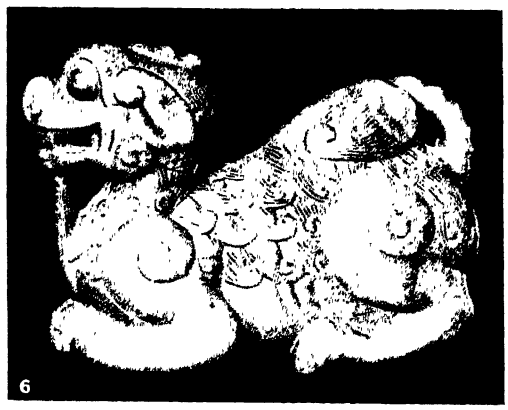

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BY COURTESY OF (1, 2, 3, 4, 6) FIELD MUSEUM OF NATURAL HISTORY, CHICAGO, (5) THE MUSEUM OF THE UNIVERSITY OF PENNSYLVANIA

JADE, LAPIS LAZULI AND OTHER STONES

Chinese: 1. *Pi* disc or symbol of heaven with associated symbols of dragons rising from sea waves. 2. Jade images and symbols of the deity Earth, one greyish green and one veined with reddish yellow. Chow period, 1122–255 B.C. 3. Jade celt, 22 cm. long. 4. Symbol of Deity of Earth, ornament for scabbard, and archer's thumb-ring. Han period, 206 B.C.–A.D. 220. 5. Lapis lazuli vase, ht. 28 in. Ch'ien Lung period, 1736–96. 6. Green jade monster, Han period. 8. Ornamental green jade table screen. Ch'ien Lung period. 9. Crystal ball, 12.83 in. diam., wt. 106.75 lb.; the most perfect one of large size known. Made in China in 1924. In the U.S. National Museum. 10. Resonant white and greenish jade. ch'ien Lung period. *Mexican:* 7. Votive ceremonial axe from Oaxaca; green jade

Colour.—Absolutely pure jadeite should be white, without a tinge of colour. So also an ideal nephrite, containing only lime and magnesia, should be colourless. The colours which actually exist are due to the admixture of other bases in the composition. In general, the green colour of jadeite is due to chromium—the colouring matter of the emerald, but jadeite is never transparent as is the emerald, but is at its best translucent—and that of nephrite to iron. Occasionally, however, anomalies are found, and the analytical data fail to account for the colour or lack of it of an occasional particular specimen.

Lustre.—The lustre of both jadeite and nephrite on fresh fracture is dull and wax-like, with very few reflecting surfaces. Polished jadeite has ordinarily a somewhat vitreous luster, while polished nephrite ordinarily has an oily lustre. This oily appearance is highly characteristic of many of the green nephrites.

Sonority.—The resonant character of jade has been known to the Chinese since ancient times, and when united with the proper translucency and colour, was regarded as a sure sign of the genuineness of the material. "Sounding-stones" and stones for polishing them are mentioned in the earliest historical records of China (23 centuries B.C.).

The musical jade is often cut in the form of a fish and suspended by a thong, and when struck the full tones can be heard.

Composition.—The following table shows characteristic chemical analyses for nephrite, jadeite and chloromelanite.

	Nephrite	Jadeite	Chloromelanite
	%	%	%
Silica (SiO_2)	58·00	58·24	56·12
Titanium dioxide (TiO_2)	..	..	0·19
Alumina (Al_2O_3)	1·30	24·47	14·96
Ferric oxide (Fe_2O_3)	..	1·01	3·34
Ferrous oxide (FeO_3)	2·07	..	6·54
Manganese oxide (MnO)	..	..	0·47
Lime (CaO)	13·24	0·69	5·17
Magnesia (MgO)	24·18	0·45	2·79
Soda (Na_2O)	1·28	14·70	10·99
Potash (K_2O)	..	1·55	trace
	100·07	101·11	100·57

Occurrence.—Although jade objects in considerable numbers have been found over rather wide-spread areas, there are only a few localities identified where it is known to occur in place. In addition to these there are several others where jade has been found, having been transported there from its place of origin by the action of rivers or glaciers. And finally, there are other localities in which worked jade is found, sometimes in considerable profusion; in many of these cases the source of the material is pure conjecture, while in others the character of the material is such as to give some indication as to its point of origin. The greatest source of material, and the one that has been studied the most, is in the Kachin country of Upper Burma, near the junction of the Chadwin and Uru rivers, at about 25° to 27° N. lat. and 95° to 97° E. longitude. These quarries were discovered in the 13th century, but it was not until 1784 that trade was established with China, and a regular supply of stone was carried to Yunnan. Since the beginning of the 19th century Mogaung has been the centre of the jade trade in Burma.

Jade occurs in small amounts in several places in Central India, particularly in the State of Rewa. Although conclusive evidence is lacking, the indications seem to show that the Indian jade is all nephrite. One of the oldest and most important of the jade-producing districts is in the K'un Lun mountains, south of Khotan, in south-eastern Turkistan, described by the Sekloge-witt brothers. Here are found both nephrite and jadeite, the former, however, greatly predominating. It was from this district that much of the early Chinese material was obtained.

The occurrence of nephrite in Siberia has been known since early in the 19th century, but it was not until 1896–97 that any definite information was obtained. At that time a Russian Government expedition under von Jaczewski, discovered several occurrences of nephrite in place in the Sajan mountains of central Siberia, between the Belaja and Kitou rivers on the north and south, and the Onot and Urick rivers on the east and west.

Although boulders and worked objects of jade had been known in Europe for many years, it was not until 1884 that it was discovered in place by Traube at Jordansmühl, and a few years later at Reichenstein, in Silesia. This material is nephrite. These discoveries were supplemented in 1899 by that of Dr. George F. Kunz, who found at Jordansmühl one of the largest pieces of nephrite that has ever been quarried. This specimen, weighing 4,812 lb., is now in the American Museum of Natural History in New York city. Although several nephrite boulders have been found in glacial deposits in other localities, no other occurrences of nephrite in place are known in Europe. No occurrence of jadeite *in situ* is known in Europe but it is mined extensively in Mogoung, Burma.

In North America nephrite has been found in place in Alaska, about 150 m. above the mouth of the Kowak river, at 67° 5′ N. lat. and 158° 15′ W. longitude. Boulders of nephrite have also been found along the lower Fraser and the upper Lewes rivers in British Columbia. While material has not been found in place in either of these localities, all indications lead to the conclusion that the boulders had originated in the immediate locality.

Nephrite has long been used by the natives of New Zealand in tools, ornaments and magnificent ceremonial implements of various kinds. The material occurs in boulders chiefly on the west coast of South island, although other localities of lesser importance are known. Nephrite is found in place on the west coast of the island of Uen, off the south-eastern point of New Caledonia.

Although a fondness for jade is almost a national characteristic in China, there are no known occurrences in China. Most of the material used by the Chinese has come from either Chinese Turkistan or Burma. It is also possible that some Siberian or New Zealand material has been used.

Of the many thousand pieces of carved jade from China and India, with the possible exception of the small buttons, there are scarcely two pieces alike. The artist studied the piece of rough material to discover what could best be made of it and then made the design to fit the piece. The result is that most of the pieces are artistic and the lapidary work unique. They stand in an art by themselves.

In Europe worked objects of both nephrite and jadeite have been found over wide areas. Nephrite has been found particularly in the vicinity of the ancient lake villages of Switzerland. Jadeite objects were more widely distributed in Germany, France, Belgium, Switzerland and Italy. In Mexico and Central America large numbers of jadeite objects have been found. While these are the chief localities, there are also numerous others in which either jadeite or nephrite objects, or both, have been found, without clear evidence as to the source of the material.

There have been two historic debates concerning the occurrences of jade, both of which extended over many years. The first was concerned with the question as to whether jade was to be found in place in Europe, or whether the material used by the prehistoric peoples of central Europe was all brought from the outside, either by glacial action or by commerce. This question was definitely settled by the discoveries of Traube and Kunz, described above. The second concerned a similar question with regard to Mexican and Central American material. No jade has as yet been discovered in place in these countries, and many have thought that its presence and use there was an indication of ancient contacts between these peoples and the Orient. While this theory has been actively promulgated by many adherents, no definite proofs have as yet been forthcoming on either side.

Uses.—It is remarkable that men even from the earliest times, whether the prehistoric lake-dwellers of Europe, the ancient inhabitants of the valley of Mexico, the aborigines of north-west America, the natives of New Zealand, or the people of China, found small blocks or boulders of jade, of a wide variety and range of colour, but which they had the acumen to determine were of a hard, tough material suitable for axes and other utilitarian purposes, as well as for artistic uses. We know that there was prehistoric jade in the graves in China, and more would

have been found had there not been a sentiment against opening up the buried remains in that country. Later on jade was selected as a material possessing many of the most charming qualities of beauty, lustre and toughness, so that many thousands of pieces of jade, from the purest white and the palest green to a dark green, have been carved in the designs of many countries, pieces that in many cases have required years to make. As an example of the endless patience used in the execution of such pieces, there is a necklace of 100 links with a pendant, all of one unbroken piece in the American Museum of Natural History. And in the F. O. Mathieson bequest to the Metropolitan Museum of Art are four covered vases which open in the centre for fruits, the cover and lower part all of one unbroken piece.

The greatest rulers of the East have treated this stone with a reverence attributed to no other material. The poems of emperors have been recorded on tablets of jade and the great fish bowl in the Bishop collection, weighing 120 lb., has the poem of an emperor on its inner base. The respect and reverence placed in this stone is well deserved, and if the Chinese had all the articles that were originally in China, they would form a collection not rivalled by that of any other nation or by that of any other material.

Great masses of a wonderful material stained brown by contact with bodies, or stained brown to look as if they had been buried with bodies, is known as tomb jade. Some of it is believed to date back 20 centuries. The Chinese have obtained some of the most magnificent jade and frequently have spent as much as a year searching for a single piece. Some splendid examples of these may be seen in the Heber R. Bishop collection in the Metropolitan Museum of Art; the Johnson collection in Philadelphia, gifts in memory of Dr. George Byron Gordon. Other specimens are in the Boston Museum of Fine Arts, the British Museum, the Louvre and in Berlin, and many other places throughout the world.

Jade of different colours was used in China for the six precious tablets employed in the worship of heaven and earth and the four cardinal points. For the worship of heaven there was a dark-green round tablet, and for the earth an octagonal yellow tablet; the east was worshipped with a green pivoted tablet, the west with a white "tiger tablet," the north with a black semi-circular tablet, and the south with a tablet of red jade. The yellow girdles worn by the Chinese emperors of the Manchu dynasty were variously ornamented with precious stones, according to the different ceremonial observances at which the emperor presided. For the services in the temple of heaven, lapis lazuli was used; for the altar of earth, yellow jade; for a sacrifice at the altar of the sun, red coral; and for ceremonies before the altar of the moon, white jade.

Jade amulets of many different forms were popular with the Chinese, as were also rings, ear-rings and beads, but in general, jade was much more used for decorative pieces than for articles of personal adornment. While in other localities jade has been used extensively for axes, adzes, knives and other purely utilitarian objects, for which its hardness and toughness make it peculiarly applicable, the reverence with which the stone was held in China seems to have precluded its use in such fashion, and the purely utilitarian is almost entirely absent in the Chinese uses; here the ornamental features greatly predominate, and where the utilitarian features do come in, it is usually in a vase, cup, plate or bowl, or some similar object, in which beauty may be combined with utility. It is possible that the pre-Chinese used jade for axes and celts but the later Chinese ornamented and recarved these.

The jade objects found in Mexico and Central America are frequently of a rich, almost emerald green colour, and there have been thousands of pieces found, from the smallest fragments to the great adze weighing 16 lb., which is now in the American Museum of Natural History. Much of the Mexican material has been used in religious ceremonies, but utilitarian and ornamental material is also found. The outstanding find of jade objects in Mexico was at the sacred well of Chitzinitza in Yucatán, into which had been cast as votive offerings hundreds of pieces of jadeite. This valuable discovery was made by Dr. E. H. Thompson of the Peabody Museum, who spent a lifetime in this region.

In New Zealand, where the most primitive methods held, jade was in high esteem among the Maori chiefs, who had their *patou-patous* (small axes which they held under the arm) perforated at the upper end and ornamented with jade. *Hei tikis*—crudely carved small human figures—were made of jade with narrow slant eyes of abalone shell, usually facing to the right, but occasionally to the left. These were worn as amulets and frequently handed down from one generation to another, as the material is almost indestructible.

Commercial Value.—Jade of medium colour cut into the form of bead necklaces sell as low as $50, but exceptional quality commands correspondingly high prices. An emerald green *feitsui* necklace, 30 in. long, of 125 beads, weighing 304 carats (approximately 2 oz. Troy), with a centre bead ½ in. in diameter, and end beads ⅛ in. in diameter, commanded a price of $80,000; larger necklaces have brought more than $100,000. Exceptional pieces have been made into brooches at prices from $1,000 to $5,000. Ring stones cut cabochon on top sell at from $100 to $2,000 each. The thumb rings worn by the Chinese nobility frequently commanded over £1,000, and, it is claimed, even up to £2,000 for the ring which is a relic of the time when the archer drew his bow with a thumb ring of wood, horn, agate or jade. An exceptionally fine ring of this character was worn by the former ambassador to the United States, Wu Ting Fang; this ring had been originally worn on a larger hand, and had a lining of fine gold to fit it to the finger of the new wearer of the ring.

Minerals and Imitations Mistaken for Jade.—Under this heading we have three types of material to consider: those which through a close similarity to jade in colour, toughness and lustre may be mistaken for the true material; those which have been stained, coloured, or otherwise treated in order to enhance this similarity; and those that are purely and entirely artificial imitations. The natural minerals that resemble jade most closely are those having a similar chemical composition, *i.e.*, complex silicates, but various forms of pure quartz and a few other minerals also fall into this group. The determination of the hardness and specific gravity of the specimen is usually sufficient to differentiate between the true and false jade. Jadeite has a hardness of approximately 7·0 and a specific gravity of 3·2 to 3·4; nephrite has a hardness of 6·5 and a specific gravity of 2·9; very few other minerals show this particular combination of hardness and gravity.

Saussurite is probably the most important of these materials easily mistaken for true jade. It is a compact, tough, heavy mineral with a hardness and gravity almost identical with jadeite, and this makes the differentiation difficult. Next in point of resemblance is fibrolite, or sillimanite. Like saussurite it has the hardness and gravity of jadeite, but it is readily identified chemically, being a practically pure silicate of aluminium. The Alaskan natives have frequently used pectolite for jade. This has a gravity close to nephrite, but is much softer. Wollastonite, occasionally confused with jade, can be detected by its softness as compared with jade. A number of different varieties of feldspar sometimes resemble jade. These are also lower in gravity than jade, and most of them are lower in hardness. Chief among these are amazon-stone, eupholide, saccharite and labradorite.

Jadeite is classed chemically as a pyroxene, and in the same family of rocks are several other minerals quite similar to it, particularly omphacite and eclogite. These have the gravity of jadeite, but are softer. Diopsite has the hardness of nephrite and the gravity of jadeite, but can be distinguished by the difference in cleavage. Nephrite is an amphibole rock, and in this group we find also actinolite closely resembling it, but differing in the texture of the fibrous structure.

Outstanding among the green minerals is the emerald, a green variety of beryl, and it is possible for an opaque emerald to be mistaken for jade, though it may be readily differentiated by its higher hardness, lower gravity, and the presence of beryllium in its composition.

One of the minerals that most frequently resembles jade, especially in the East, is a variety of serpentine known as bowen-

ite. This has both hardness and gravity higher than the average serpentine, but still lower than nephrite. It has a texture similar to that of jadeite, and where the colour was lacking, it has been stained in imitation. Antigorite and williamsite are translucent varieties of serpentine of a rich, green colour. Although the latter is much harder than the former, both are far softer than jade. Williamsite has an intense rich green colour.

A material recently placed on the market as South African jade is really a compact, translucent, green garnet. It is higher than jade in both gravity and hardness. Numerous forms of pure quartz may, by their colour and opacity be mistaken for jade, particularly prase, plasma, chrysoprase, jasper, aventurine and moss agate. All these have a lower gravity than jade, and a hardness equalled only by the hardest jadeite. The minerals most difficult to differentiate from jade are prehnite, epidote, vesuvianite and agalmatolite. Prehnite has the hardness of nephrite and a gravity close to the lower limit for nephrite; its colour is good, but it lacks lustre, and is more brittle than true jadé. Epidote has the hardness of jade, and a gravity in the upper limits of the range for jadeite, from which it may be distinguished by its strong cleavage, a more vitreous lustre, and the presence of considerable iron in its composition. Vesuvianite has about the same hardness and gravity as epidote, and like it has a more vitreous lustre than jade; it is also more brittle, and has an uneven fracture. Another form of vesuvianite is named califonite by the author. Agalmatolite is one of the minerals most frequently sold to the uninitiated in China, under misrepresentation as jade. It is readily detected, however, by its extreme softness, and less readily by its lower gravity. It has a compact, fine and homogeneous structure that makes it ideal for carving, but its colour is such that it is usually stained green in imitation of nephrite. It is stained in many other colours.

Under some conditions turquoise (a phosphate), malachite (a copper carbonate), and mossotite (a lime carbonate), may be mistaken for jade, but identification is simple in all cases by hardness, gravity and chemical composition.

China probably takes the lead over all other countries in the number of substances that have been mistaken, or substituted, for jade. This is due partly, particularly in earlier times, to lack of exact mineralogical information and technical methods of identification, and partly to the natural tendency toward substitution for, or imitation of, a highly prized and equally highly priced material. Prominent among these fabrications is the so-called pink jade, which, if truly pink, and not the pinkish-lavender characteristic of some Burmese jade, has always turned out on careful examination to be quartz, aniline dye absorbed into fine cracks and fissures in the material. This may be detected by rubbing the piece with cotton moistened in alcohol.

Another important type of fabricated material is made from a heavy lead glass, carefully tinted and most ingeniously polished to give the characteristic jade-like lustre by first giving a high polish and then deadening this to the desired degree by a fine hard powder. One form of this is made in imitation of the white and green "imperial jade" of China, and may be found in bracelets, ear-rings and other trinkets, in almost every Chinese shop. Another type is all green, in imitation of the Burmese jadeite, and another, known under the name of *pâte de riz,* is white with a faint bluish-green or bluish-grey tint. This same method of preparation of the surface has also been used on varieties of green quartz to simulate the lustre of jade.

Descriptive Literature.—Of all the Chinese works on jade the most interesting and most remarkable is the *Ku yü t'ou pu,* or *Illustrated Description of Ancient Jade,* a catalogue divided into 100 books and embellished with nearly 700 figures. It was published in 1176, and lists the magnificent collection of jade objects belonging to the first emperor of the Southern Sung dynasty. One of the treasures here described was a four-sided plaque of pure white jade, over 2 ft. in height and breadth. The design was a figure seated on a mat, with a flower vase on its left and an alms-bowl on its right, in the midst of rocks enveloped in clouds.

The most complete and modern descriptive work on jade is the catalogue of the H. R. Bishop collection of jade in the Metropolitan Museum of Art. This is the most remarkable collection of jade in existence, and the two great volumes of the catalogue and accompanying descriptive matter fully match the collection itself in magnificence. The catalogue was illustrated by some of the greatest artists of the time. The volumes were not sold, but were distributed to libraries and museums here and abroad, to a few royal personages, and to several of Mr. Bishop's relatives. The author of this article devoted 12 years of his leisure to the mineralogical studies and the guidance of the scientific study of the many experts whom he called upon to aid in this great work.

OTHER HARD STONES

Among the other hard stones that have been cut, engraved and polished along lines similar to jade are the various forms of quartz (rock crystal, agate, carnelian, chalcedony and jasper) and the softer but highly valued materials, such as malachite, fluorite, rhodonite and lapis lazuli. All of these materials lend themselves well to this type of treatment, and in fact, as has already been mentioned, many of them have in some form or other frequently been mistaken, or substituted, for jade.

Of all the hard stones, probably rock crystal and agate have been most used, and in a wide variety of forms. Crystal has been particularly popular in vases and other ornamental forms, and as crystal balls. The outstanding example of the latter form is a ball 30 in. in diameter, made from Burmese crystal, and finished in Japan.

Jasper (*q.v.*) found in Russia is not excelled by that of any other country. It has a grey, almost putty colour, and a texture of wonderful homogeneity. Of this material tables and other pieces are made which are unequalled by any other lapidary work in existence. Aventurine, a quartz containing brilliant scales of other coloured minerals, is found in the Ural mountains, and has been used in vases up to 6 ft. in height. Rhodonite (*q.v.*) is a member of the pyroxene group, the same family to which jadeite belongs; it is usually a beautiful rose or red colour, but is sometimes a light brown. The name rhodonite, from the Greek word *rhodon,* rose, suggests its colour. The mineral has been used as a gem, and for various types of ornamental objects; the sarcophagus of the Tsar Alexander II. was constructed from rhodonite found near Ekaterinburg (now Sverdlovsk). It is also found associated with manganese deposits in other parts of the world, its composition being manganese silicate. It has a hardness between 5 and 6, and a specific gravity of 3·5 to 3·6. It is slightly translucent, has little lustre, but takes a fairly good polish. Rhodonite was especially the imperial stone of Russia, and is there found in great masses.

One of the tsarinas of Russia wished an egg cut of pure rose rhodonite, without a streak of black in it, and one ton of this material was cut without finding a single piece large enough to cut the egg which did not have a streak of some kind in it.

It is strange that two great colours have been generally known and appreciated throughout the ages, one a royal blue and the other a royal green—lapis lazuli and malachite. Both of these being opaque, very wonderful pieces can be made from them, as they can be cut into thin sections, from $\frac{1}{8}$ to $\frac{1}{4}$ in. in thickness, and then strengthened by cementing them to a suitable backing, either slate or some material that does not contract or bend.

Lapis lazuli (*q.v.*) is one of the oldest of the gem materials, having been used for 6,000 years, and the supply has been continuous. During this entire period the chief sources of supply have been Persia and Afghanistan. It is sent to the markets in masses of from 1 to 5 lb. One mass of 160 lb. reached the United States several years ago, and another of 30 lb. was found in the Oxus river district of Afghanistan. One of the results of the visit to Europe of King Amanullah in 1928 was a grant to a German firm of a monopoly for the exportation of Afghan lapis lazuli.

Obsidian (*q.v.*), or volcanic glass, is found in great quantities in the Valley of Mexico. Some wonderful chipping, grinding and polishing has been done on this material. One of the best examples is the Father Fisher knife in the Blake collection in the National Museum in Washington—a knife 19 in. in length. Another fine example is a mask, almost the size of a human face.

Ornaments for the ear and for the lips were frequently made with the thinness of paper and polished exquisitely and carved in the centre. Mirrors 1 in. thick were made of this material, some of which may be seen in the American Museum of Natural History that are 15 by 12 inches.

Emeralds (*q.v.*) were looted and mined in great quantities by the Spanish when they invaded Peru; these stones were also brought from the mines of the United States of Colombia. Five cases are believed to have been lost at sea. Large assignments were shipped to Spain and then sold in Paris. The more perfect stones were kept by the Spanish and French and the rest were shipped to India, Persia and Turkey, where the natives engraved them to hide the flaws. For many centuries they were known, and still are, as Indian emeralds. It is quite possible that these sustained the expense of the great traveller, Tavernier, who took many of these to India where he traded them for rubies from the Burmese mines and then sold the rubies in Europe. Louis XIV. is said also to have financed him. Some of these—very large ones—were found when the British captured King Thebaw's palace at Rangoon and they are now in the Indian museum at London. Several hexagonal sections of the crystal were used, over three inches. There is hardly an Indian, Persian or Turkish ruler who does not possess some of these emeralds even to the present day, and frequently an encabochon unengraved emerald is worn in one ear and an encabochon ruby in the other ear. These emeralds must have been sent to Turkey and Russia eastward by the thousands and it is very possible that Tavernier is responsible for the placing of many of them, and the great quantity that he had made his great trip possible. Among the Russian crown jewels and in some of the jewels of the Ourejene, Kremlin, and the treasury of the bishops are many fine emeralds, one of which the writer saw which was more than an inch across and excellent in colour. (*See* also JADE, GEMS, JEWELLERY.)

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JAEGER, in ornithology, the name given in North America to several of the skuas (*q.v.*).

JAEN, an inland province of southern Spain, formed in 1833 of districts belonging to Andalusia; bounded on the north by Ciudad Real and Albacete, east by Albacete and Granada, south by Granada, and west by Cordova. Pop. (1920), 592,297; area, 5,848 sq.m. Jaen comprises the upper basin of the river Guadalquivir. The Sierra Morena, which divides Andalusia from New Castile, extends along the northern half of the province, its most prominent ridges being the Loma de Chiclana and the Loma de Ubeda; the Sierras de Segura, in the east, derive their name from the river Segura, which rises just within the border; and between the last-named watershed, its continuation the Sierra del Pozo, and the parallel Sierra de Cazorla, is the source of the Guadalquivir. The loftiest summits in the province are those of the Sierra Magina (7,103 ft.).

In a region which varies so markedly in the altitude of its surface, the climate is naturally unequal; and, while the bleak, windswept highlands are available only as sheep-walks, the well-watered and fertile valleys favour the cultivation of the vine, the olive and all kinds of cereals. The mineral wealth of Jaen has been known since Roman times, and mining is an important industry, with its centre at Linares. Lead chiefly, but also iron, copper and salt are obtained. There is some trade in sawn timber and cloth; esparto fabrics, alcohol and oil are manufactured. The main line Madrid-Cordova-Seville is joined south of Linares by two important railways—from Algeciras and Malaga on the south-west, and from Almería on the south-east. The eastern half of Jaen is inaccessible by rail. In the western half are Jaen (*q.v.*), the capital, with Andujar, pop. (1920) 17,950, Baeza 15,326, Bailen 8,998, Linares 40,010, Martos 19,833 and Ubeda 22,988.

JAEN, the capital of the Spanish province of Jaen, on the Linares-Puente Genil railway, 1,500 ft. above the sea. Pop. (1920), 33,444. Jaen is finely situated on the well-wooded northern slopes of the Jabalcuz Mountains, overlooking the valleys of the Jaen and Guadalbullon rivers, which flow north into the Guadalquivir. The hillside upon which the narrow and irregular city streets rise in terraces is fortified with Moorish walls and a Moorish citadel. After the Moorish conquest the town became an important commercial centre with the name *Jayyan*. Jaen is an episcopal see. Its cathedral was founded in 1532; and, although it remained unfinished until late in the 18th century, its main characteristics are those of the Renaissance period. The identification, sometimes suggested, of Jaen with the Roman Aurinx, is most questionable.

JAFARABAD, state of India, in the Western India States agency, Kathiawar, Bombay, forming part of the territory of the nawab of Janjira; area, 53 sq.m.; pop. (1921), 10,996. The town of Jafarabad (pop. 5,230), situated on the estuary of a river, carries on a coasting trade.

JAFFA: *see* JOPPA.

JAFFNA (native Yalpannan), a town of Ceylon, at the northern extremity of the island. Pop. (1921) 42,436. It was occupied by the Tamils about 204 B.C., and there continued to be Tamil rajahs of Jaffna till 1617, when the Portuguese took possession of the place. As early as 1544 missionaries under Francis Xavier had made converts in this part of Ceylon, and after the conquest the Portuguese maintained their proselytizing zeal. They had a Jesuit college, a Franciscan and a Dominican monastery. The Dutch drove out the Portuguese in 1658. The European section still has Dutch associations. Several of the church buildings date from the time of the Portuguese. The natives grow palmyras freely, and have a trade in the fibre of this palm. They also grow and export tobacco, but not enough rice for their own requirements.

JÄGER, GUSTAV (1832-1917), German naturalist and hygienist, was born at Bürg, Württemberg, on June 23, 1832. After studying medicine at Tübingen he became a teacher of zoology at Vienna. In 1867 he was appointed professor of zoology at the academy of Hohenheim, and subsequently he became teacher of zoology and anthropology at Stuttgart polytechnic and professor of physiology at the veterinary school. In 1884 he abandoned teaching and started practice in Stuttgart. In 1876 he anticipated Weismann's germ-plasm theory by suggesting that the germinal protoplasm retains its specific properties from generation to generation, dividing in each reproduction into an ontogenetic portion, from which the individual arises, and a phylogenetic portion, reserved to form its reproductive material. In *Die Normalkleidung, als Gesundheitsschutz* (1880, 4th ed. 1885), he advocated the system of clothing associated with his name, objecting especially to the use of vegetable fibre for clothes. He died at Stuttgart on May 14, 1917.

Jäger's other works include: *Die Darwinsche Theorie* (1869), *Lehrbuch der allgemeinen Zoologie* (1871–78), and *Die Entdeckung der Seele* (1878); *Selbstarznei im Heilmagnetismus* (1908) and *Leben im Wasser* (3rd ed. 1908).

JÄGERNDORF: *see* KRNOV.

JAGERSFONTEIN, a town in South Africa, 29° 42′ S., 25° 25′ E. Pop. (1921), 1,742 whites, 2,345 non-Europeans. The town is situated about 4,500 ft. above sea-level, and owes its existence to the most important diamond mine in the Orange Free State. The mine was originated in 1870, and produces stones of fine quality. Here were found the "Excelsior" (971 carats), and the "Jubilee." (*See* DIAMONDS.)

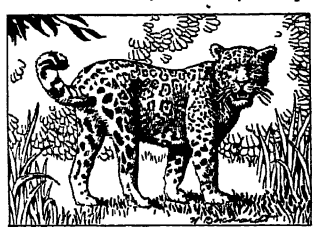
JAGO, RICHARD (1715–1781), English poet, son of Richard Jago, rector of Beaudesert, Warwickshire, was born on Oct. 1, 1715, and educated at University college, Oxford. After holding various preferments, he died at Smitherfield May 8, 1781.

See the edition of his poems in Chalmers's *English Poets,* vol. xvii.

JAGOW, GOTTLIEB VON (1863–), German Foreign secretary at the outbreak of the World War, was born on June 22, 1863 in Berlin. He entered the diplomatic service in 1895 and after having been Prussian minister at Munich, German ambassador at Rome and German minister at The Hague, was appointed in 1913 foreign secretary. He played an active part in the negotiations preceding the outbreak of the World War, and was, in particular, concerned in the German relations with Austria, having been the first member of the Imperial Government in Berlin to become acquainted with the terms of the Austrian ultimatum to Serbia. He wrote a defence of German policy entitled *Ursachen und Ausbruch des Weltkrieges* (1919).

JAGUA: *see* CIENFUEGOS.

JAGUAR (*Felis onca*), the largest species of the *Felidae* on the American continent, where it ranges from Texas through Central and South America to Patagonia. In the countries which bound its northern limit it is not frequently met with, but in South America it is quite common. The jaguar is usually found singly and preys upon such quadrupeds as the horse, tapir, capybara, dogs, or cattle. Occasionally the jaguar becomes a man-eater. The cry of this great cat, which is heard at night, and most frequently during the pairing season, is deep and hoarse. Towards the close of the year the female brings forth from two to four cubs which are able to follow their mother in about 15 days after birth. The ground colour of the jaguar varies greatly, ranging from white to black, these extremes being, however, definite spots. The typical coloration is a rich tan upon the head, neck, body, outside of legs and tail near the root, marked, except towards the end of the tail, which is ringed, with black spots, arranged in rosettes with a black spot in the centre (unlike the leopard). The nose and upper lip are light rufous brown. The average length is about 4ft. from nose to root of tail. The jaguar is thick-set; it does not stand high upon its legs and in comparison with the leopard is heavily built; but its movements are rapid, and it is fully as agile as its more graceful relative. There are a number of local races in various parts of its range.



BY COURTESY OF THE N.Y. ZOOLOGICAL SOCIETY

JAGUAR, AN AMERICAN WILDCAT

JAGUARONDI or YAGUARONDI (*Felis jaguarondi*), a South American wild cat, found in Brazil, Paraguay, and Guiana, ranging to north-eastern Mexico. This small cat is generally brownish-grey, but in some individuals the fur has a rufous coat, while in others grey predominates. The names jaguarondi and eyra are applied indifferently to this species and *Felis eyra.*

JAHANGIR or **JEHANGIR** (1569–1627), Mogul emperor of Delhi, succeeded his father Akbar the Great in 1605. His name was Salim, but he assumed the title of Jahangir, "Conqueror of the World," on his accession. During his father's Deccan campaign of 1598–99, he had meditated rebellion, but in 1604 they were reconciled, the son being made viceroy of southern and western India and allowed to live in Agra as heir apparent. After his enthronement on Oct. 24, 1605, Jahangir won a certain amount of popularity by declaring himself a Muslim, but his zeal soon waned, and his natural scepticism manifested itself in his indifferent toleration both of Christians and Hindus. In 1606, his son, the popular prince Khusru, attempted rebellion with the result that some 300 of his supporters were brutally put to death and he himself blinded and imprisoned until 1622 when he was strangled by order of his brother Prince Khurram. Jahangir succeeded in keeping under control the rana of Udaipur, Malik Amber the vizier of the Nizam Shah in the Deccan, and the rebels of Bengal, though in 1622 he lost Kandahar to the Shah of Persia. The rebellion of his son Shahjahan in 1624 was patched up by an apparent reconciliation in the following year.

In spite of opposition from the Portuguese, the missions of the Englishmen, William Hawkins, William Edwards, and the ambassador, Sir Thomas Roe, led to the emperor's sanction of English trade at Surat. Though possessed of many natural abilities and a lover of art and literature, Jahangir was a dissolute, capricious and tyrannical ruler who gradually allowed his Persian wife, Nur Jahan, to secure the reins of government and thereby to satisfy the interests of her relatives and her own thirst for gold. He died while returning from Kashmir in Oct. 1627, and is buried in the gardens of Shahdera on the outskirts of Lahore.

The best editions of his *Memoirs,* which were either written by himself or dictated to a scribe, appeared at Ghazipur in 1863 and at Aligarh in 1864 (Eng. trans. by Rogers and Beveridge, 2 vols., 1909–14). *See* also *Jahangir's India,* a translation from the Dutch of F. Pelsaert by W. H. Moreland (1925) and bibliography in W. A. Smith's *Oxford History of India* (2nd ed., 1923).

JĀḤIẒ (ABŪ 'UTHMĀN 'AMR IBN BAHR UL-JĀḤIẒ; *i.e.,* "the man the pupils of whose eyes are prominent") (d. 1869), Arabian writer, spent his life in Basra where he devoted himself chiefly to the study of polite literature. A Mu'tazilite in his religious beliefs, he developed a system of his own and founded a sect named after him. He was favoured by Ibn uz-Zaiyāt, the vizier of the caliph Wāthiq.

His work, the *Kitāb ul-Bayān wat-Tabyīn,* a discursive treatise on rhetoric, appeared in 2 vols. at Cairo (1895). The *Kitāb ul-Maḥāsin wal-Addād* was edited by G. van Vloten as *Le Livre des beautés* (Leiden, 1898); the *Kitāb ul-Bu-halā, Le Livre des avares,* ed. by the same (Leiden, 1900); two other smaller works, the *Excellences of the Turks* and the *Superiority in Glory of the Blacks over the Whites,* also prepared by the same. The *Kitāb ul-Ḥayawān,* or "Book of Animals," a philological and literary work, was published at Cairo (1906).

(G. W. T.)

JAHN, FRIEDRICH LUDWIG (1778–1852), German pedagogue and patriot, commonly called *Turnvater* ("Father of Gymnastics"), was born in Lanz on Aug. 11, 1778. He studied theology and philology from 1796 to 1802 at Halle, Göttingen and Greifswald. After Jena he joined the Prussian army. In 1809 he went to Berlin, where he became a teacher at the Gymnasium zum Grauen as well as at the Plamann School. Brooding upon the humiliation of his native land by Napoleon, he conceived the idea of restoring the morale of his countrymen by the development of their physical and moral powers through the practice of gymnastics. The first *Turnplatz,* or open-air gymnasium, was opened by him at Berlin in 1811, the young gymnasts being taught to regard themselves as members of a kind of gild for the emancipation of their fatherland. In 1813 he took an active part at Breslau in the formation of the famous corps of Lützow, a battalion of which he commanded, though during the same period he was often employed in secret service. After the war he returned to Berlin, where he was appointed state teacher of gymnastics. As such he was a leader in the formation of the student *Burschenschaften* (patriotic fraternities) in Jena.

A man of democratic nature, rugged, honest, eccentric and outspoken, Jahn often came into collision with the reactionary spirit of the time, and in 1819 the *Turnplatz* was closed and Jahn was arrested. He was detained at the fortress of Kolberg until 1824, and sentenced to imprisonment for two years; but this sentence was reversed in 1825, though he was forbidden to live within ten miles of Berlin. He settled at Freyburg on the Unstrut, where he remained until his death (Oct. 15, 1852), with the exception of a short period in 1828, when he was exiled to Cölleda on a charge of sedition. In 1840 he was decorated by the Prussian government with the Iron Cross for bravery in the wars against Napoleon. In the spring of 1848 he was elected by the district of Naumburg to the German national parliament.

Among his works are: *Bereicherung des hochdeutschen Sprach-*

schatzes (Leipzig, 1806), *Deutsches Volksthum* (Lübeck, 1810), *Runenblätter* (Frankfort, 1814), *Neue Runenblätter* (Naumburg, 1828), *Merke zum deutschen Volksthum* (Hildburghausen 1833), and *Selbstvertheidigung* (Vindication) (Leipzig, 1863). A complete edition of his works appeared at Hof in 1884–87. *See* the biography by Schultheiss (Berlin, 1894), and *Jahn als Erzieher*, by Friedrich (Munich, 1895).

JAHN, JOHANN (1750–1816), German Orientalist, was born at Tasswitz, Moravia, on June 18, 1750. He studied philosophy at Olmütz, and in 1772 began his theological studies at the Premonstratensian convent of Bruck, near Znaim, where, after a short interval, he became professor of Oriental languages and biblical hermeneutics. On the suppression of the convent by Joseph II. in 1784, Jahn took up similar work at Olmütz, and in 1789 he was transferred to Vienna as professor of Oriental languages, biblical archaeology and dogmatics. His *Einleitung ins Alte Testament* (2 vols., 1792), rendered him suspect to the cardinal-archbishop of Vienna who laid a complaint against him for having departed from the traditional teaching of the Church, *e.g.*, by asserting Job, Jonah, Tobit and Judith to be didactic poems, and the cases of demoniacal possession in the New Testament to be cases of dangerous disease. An ecclesiastical commission reported that the views themselves were not necessarily heretical, but he was advised to modify his expressions in future. At last (1806) he was compelled to resign his chair and to accept a canonry at St. Stephen's, Vienna. Both his *Introductio in libros sacros veteris foederis in compendium redacta* (1804) and his *Archaeologia biblica in compendium redacta* (1805) were condemned. He died on Aug. 16, 1816.

He also published *Hebräische Sprachlehre für Anfänger* (1792); *Aramäische od. Chaldäische u. Syrische Sprachlehre für Anfänger* (1793); *Arabische Sprachlehre* (1796); *Elementarbuch der hebr. Sprache* (1799); *Chaldäische Chrestomathie* (1800); *Arabische Chrestomathie* (1802); *Lexicon arabico-latinum chrestomathiae accommodatum* (1802); an edition of the Hebrew Bible (1806); *Grammatica linguae hebraicae* (1809); *Enchiridion Hermeneuticae* (1812); and a critical commentary on the Messianic passages of the Old Testament (*Vaticinia prophetarum de Jesu Messia*, 1815). The English translation of the *Archaeologia* by T. C. Upham (1840) passed through several editions.

JAHN, OTTO (1813–1869), German archaeologist, philologist, and writer on art and music, was born at Kiel on June 16, 1813. He was professor of archaeology at Greifswald, and then at Leipzig, but was dismissed (1851) from the Leipzig chair for political reasons. He was then director of the art museum at Bonn, and in 1867 was appointed to a chair in Berlin. He died at Göttingen, on Sept. 9, 1869. Jahn wrote many books on Greek art, and prepared editions of various classical authors. Of his works on musical history the most important is his *Biographie Mozarts* (3rd ed. by H. Disters, 1889–1891; Eng. trans. by P. D. Townsend, 1891).

JAHRUM, a town of Persia in the province of Fars, about 90 miles S.E. of Shiraz. The neighbourhood is celebrated for its dates, which are exported in great quantities; it also produces much tobacco and fruit. The water supply depends on wells. It has a population of about 15,000.

JAI-ALAI, the national Spanish ball game, a combination of three games, tennis, handball and lacrosse, originated in the Basque country of Spain in the 17th century. The terrific speed of the game calls for great strength, endurance, skill and dexterity. Eight balls about as large as baseballs are used in a game. The balls are thrown and caught with a *cesta* (basket) fastened to a glove worn by each player.

JAINS, an important sect of dissenters from Hinduism, whose wealth gives them greater influence than their numbers, only 1,178,596 in 1921. Being generally traders they are found in most Indian cities, especially in those of Mewār, Guzerāt and the upper Malabār coast. Their religious centres are Mt. Abu in Rājpūtāna, Girnār and Satrunjāya, "one of the loveliest temple cities of the world," and Ellora. Jainism is at least as old as Buddhism, the canons of the latter referring to it as a rival sect, the *Nirgrantha*, (Skt. "free from bonds").

Vardhamana Mahāvīra, their last leader, is identifiable on strong grounds with Nigantha Nata-putta (Nirgrantha of the Jnatrika clan) of the Buddhist *Pitakas* and Buddha's contemporary. But Jain tradition claims a far greater antiquity, averring that Mahāvīra was preceded by 23 Tirthankaras or saints who have attained *nirvāna* and are also called *Jinas*, "conquerors" or leaders of schools of thought, whence the term "Jain." But how far these were historical personalities is open to grave doubt. The first, Rishabha, depicted as a golden bull, is probably mythical. The 23rd, Parshva ("a snake, and blue"), has better claims to have founded the sect some 250 years before Mahāvīra. The Tirthankaras, though without care for or influence on the world, are worshipped as gods (*devas*), the three mentioned being specially affected, while Nemi or Aristanemi, Parshva's predecessor (a black conch) also has many temples. Nemi is indeed related to Krishna in legend and this may indicate that he too is purely mythical. Mahāvīra, on the other hand, is said to have been a Kshatriya (like all the rest of the 24 Jīnas) of Vaishali, 27m. north of Patna; brought up as a pious Jain he became a monk who discarded clothing; and after instructing 11 disciples he died at Pava (confirmed by Buddhist canons) aged 72, probably in 476 or 477 B.C.



FROM RUSSEL "TRIBES AND CASTES OF THE CENTRAL PROVINCES OF INDIA"

JAIN ASCETICS, CLOTH COVERING MOUTHS, WITH SWEEPING BRUSHES

It appears, then, safe to regard the nucleus of the sect as a strict monastic order, which eschewed ownership of everything mundane, even garments, as the Digambara ascetic does still when feasible. But Jain history has suffered much from schism. Still some facts may be regarded as ascertained. About 317 B.C. under Bhadrabāhu, Jainism expanded vigorously in north and north-west India, and good proof of this is that the language of the canons, redacted about A.D. 600 (though the Digambaras deny their authenticity), was old Magadhi (the tongue of south Behār). While it is doubtful if Samprati, a grandson of Asoka, was the first patron King of the Jains, inscriptions show that the Jains were powerful in Orissa in the 2nd century B.C., and during the 1st at Mathura.

At an early stage, however, schisms had weakened the sect. Mahāvīra was succeeded by patriarchs. But we have two distinct lines of them. According to the Digambaras, in the time of Bhadrabāhu arose the Ardhaphālakas, an order of laxer principles, which in A.D. 80 developed into the Swetāmbaras, so called because they wear "white" clothes. The Swetāmbaras however claim to be the original order, and aver that the Digambaras originated in an heretical sect called Botika, three years later. Both orders agree that Bhadrabahu was the 6th patriarch, but the Digambaras claim that he led the true monks to the south, accompanied by Chandragupta Maurya, who had abdicated his throne. The truth may be that Chandragupta was deposed and exiled, but he was eclectic in his beliefs and can only have embraced Jainism late in life. Since this exodus the Digambaras have been strongest in the south. In the north the Swetāmbara patriarchs each set up his own *gachchha* or "school of thought"; among them the Upakesa, followed by the Oswāl Jains. About 1125 the conversion of the powerful King of Guzerāt, Siddharāja, gave the Jains their first historical royal patron, and under that dynasty they established their strong position in the west. The two orders differ little in theology, but, if we except the Swetāmbara canons, the Digambara have the older literature, mostly in Sanskrit. They deny that women can attain *nirvāna*.

Jainism may be described as lacking an absolute Godhead. Sharing in the theoretical pessimism of the Buddhist, Sankhya and Yoga philosophies, it aims in practice at the goal of liberation from the transmigration of the soul. Matter exists, but only as something which may become anything. Being is indefinite, yet complex, not simple: a thesis upheld by a subtle dialectic. All substances are divided, broadly, into lifeless things, and souls or lives (*jiva*). The former may become anything, whence the ele-

ments are bodies of souls in the lowest stage of development. But souls, though substances, are not matter: yet they are capable of expansion, indestructible and characterized by intelligence which can never be annihilated. And they are of two kinds, mundane and liberated; the former still subject to the Birth Cycle, the latter disembodied for ever. Into the mundane soul pours subtle matter, ready to be transformed into *karma*, of eight kinds, and combining almost chemically with the soul it forms a subtle body which, clinging to it, determines its state and lot. Having done its work every *karma* is purged off from the soul until it is light enough to ascend to the top of the universe. But in actual life fresh *karma* tends to replace those eliminated, and then the soul must at death enter a new body. Moreover, the soul has transcendental colours, three good and three bad, indicating its character, and the soul itself may enter five stages, according as *karma* is neutralized, annihilated or partly one or the other. There are as many vows, first of which comes that "not to kill." This leads to a remarkable care to preserve all living things, and in strict practice the mouth should be covered with a cloth, lest the air be injured. Vermin must be removed, not killed, a Jain house being kept scrupulously clean. Monastic discipline is intense, and is not confined to bodily restraints, chastity, abstinence from alcohol, flesh, honey and roots, but includes mental discipline, purity of thought, contemplation, confession and repentance. The strength of Jainism lies in its association of the laity in these principles to a degree compatible with secular pursuits. A layman may make vows, after he has made sufficient progress, without entering an order or taking its full obligations upon him. While suicide is a sin, both ascetics and laymen may hasten death by voluntary starvation, though to the latter this is only permissible in old age. The weakness of Jainism is that it is essentially a creed of a cultivated class, from which the masses are excluded. Its stability is due to its recognition of lay co-partnership in spirituality, and though many minor schools weakened the Jain solidarity, only one new movement threatened to destroy it. At the close of the 15th century Lonka Sha denounced idol-worship and founded the Dhundhia ("Searchers") or Sthānakavāsi sect, which in turn split up into several sub-sects.

The Jain literature is vast, but only a fraction of it has been published. The Digambaras say that most of the older has been lost, and the Swetāmbaras have only preserved a part of theirs. Books are strictly safeguarded and some may be concealed. In architecture the Jains excel, and though Buddhist models were adopted in *stupas* and cave-temples, they carried the art of carving in stone to the highest point. Under Brahman influence Ajāyapala (A.D. 1174–76) is said to have destroyed many fanes in Delhi and the north, but more were pillaged by the Muslims to furnish materials for mosques. To save their temples from desecration the Jains often made miniatures of Mohammedan tombs in them, and blended their style with Moghul features. In the south the original characteristics were kept more intact. The temple courtyards contain colossi of the Digambara saint, Gomata or Gomateshvara, and those in Kanara, with their reversed eaves, recall those of Nepal.

JAINTIA HILLS. A mountainous region which with the Khasi Hills forms one of the districts of British India in the Hills division of Assam. (*See* KHASI and JAINTIA HILLS.)

JAIPUR, an Indian state in the Rajputana agency; area 15,579 sq.m.; pop. (1921) 2,338,802. The centre of the state is a sandy and barren plain 1,600 ft. above sea-level, bounded on the east by ranges of hills running north and south. On the north and west it is bounded by a broken chain of hills, an offshoot of the Aravalli mountains, beyond which lies the Rajputana desert. The hills are more or less covered with jungle trees, of no value except for fuel. Towards the south and east the soil becomes more fertile. Salt is largely manufactured from the Sambhar lake (*q.v.*). The maharaja of Jaipur belongs to the Kachwaha clan of Rajputs, claiming descent from Rama, king of Ajodhya. The state is said to have been founded about 1128 by Dulha Rai, from Gwalior, who with his Kachwahas is said to have absorbed or driven out the petty chiefs. The Jaipur house furnished to the Moguls some of their most distinguished generals. Among them were Man Singh, who fought in Orissa and Assam; Jai Singh, commonly known by his imperial title of Mirza Raja, whose name appears in all the wars of Aurangzeb in the Deccan; and Jai Singh II., or Sawai Jai Singh, the famous mathematician and astronomer, and the founder of Jaipur city. Towards the end of the 18th century the state was in great confusion; there was a constant rivalry between Jaipur and Jodhpur for the honour of marrying a princess of Udaipur, and at the same time Amir Khan with the Pindaris was exhausting the country. By a treaty in 1818 the protection of the British was extended to Jaipur and an annual tribute fixed. During the Mutiny the maharaja assisted the British and was rewarded by an extension of territory. His adopted son and successor, Maharaja Madho Singh, was a type of the old school of orthodox rajput chiefs; when he went to England for King Edward's coronation, he chartered his own ship and took not only all the food and water that would be required during his stay out of India, but even the plot of Indian earth on which he could sit for his meals. In his time the state was opened up by railways, and the city greatly improved. It was also he who took a lead in establishing the "Indian People's Famine Fund," to which he and his maharani contributed in all 25 lakhs of rupees (£167,000). The present maharaja is a minor; the salute is 17 guns. The state maintains a transport corps, with an ambulance section, which saw service on the frontier, in Afghanistan, and in Mesopotamia during the World War.

Jaipur City was founded in 1728 by the warrior-astronomer, Maharaja Jai Singh II. It is well laid out and lighted, with wide (111 feet) and regular main streets which divide it into six rectangular blocks; it is also a city of colour, as the houses are painted, and the whole town is surrounded by crenellated walls, overhung by rugged hills crowned with forts. The chief buildings are the maharaja's huge palace in the middle of the city; a remarkable open-air observatory erected by Jai Singh; a college where no fees are charged; a public library and a hospital; and a School of Art, for teaching and perfecting the local artistic industries. There is also a fine public garden with a menagerie. The city is a busy and prosperous commercial centre; its trades comprise jewel cutting and setting, as a variety of precious stones are found locally; enamel and metal work; the colour printing of cloths and muslins; and the treatment of marble and inlay. Pop. 120,207 in 1921. The ancient capital of Jaipur was Amber (*q.v.*).

JAISALMER, an Indian state in the Rajputana agency. Its area is 16,062 sq.m.; and in 1921 the population was 67,652. Jaisalmer is almost entirely a sandy waste, forming a part of the great Indian desert (*q.v.*). The general aspect of the country is that of an interminable sea of sandhills, of all shapes and sizes, some rising to a height of 150 ft. There are no perennial streams, and only one small river, the Kakni, which, after flowing a distance of 28 m., spreads over a large surface of flat ground, and forms a lake or *jhil* called the Bhuj-Jhil. The climate is dry and healthy. Throughout Jaisalmer only the poorer rain-crops are grown; spring crops of wheat, barley, etc., are very rare. The main part of the population lead a wandering life, grazing their flocks and herds. Large herds of camels, horned cattle, sheep and goats are kept. The principal trade is in wool, *ghi*, camels, cattle and sheep. The capital is a small town, famed for its yellowish sandstone buildings, its Jain temples and a fine fort. The ruler has the style of Maharawal, and a salute of 15 guns.

The majority of the inhabitants are Bhatti Rajputs, who take their name from an ancestor named Bhatti, renowned as a warrior before the tribe were driven from the Punjab into this oasis in the Great desert. Deoraj, a famous prince of the Bhatti family, is esteemed the real founder of the present Jaisalmer dynasty, and with him the title of *rawal* commenced. In 1156 Jaisal, the sixth in succession from Deoraj, founded the fort and city of Jaisalmer, and made it his capital. It was sacked by the emperor Ala-ud-din after an eight years' siege; ultimately, in the time of Rawal Sabal Singh the clan had to accept the supremacy of the Mogul emperor Shah Jahan. The Jaisalmer princes had now arrived at the height of their power, but from this time till the accession of Rawal Mulraj in 1762 the fortunes of the state rapidly declined, and

most of its outlying provinces were lost. In 1818 Mulraj entered into political relations with the British, and some of the territory which had been lost in the previous century was restored after the conquest of Sindh.

JAJCE, a town of Bosnia, Yugoslavia. Pop. (1921) 4,132. Jajce occupies a conical hill, overlooking one of the finest waterfalls in Europe, where the Pliva rushes down into the Vrbas, 100 ft. below. The 14th century citadel which crowns the hill is said to have been built for Hrvoje, duke of Split (*Spalato*). The ruined church of St. Luke, the legendary burial place of the Evangelist, has a fine Italian belfry, and dates from the 15th century. Jezero, 5 m. W. of Jajce, contains the Turkish fort of Djöl-Hissar or the "Lake Fort." Here a line of waterfalls and meres formed by the Pliva stretches for several miles, enclosed by steep rocks and forest-clad mountains. Chemicals form the principal industry and the power supplied by the main fall, at Jajce, is used for the calcium carbide works which are the largest in Europe, but the beauty of the town remains unimpaired.

From 1463 to 1528 Jajce was the principal outwork of eastern Christendom against the Turks. Venice contributed money for its defence, and Hungary provided armies; while the pope entreated all Christian monarchs to avert its fall. In 1463 Mohammed II. seized Jajce, and beheaded the last king of Bosnia under its walls, in a field still called "The King's Field." His coffin and skeleton are preserved in St. Luke's church. In 1463 the Hungarians recovered the town and held it till the battle of Mohacs in 1526 destroyed their power. Two years later Jajce surrendered, and remained Turkish until the Austrian occupation (1908–18), when, at the close of the World War, Bosnia was incorporated in the kingdom of Yugoslavia.

See Bräss, *Jajce, die alte Königstadt Bosniens,* in Deutsche Geog. Blätter (Bremen, 1899).

JAJPUR, a town of British India, in Cuttack district, Behar and Orissa, situated on the right bank of the Baitarani river. Pop. (1921) 11,015. It was the capital of Orissa some time prior to the 11th century, when it was superseded by Cuttack. A monolithic shaft, called the Chandeswar pillar, standing 20 ft. high, dates back to the 5th century A.D. A stone bridge, 240 ft. long, with 11 spans is another monument of the Hindu kings, to whom also may be ascribed some of the many temples.

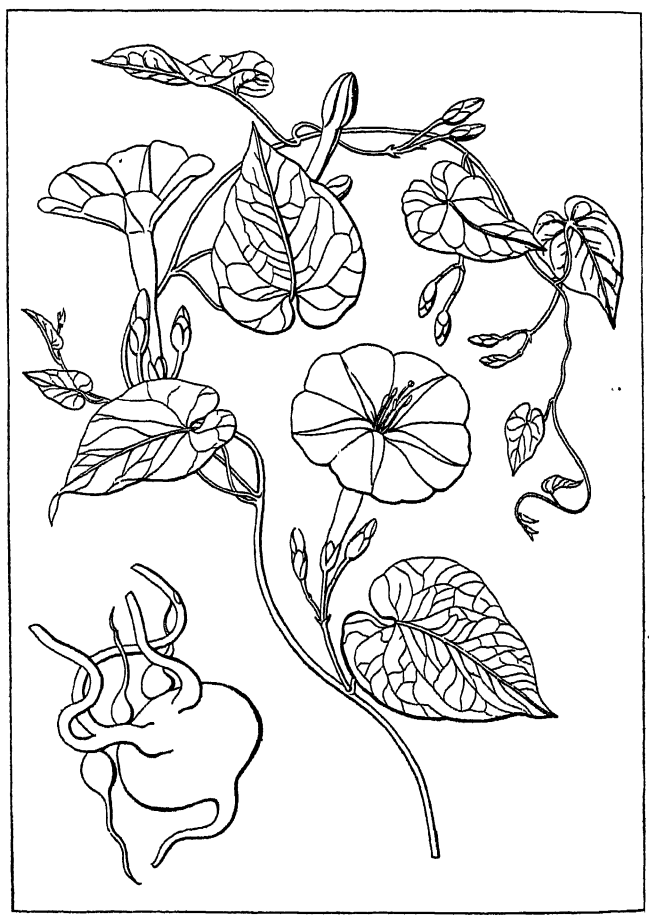
JAKOVA (also written *Diakovo, Gyakovo* and *Gjakovica*), the largest town in Montenegro, Yugoslavia. Pop. (1921) 12,724, almost entirely Muslim Albanians. It is a miserable, badly-paved town, lying in a fertile plain surrounded by wild, wooded mountains. Its inaccessibility and the lawlessness of its inhabitants protect it from the inroads of civilization, the only good approach being by the road from Prizren to Ipek. With improved communication Jakova would become an important market for agricultural produce. There is a carpet factory in the town, and iron is said to exist in the district. Jakova was captured by the Serbs in the Balkan Wars (1912–13) and ceded to Montenegro by the Treaty of Bucharest (1913).

JAKUN, a Proto-Malayan tribe of the Malay Peninsula, divided into the Orang Bukit or Hill Jakun and the Orang Laut or Sea Jakun. The former include sub-tribes such as Besisi, Baduanda, Mantra, and the latter, including the Seletar among others, are akin to the Mawkhen tribe. They are largely nomadic, though some of the Orang Bukit practise a little agriculture, and hold a marriage carnival at harvest time. They smoke tobacco, chew betel, file their teeth to a point, do not circumcise, but practise a form of incision. The general weapon is the blow-gun; the spear, and sword or kris are also used. Their huts, built of leaves or bark and raised on piles, are small and flimsy; dug-out boats are used on the rivers. At tribal feasts they sing and dance in imitation of animals. They have chiefs (*batin*), bury their dead and erect a hut for the deceased's soul.

See Skeat and Blagden, *Pagan Races of the Malay Peninsula* (1906).

JALALABAD or JELLALABAD, a town and province of Afghanistan. The town lies at a height of 1,950 ft. in a plain on the south side of the Kabul river, 96 m. from Kabul and 76 from Peshawar. Estimated pop., 6,000. Between it and Peshawar intervenes the Khyber pass, and between it and Kabul the passes of Jagdalak, Khurd Kabul, etc. The site was chosen by the emperor Baber, and he laid out some gardens here; but the town itself was built by his grandson Akbar in A.D. 1560. It resembles the city of Kabul on a smaller scale, and has one central bazaar, the streets generally being very narrow. The most notable episode in the history of the place is the famous defence by Sir Robert Sale during the first Afghan war, when he held the town from Nov. 1841 to April 1842. The town is now fortified, surrounded by a high wall with bastions and loopholes. The province of Jalalabad is about 80 m. in length by 35 in width, and includes the large district of Laghman north of the Kabul river, as well as that on the south called Ningrahar. The climate of Jalalabad is similar to that of Peshawar. It is one of the most important positions in Afghanistan, for it dominates the entrances to the Laghman and the Kunar valleys, commanding routes to Chitral or India north of the Khyber, as well as the Kabul-Peshawar road.

JALAP, a cathartic drug consisting of the tuberous roots of *Ipomaea purga,* a convolvulaceous plant growing on the eastern declivities of the Mexican Andes at an elevation of 5,000ft. to 8,000ft. above the level of the sea. The jalap plant has slender herbaceous twining stems, with alternately placed heart-shaped pointed leaves and salver-shaped deep purplish-pink flowers. The underground stems are slender and creeping; their vertical roots



FROM KOEHLER, "MEDIZINALE PFLANZEN"

JALAP, CULTIVATED IN MEXICO FOR THE MEDICINAL RESIN IT CONTAINS

enlarge and form turnip-shaped tubers. The roots are dug up in Mexico throughout the year, and are suspended to dry in a net over the hearth of the Indians' huts, and hence acquire a smoky odour. The large tubers are often gashed to cause them to dry more quickly. In their form they vary from spindle-shaped to ovoid or globular, and in size from a pigeon's egg to a man's fist. Externally they are brown and marked with small transverse paler scars, and internally they present a dirty white resinous or starchy fracture. The ordinary drug is distinguished in commerce as Vera Cruz jalap, from the name of the port whence it is shipped.

Jalap has been cultivated for many years in India, chiefly at Ootacamund, and grows there as easily as a yam, often producing clusters of tubers weighing over 9 lb.; but these, as they differ in appearance from the commercial article, have not as yet obtained a place in the English market. They are found, however, to be rich in resin, containing 18%. In Jamaica also the plant has been grown, at first amongst the cinchona trees, but more recently in new ground, as it was found to exhaust the soil.

Besides Mexican or Vera Cruz jalap, a drug called Tampico jalap has been imported for some years in considerable quantity. It has a much more shrivelled appearance and paler colour than ordinary jalap, and lacks the small transverse scars present in the true drug. This kind of jalap, the Purga de Sierra Gorda of the Mexicans, was traced by Hanbury to *Ipomaea simulans*. It grows in Mexico along the mountain range of the Sierra Gorda in the neighbourhood of San Luis de la Paz, from which district it is carried down to Tampico, whence it is exported. A third variety of jalap known as woody jalap, male jalap or Orizaba root, or by the Mexicans as Purgo macho, is derived from *Ipomaea orizabensis*, a plant of Orizaba. The root occurs in fibrous pieces, which are usually rectangular blocks of irregular shape, 2in. or more in diameter, and are evidently portions of a large root. It is only occasionally met with in commerce.

The dose of jalap is from five to 20 grains, the British Pharmacopeia directing that it must contain from 9 to 11% of the resin, which is given in doses of two to five grains. One preparation of this drug is in common use, the *Pulvis jalapae compositus*, which consists of 5 parts of jalap, 9 of cream of tartar and 1 of ginger. The dose is from 20 grains to a dram. It is best given in the maximum dose which causes the minimum of irritation.

The chief constituents of jalap resin are two glucosides—*convolvulin* and *jalapin*—sugar, starch and gum. Convolvulin constitutes nearly 20% of the resin. It is insoluble in ether, and is more active than jalapin. It is not used separately in medicine. Jalapin is present in about the same proportions. It dissolves readily in ether, and has a soft resinous consistence. It may be given in half-grain doses. It is the active principle of the allied drug *scammony*. According to Mayer, the formula of convolvulin is $C_{31}H_{50}O_{16}$, and that of jalapin $C_{34}H_{56}O_{16}$.

Jalap is a typical hydragogue purgative, causing the excretion of more fluid than scammony, but producing less stimulation of the muscular wall of the bowel. For both reasons it is preferable to scammony. It is a powerful cholagogue, an action possessed by few hydragogue purgatives. The drug is largely employed in dropsy from any cause, being especially useful when the liver shares in the general venous congestion. It is not much used in ordinary constipation.

JALAPA (or **JALAPA ENRÍQUEZ**), a city of Mexico and capital of the State of Veracruz, 70m. by rail N.W. of the port of Veracruz. Pop. (1921) 27,623. It is picturesquely situated on the slopes of the sierra which separates the central plateau from the *tierra caliente* of the gulf coast, at an elevation of 4,300 ft., and with the Cofre de Perote behind it rising to a height of 13,419 feet. Its climate is cool and healthy and the town is frequented in the hot season by the wealthier residents of Veracruz. The city is well built, in the old Spanish style. Among its public buildings are a fine old church, a Franciscan convent founded by Cortés in 1556, and three hospitals, one of which, that of San Juan de Dios, dates from colonial times.

JALAUN, a town and district of British India, in the Allahabad division of the United Provinces. Pop. of town (1921), 7,324. Formerly it was the residence of a Mahratta governor, but never the headquarters of the district, which are at Orai, an equally insignificant village (pop. 8,914).

The DISTRICT OF JALAUN has an area of 1,549 sq.m. It lies entirely within the level plain of Bundelkhand, north of the hill country, and is almost surrounded by the Jumna and its tributaries the Betwa and Pahuj. The central region thus enclosed is a dead level of cultivated land, largely black-cotton soil, and almost treeless. The river Non flows through the centre of the district, which it drains by innumerable small ravines instead of watering. Jalaun has suffered much from the noxious *kans* grass, owing to the spread of which many villages have been abandoned and their lands thrown out of cultivation. Pop. (1921) 405,439. The two largest towns are Kunch (14,503). and Kalpi (10,037). The district is particularly susceptible to famine and only a small part of it is watered by the Betwa canal. Grain, oil-seeds, cotton and *ghi* are exported.

In early times Jalaun seems to have been the home of two Rajput clans, the Chandels in the east and the Kachwahas in the west. The town of Kalpi on the Jumna was conquered for the princes of Ghor as early as 1196. Early in the 14th century the Bundelas occupied the greater part of Jalaun, and even after Akbar's governors established at Kalpi a nominal authority over the surrounding district, the Bundela chiefs were in a state of chronic revolt, which culminated in the war of independence under Chhatar Sal. In 1671, assisted by the Mahrattas, he reduced the whole of Bundelkhand. On his death he bequeathed one-third of his dominions to his Mahratta allies, who before long succeeded in annexing them completely. Under Mahratta rule the country was a prey to constant anarchy and intestine strife. To this period must be traced the origin of the poverty and desolation which are still conspicuous throughout the district. In 1806 Kalpi was made over to the British, and in 1840, on the death of Nana Gobind Ras, his possessions lapsed to them also. Various interchanges of territory took place, and in 1856 the present boundaries were substantially settled.

JALISCO or XALISCO, a Pacific coast State of Mexico. Pop. (1921) 1,208,855. Area, 31,151 sq. miles. Jalisco is traversed from north north-west to south south-east by the Sierra Madre, locally known as the Sierra de Nayarit and Sierra de Jalisco, which divides the State into a narrow, heavily forested coastal plain and a high plateau region, part of the great Anáhuac tableland, with an average elevation of about 5,000 ft., broken by spurs and flanking ranges of moderate height. The sierra region is largely volcanic and earthquakes are frequent; in the south are the active volcanoes of Colima (12,750 ft.) and the Nevado de Colima (14,363 ft.). The *tierra caliente* zone of the coast is tropical, humid and unfavourable to Europeans, while the inland plateaux vary from subtropical to temperate and are generally drier and healthful. The greater part of the State is drained by the Río Grande de Lerma (called the Santiago on its lower course) and its tributaries, chief of which is the Río Verde. Lakes are numerous, the largest being Chapala, about 80 m. long by 10 to 35 m. wide, which is considered one of the most beautiful inland sheets of water in Mexico.

The agricultural products of Jalisco include Indian corn, wheat and beans on the uplands, and sugar-cane, cotton, rice, indigo and tobacco in the warmer districts. Rubber and palm oil are natural forest products of the coastal zone. Stock-raising is an important occupation in some of the more elevated districts. The mineral resources include silver, gold, cinnabar, copper, bismuth and various precious stones. There are reduction works and some manufactures, including cotton and woollen goods, pottery, refined sugar and leather. The State has railway outlets eastward to Mexico City, westward to Manzanillo on the coast and northward, via the Southern Pacific of Mexico to the United States.

There is a large percentage of Indians and mestizos in the population. The capital is Guadalajara, and other important towns with their populations (1921) are: Ciudad Guzmán (16,842), 60 m. N.E. of Colima; Lagos (10,012), a mining town 100 m. E.N.E. of Guadalajara, on the Mexican Central railway; Autlán (12,383); Ameca (11,304), in a fertile agricultural region on the western slopes of the sierras.

JALPAIGURI, a town and district of British India, in the Rajshahi division of Bengal. The town is on the right bank of the river Tista, with a station on the Eastern Bengal State railway. Pop. (1921), 14,520. It is the headquarters of the commissioner of the division.

The DISTRICT OF JALPAIGURI occupies an irregularly shaped tract south of Darjeeling and Bhutan and north of the State of Cooch Behar. Area, 2,931 sq. miles. Pop. (1921), 936,269. The district is divided into a "regulation" tract, and a strip of country, about 22 m. in width, running along the foot of the Himalayas,

and known as the Western Duars, annexed from Bhutan after the war of 1864–65. The former is a continuous expanse of level paddy fields. The latter is a centre of tea cultivation; there were 131 tea gardens in the district in 1921, 102,000 ac. were plucked, and the out-turn of tea was 43¼ million pounds. The staple crop elsewhere is rice; jute and tobacco are largely grown. The frontier towards Bhutan is formed by the Sinchula mountain range, some peaks of which attain an elevation of 6,000 feet. Buxa, standing 2,000 ft. high and commanding one of the chief passes into Bhutan, was formerly a cantonment; it has a rainfall of 209 inches.

JALUD, a tributary of the river Jordan in Palestine. It descends from the plains of Esdraelon to near Beisan. *See* JORDAN; PALESTINE.

JAMAICA, the largest island in the British West Indies. It lies about 80 m. S. of the eastern extremity of Cuba, between 17° 43′ and 18° 32′ N. and 76° 10′ and 78° 20′ W., is 144 m. long, 50 m. in extreme breadth and has an area of 4,207 sq.m. A mountainous backbone runs through the island from east to west, broken by pressure into a series of ridges running diagonally N.W. and S.E. The highest of these ranges is towards the east end of the island and is called the Blue mountains. They trend west by north, culminating in Blue Mountain Peak (7,360 ft.) and are crossed by five passes at altitudes varying from 3,000 to 4,000 feet. Two-thirds of the island are occupied by a plateau of deep-sea white limestone, forming a region of great beauty broken by innumerable hills, valleys, "cockpits" and sink-holes, and covered with luxuriant vegetation. These uplands usually terminate in steep slopes or bluffs, separated from the sea, in most cases, by a strip of level land. On the south coast, especially, these plains are often extensive, the Liguanea plain, on which Kingston and Spanish Town stand, having an area of 200 sq.m. More than a hundred rivers and streams find their way to the sea, with numerous tributaries which issue from every ravine in the mountains. These streams are mostly not navigable, and in times of flood become violent torrents. Some of the larger rivers have laid down alluvial plains in their lower valleys and considerable deltas at their mouths. The Black river threads a vast morass, once the seabed, and is navigable by small craft for about 30 m. The Salt river and the Cabaritta, also in the south, are navigable by barges. Vestiges of intermittent volcanic action occur (including one truncated cone of basaltic lava), and there are several radio-active hot springs. Jamaica has 16 harbours, the chief of which are Port Morant, Kingston, Old Harbour, Lucea, Montego Bay, Falmouth, St. Ann's Bay, Port Maria and Port Antonio.

Geology.—The greater part of Jamaica is bedded with Tertiary deposits, but in the Blue mountains and some of the other ranges older rocks emerge. The foundation of the island is composed of stratified shales and conglomerates, with tuffs and other volcanic rocks and occasional bands of marine limestone. The limestones contain Upper Cretaceous fossils, and the whole series has been heavily folded. Upon this foundation rests unconformably a series of marls and limestones of Eocene and early Oligocene age. Some of the limestones are composed of Foraminifera, together with Radiolaria, and indicate a subsidence to great depths, whilst the higher peaks of the island still remained above the sea. Towards the middle of the Oligocene period, when the folding pressure took place, the island was lifted far above its present level and was probably connected with the rest of the Greater Antilles and perhaps with the American mainland also. In the same period plutonic rocks of various kinds were intruded into the deposits already formed, and in some cases produced considerable metamorphism. During the Miocene and Pliocene periods the island again sank, but never to the depths which it reached in the Eocene period. The deposits formed in this period were shallow-water conglomerates, marls and limestones, with Mollusca, Brachiopoda, corals, etc. Finally, a series of successive small upliftings, less than 500 ft. in the aggregate, raised the island to its present level. The terraces which mark the successive stages in this elevation are well shown near Montego bay. The remarkable cavities of the Cockpit country and the closed basins of various rivers have been formed by the solution of the white limestone layer resting upon insoluble rocks. The island produces a great variety of marbles, porphyrites, granite and ochres. Traces of gold have been found associated with some of the oxidized copper ores (blue and green carbonates) in the Clarendon mines. Copper ores are widely diffused and lead and cobalt are found, but do not pay to work. Manganese iron ores and a form of arsenic occur.

Climate.—The climate is one of the island's chief attractions. Near the coast it is warm and humid, tempered by sea breezes, but in the uplands is delightfully mild and equable. At Kingston the temperature ranges from 70·7° to 87·8° F, and this is generally the average of all the low-lying coast land. At Hill Gardens in the Blue mountains, 4,907 ft. above the sea, it varies from 57·5° to 68·5°. The vapours from the rivers and the ocean generate in the upper regions clouds saturated with moisture which there maintain vegetation belonging to a colder climate. During the rainy seasons the accumulation of these vapours causes a general coolness and occasional heavy showers, and sometimes destructive floods. These seasons, in May and October, last for about three weeks, although, as a rule, no month is quite without rain. The fall varies greatly; while the annual average for the island is 66·3 in., at Kingston it is 32·6 in., at Hill Gardens 105·5 in., and at some places in the north-east exceeds 200 in. The climate of the Santa Cruz mountains is very favourable to sufferers from tubercular and rheumatic diseases. Excepting near morasses and lagoons, the island is very healthy, and yellow fever, once prevalent, is extinct. In the early part of the 19th century, hurricanes often devastated Jamaica, but now, though they frequently pass to the N.E. and S.W. they more rarely strike the island itself.

Flora.—The flora is remarkable, showing types from North, Central and South America, with a few European forms, besides the common plants found everywhere in the tropics. Of flowering plants, 2,180 distinct species have been identified, and of ferns 450 species, several of both being indigenous. This abundance may be to some extent accounted for by differences of altitude, temperature and humidity. There are many beautiful flowers, such as the aloe, the yucca, the datura and the mountain pride; and the cactus tribe is well represented. The sensitive plant is a pest in pastures. There are pretty wild orchids. Though most of the ancient forests have been cut or destroyed, and the existing woodlands are of secondary growth, there is still much useful timber: cedar and mahoe being the most important. Fine cabinet-making woods are mahogany, yucca, rosewood, satin wood, lignum vitae and ebony. Lancewood spars and hardwoods suitable for railway ties are cut in great quantities. Logwood is a very important crop, grown in lowland pastures. This wood is exported, but the making of logwood extract for dye is a valuable industry. Fustic is used for khaki dye. A very conspicuous but useless tree is the huge silk-cotton tree (*Ceiba Bombax*). Pimento (allspice) is indigenous. Bamboo is plentiful. Several species of palm abound —the mountain cabbage, the fan palm, screw palm and palmetto royal. There are large plantations of coco palms. Other noticeable trees and plants are the mango, the breadfruit tree, the papaw, the lacebark tree, the guava and the castor oil plant. English vegetables grow in the hills. There is much cultivation of bananas, plantains, coffee, cocoa, yams, cassava, ochra, beans, pease, ginger, annatto and arrowroot. Maize and guinea-corn are grown and the guinea-grass, accidentally introduced in 1750, is very valuable for horses and cattle. Among the principal fruits are the orange, shaddock, lime, grape-fruit, pine-apple, mango, banana, grapes, melons, star-apple, avocado pear, breadfruit and tamarind.

Fauna.—There are fourteen sorts of *Lampyridae* or fireflies, besides the *Elateridae* or lantern beetles. There are no venomous serpents, but a few harmless snakes and many lizards. The land crab is highly reputed as a table delicacy. The scorpion and centipede, though poisonous, are not very dangerous. Ants, sand-flies and mosquitoes abound in the lowlands. There are

20 different song-birds, and 43 varieties of birds are believed to be peculiar to the island. The sea and the rivers swarm with fish. Turtles are plentiful, and the seal, the manatee and the crocodile are occasionally found. The coral reefs, with their varied polyps and anemones, the numerous alcyonarians and coral-dwelling animals are readily accessible to the student, and the island is also celebrated for the number of species of its land-shells.

People.—The population of the island was estimated in 1925 as 916,620. Jamaica is rich in traces of its former Arawak inhabitants. Aboriginal petaloid celts and other implements, flattened skulls and vessels are common. Images and drawings have been found in limestone caverns. Of the present inhabitants, according to the 1921 census less than 2 per cent were white, 18 per cent "coloured," *i.e.*, of mixed race, and 77 per cent black: but among these there is probably in many cases some share of European descent. Coloured persons and negroes are found in all professions and occupations represented in the community, but leadership and initiative still remain predominantly with the white and lighter-coloured citizens. Most of the elementary school teachers of both sexes are black.

The capital, Kingston, stands on the south-east coast, and near it is the town of Port Royal. Spanish Town (pop. about 9,000), the former capital, is in the parish of St. Catherine, Middlesex, 11¾ m. by rail west of Kingston. After the transfer of the seat of government to Kingston, Spanish Town sank greatly in importance, but has revived as the centre of valuable banana and sugar cultivation in the irrigated Liguanea plain. In the cathedral many of the governors of the island are buried. A marble statue of Rodney commemorates his victory over the Count de Grasse off Dominica in 1782. Montego Bay (pop. 6,000), on the north-west coast, is the second town on the island, and is a favourite bathing resort. Port Antonio (pop. 4,000) lies between two secure harbours on the north-east, and owes its prosperity mainly to the development of the trade in fruit, for which it is the chief place of shipment.

Industries.—Agricultural enterprise falls into two classes—planting and pen-keeping, *i.e.*, the breeding of horses, mules, cattle and sheep. The chief products are in order of value of exports, bananas 40%, sugar and rum 20%, coffee 12%, pimento, coconuts and copra, logwood and its extract, cocoa ginger, oranges and their oil, cigars, grape-fruit and honey.

The island contains about 120,000 head of cattle and 25,000 horses and mules. Motor carriage has diminished the importance of horse and mule breeding. The banana industry (export latterly exceeding 20 million bunches a year) is highly organized, both as regards the cultivation, much of it in large arable fields, and the transport and shipping of the fruit. There is a strong Government Department of Agriculture and Science, which co-operates with the Jamaica Agricultural Society, a very efficient institution, which directs the activities of 16 agricultural instructors, doing their work through contact with 260 branch agricultural societies, mostly composed of peasants. The board of management of the society meets monthly, with the Governor as president, to discuss agricultural interests in all aspects. The Jamaica Imperial Association and the Producers Association are valuable auxiliaries in the political and commercial spheres. In regard to productive agriculture Jamaica is the most highly developed community in the British West Indies. The estates are ably managed, whilst there are about 140,000 peasant holdings of land valued at from £20 to £100, which largely feed the population, supply the local markets, produce fruit, coffee, spices, honey and other minor staples for export, and contribute to the labour supply of estates. Provision is made through a Government Land Bank for the purchase and cutting up of estates for small holders. The manufactures are few. In addition to the sugar and coffee estates there are cigar factories, tanneries, distilleries, breweries, electric light and gas works, iron foundries, potteries and factories of logwood extract, coconut oil, essential oils, ice, matches and mineral waters. Of the imports (valued £5,636,188 in 1925), about 45% are from the British Empire, 40% from the United States, which took about the same proportion of the exports (value, 1925, £3,935,059). Jamaica was a signatory of the Canada-West Indies trade agreements of June 18, 1920 and July 6, 1925. Under the latter, Canada imposes a customs duty of 50 c. per bunch on foreign bananas, admits Jamaica bananas free and provides a fortnightly mail passenger and freight service with refrigeration for 70,000 bunches of bananas, alternating with a fortnightly freight service with refrigeration for 50,000 bunches between Canadian ports and Kingston. At present the fruit industry is handled by five concerns, of which all but one carry the fruit to America.

Under the Canada-West Indies agreement Jamaica sugar enjoys the increased preference of $1.00 per 100 lb. on 96° sugar entering the Dominion. In the United Kingdom the preference on British colonial sugar was restored in 1925 to 3s. 8½d. per cwt., and an undertaking was given by Parliament that it would remain at that figure for 10 years. This has helped to establish confidence in the industry. The revenue averages about £2,000,000 p.a. (£866,000 from customs duties). Direct property and income taxes are levied. Of the expenditure (normally somewhat less than the revenue), the largest items are debt charges £273,600, public works, £315,160, constabulary £178,600, education, £155,600, medical services, £136,470.

There is a government savings bank at Kingston with branches throughout the island, and branches of Barclay's Bank, the Bank of Nova Scotia, the Canadian Bank of Commerce and the Royal Bank of Canada at Kingston and in most of the towns. There is a system of Agricultural Loan Banks, under Government control, with an issued Share Capital of £70,602. The coins in circulation are British gold and silver, but not bronze, instead of which local nickel currency is used. United States gold is current. Notes of the various Banks are in circulation and a Government currency of £1 and 10/– notes, which are legal tender. English weights and measures are used.

Communications.—There is frequent regular steamer communication with England by the Elders and Fyffes fruit boats, also by the Harrison Leyland and Pacific Steam Navigation lines and the Royal Mail S.P. Co.: with the U.S.A. by the United Fruit Co., the Hamburg American Line and the Atlantic Fruit Co.; with Canada by the Canadian Government Merchant Marine line and Pickford & Black's. Sailing "droghers" ply from port to port of the island. Jamaica has an excellent system of good motoring roads, subsidiary metalled roads and bridle paths; the main roads are controlled by the public works department, the parochial roads by the parish boards. The railway runs from Kingston in the south-east to Montego bay in the north-west with branches to Port Antonio, and to Ewarton and Frankfield in the interior of the island. Jamaica is included in the Imperial 1½d. post, and there is almost daily mail communication with the United States and England. There is cable connection with the United States via Cuba, and with Halifax, Nova Scotia, via Bermuda. A new and improved wireless telegraphic station near Kingston was completed in 1927.

Administration.—The public administration is conducted by a Governor who bears the old Spanish title of Captain General, a Privy Council, of three public officers, *ex-officio*, and not more than eight nominated members, and a Legislative Council, composed of the Governor, as President, five public officers ex-officio, nominated members not exceeding ten in number, and fourteen elected members, one for each parish of the island. The vote of nine elected members controls finance. The qualification for membership is residence in the parish or an income of £150 a year arising from lands therein. The electors are all adult men and women occupying premises on which taxes of not less than 10/– a year are paid, or having personal property paying not less than 30/– a year in taxes or a salary or wages of not less than £50 a year, or paying a rent of not less than £10 a year. There were, in 1921, 42,267 electors on the register. Local administration is carried on by elected parochial boards (Kingston and Saint Andrew's being united, with a mayor and corporation), which deal with local roads, markets, public health, poor relief and water supplies. The revenues of parochial boards amount to about £350,000 a year. There is a small imperial garrison consisting of Royal Engineers, Royal Artillery, three infantry companies and

the appropriate staff and auxiliary services. There is a local militia artillery company, and a corps of infantry volunteers.

Previous to 1870 the Church of England was established in Jamaica, but in that year a disestablishment act was passed which provided for gradual disendowment. It is still the most numerous body, and is presided over by the bishop of Jamaica. The Baptists, Wesleyans, Presbyterians, Roman Catholics and Moravians are considerable communities. There is a Jewish synagogue at Kingston, and the Salvation Army has a branch on the island. The Church of England maintains a theological college, a deaconesses' home and an orphanage. The Baptists have a theological college, and the Roman Catholics support a training college for teachers, two industrial schools and two orphanages. Elementary education is maintained by Government grants. There are (1927) 118 Government schools, 193 Church of England, 111 Baptist, 74 Wesleyan, 57 Moravian, 126 of other denominations—total 679. The number of students amounts to 120,000; average attendance 75,000. The excellent Mico Training college (endowed and receiving a Government capitation grant) provides male teachers, and Shortwood college and Bethlehem (Moravian) college for women. The Government maintains a continuation technical and commercial school in Kingston. The provision for secondary and higher education is very good and efficient: there being a number of endowed foundations in different parts of the island, supplemented elsewhere by Government and denominational colleges and high schools. The Government gives liberal annual scholarships (tenable for 3, 4 or 5 years) for boys and girls to maintain them at universities: and a Rhodes Scholarship of £400 a year for 3 years is also awarded annually.

HISTORY

Jamaica was discovered by Columbus on May 3, 1494. He was subsequently stranded for 12 months on the north coast, in 1503–4. In 1509 Don Juan de Esquivel was appointed by Diego, Columbus's son, as governor, and from that date till 1655 the island remained under Spanish rule. The Spaniards named it Sant' Jago. Its native Arawak name was Xaymaca, "Isle of Springs." Villa de la Vega (first called by the English Sant' Jago de la Vega and, later, Spanish Town), was founded in 1523 and was the capital till 1872. Sir Anthony Shirley, a British admiral plundered and burnt that town in 1596, but effected no occupation. Another raid was made in 1635, by Colonel Jackson. During the Spanish occupation the inoffensive Arawak inhabitants, with whom Las Casas said the island "abounded as an ant-hill with ants," were exterminated by oppression, and negro slaves were imported. The whole island was divided among eight noble Spanish families, who so discouraged immigration that when Jamaica was taken by the British the white and slave population together did not exceed 3,000. Cromwell attacked the empire of Spain in the West Indies, and Admirals Penn and Venables succeeded in capturing and holding Jamaica in 1655. The Spanish were completely expelled in 1658. Their slaves took to the mountains, and till the end of the 18th century the efforts of these Maroons, as they were called, to maintain their independence gave rise to repeated fighting. Jamaica continued to be governed by military authority until 1661, when Colonel D'Oyley was appointed captain-general and governor-in-chief with an executive council. He was succeeded next year by Lord Windsor, under whom a legislative assembly was established with power to make laws subject to disallowance by the Crown. Jamaica soon became the chief resort of the buccaneers, who not infrequently united the profession of merchant or planter with that of pirate or privateer. By the Treaty of Madrid, 1670, the British title to the island was recognized, and the buccaneers were suppressed. The Royal African Company was formed in 1672 with a monopoly of the slave trade, and from this time Jamaica was one of the greatest slave marts in the world. At this date there were in Jamaica 70 sugar works, 60 indigo works and 60 cacao works. An attempt was made in 1678 to impose on the island a yearly tribute to the Crown and to supersede the powers of the legislature. The privileges were restored in 1682; but not till 46 years later was the question of revenue settled, by a compromise by which Jamaica undertook to pay £8,000 (afterwards reduced to £6,000) per annum to the Crown, provided that English statute laws were made binding in Jamaica.

In 1692 a severe earthquake destroyed the greater part of the town of Port Royal. Hurricanes occurred in 1712, 1714 and 1722, the last doing so much damage that the seat of commerce was transferred from Port Royal to Kingston.

The most important event during the later years of the 18th century was the threatened invasion by the French and Spanish in 1782, averted by the victory of Rodney and Hood off Dominica. The last attempt at invasion was made in 1806, when the French were defeated by Admiral Duckworth. When the slave trade was abolished (in 1807) the island was at the zenith of its prosperity; sugar, coffee, cocoa, pimento, ginger and indigo were being produced in large quantities, and it was the depot of a very lucrative trade with the Spanish Main. There were then 319,351 slaves in Jamaica. The anti-slavery agitation in Great Britain was paralleled in the island, and in 1831 some of the negroes revolted, believing that emancipation had been granted. They killed a number of whites and destroyed property valued at £657,000. Two years later the Emancipation Act was passed, and, subject to a short term of apprenticeship, 125,590 slaves were freed. Emancipation crippled the planters. The British Government awarded them compensation at the rate of £19 per slave, but most of this compensation went into the hands of their creditors. They were left financially exhausted and with a scarcity of labour. The abolition in 1846 of the tariff protection of colonial produce in the British market reduced the price of sugar by one-half and in many cases destroyed the profits of the already impoverished planter. Many estates, already heavily mortgaged, were abandoned, and the trade of the island was greatly diminished. Dissensions between the executive, the legislature, and the home Government, as to the means of retrenching public expenditure, created much bitterness. Although some slight improvement marked the administration of Sir Charles Metcalfe and the earl of Elgin, when Indian immigration was introduced to redress the scarcity and irregularity of labour and the railway was opened, the improvement was not permanent. In 1865 Edward John Eyre became governor. The public finances were in great difficulties and the colonial treasury showed a deficit. To meet this difficulty new taxes were imposed and from this and other causes of grievance (notably exclusion from land and maladministration of justice) discontent was rife among the negroes. On Oct. 11, 1865, there was an outbreak at Morant bay and the chief magistrate of the parish and 18 other white persons were killed. The disturbance which followed filled the island with terror, and many excesses were committed on both sides. The assembly passed an act under which martial law was proclaimed, and subsequently one abrogating the constitution.

THE COLONY REORGANIZED

The action of Governor Eyre, in hanging G. W. Gordon, a leading spokesman of the popular discontents, and the severities with which the rising was punished, though generally applauded in the West Indies, caused much indignation in England, and he was recalled. A prosecution was instituted against him, resulting in an elaborate exposition of martial law by Chief Justice Cockburn, but the jury threw out the bill and Eyre was discharged. He was succeeded in the government of Jamaica by Sir John Peter Grant. Crown colony government was established and Grant did a magnificent work in reorganizing the affairs of the colony. He established a constabulary on the lines of that of Ireland, reconstructed the judicial establishment, substituting stipendiary magistrates for the planter-justices, established a public medical service, a public works department and Government savings bank; improved education and irrigated the fertile but drought-stricken plain between Spanish Town and Kingston. During his government the planters were helped by the importation of Indian labourers, and the fruit (banana) trade with America, which has restored the prosperity of the island, was started by Capt. A. W. Baker of Boston, U.S.A.

In 1884 the constitution of the legislature was altered by the

introduction of nine elected members, whose number was in 1895 increased to fourteen.

On Jan. 14, 1907, a violent earthquake visited Kingston. Almost every building in the capital and in Port Royal, and many in St. Andrews, were destroyed or seriously damaged. About 800 persons were killed and a large part of the city was burnt. On Jan. 17 assistance was brought by three American warships under Rear-Admiral Davis, who withdrew them on the 19th, owing to a misunderstanding with the governor of the island, Sir Alexander Swettenham, on the subject of the landing of marines from the vessels to help in preserving order. The incident caused considerable sensation, and led to Sir A. Swettenham's resignation in the following March. The earthquake and fire afforded the opportunity of considerably improving Kingston, and under the government of Sir Sydney (Lord) Olivier the scattered public offices were reconstructed in two blocks flanking a planted square on the finest street of the city.

During the World War of 1914–18, 250 officers and 11,042 non-commissioned officers and men, for the British West India Regiment, and 381 officers for other regiments went overseas from Jamaica. Eighty-two commissioned officers connected with Jamaica lost their lives and 1,019 non-commissioned officers and men.

See Bryan Edwards, *History of the West Indies* (1809; appendix, 1819); P. H. Gosse, *Journal of a Naturalist in Jamaica* (1851); *Jamaica Handbook* (annual); F. Cundall, *Bibliotheca Jamaicensis* (Kingston, 1895, 1902, 1908); *Studies in Jamaica History* (1900); *Historic Jamaica* (1915); *Jamaica under the Spaniards* (1919); *Jamaica in 1924; Jamaica's part in the Great War;* W. J. Gardner, *History of Jamaica* (1909). For geology, *see* R. T. Hill, "The Geology and Physical Geography of Jamaica," *Bull. Mus. Com. Zool. Harvard,* xxxiv. (1899). (O.)

JAMAICA, formerly a village of Queens county, Long Island, N.Y., U.S.A., but since 1898 a part of the borough of Queens, New York city. For two guns, a coat and a quantity of powder and lead, several New Englanders obtained from the Indians a deed for a tract of land here in 1655. In 1657 they received permission from Gov. Stuyvesant to found a town, which was chartered in 1660 and was named Rustdorp by Stuyvesant, but the English called it Jamaica. The village was incorporated in 1814 and reincorporated in 1855. In 1665 it was made the seat of justice of the north riding; in 1683–1788 it was the shire town of Queens county. With Hempstead, Gravesend, Newtown and Flushing, also towns of New England origin and type, Jamaica was early disaffected towards the provincial government of New York. In 1669 these towns complained that they had no representation in a popular assembly, and in 1670 they protested against taxation without representation. The founders of Jamaica were mostly Presbyterians, and they organized one of the first Presbyterian churches in America. At the beginning of the Revolutionary War Jamaica was under the control of Loyalists; after the defeat of the Americans in the battle of Long Island (Aug. 27, 1776) it was occupied by the British; and until the end of the war it was the headquarters of Gen. Oliver Delancey.

JAMB, in architecture, originally the post at each side of a door, window or opening to carry the lintel; now, more loosely, the side surfaces of any opening. Colonettes, flanking doors and windows, are known as jamb-shafts.

JAMBI, a residency in Sumatra, Dutch East Indies, area 44,452 sq.km., on the east coast, separated from the islands of Singkep and Lingga by the Straits of Berhala, bounded on the south by Palembang residency, north by the mainland dependency of Riouw and west by Sumatra West Coast residency (Dutch: *Djambi*). It is a long and narrow strip of territory, extending nearly across the country to the mountain range which traverses Sumatra west coast and throws out spurs into Jambi. On its borders are Mt. Tuju, 8,466 ft., and the Peak of Indrapura, 12,484 ft., and, well within them, Mts. Tebatalas, 6,662 ft., and Mesarai, 8,125 feet. Except for a hilly range in the mid-north region extending from Bukit Merbau, 2,500 ft., the country slopes gradually to the sea, and, some distance before reaching it, is very flat and swampy, whilst near the coast it is intersected by numerous small rivers, Sungei Tungkal being the largest. A number of rivers, large and small, flow down from the western mountains, water the country abundantly and unite at a point in the centre, not far from Muaru Tembesi, to form the Batang Hari (Jambi river), which is navigable for ocean-going ships from Jambi, the capital, to the sea, a distance of 50 miles. High up among the western mountains there is a small lake—Korinchi. There are no railways, and roads are few and poor, but Jambi is connected by road with Palembang. Many of the rivers are used for great distances by the natives for small-craft transport; and Jambi is sea-connected with Java, Sumatra and Straits Settlements' ports, and by telegraph with Padang, whilst several of the small towns of the interior are connected with each other and with Palembang by telephone. Jambi with a population of 180,584 (263 Europeans and Eurasians and 7,424 foreign Asiatics, including Chinese), is almost wholly village-settled and Malay in character, though in the extreme west there are some Korinchis, a warlike and very little-known people. Jambi (pop. 16,164), Muaru Tembesi, Bangku, Sarolangun, Muaru, Bungu, Muaru Tebu and Sungai Penuh are the chief centres of population, and all but Jambi are quite small. The people are agriculturists and fishermen, rice is grown very largely, and a great proportion of it is *sawah*, or dry culture. Coffee is grown for export, chiefly in the districts of Muaru Bungu and Bangku, and Jambi is one of the chief centres of native-grown rubber which is also exported. Jambi, under an independent sultan, caused the Dutch considerable trouble (they were established in the neighbouring territory of Palembang), until, in 1901, they sent an armed expedition into the country, and later made it into a Dutch residency. (E. E. L.)

JAMES, a masculine proper name popular in Christian countries as having been that of two of Christ's apostles (a variant of the name Jacob, Heb. יַעֲקֹב, one who holds by the heel, outwitter, through O.Fr. *James,* another form of *Jacques, Jaques,* from Low Lat. *Jacobus*). It has been borne by many sovereigns and princes.

JAMES, the name of several persons mentioned in the New Testament (Gr. Ἰάκωβος, the Heb. *Ya'akob* or Jacob).

1. JAMES, the son of Zebedee: *see* APOSTLE.

2. JAMES, the son of Alphaeus: *see* APOSTLE.

3. JAMES, the little, is described as the son of a Mary (Matt. xxvii. 56; Mark xv. 40), who was in all probability the wife of Clopas (John xix. 25). And on the ground that Clopas is another form of the name Alphaeus, this James has been thought by some to be the same as 2. But the evidence of the Syriac versions, which render Alphaeus by *Chalphai,* while Clopas is simply transliterated *Kleopha,* makes it extremely improbable that the two names are to be identified. And as we have no better ground for finding in Clopas the Cleopas of Luke xxiv. 18, we must be content to admit that James the little is an almost unknown personality.

4. JAMES, the father of Judas. There can be no doubt that in the mention of "Judas of James" in Luke vi. 16 the ellipsis should be supplied by "the son" and not as in the A.V. by "the brother" (*cf.* Luke iii. 1, vi. 14; Acts xii. 2, where the word ἀδελφός is inserted). This Judas, known as Thaddaeus by Matthew and Mark, afterwards became one of the apostles, and is expressly distinguished by St. John from the traitor as "not Iscariot" (John xiv. 22).

5. JAMES, the Lord's brother. In Matt. xiii. 55 and Mark vi. 3 we read of a certain James as, along with Joses and Judas and Simon, a "brother" of the Lord. The exact nature of the relationship there implied has been the subject of much discussion. Jerome's view (*de vir. ill.* 2), that the "brothers" were in reality cousins, "sons of Mary the sister of the Lord's mother," may be said to have been finally disposed of by Bishop Lightfoot in his essay on "The Brothers of the Lord" (*Galatians,* pp. 252 *sqq., Dissertations on the Apostolic Age,* pp. 1 *sqq.*). Even, however, if we understand the word "brethren" in its natural sense, it may be applied either to the sons of Joseph by a former wife, or to sons born to Joseph and Mary after the birth of Jesus. The former of these views, generally known as the *Epiphanian* view from its most zealous advocate in the 4th century, can claim for its support the preponderating voice of tradition (*see* the catena of references given by Lightfoot, *loc. cit.,* who himself inclines to this view). On the other hand the *Helvidian* theory as propounded by Helvidius, and apparently accepted by Tertullian (*cf. adv.*

Marc. iv. 29), which makes James a brother of the Lord, as truly as Mary was his mother, undoubtedly seems more in keeping with the direct statements of the Gospels, and also with the after history of the brothers (*see* W. Patrick, *James the Brother of the Lord*, 1906, p. 5). In any case there can be no question as to the important place which James occupied in the early Church. Converted to a full belief in the living Lord, perhaps through the special revelation that was granted to him (1 Cor. xv. 7), he became the recognized head of the Church at Jerusalem (Acts xii. 17, xv. 13, xxi. 18, *cf.* Gal. ii. 9). He was traditionally the author of the epistle of the New Testament which bears his name (*see* JAMES, EPISTLE OF). According to Hegesippus (*see* Eus. *H.E.* ii. 23) he was a Nazarite, and on account of his eminent righteousness was called "Just" and "Oblias." So great was his influence with the people that he was appealed to by the scribes and Pharisees for a true and (as they hoped) unfavourable judgment about the Messiahship of Christ. But from a pinnacle of the temple, he made public confession of his faith, and was at once thrown down and murdered. This happened immediately before the siege. Josephus (*Antiq.* xx. 9, 1) tells that it was by order of Ananus the high priest that James was put to death; and his narrative gives the idea of some sort of judicial examination, for he says that James and some others were brought before an assembly of judges, by whom they were condemned and delivered to be stoned. Josephus is also cited by Eusebius (*H.E.* ii. 23) to the effect that the miseries of the siege were due to divine vengeance for the murder of James. Later writers describe James as an ἐπίσκοπος (Clem. Al. *apud* Eus. *H.E.* ii. 1) and even as an ἐπίσκοπος ἐπισκόπων (Clem. *Hom., ad init.*). According to Eusebius (*H.E.* vii. 19) his episcopal chair was still shown at Jerusalem at the time when Eusebius wrote.

BIBLIOGRAPHY.—In addition to the relevant literature cited above, *see* the articles under the heading "James" in Hastings's *Dictionary of the Bible* (Mayor) and *Dictionary of Christ and the Gospels* (Fulford), and in the *Encycl. Biblica* (O. Cone); also the introductions to the Commentaries on the Epistle of James by Mayor and Knowling. Zahn has an elaborate essay on *Brüder und Vettern Jesu* in the *Forschungen zur Geschichte des neutestamentlichen Kanons*, vi. 2 (Leipzig, 1900). *See* art. APOSTLE. (G. MI.)

JAMES I., THE CONQUEROR (1208–1276), king of Aragon, son of Peter II. and of Mary of Montpellier, was born at Montpellier on Feb. 2, 1208. Peter, whose possessions in Provence entangled him in the wars between the Albigenses and Simon de Montfort, arranged an alliance between James and Simon's daughter, and in 1211 he entrusted the boy to Montfort's care. At his death (Sept. 12, 1213) the Aragonese and Catalans appealed to the pope for the surrender of the child, and he was put in the care of the Templars, who brought him in 1216 to Saragossa. In 1221 he married Leonora, daughter of Alphonso VIII. of Castile, but divorced her later on the ground of consanguinity and married Yolande, daughter of Andrew II. of Hungary. James was astute and patient, of gigantic stature and immense strength, and by 1228 he had so far reduced his unruly vassals that he was able to undertake the conquest of the Balearic islands, which he achieved in four years. He then turned his attention to the territory of the decadent Mohammedan princes of Valencia, conquering the town on Sept. 28, 1238. Physical, social and political obstacles were against his endeavours to form a southern State on both sides of the Pyrenees, and on May 11, 1258, he signed the Treaty of Corbeil with Louis IX., contenting himself with the surrender of antiquated French claims to the overlordship of Catalonia.

During the last 20 years of his life James carried on war with the Moors in Murcia on behalf of his son-in-law, Alphonso the Wise of Castile. As a legislator and organizer he occupies a high place among the Spanish kings. Though orthodox and pious, he had an ample share of moral laxity and the favour he showed his bastards led to protest from the nobles and to conflicts between his sons, legitimate and illegitimate. He divided his States between his sons Pedro and James, leaving the Spanish possessions on the mainland to the first, the Balearic islands and the lordship of Montpellier to the second—a division which inevitably produced fratricidal conflicts. James died at Valencia on July 27, 1276.

See *Gestas del Rey Don Jaime de Aragón*, edit. R. Foulché-Delbosc (1909); *The Chronicle of James I.*, trans. from the Catalan by . . . John Foster . . . with introd., notes . . . by P. Gayangos (2 vols., 1883); F. Darwin Swift, *The Life and Times of James the First, the Conqueror* (1894).

JAMES II. (*c.* 1260–1327), king of Aragon, grandson of James I. and son of Peter III. and Constance, daughter of Manfred of Beneventum, was left king of Sicily (1285) by his father. Upon inheriting Aragon on the death of his brother Alphonso (1291), he resigned Sicily and married Blanca, daughter of Charles of Anjou, king of Naples, in the endeavour to restore peace between his family and the Angevin house.

JAMES I. (1566–1625), king of Great Britain and Ireland and James VI. of Scotland, the only child of Mary Queen of Scots, and her second husband, Henry Stewart Lord Darnley, was born in Edinburgh castle on June 19. 1566. He was proclaimed king of Scotland on July 24, 1567, upon the forced abdication of his mother, but was kept in the castle of Stirling for safety's sake amid the confused fighting of the early years of his minority, until 1578. He was a weakly boy, and although he lived until he was nearly sixty, he was never a strong man.

James was brought up by the earl and countess of Mar. When the earl died in 1572 his place was well filled by his brother, Sir Alexander Erskine. The king's education was placed under the care of George Buchanan, assisted by Peter Young, and two other tutors, who gave the boy a sound training in languages and in theology. The scholastic quality of his education helped to give him a taste for learning, but also tended to make him a pedant.

James was only twelve when the earl of Morton was driven from the regency, and for some time after he can have been no more than a puppet in the hands of intriguers and party leaders. The so-called raid of Ruthven in 1582, was in fact a kidnapping enterprise carried out in the interest of the Protestant party. It was not indeed till 1583, when he broke away from his captors, that James began to govern in reality.

His work can be divided into the part which was a failure and a preparation for future disaster, and the part which was solid achievement, honourable to himself and profitable to his people. His native kingdom of Scotland had the benefit of the second. Between 1583 and 1603 he reduced the anarchical baronage of Scotland to obedience, and replaced the subdivision of sovereignty, which had been the very essence of feudalism, by a strong centralized royal authority. In fact he did in Scotland the work which had been done by the Tudors in England, by Louis XI. in France, and by Ferdinand and Isabella in Spain. But James not only brought his disobedient and intriguing barons to order but also quelled the attempts of the Protestants to found what Hallam has well defined as a "Presbyterian Hildebrandism." He enforced the superiority of the state over the church. Both before his accession to the throne of England (1603) and afterwards he took an intelligent interest in the prosperity of his Scottish kingdom, and did much for the pacification of the Hebrides.

James's methods of achieving ends in themselves honourable and profitable have made posterity unjust to his real merits. He boasted of his "king-craft" and probably believed that he owed it to his studies. But it was in reality the resource of the weak, the art of playing off one possible enemy against another by trickery. The marquis de Fontenay, the French ambassador, who saw him in the early part of his reign, speaks of him as cowed by the violence about him, and the terror in which he passed his youth sufficiently explains his preference for guile. He would make promises to everybody, as when he wrote to the pope in 1584 more than hinting that he would be a good Roman Catholic if helped in his need. His very natural desire to escape from the poverty and insecurity of Scotland to the opulent English throne led him to behave basely in regard to the execution of his mother in 1587, taking good care to do nothing to offend Elizabeth. His crafty methods did him harm in England, where his reign prepared the way for the great civil war. In his southern kingdom his failure was complete. Although England accepted him as the alternative to civil war, and received him with fulsome flattery, he did not win the respect of his English subjects. His undignified personal appearance was against him, and so were his garrulity, his Scottish accent, his slovenliness and his toleration of disorders

in his court, and his favour for handsome male favourites. In ecclesiastical matters he offended many, who contrasted his severity and rudeness to the Puritan divines at the Hampton Court conference (1604) with his politeness to the Roman Catholics. In a country where the authority of the state had been firmly established and the problem was how to keep it from degenerating into the mere instrument of a king's passions, his insistence on the doctrine of divine right aroused distrust and hostility, though the doctrine had originated in a necessary assertion of the independence of the state in face of the "Hildebrandism" of Rome and Geneva alike. James's favour for his countrymen helped to defeat his wise wish to bring about a full union between England and Scotland. His profusion kept him necessitous, and drove him to shifts. Posterity can give him credit for his desire to forward religious peace in Europe, but his Protestant subjects could not see the consistency of a king who married his daughter Elizabeth to the elector palatine, a leader of the German Protestants, and also sought to marry his son to an infanta of Spain. The king's subservience to Spain was indeed almost besotted, and allowed him to be befooled by the ministers of Philip III. and Philip IV. The end of his scheming was that he was dragged into a needless war with Spain by his son Charles and his favourite George Villiers, duke of Buckingham, just before his death on March 5, 1625 at his favourite residence, Theobalds.

James married in 1589 Anne, second daughter of Frederick II., king of Denmark, by whom he had three children who survived infancy: Henry Frederick, prince of Wales, who died in 1612; Charles, the future king; and Elizabeth, wife of the elector palatine, Frederick V.

Not the least of James's many ambitions was the desire to excel as an author. He left a body of writings which, though of mediocre quality as literature, entitle him to a unique place among English kings since Alfred for width of intellectual interest and literary faculty. His efforts were inspired by his preceptor George Buchanan. His first work was a youthful production in verse, *Essayes of a Prentise in the Divine Art of Poesie* (Edin. Vautrollier, 1584), containing fifteen sonnets, "Ane Metaphoricall invention of a tragedie called Phoenix," a short poem "Of Time," translations from Du Bartas, Lucan and the Book of Psalms ("out of Tremellius"), and a prose tract entitled "Ane short treatise, containing some Reulis and Cautelis to be observit and eschewit in Scottis Poesie." This tract shows acquaintance with the critical reflections of Ronsard and Du Bellay, and of Gascoigne in his *Notes of Instruction* (1575). In 1591 James published *Poeticall Exercises at Vacant Houres*, including a translation of the *Furies* of Du Bartas, his own *Lepanto*, and Du Bartas's version of it, *La Lepanthe*. His *Daemonologie*, a prose treatise denouncing witchcraft and exhorting the civil power to the strongest measures of suppression, appeared in 1599. In the same year he printed the first edition (seven copies) of his *Basilikon Doron*, strongly Protestant in tone. A French edition, specially translated for presentation to the pope, has a disingenuous preface explaining that certain phrases (*e.g.*, "papistical doctrine") are omitted, because of the difficulty of rendering them in a foreign tongue. The original edition was, however, translated by order of the suspicious pope, and was immediately placed on the Index. In his famous *Counterblaste to Tobacco* (published anonymously, 1604), James forsakes his Scots tongue for Southern English. James's prose works (including his speeches) were collected and edited (folio, 1916) by James Montagu, bishop of Winchester, who also translated them into Latin, in 1619 (also Frankfort, 1689). "The True Law of Free Monarchies," appeared in 1603; "An Apology for the Oath of Allegiance" in 1607; and a *"Déclaration du Roy Jacques I. . . . pour le droit des Rois"* in 1615. In 1588 and 1589 James issued two small volumes of *Meditations* on some verses of (*a*) Revelations and (*b*) 1 Chronicles. Other two "meditations" were printed posthumously.

See I. F. Henderson, *James I. and VI.* (1904); P. Hume Brown, *History of Scotland*, vol. ii. (1902); and Andrew Lang, *History of Scotland*, vol. ii. (1902) and *James VI. and the Gowrie Mystery* (1902); *The Register of the Privy Council of Scotland* (1877, etc.), vols. ii. to xiii.; S. R. Gardiner, *History of England 1603–1642* (1833–84). A comprehensive bibliography will be found in the *Cambridge Modern Hist.* iii. 847 (1904).

For James's literary work, *see* Edward Arber's reprint of the *Essayes* and *Counterblaste* ("English Reprints," 1869, etc.); R. S. Rait's *Lusus Regius* (1900); G. Gregory Smith's *Elizabethan Critical Essays* (1904), vol. i., where the *Treatise* is edited for the first time; A. O. Meyer's "Clemens VIII. und Jacob I. von England" in *Quellen und Forschungen* (Preuss. Hist. Inst., VII. ii., for an account of the issues of the *Basilikon Doron*; P. Hume Brown's *George Buchanan* (1890), pp. 250–261, for a sketch of James's association with Buchanan. *New Poems by James I. of England*, from a hitherto unpublished manuscript, edited by A. F. Westcott (1911); *Mary, Queen of Scots, and the Prince, Her Son*; transcribed from a contemporary Venetian manuscript, edited by Robt. McClure (1913); *The Political Works of James I.*, reprinted from the edition of 1616, with an introduction by C. H. McIlwain, Cambridge, Mass. (1918); C. MacLaurin, *Mere Mortals* (1925).

JAMES II. (1633–1701), king of Great Britain and Ireland, second surviving son of Charles I. and Henrietta Maria, was born on Oct. 14, 1633, and created duke of York in January, 1643. James was at Oxford when the city surrendered in 1646, and by the terms of capitulation was handed over to the Parliamentarians. He was sent to London and, with his younger brother and sister, placed in St. James's Palace. He escaped on April 20, 1648, in disguise, took ship at Greenwich, and settled at The Hague with his sister the princess of Orange. His mother sent for him at Paris, and after some time spent in the poverty and squabbles of the exiled court he entered the French army. He was now nineteen, he liked a soldier's life, and showed not only consummate courage but a keen scientific interest in his profession which won him the praise of Condé. He then spent some time in the Spanish service.

At the Restoration, therefore, when he returned to England with his brother, he was already an experienced and able soldier. He was now appointed Lord High Admiral and Warden of the Cinque Ports. Pepys, who was secretary to the navy, has recorded the patient industry and unflinching probity of his naval administration. Indeed, James improved memorably the organization of the British navy. The fleet was provisioned, the naval arsenals put in repair, and he created a permanent and professional body of naval officers. He arranged for the regular recruitment of officers from young lads trained on board ship and overhauled and reorganized the administration. His victory over the Dutch in 1665 and his drawn battle at Southwold bay with De Ruyter in 1672 show that he was a good commander as well as an excellent administrator.

In December 1660 he admitted having contracted a secret marriage with Anne Hyde (1637–1671), daughter of Lord Clarendon, in the previous September. Both before and after the marriage he seems to have been a libertine as unblushing, though not so fastidious, as Charles himself.

Catholicism.—In 1672 he made a public avowal of his conversion to Roman Catholicism. His wife, who had a strong hold over him, had died on March 31, 1671, and before her death had been received into the Roman Catholic Church. At what date James's reception took place is unknown, but it was probably in 1671. The passage of the Test Act (1673), nominally directed against both Non-Conformist and Roman Catholic officials, was, in fact, since it demanded repudiation of the doctrine of transubstantiation, an absolute bar to Catholics. James had to choose between his life work at the Admiralty and his religion. He resigned. On Sept. 30 he married a Catholic princess, Mary of Modena. Both his children by Anne Hyde, Mary and Anne were, however, brought up as Protestants, and in November 1677 he assented reluctantly to Charles II.'s insistence on the marriage of Mary to William, prince of Orange. The hysterical excitement which attended the disclosures of the Popish plot made James's position extremely difficult. In Oct. 1678 Shaftsbury demanded his removal from the council. He withdrew to Antwerp, The Hague, and then to Brussels. Meanwhile, the second reading of the exclusion bill (May 1679) threatened his exclusion from the succession. But many Whigs who detested James feared the influence of the duke of Monmouth on his father Charles II.; they were not prepared to see the succession fall to him, and when Charles fell ill in August, James was recalled.

He was made High Commissioner in Scotland, with the idea of removing him from English politics, and seems to have been at

first acceptable to the Scots. In Feb. 1680 he returned to England, but his enemies demanded his return to Edinburgh, and in October he again left London. The Oxford parliament of 1681 rejected the compromises suggested by Halifax and insisted on the duke's absolute exclusion. Charles dissolved it. James's administration in Scotland now became more severe, and Argyll who opposed the rigorous tests applied under the Test Act passed through the Scottish parliament in 1680, was sentenced to death, but escaped from his prison in Edinburgh castle. Discontent in the west showed itself in the holding of armed conventicles. In 1682 James returned to London and became a powerful personage at court. The exclusionists were finally vanquished, and James became once more Lord High Admiral (1684). On Feb. 6, 1685, Charles died; before his death James had secured the admission to his bedside of a priest, and he was received into the Catholic Church.

As King.—James's accession took place without incident on the same day. Parliament was summoned for May 19 and showed a large Tory majority. Relations with Louis XIV. showed a certain coolness, for Louis disapproved the summoning of parliament, and the payments under the Treaty of Dover, though they were continued for a few months, soon ceased. James showed unremitting attention to public business, especially to the affairs of the army and of the navy. The administration of the navy was strengthened according to the plans laid down by Pepys. The nation showed its loyalty by its firm adherence to James during the rebellions of the duke of Argyll (*q.v.*) in Scotland and of Monmouth (*q.v.*) in England (1685). The savage reprisals on their suppression, especially the "Bloody Assizes" of Jeffreys, who was rewarded for his services with the chief justiceship, caused a revulsion of public feeling. The Tory supporters of James were horrified. Moreover, the death of Monmouth removed the objection which the Whigs had felt to the exclusion of James. They had desired to exclude James but not to substitute Monmouth for him. The way was now clear for the prince of Orange.

James was not a mere tyrant or bigot, as the popular imagination speedily assumed him to be. He was rather a mediocre and obtuse man, who lacked political judgment and had never learned to understand his fellow-men. Thus he greatly underrated the strength of the Establishment, and preposterously exaggerated that of Dissent and Catholicism. He perceived that opinion was seriously divided in the Established Church, and thought that a vigorous policy would soon prove effective. He thought the hatred of high churchmen for dissent indicated a leaning to the older Church. Hence he publicly celebrated Mass, prohibited preaching against Catholicism, and showed exceptional favour to renegades from the Establishment. By undue pressure he secured a decision of the judges, in the test case of *Godden* v. *Hale* (1687), by which he was allowed to dispense Catholics from the Test Act. Catholics were now admitted to the chief offices of the army, and to some important posts in the state, in virtue of the dispensing power of James. The judges had been intimidated or corrupted and the royal promise to protect the Establishment violated. The army had been increased to 20,000 men and encamped on Hounslow Heath to overawe the capital. James put implicit and, as the event proved, mistaken confidence in his army. Public alarm was speedily manifested and suspicion to a high degree awakened. Halifax had been dismissed in Oct. 1685, and Father Petre became one of James's chief advisers. Rochester resigned in Jan. 1687.

Toleration.—James now made a bid for the support of the Dissenters by advocating a system of joint toleration for Catholics and Dissenters. In April 1687 he published a Declaration of Indulgence, exempting Catholics and Dissenters from penal statutes. No doubt the immediate political motive was to favour the Catholics, but in his later years, when he was an exile, he continued to advocate toleration. In this he was in advance of his time. He followed up the Declaration of Indulgence by dissolving parliament and by antagonizing the universities. He had sought to impose Roman Catholic fellows on the colleges; he introduced Catholics and Dissenters into all departments of State and into the municipal corporations. The Declaration was destructively analysed in Halifax's *Letter to a Dissenter*. In April 1688 James took the suicidal step of issuing a proclamation to force the clergy and bishops to read the Declaration in their pulpits and thus personally advocate a measure they detested. Seven bishops refused, were indicted by James for libel, but acquitted (June 30, 1688), amid the enthusiasm of the populace. Prominent English gentry, enraged at the tolerant policy of James, had been in touch with William of Orange since 1687. In that year William's envoy, Dykvelt, sent over a polite mission to James, met Halifax, Danby, Shrewsbury and others to ascertain their views on the Declaration and other matters. He seems to have informed James of their views, so that there was no question of conspiracy. But from that time William knew where he was likely to find support. The birth of a son to James (June 10), which was likely to ensure a Catholic succession, and the trial of the seven bishops, now induced the Whig lords to send William a definite invitation (June 30). The letter was carried by Admiral Herbert.

FLIGHT TO FRANCE

Meanwhile, James, relying on his navy, refused the proffered help of Louis XIV., who warned him repeatedly of danger. He was determined not to accept foreign help against his subjects. Louis was offended, and turned his army, not against Holland, but towards the Rhine. In August James ordered all officers in the army and navy to be at their posts. On Sept. 21 he issued a proclamation that Roman Catholics would be ineligible for the coming parliament; on the 29th he issued a general pardon, but made the blunder of excluding the clergy. The pardon was issued on the day of the Declaration of William of Orange to the people of England.

William landed at Tor bay (Nov. 5, 1688) and swept all before him. Churchill went over to the enemy on Nov. 24. James, who had been with the army at Salisbury, returned to London on Nov. 26 to find that his daughter Anne had fled with Lady Churchill. James pretended to treat, and in the midst of the negotiations started for France (Dec. 10–11). He was intercepted at Faversham, and brought back (Dec. 16), but the politic prince of Orange allowed him to escape a second time (Dec. 23, 1688). Louis XIV. gave him a home at St. Germain.

Manoeuvres in Exile.—At the end of 1688 James seemed to have lost his old courage. He had been in touch with Tyrconnell in Ireland, and on March 12, 1689, he landed at Kinsale, and proceeded to Dublin, where he summoned a parliament. After his defeat by William at the Boyne (July 1, 1690), he left Ireland, where he had shown none of his former military capacity. His proclamations and policy towards England during these years show unmistakable traces of the same incompetence. On May 17, 1692, he saw the French fleet designed for England destroyed before his very eyes off Cape La Hogue. He was aware of, though he did not advocate, the "assassination plot" which was directed against William. By its revelation and failure (Feb. 10, 1696), the third and last serious attempt of James at his restoration failed.

He refused in the same year to accept the French influence in favour of his candidature to the Polish throne on the ground that it would exclude him from the English. Henceforward he ceased to be a political factor. A mysterious conversion had been effected in him by a Cistercian abbot. He was transformed into an austere penitent, who worked miracles of healing. He died at St. Germain on Sept. 17, 1701.

The political ineptitude of James is clear; he often showed firmness when conciliation was needful, and weakness when resolution alone could have saved the day. Moreover, though he mismanaged almost every political problem with which he personally dealt, he was singularly tactless and impatient of advice. At no point in his life did he display any real judgment of men. But in general political morality he was not below his age, and in his advocacy of toleration far in advance of it. He was more honest and sincere than Charles II., more genuinely patriotic in his foreign policy, and more consistent in his religious attitude. That his brother retained the throne while James lost it is an ironical demonstration that a more pitiless fate awaits the ruler whose faults are of the intellect than the one whose faults are of the heart.

By Anne Hyde James had eight children, of whom two only, Mary and Anne, both queens of England, survived their father. By

Mary of Modena he had seven children, among them being James Francis Edward (the Old Pretender) and Louisa Maria Theresa, who died at St. Germain in 1712. By one mistress, Arabella Churchill (1648–1730), he had two sons, James, duke of Berwick, and Henry (1673–1702), titular duke of Albemarle and grand prior of France, and a daughter, Henrietta (1667–1730), who married Sir Henry Waldegrave, afterwards Baron Waldegrave; and by another, Catherine Sedley, countess of Dorchester (1657–1717), a daughter, Catherine (d. 1743), who married James Annesley, 5th earl of Anglesey, and afterwards John Sheffield, duke of Buckingham and Normandy.

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JAMES I. (1394–1437), king of Scotland and poet, son of Robert III. and Annabella Drummond of Stobhall, was born at Dunfermline in July 1394. Robert, suspecting Robert, duke of Albany, of complicity in the mysterious death of his elder son David, sent James to France for safety in 1406. He was captured on the journey by English sailors, and imprisoned by Henry IV., who refused ransom. Shortly after the accession of Henry V. in 1413 James was taken to Windsor, where he was treated with great kindness by the king. He was given capable tutors, devoted much time to study, and became a poet of some repute. It is evident from his subsequent career that he made a thorough study of jurisprudence. In person he was short and stout, but well-proportioned and very agile, and he excelled in all forms of sport. He also showed proficiency in music and singing.

Robert of Albany had been virtual ruler of Scotland for some years, as Robert III. was an invalid, and on the king's death in 1406 he made no attempt to obtain the release of James, who became nominally king. In 1420 Henry V. took James on his French campaign, but failed in his intention of detaching the Scotch auxiliaries from the French standard. James returned to England after Henry's death in 1422. About this time, Robert of Albany having died in 1419, negotiations were begun for James's release, and a Scottish commission was appointed to treat with England. In Sept. 1423, in a treaty signed at York, Scotland undertook to pay 60,000 marks for his "maintenance in England," and agreed to his marriage with a "high-born English lady," Jane, daughter of John Beaufort, earl of Somerset. It is doubtful whether *The Kingis Quair* (*see* below) was addressed to her or not. Ten thousand marks of his ransom were remitted as Jane's dowry, and they were married at Southwark on Feb. 12, 1424, entering Scotland in April. James was crowned at Scone on May 21, 1424.

James I.'s reign is noteworthy for the introduction of a system of statute law, modelled to some extent on that of England. An attempt was also made to institute social legislation. He thought the independence of the nobles was harmful to the country, and tried to weaken their power by increasing the power of parliament. To this end he used more violent measures. Albany's son, Sir Walter Stewart, and brother-in-law, Malcolm Fleming, were arrested in the first months of James' reign and, later, Duncan, earl of Lennox. Although James allowed the second duke of Albany, as earl of Fife, to crown him, Albany and his son Alexander were arrested in March 1425 at a parliament in Perth. They were executed on May 26–27 with Sir Walter Stewart and Malcolm Fleming. At Inverness in 1427 many other turbulent northern chiefs were arrested, but while order was to some extent restored, a spirit of rebellion was aroused which eventually cost James his life. Just before Christmas 1436, in spite of a warning of danger, he went to Perth, where he was the victim of a dynastic conspiracy by Walter Stewart, earl of Atholl, whose ultimate hope of the throne had been destroyed by the birth of a son to James. Sir Robert Graham (who had been imprisoned by James and subsequently banished), instigated by Atholl, burst into the king's presence on Feb. 20, 1437, and stabbed him to death. Graham and Atholl were afterwards tortured and executed.

James had two sons: Alexander, who died young, and James II., who succeeded to the throne; and six daughters, among them being Margaret, the queen of Louis XI. of France. His widow, Jane, married Sir James Stewart, the "black knight of Lorne," and died on July 15, 1445.

During the latter part of James's reign difficulties arose with England and also with the papacy. Part of the king's ransom was still owing to England; other causes of discord between the two nations existed, and in 1435 the earl of Mar defeated an invading English force at Piperden. In ecclesiastical matters James showed himself merciless towards heretics, but his desire to reform the Scottish Church and to make it less dependent on Rome brought him into collision with Popes Martin V. and Eugenius IV.

James was the author of two poems, *The Kingis Quair* and *Good Counsel* (a short piece of three stanzas). The *Song of Absence, Peblis to the Play* and *Christis Kirk on the Greene* have been ascribed to him without conclusive evidence. *The Kingis Quair* (preserved in the Selden MS. B. 24 in the Bodleian) is an allegorical poem of the *cour d'amour* type. Its language is an artificial blend of northern and southern (Chaucerian) forms, of the type shown in *Lancelot of the Laik* and the *Quair of Jelusy*.

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JAMES II. (1430–1460), king of Scotland, the only surviving son of James I., was born on October 16, 1430. Crowned king at Holyrood in March 1437, shortly after the murder of his father, he was at first under the guardianship of his mother. Archibald, 5th earl of Douglas, was regent of the kingdom, and considerable power was possessed by Sir Alexander Livingstone and Sir William Crichton (d. 1454). When in 1439 Queen Jane was married to Sir James Stewart, the knight of Lorne, Livingstone obtained the custody of the young king (Sept. 4, 1439) whose minority was marked by fierce hostility between the Douglases and the Crichtons, with Livingstone first on one side and then on the other. About 1443 the royal cause was espoused by William, 8th earl of Douglas, who attacked Crichton in the king's name, and civil war lasted until about 1446. In July 1449 James was married to Mary (d. 1463), daughter of Arnold, duke of Gelderland, and undertook the government himself; and in 1450 Livingstone was arrested and executed. In 1452 the king heard of the earl of Douglas's attempt to conspire with Crawford against him. The earl was invited to Stirling by the king, and, after being charged with treachery, stabbed by James and killed by attendants. Civil war broke out at once between James and the Douglases, which ended in the attainder of James, the new earl of Douglas, and the forfeiture of his lands. Fortified by this success and assured of the support of the parliament and of the nobles, James could view without alarm the war which had broken out with England. After two expeditions across the borders, a truce was made in July 1457. During the Wars of the Roses he showed

his sympathy with the Lancastrian party after the defeat of Henry VI. at Northampton by attacking the English possessions to the south of Scotland. While conducting the siege of Roxburgh Castle James was killed, through the bursting of a cannon, on Aug. 3, 1460. He left three sons, his successor, James III., Alexander Stewart, duke of Albany, and John Stewart, earl of Mar (d. 1479); and two daughters. His reign is a period of some importance in the legislative history of Scotland, as measures were passed with regard to the tenure of land, the reformation of the coinage, and the protection of the poor, while the organization for the administration of justice was greatly improved.

JAMES III. (1451–1488), king of Scotland, eldest son of James II., was born on July 10, 1451. He was crowned at Kelso in 1460. After the death of his mother in 1463, and of her principal supporter, James Kennedy, bishop of St. Andrews, two years later, the person of the young king, and with it the chief authority in the kingdom, were seized (1456) by Sir Alexander Boyd and his brother Lord Boyd, while the latter's son, Thomas, was created earl of Arran and married to the king's sister, Mary. In July 1469 James himself was married to Margaret (d. 1486), daughter of Christian I., king of Denmark and Norway, but before the wedding the Boyds had lost their power. Having undertaken the government in person, the king's authority was strengthened by the submission of the powerful earl of Ross. About 1479, probably with reason both suspicious and jealous, James arrested his brothers, Alexander, duke of Albany, and John, earl of Mar; Mar met his death in a mysterious fashion at Craigmillar, but Albany escaped to France and then visited England, where in 1482 Edward IV. recognized him as king of Scotland by the gift of the king of England. War broke out with England, but James, made a prisoner by his nobles, was unable to prevent Albany and his ally, Richard, duke of Gloucester (afterwards Richard III.), from taking Berwick and marching to Edinburgh. Peace with Albany followed, but soon afterwards the duke was again in communication with Edward, and was condemned by the parliament after the death of the English king in April 1483. He died in France in 1485. James's policy of peace with England did not commend itself to the turbulent section of his nobles; his lavish expenditure added to the discontent, and a rebellion broke out. Fleeing into the north of his kingdom James collected an army and came to terms with his foes; but the rebels, having seized the person of the king's eldest son, afterwards James IV., renewed the struggle. The rival armies met at the Sauchieburn near Bannockburn, and James was defeated and subsequently murdered (June 11, 1488), according to rumour, by a soldier in the guise of a priest. He left three sons—his successor, James IV.; James Stewart, duke of Ross, afterwards archbishop of St. Andrew, and John Stewart, earl of Mar. James was a cultured prince with a taste for music and architecture, but was a weak and incapable king.

JAMES IV. (1473–1513), king of Scotland, eldest son of James III., was born on March 17, 1473. He was nominally the leader of the rebels who defeated the troops of James III. at the Sauchieburn in June 1488, and became king when his father was killed. Few if any of the kings of Scotland have won such general popularity, or passed a reign so untroubled by intestine strife. Crowned at Scone a few days after his accession, James began at once to take an active part in the business of government. A slight insurrection was easily suppressed, and a plot formed by some nobles to hand him over to the English king, Henry VII., came to nothing. In spite of this proceeding Henry wished to live at peace with his northern neighbour; a five years' truce was concluded on Dec. 21, 1491. When, in 1495, Perkin Warbeck, pretending to be the duke of York, Edward IV.'s younger son, came to Scotland, James prepared to invade England in his interests, but the war was confined to a few border forays, and a seven years' peace was negotiated in 1497. In 1502 a marriage was arranged between James and Henry's daughter Margaret (1489–1541) which took place at Holyrood in Aug. 1503. This union led to the accession of the Stewart dynasty to the English throne.

About this time James crushed a rebellion in the western isles, and parliament took measures to strengthen the royal authority therein. He may be said to have been responsible for the unification of the country. James also began to treat as an equal with the powerful princes of Europe, Maximilian I., Louis XII. and others; sending assistance to his uncle Hans, king of Denmark, and receiving special marks of favour from Pope Julius II. But his position was weakened when Henry VIII. succeeded to the English throne in 1509. Causes of quarrel already existed, and Henry's attitude was not conciliatory; sea-fights took place between their ships, while war was brought nearer by the treaty of alliance which James concluded with Louis XII. in 1512. Urged on by his French ally and his queen, James declared for war, in spite of the counsels of his advisers. Gathering a large and well-armed force, he took Norham, Ford and other castles in August 1513. He met the advancing English army under Thomas Howard, earl of Surrey, at Flodden, or more correctly, at the foot of Brankston Hill. The battle, which took place on Friday, Sept. 9, 1513, is among the most famous and disastrous, if not among the most momentous, in the history of Scotland. Having led his troops from their position of vantage, the king himself was killed while fighting on foot, together with nearly all his nobles. He left one legitimate child, his successor James V., but he had many illegitimate children, among them (by Marion Boyd) Alexander Stewart, archbishop of St. Andrews and chancellor of Scotland, who was killed at Flodden, and (by Janet Kennedy) James Stewart, earl of Moray (d. 1544). One of his other mistresses was Margaret Drummond (d. 1501).

James appears to have been a brave and generous man, and a wise and energetic king. He was possessed of considerable learning; during his reign the Scottish court attained some degree of refinement, and Scotland began to count in European politics. Literature flourished under the royal patronage, education was encouraged, and the material condition of the country improved enormously. The king was specially interested in his navy. The tournaments which took place under his auspices were worthy of the best days of chivalry in France and England. He is said to have worn an iron belt as penance for his share in his father's death; and by his frequent visits to shrines, and his benefactions to religious foundations, he won a reputation for piety.

JAMES V. (1512–1542), king of Scotland, only legitimate son of James IV., was born at Linlithgow on April 10, 1512, and succeeded his father in 1513. The regency was at first vested in his mother, but after Queen Margaret's second marriage, with Archibald Douglas, 6th earl of Angus, in Aug. 1514, it was transferred by the estates to John Stewart, duke of Albany. The minority of James was disturbed by constant quarrels between a faction, generally favourable to England, under Angus, and the partisans of France under Albany; while the queen-mother and the nobles struggled for possession of the king's person. The English had not followed up their victory at Flodden, but Henry VIII. was watching affairs in Scotland with an observant eye, and other European sovereigns were not indifferent to the possibility of a Scottish alliance. In 1524, when Albany had retired to France, the parliament declared James fit to govern with the advice of his mother and a council. This "erection" of James as king was mainly due to the efforts of Henry VIII. In 1526 Angus obtained control of the king, and kept him in close confinement until 1528, when James, escaping from Edinburgh to Stirling, compelled him to flee to England. In 1529 and 1530 the king made a strong effort to suppress his turbulent vassals in the south of Scotland. Negotiations for peace with England were begun, and in May 1534 a treaty was signed. Henry VIII. wished James to marry his daughter Mary, but the Scottish king married Madeleine, daughter of King Francis I. at Paris in Jan. 1537. Madeleine died on June 7, 1537, and in 1538 James made a much more important marriage, being united to Mary (1515–60), daughter of Claude, duke of Guise, and widow of Louis of Orleans, duke of Longueville. This connection probably induced James to forsake his vacillating foreign policy, and to range himself definitely among the enemies of England. In 1536 he had refused to meet Henry VIII. at York, where Henry had hoped to kidnap him, and in the following year had received the gift of a cap and sword from Pope Paul III., thus renouncing the friendship of his uncle. Although in 1540 the English king made another attempt to win the support of James for his religious pol-

icy, the relations between the two countries became very unfriendly, and in 1542 Henry sent an army to invade Scotland. James's forces, owing to the lack of support from the nobles, were easily scattered at the rout of Solway Moss on Nov. 25, 1542. This blow preyed upon the king's mind, and on Dec. 14 he died at Falkland, having just heard of the birth of his daughter. His two sons had died in infancy, and his successor was his only legitimate child, Mary. He left several bastards, among them James Stewart, earl of Moray (the regent Moray), Lord John Stewart (1531–63) prior of Coldingham and Lord Robert Stewart, earl of Orkney (d. 1592).

James showed great vigour and independence as a sovereign, both in withstanding the machinations of his uncle, Henry VIII., and in opposing the influence of the nobles, and his habit of mingling with the peasantry secured for him a large amount of popularity. The persecutions of heretics during this reign were due mainly to the influence exercised by the ecclesiastics, especially by David Beaton, archbishop of St. Andrews.

JAMES (James Francis Edward Stuart) (1688–1766), prince of Wales, known to the Jacobites as James III. and to the Hanoverian party as the Old Pretender, the son and heir of James II. of England, was born in St. James's Palace, London, on June 10, 1688. The scandalous story that he was a supposititious child has been completely disproved, and contemporary writers allude to his family likeness to the Royal Stuarts. Shortly before the flight of the king to Sheerness, the infant prince with his mother was sent to France, and afterwards he continued to reside with his father at the court of St. Germain. On the death of his father, on Sept. 16, 1701, he was immediately proclaimed king by Louis XIV. of France, but a fantastic attempt to perform a similar ceremony in London so roused the anger of the populace that the mock pursuivants barely escaped with their lives. A bill of attainder against him received the royal assent a few days before the death of William III. in 1702, and the Princess Anne, half-sister of the Pretender, succeeded William on the throne. An influential party continued to adhere to the Jacobite cause; but an expedition from Dunkirk in favour of James in the spring of 1708 failed, although the French ships reached the Firth of Forth. At the Peace of Utrecht James withdrew from French territory to Bar-le-Duc in Lorraine. A rebellion in the Highlands of Scotland in his favour in Sept. 1715 was checked in November by the indecisive battle of Sheriffmuir and by the surrender at Preston. James landed in Dec. 1715 at Peterhead, and advanced as far south as Scone, accompanied by a small force under the earl of Mar; but on learning of the approach of the duke of Argyll he retreated to Montrose, where the highlanders dispersed to the mountains, and he embarked again for France. A Spanish expedition sent out in his behalf in 1719, under the direction of Alberoni, was scattered by a tempest, only two frigates reaching the appointed rendezvous in the island of Lewis.

In 1718 James had become affianced to the young princess Maria Clementina Sobieski, grand-daughter of the warrior king of Poland, John Sobieski. The marriage was forbidden by the emperor, who kept the princess and her mother in honourable confinement at Innsbruck. Clementina was abducted by a zealous Jacobite, Charles Wogan, reached Italy in safety, and married James at Montefiascone on Sept. 1, 1719. James and Clementina were now invited to reside in Rome at the special request of Pope Clement XI., who openly acknowledged their titles of British King and Queen, gave them a papal guard of troops, presented them with the Palazzo Muti, and made them an annual allowance of 12,000 crowns. At the Palazzo Muti, the chief centre of Jacobite intriguing, were born James's two sons, Charles Edward (the Young Pretender) and Henry Benedict Stuart. James's married life proved turbulent and unhappy, owing to the hot temper and jealous nature of Clementina, who soon after Henry's birth in 1725 left her husband and spent over two years in a Roman convent. At length a reconciliation was effected, but Clementina died in Feb. 1735. Full regal honours were paid to the Stuart queen at her funeral, and the splendid but tasteless monument by Pietro Bracchi (1700–73) in St. Peter's was erected to her memory by order of Pope Benedict XIV.

His wife's death affected James's health and spirits greatly, and he began to grow indifferent, so that the political adherents of the Stuarts were gradually led to fix their hopes upon the two young princes. James appeared seldom in public, and much of his time was given up to religious exercises; he was *dévot à l'excès*, so Charles de Brosses, an unprejudiced Frenchman, informs us. With great reluctance James allowed his elder son to leave Italy for France in 1744; in the following year, he permitted Henry to follow his brother's example, but with the news of Culloden regarded his cause as definitely lost. Henry's adoption of an ecclesiastical career so embittered his last years that he sank into a moping invalid and rarely left his chamber. With the crushing failure of the "Forty-five" and his quarrel with his heir, the once-dreaded James soon became a mere cipher in British politics, and his death at Rome on Jan. 2, 1766 passed almost unnoticed in London. He was buried with regal pomp in St. Peter's, where Canova's famous monument, erected by Pius VII. in 1819, commemorates him and his two sons. James was grave, high-principled, industrious and dignified, and the unflattering portrait drawn of him by Thackeray in *Esmond* is utterly at variance with historical facts. Although a fervent Roman Catholic, he was far more reasonable and liberal in his religious views than his father, as many extant letters testify.

See Earl Stanhope, *History of England and Decline of the Last Stuarts* (1853); *Calendar of the Stuart Papers at Windsor Castle;* J. H. Jesse, *Memories of the Pretenders and their Adherents* (1845); Dr. John Doran, *"Mann," and Manners at the Court of Florence* (1876); Charles de Brosses, *Lettres sur l'Italie* (1885). (H. M. V.)

JAMES, DAVID (1839–1893), English actor, was born in London, his real name being Belasco. He began his stage career at an early age, and after 1863 gradually made his way in humorous parts. His creation, in 1875, of the part of Perkyn Middlewick in *Our Boys* made him famous as a comedian, the performance obtaining for the piece a then unprecedented run from the 16th of January 1875 till the 18th of April 1879. In 1885 he had another notable success as Blueskin in *Little Jack Sheppard* at the Gaiety Theatre, his principal associates being Fred Leslie and Nellie Farren. His song in this burlesque, "Botany Bay," became widely popular. In the part of John Dory in *Wild Oats* he again made a great hit at the Criterion Theatre in 1886; and among his other most succesful impersonations were Simon Ingot in *David Garrick*, Tweedie in *Tweedie's Rights*, Macclesfield in *The Guv'nor*, and Eccles in *Caste*. His unctuous humour and unfailing spirits made him a great favourite with the public. He died on the 2nd of October, 1893.

JAMES, GEORGE PAYNE RAINSFORD (1799–1860), English novelist, son of Pinkstan James, physician, was born in London, on Aug. 9, 1799, and was educated at a private school at Putney, and in France. He had, according to his own account, composed the stories afterwards published as *A String of Pearls* before he was 17. His early works were: *Life of Edward the Black Prince* (2 vols., 1822), and *Richelieu* (1829), which was well thought of by Sir Walter Scott. James took up historical romance writing at a lucky moment. Scott had firmly established the popularity of the style, and James in England, like Dumas in France, reaped the reward of their master's labours as well as of their own. For 30 years the author of *Richelieu* continued to pour out novels of the same kind, and also some historical works and verse narrative. In the British Museum 67 of his works are catalogued. The best examples of his style are *Richelieu* (1829); *Philip Augustus* (1831); *Henry Masterton* (1832); *Mary of Burgundy* (1833); *Darnley* (1839); *Corse de Léon* (1841); *The Smuggler* (1845). His poetry does not require special mention. For a short time during the reign of William IV. he held office of historiographer royal. In 1850 he went to America as British Consul for Massachusetts. He was consul at Richmond, Virginia in 1852, and in Venice from 1856 until his death on June 9, 1860.

JAMES, HENRY (1843–1916), Anglo-American novelist, brother of William James, was born in New York on April 15, 1843. His father, Henry James the elder (1811–1882) was a

highly original philosophical and theological author, a Swedenborgian by faith, profoundly devoted equally to the life of thought and to the education of his children. Both sons inherited a large part of their psychological insight and subtlety and their feeling for English style from their father. James's early life was spent first in New York, then, off and on during the impressionable years, from 12 to 17, in Europe, chiefly in Geneva, and finally in Newport, R.I., where he began to fit himself for his career by a profound study of French fiction of the realistic school. No novelist probably has ever undergone a more severe and devoted apprenticeship, and it was one that left its mark on James's entire literary career. He entered the Harvard Law school in 1862, his family joining him in Cambridge two years later, and while he gained little from his academic studies he came in touch for the first time in Boston and Cambridge with a purely literary circle. There he formed the friendship of Prof. Charles Eliot Norton and began a lifelong intimacy with William Dean Howells who opened for him the pages of *The Atlantic Monthly,* for he had already begun writing; and his stories began to attract notice while he was still in his early twenties. But although he had become in a sense a New Englander he had never lost that sense of the fascination of Europe which had become the dominant fact and impulse of his adolescence; and in 1868 he returned there, settling first in London and then in Paris and establishing tentatively a European residence that was to be unbroken, save for a few brief visits to his native country, for the remainder of his life. His first two principal contacts, with London and Paris, signified respectively his initiation into English society, which was to form so largely the theme of his writings, and into the society of the writers whose work he had studied so assiduously, Flaubert, Zola, Maupassant and Daudet, whose actual friendship greatly increased, if such a thing were possible, his ambition, while destroying certain of his illusions in regard to their personal lives and characters. The charm of Europe at once assumed a complete and final domination over him. At first this charm extended to France and Italy as well as England, and under its compulsion he wrote the travel books, *Transatlantic Sketches* (1875), *Portraits of Places* (1883) and *A Little Tour in France* (1884), that interrupted the steady stream of novels and stories, most of which dealt with the relations between Americans in Europe and European society. His first volume had borne the prophetic title, *A Passionate Pilgrim and Other Tales* (1875) and this was followed by *Roderick Hudson* (1876), *The American* (1877), *Watch and Ward* (1878), *The Europeans* (1878), *Daisy Miller* (1878), his first pronounced success, *An International Episode* (1878), *Washington Square* (1881) and *The Portrait of a Lady* (1881), after which he published a new volume, and sometimes two or three volumes, virtually every year to the end of his life. Only two of his novels, *Washington Square* and *The Bostonians* (1886), although they were among the most distinguished, dealt exclusively with American life. Meanwhile he had gradually entered into the social life of London, at first as an extremely critical guest but more and more as what one of his critics describes as an old-established colonist, now identified with his surroundings, a sharer in the general fortunes and responsibilities of the place. The outward events of his life were few, chiefly indeed purely social engagements, varied by occasional trips to the continent for the sake of recreation or seclusion. His English friends included a few men of his own profession, the most notable being Robert Louis Stevenson and Edmund Gosse. The first phase of his career, and with it his first "manner," had ended with *The Bostonians. The Tragic Muse* (1890) represented his first attempt to deal exclusively with English characters in an English setting. Thereafter for some years he devoted himself chiefly to the writing of short stories, although he made constant but constantly defeated attempts to succeed as a playwright, producing two volumes of *Theatricals* (1894–95). He also published during this period several volumes of critical and topographical essays, *Partial Portraits* (1888), *Picture and Text* (1893) and *Essays in London* (1893). In 1896, feeling the need of a permanent establishment, whither he could retire to some extent from the social world whose claims had become more and more exhausting to him, he purchased Lamb house at Rye in Sussex which became his home henceforth. It was from there that he made his periodical trips to the continent and especially, during the season, to London. There, too, he began the series of works that marked his second and more complex manner, *The Spoils of Poynton* (1897) and *What Maisie Knew* (1897), short novels that were followed by the more ambitious *The Awkward Age* (1899), *The Wings of the Dove* (1902), *The Ambassadors* (1903) and *The Golden Bowl* (1904). With the exception of a few briefer works, these brought to an end the list of his novels and tales. In 1899, on a visit to Rome, he accepted the suggestion that he should write the life of his old friend William Wetmore Story which was published in 1903. And in 1904 he made the long visit to America, the first in 20 years, which resulted in the memorable volume of impressions entitled *The American Scene* (1907). During the years immediately preceding his death he wrote the two volumes of autobiography, *A Small Boy and Others* (1913) and *Notes of a Son and Brother* (1914). A final volume of his critical essays was published in 1914 under the title *Notes on Novelists.* In June 1915, as a result of his passionate attachment to the Allied cause in the war, James became naturalized as a British subject, and in 1916 he received the Order of Merit. He died in his flat in Chelsea, London, on Feb. 28, 1916. Two unfinished novels, *The Sense of the Past* and *The Ivory Tower,* were published in 1917, and in 1919 appeared also a collection of papers dealing with the war entitled *Within the Rim.*

It is James's peculiarity and distinction that he carried to its utmost limits, to the limits virtually of the impossible, the objective psychological novel. His effort was always to reflect faithfully the social life that he studied with such scrupulous devotion, and in this he was in the main successful, although his necessarily inadequate "saturation," to use his own word, in the *milieu* which he adopted in early middle life restricted his field to such an extent that his work developed into subtleties that were increasingly abnormal. From this point of view the later works of his early maturity, especially *Washington Square* and *The Portrait of a Lady,* are his most successful, although they are not generally so regarded by the special disciples of the master. James chose his characters from among those leisured people of the world for whom life is naturally a work of art and who are far removed from all the more practical aspects of existence. Their main preoccupations are problems of ethical conduct which they feel and discuss with a measure of casuistry never before reflected in fiction, and for the most part with a conscientiousness that reveals the author's nonconformist American heredity. They reflect also with remarkable fidelity their race and class, James having been to a rare degree familiar with at least three nationalities. It may be said that his own point of view and the tendency of his fiction became increasingly tragic. No novelist has been more profoundly concerned with the technique of his art, none has ever been more sensitive as a receiver and transmitter of impressions, whether of persons or places. Indeed, he might be described as pre-eminently a novelists' novelist, one who has been studied to an extraordinary degree by other practitioners of his craft, but whose general public is, for the same reason, among others, necessarily limited, while it is limited also by the extremely restricted character of his own outlook on life. In his later work, as markedly distinguished from his earlier, the characters are frequently to such a degree in solution, the solution of psychological analysis, that they exist only in the minds of other characters, having no objective life, while the setting also exists only in the same way. But James's originality, his distinction of style and his fineness of feeling are acknowledged by all and place him very close to the first rank of modern writers.

The New York edition of the novels and tales of Henry James, embodying drastic revisions by which the author's earlier work was virtually rewritten in the later manner, appeared in 1908–09. Two volumes of his letters were issued in 1920 under the editorship of Percy Lubbock. Critical and biographical studies of James have been written by Rebecca West (1916), Ford Madox Hueffer (1916) and Pelham Edgar (1927). (V. W. B.)

JAMES, JESSE WOODSON (1847–1882), American outlaw, was born Sept. 5, 1847, in Clay county, Mo., U.S.A. In the early months of the Civil War the family was partisan to the Southern cause, and as a result suffered greatly at the hands of the Union forces. By way of retaliation, Jesse turned informer and later, when only 15 years of age, joined the guerrilla forces of C. W. Quantrell. Here he soon established a reputation for marksmanship and daring. At the conclusion of the war, he, with other members of the band, surrendered, but soon afterward was treacherously shot and severely wounded. In the following year he was declared an outlaw, and thereafter until his death, he was a fugitive from the law. In 1867 he became the leader of the "James band" of bank and train robbers, and during the following years attained a wide repute for crimes of the most daring and cold-blooded type. As the result of a reward of $10,000 offered by Governor Crittenden of Missouri for the capture of Jesse James, dead or alive, two members of his own band, Robert and Charles Ford, turned traitors and shot and instantly killed him in his home at St. Joseph, Mo., April 3, 1882. Jesse's brother, Frank (1843–1915), was a partner in crime in most of the exploits of the James band. He surrendered soon after the death of his brother, but was never brought to trial. The closing years of his life were spent quietly on a farm in Missouri.

JAMES, WILLIAM (d. 1827), English naval historian, author of the *Naval History of Great Britain from the Declaration of War by France in 1793 to the Accession of George IV.*, practised as a proctor in the admiralty court of Jamaica between 1801 and 1813. He was in the United States when the war of 1812 broke out, and was detained as a prisoner, but escaped to Halifax. His literary career began by letters to the *Naval Chronicle* over the signature of "Boxer." In 1816 he published *An Inquiry into the Merits of the Principal Naval Actions between Great Britain and the United States.* In 1819 he began his *Naval History* (1822–1824). James died on May 28, 1827, in London.

An edition of the *Naval History* epitomized by R. O'Byrne appeared in 1888, and an *Index* by C. G. Toogood was issued by the Navy Records Society in 1895.

JAMES, WILLIAM (1842–1910), psychologist, philosopher, leader of the movement known as Pragmatism, and most renowned and representative of the thinkers of America, was born in New York city, on Jan. 11, 1842. He was the eldest of the five children of Henry and Lucy (Walsh) James; the second of the five, William's brother Henry, became the distinguished author of novels proclaimed for their psychological subtlety and their refinement of style. The other brothers and sisters do not figure notably; nor do the ancestors of William and Henry James. There is no indication in the American line of Irish, Scotch and English forbears, whose bloods mingled in their veins, of that deep and urgent concern with the ultimates of nature and human nature which moved the two brothers and their father. The grandfathers were "farmers, traders and merchants," prosperous and Presbyterian, with hardly even a doctor or a lawyer among them. There is a probable connection between the father's philosophic interests and an accidental burning during his boyhood that required the amputation of one leg above the knee. Both the physical and the spiritual life of Henry James the elder are marked by restlessness and wanderings, largely in Europe, which affected the training of his children at school and their education at home. He had himself graduated from Union college, in Schenectady, N.Y., and then gone to the Princeton Theological seminary, to prepare himself for the Presbyterian ministry, but had developed while there "antipathy to all ecclesiasticisms which he expressed with abounding scorn and irony throughout all his later years." In 1844, when William was two years old, a friend introduced to his father the works of Swedenborg. In these he seems to have found something of the consolation and security that he was seeking, and upon them he built a system of his own which seems to have served as a vision of spiritual life adequate to compensate for his bodily misfortune. The best of it William James conserved in "The Literary Remains of Henry James," published in 1886. It provided the permanent intellectual atmosphere of William James' home life. Its perduration made up for the disciplineless irregularity of his schooling, which ranged from New York in the United States to Boulogne in France, Geneva in Switzerland, and back. The habits acquired in dealing with the father's views at dinner and at tea, carried over into the extraordinarily sympathetic yet critical manner of dealing with anybody's views on any occasion.

When James was 18 years old and the family was living in Newport, R.I., he tried his hand at studying art, with William M. Hunt for a teacher and John LaFarge for a fellow pupil. But he soon tired of it, and the following year entered the Lawrence Scientific school of Harvard university. From courses in chemistry, anatomy and similar subjects there, he went to the study of medicine in the Harvard Medical school, but interrupted this study in order to accompany Louis Agassiz, in the capacity of assistant, on an exploring expedition to the Amazon. There his health failed and his duties irked him. He returned to the medical school for a term, and then during 1867–68, went to Germany for courses with Helmholtz, Virchow and Bernard, among others. At the same time he read widely in the psychology and philosophy then current, especially Renouvier.

The acquaintance with Renouvier is a focal point in James' personal and intellectual history. He seems from adolescence to have been a delicate boy, always ailing, and at this period of his stay in Germany to have suffered a breakdown, with thoughts of suicide. When he returned home, in Nov. 1868, after 18 months in Germany, he was still ill. Though he took the degree of M.D. at the Harvard Medical school in June 1869, he was unable to begin practice. Between that date and 1872 he lived in a state of semi-invalidism in his father's house, doing nothing but reading, and writing a very occasional review. Early in this period he experienced a sort of phobic panic which persisted until the end of April 1870. It was relieved, according to his own statement, by the reading of Renouvier on Freewill and the decision that "my first act of freewill shall be to believe in freewill." The decision carried with it the abandonment of all determinisms—both the scientific kind which his training had established for him, and which seems to have had some relation to his neurosis, and the theological, metaphysical kind, that he kept combating in the notion of "the block universe." His revolutionary discoveries in psychology and philosophy, his views concerning the methods of science, the qualities of men and the nature of reality, seem all to have received a definite propulsion from this resolution of his poignant personal problem.

In 1872 James was appointed instructor in physiology in Harvard college. He served in this capacity till 1876. But he could not be diverted from his ruling passion, and the step from teaching physiology to teaching psychology—not the traditional "mental science" but physiological psychology—was as inevitable as it was revolutionary. It meant a challenge to the vested interests of the mind, mainly theological, which were entrenched in the colleges and universities of the United States. It meant a definite break with what Mr. Santayana has called "the genteel tradition." Psychology ceased to be mental philosophy and became a laboratory science. Philosophy ceased to be an exercise in the grammar of assent and became an adventure in methodological invention and metaphysical discovery.

With his marriage in 1878, to Miss Alice H. Gibbens of Cambridge, Mass., a new life began for James. The old neurasthenia practically disappeared. He went at his tasks with a zest and an energy his earlier record had given no hint of. It was as if some deeper level of his being had been tapped: his life as an originative thinker began in earnest. He signed a contract with Henry Holt and Company to produce a text-book of psychology by 1880. But the work grew under his hand and did not appear till 1891. When it did appear, as *The Principles of Psychology*, it was not a text-book but a monumental work in two great volumes from which the text-book was condensed the following year. The *Principles* was at once recognized as both definitive and innovating in its field. It established the "functional point of view" in psychology. It assimilated mental science to the biological disciplines and treated also thinking and knowledge in the aspect

f instruments in the struggle to live. It made at one and the ime time the fullest use of principles of psychophysics and efended, without embracing, freewill.

The *Psychology* completed, James seems to have lost interest ı the subject. Creator of the first psychological laboratory in merica, he had an aversion to laboratory work and did not think imself fitted for it. He liked best the adventure of free observaion and reflection. Compared with the problems of philosophy nd religion, psychology seemed to him "a nasty little subject" hat he was glad to have done with. His studies were now of the ature and existence of God, the immortality of the soul, freewill nd determinism, the values of life. They differed from the usual hing in method. They were empirical, not dialectical. James vent directly to religious experience for the nature of God, to sychical research for survival after death, to the fields of belief nd action for freewill and determinism. He was searching out hese things, not arguing foregone conclusions. He had begun to each ethics and religion in the late '80s and his collaboration with he psychical researchers dated even earlier. Survival after death ıe found at the end to be unproved, but the existence of divinity ıe held to be established by the record of the religious experience, ut as a plurality of saving powers, "a more of the same quality" s oneself, that one's personality can in a crisis, make contact with nd be saved. Freedom he found to be a certain looseness in the onjunction of things, so that what the future shall be is not made nevitable by past history and present form; freedom or chance orresponds to Darwin's "spontaneous variations"; it is what aves history from being mere repetition. These views were set orth in the period between 1893 and 1903 in various essays and ectures, afterwards collected into works: *The Will to Believe and Other Essays in Popular Philosophy* (1897); *Human Immortality* (1898); *Talks to Teachers on Psychology and to Students on Some of Life's Ideals* (1899); *The Varieties of Religious Experience* (1902). The decade may be correctly described as James' religious eriod. All his studies are concerned with one aspect or another of the religious question. His natural interest in the subject was einforced by the practical stimulus of an invitation to give the Gifford lectures on natural religion at the University of Edinburgh. He was not able to give them until 1901–02 and the preparation of them focussed his labours for a number of years.

His disability, involving his heart, was due to prolonged effort nd exposure during a holiday in the Adirondacks, in June 1899. A trip to Europe which was to have taken up a sabbatical year away from university duties turned into two years of invalidism. The Gifford lectures were prepared during this distressful period. Published as *The Varieties of Religious Experience,* they had an even greater acclaim as a book than as articles. Cautious and tentative though it was, the rich concreteness of the material, the final summary of the evidence that the varieties of religious experience point to the existence of specific and various reservoirs of consciousness-like energies which we can make specific contact with in times of trouble, touched something fundamental in the minds of religionists and at least provided them with apologetic material not in conflict with science and scientific method.

The book also topped off James' interest in the psychology of religion. He now explicitly turned his attention to the ultimate philosophic problems that were at least marginally present with his other interests. Already in 1898, in a lecture at the University of California on philosophical conceptions and practical results, he had formulated the theory of method known as Pragmatism. Having its roots in the strict analysis of the *real* logic of the sciences made in the middle '70s by that extraordinary eccentric genius, Charles S. Peirce, it underwent, in James' hands a transforming generalization. He showed how the meaning of any idea whatsoever—scientific, religious, philosophical, political, social, personal—can be found ultimately in nothing save the succession of experiential consequences it leads through and to, that truth and error are identical with these consequences or else nothing within reach of the mind at all. He had made use of the pragmatic rule in his study of religious experience. He now turned it upon the ideas of change and chance, of freedom, variety, pluralism, novelty, which, from the time he had read Renouvier it had been his preoccupation to establish. He used the pragmatic rule in his polemic against monism and the "block universe," against internal relations, *i.e.,* the notion that you can't have one thing without having everything, against all finalities, staticisms and completenesses. His classes rang with the polemic against absolutes, and a new vitality crept into the veins of American philosophers. The historic controversy over Pragmatism saved the profession from iteration and dullness.

Meantime (1906) James had been asked to lecture at Stanford university, in California, and experienced there the earthquake which destroyed San Francisco. The same year he delivered the Lowell lectures, in Boston, Mass., afterwards published as *Pragmatism: A New Name for Old Ways of Thinking.* Various studies: "Does Consciousness Exist," "The Thing and its Relations," "The Experience of Activity," etc. appeared, chiefly in the Journal of Philosophy, which were essays in the extension of the empirical and pragmatic method to everything that has a name. These studies were collected after James' death and published as *Essays in Radical Empiricism* (1912). The fundamental point of these essays is that the relations between things, holding them together or separating them, are at least as real as the things themselves, that their function is real and that no hidden substrata is necessary to account for the clashes and coherences of the world. The empiricism was *radical,* because until this time even empiricists believed in a hidden turtle on whose back the cosmic elephant rode.

James was now the centre of a new life for philosophy in the English speaking world; the continentals did not "get" Pragmatism; if its German opponents altogether misunderstood it, its Italian adherents—Papini, of all people—travestied it. In England it was championed by Schiller; in the United States there were Dewey and his school. The pragmatists were by no means unanimous among themselves, but that added to the interest of the situation. In 1907 James gave his last course—an introduction to philosophy—in Harvard, and the students surprised him and broke an academic precedent, by presenting him with a loving cup. In the spring he went to Columbia university in New York city to repeat the lectures on "Pragmatism." It was as if a new prophet had come: the lecture halls were crowded on the last day as on the first, with people standing outside the door. He was fêted and photographed; he himself describes the visit as the "high tide of my existence." His hope was, when the thing was over, to settle down at last, to a free consideration of the philosophical questions that obsessed him. But there came an invitation to give the Hibbert lectures at Manchester college in Oxford, England, that constituted, he felt, a challenge which, in view of the status of Pragmatism in England at that time, he might not disregard. These lectures, published in 1909 as *A Pluralistic Universe,* state in a more systematic and less technical way than the *Essays in Radical Empiricism,* the same essential positions. They present in addition certain religious overbeliefs of James' which further thinking, if one may trust the implications of the posthumous *Some Problems in Philosophy,* seemed to be mitigating. These overbeliefs involve a pan-psychistic interpretation of experience which goes beyond radical empiricism and the pragmatic rule into conventional metaphysics.

Home again, James found himself working, against growing physical trouble, upon the material of which some was published after his death (1911) as the *Some Problems, etc.* referred to above. He also collected the occasional pieces in the controversy over Pragmatism and published them as *The Meaning of Truth* (1909). He remained available to students and good causes, and he wrote various other pieces—the last one about B. P. Blood, the "pluralistic mystic." Finally his physical discomfort exceeded even his remarkable voluntary endurance. It was decided to try again a cure at Nauheim and he sailed with Mrs. James in the spring of 1910 for Europe. But in Europe he gave himself too freely to people and Nauheim did not help him. They came back, in the company of his brother Henry, in midsummer, going straight to the country home in Chocorua, N.H. There he died on Aug. 26, 1910. He was survived by his widow, three sons and one daughter.

It is still too early to estimate James' significance and influence.

In psychology, his work is of course dated, but it is dated as Galileo's was in physics or Darwin's in biology, because it was the originative matrix of the great variety of new developments which are the current vogue. In philosophy, his positive work still is prophetic. The world he argued for is that which the new physics, the physics of Einstein and Russell and Bohr definitely point to—a world of events connected with one another by kinds of next to next relations, a world various, manifold, changeful, originating in chance, perpetuated by habits (we call such habit laws) and transformed by breaks, spontaneities and freedoms. In human nature, James thinks, these visible traits of the world are equally manifest. The real specific event is the individual; his character, his beliefs, his endeavour are an adventure in autobiography of which the conclusion is not established in advance. He integrates societies as he lives, and he breaks them. He validates beliefs by living them out or he makes them false. He is the primary event from which history dates, and whose intervention gives it in each case a new and unexpected turn. But in history as in nature, the flux of change and chance transforms every being, invalidates every law and alters every ideal. "What," he asks, "has concluded, that we should conclude about it"? Let us therefore, he urged, allow the claim of everything that makes a claim before us, let us give it an opportunity to make good its claim. The world of thought and the world of things, are alike to be treated in the spirit of sportsmanlike fair play; the new, the untried, the doubtful are to have their chance whenever they arise, and however.

James lived his philosophy. It enters into the texture and rhythms of his rich and vivid literary style. It determined his attitude toward scientifically unaccepted therapies, like Christian Science or mind cure and repugnant ideals like militarism. It made him an anti-imperialist, a defender of the small, the variant, the unprecedented, the weak, wherever and whenever they appeared. His philosophy is too viable and subtle, too hedged, experiential and tentative to have become the dogma of a school. It has functioned rather as a germinative of new thought in others than as a standard old system for others to repeat.

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JAMES, EPISTLE OF. This epistle, according to its opening verse, is addressed by James to "the twelve tribes of the dispersion," which probably means Christendom in general, conceived as the new Israel (*cf.* 1 Peter i. 1, 3, 23–5; Gal. vi. 16). According to the traditional view, this James is the Lord's brother, the "pillar" of Gal. ii. 9. But this is very far from being certain. With the superscription of this epistle may be compared that of the Epistle of Jude (*q.v.*), whose author, it would seem, seeks to clothe a message of denunciation against heretics guilty of moral laxity with similar apostolic authority, the "kindred of the Lord" being regarded in post-apostolic times as guardians of faith and morals for the Church (Hegesippus *ap.* Euseb., *H. E.* iv., xxii. 4).

Though some conservative critics still maintain the authenticity of the work, the superscription failed, even in antiquity, to secure its general acceptance; for Origen (A.D. 230), who is the first writer to make explicit mention of it, speaks of it as only "the so-called Epistle of James," Eusebius classes it among the "disputed" writings, and even Jerome admits that it was "said to have been published by another in the name of James." It is included in the *Catalogus Claromontanus* (Alexandria, 4th century) and in the lists of Athanasius, Cyril of Jerusalem and Epiphanius. But the Western Church, like the Syrian, refused it recognition down to the 5th century.

Luther maintained that the epistle was not apostolic (*Sämmtl. Werke.* Erl., vol. lxiii. p. 157), but his objections were largely doctrinal in character and the later reformers, disregarding the well-founded doubts of Erasmus and Cajetan, fell back upon the traditional view. Modern criticism begins with de Wette's *Introd. to the N.T.* (1826), which definitely denied the claim to apostolic origin. It is true that the epistle cannot have been composed later than A.D. 150, and that from the beginning it bore the name of James. But the language in which it was composed is a strongly Hellenized type of patristic Greek. This, and its motive, that of combating the type of degenerate Paulinism denounced in the Pastoral Epistles, Polycarp, and Papias as "vain talk" in place of a life in accordance with the new commandment of love, serve to link it, so far as motive is concerned, with the Gospel of Matthew, the Epistles of John (*cf.* 1 John iii. 16–24), Ps.-Barnabas (A.D. 132?), and the Ignatian Epistles (115).

Zahn and Mayor would avoid the difficulty of taking ii. 14–26 as a direct polemic against the watchword of Paul by assuming a date shortly before the beginning of the legalistic controversy or immediately after the death of Paul. But internal evidence shows that the date must fall "in the period of quiet after the destruction of Jerusalem in A.D. 70 and before the disturbances which culminated in the rebellion of Bar-Cochba, A.D. 132–135." This conclusion is that of Prof. J. H. Ropes of Harvard in the most thorough treatment ever given to the epistle (*I.C. Comm.,* 1916).

While, as regards motive, the writer stands close to the Pastoral Epistles and Matthew, his use of the moral teachings of Jesus is closer to the form reflected in Luke. Like the Lucan source James shows affinity with the Jewish wisdom literature as well as with the Hellenistic diatribe. His extraordinary lack of interest in Jesus as actual Leader and Founder of the Church (*cf.* James v. 10, 11 with 1 Peter iii. 13–iv. 6), resulting in a type of religion equivalent to the Jewish doctrine of the Torah as an indwelling better impulse (*yetser hattob*), informing and sustaining the spiritual life, can scarcely be paralleled unless in the *Preaching of Peter,* an early product of the Syrian Church in which, as Clement reports, the titles applied to Christ were Word and Law (Λόγος καὶ Νόμος). Hermas at Rome, who shows several other contacts with James, has also the strange declaration that "The Law of God given to the whole world is the Son of God" (*Simil.* viii. 3). The foundation is seemingly 1 Peter i. 23–25, adopted in James i. 18, 21; but the outcome is a Logos doctrine widely different from that developed in Asia under the influence of Paul.

As between Syria and Rome internal indications, such as the reference to conditions of agriculture (v. 7) as well as the pseudonym invoked, suggest a Syrian origin as more probable. As an example of the kind of surroundings likely to give rise to such a writing Ropes suggests Caesarea, second only to Jerusalem as a Palestinian cradle of the Church. In his carefully chosen words "The epistle is probably the pseudonymous production of a Christian of Jewish origin, living in Palestine in the last quarter of the 1st century or the first quarter of the 2nd."

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JAMES-LANGE THEORY OF EMOTIONS. The usual way of thinking about the emotional experiences and their facial or other bodily manifestations is that the emotional experience is excited by the perception of some object, and that the emotional feeling then expresses itself in the bodily manifestations in question. The feelings, in other words, are commonly regarded as causing, or expressing themselves in, the physical manifestations, and that is why these are called the "expressions" of the former. In opposition to this view, the theory of C. G. Lange (1834–1900) and W. James (1840–1910) states that the so-called expressions or bodily changes are the direct results of the perception of the exciting object, and that the emotion is just the feeling of these bodily changes as they occur. Common sense says, we lose our fortune, are sorry and weep; we meet a bear, are frightened and run; we are insulted, are angry and strike. But this, says James, misrepresents the actual sequence. Really we feel sorry because we cry; we feel angry because we strike; we are frightened because we run away. The main argument by which this theory is supported is that it is impossible to imagine a strong emotion, like anger or fear, in the absence of all those widespread organic disturbances which constitute its bodily symptoms. But this would only show that emotions cannot be experienced without these organic disturbances; it does not prove

that these sense experiences are the whole emotion. There are organic sensations, like hunger and thirst, which are not emotional at all. It has been shown, moreover, that different organic changes may be connected with the same emotion, and similar organic changes with different emotions. The mere sight of a bear, in fact, does not even produce any organic disturbances unless it is felt to threaten the instinct of self-preservation, and so induces fear. As James Ward has said, "Let Professor James be confronted first by a chained bear and then by a bear at large; to the one object he presents a bun and to the other a clean pair of heels" (*Psychological Principles*, p. 586).

See PSYCHOLOGY; HISTORY OF PSYCHOLOGY; W. James, *Principles of Psychology* (1890); J. Ward, *Psychological Principles* (1918); G. F. Stout, *Manual of Psychology* (1919).

JAMES OF HEREFORD, HENRY JAMES, 1ST BARON (1828–1911), English lawyer and statesman, son of P. T. James, surgeon, was born at Hereford on Oct. 30, 1828, and educated at Cheltenham college. He was called to the bar at the Inner Temple in 1852 and joined the Oxford circuit. In 1867 he was made "postman" of the court of exchequer, and in 1869 became a Q.C. At the General Election of 1868 he obtained a seat in parliament for Taunton as a Liberal, by the unseating of Mr. Serjeant Cox on a scrutiny in March 1869, and he kept the seat till 1885, when he was returned for Bury. He attracted attention in parliament by his speeches in 1873 in the debates on the Judicature Act, and in September he was made solicitor-general, and in November attorney-general, and knighted; and when Gladstone returned to power in 1880 he resumed his office. He was responsible for carrying the Corrupt Practices Act of 1883. On Gladstone's conversion to Home Rule, Sir Henry James parted from him and became one of the most influential of the Liberal Unionists; Gladstone had offered him the lord chancellorship in 1886, but he declined it; and the knowledge of the sacrifice he had made in refusing to follow his old chief in his new departure lent great weight to his advocacy of the Unionist cause in the country. He was one of the leading counsel for *The Times* before the Parnell Commission, and from 1892 to 1895 was attorney-general to the prince of Wales.

From 1895 to 1902 James was a member of the Unionist ministry as chancellor for the duchy of Lancaster, and in 1895 he was made a peer as Baron James of Hereford. The next year he joined the judicial committee of the Privy Council, and sat there and as a lord of appeal in the House of Lords. He delivered a number of important decisions as chairman of the Coal Conciliation Board from 1898 to 1909. In his later years the new policy of the Unionist Government drove him into opposition again; he opposed the Tariff Reform policy, and he opposed the rejection of the Budget by the House of Lords. He died on Aug. 18, 1911 at Kingswood Warren near Epsom.

JAMESON, ANNA BROWNELL (1794–1860), English writer on art, was born in Dublin on May 17, 1794, the daughter of Denis Brownell Murphy, a miniature and enamel painter. Anna went to England as a governess, and married, in 1825, Robert Jameson. The marriage was unhappy, and when Jameson was appointed a colonial judge the two parted. Anna Jameson is remembered for her essays on Shakespeare's heroines, *Characteristics of Shakespeare's Women* (1832), and her books on sacred art: *Poetry of Sacred and Legendary Art* (1848), *Legends of the Monastic Orders* (1850), *Legends of the Madonna* (1852), and *History of Our Lord as represented in Art* (1864), completed by Lady Eastlake.

Anna Jameson also took a keen interest in questions affecting the education, occupations and maintenance of her own sex. On these subjects she wrote *Sisters of Charity* (1855) and *The Communion of Labour* (1856). She died on March 17, 1860.

See Geraldine Macpherson, *Memoirs of Mrs. Jameson* (1878), and Mrs. Stuart Erskine, *Letters and Friendship* (1915).

JAMESON, SIR LEANDER STARR (1853–1917), British colonial statesman, son of R. W. Jameson, a writer to the signet in Edinburgh, was born at Edinburgh in 1853, and was educated for the medical profession at University College Hospital, London (M.R.C.S. 1875; M.D. 1877). After acting as house physician, house surgeon and demonstrator of anatomy, his health broke down from overwork in 1878, and he went out to South Africa and settled down in practice at Kimberley. There he came into contact with Cecil Rhodes. In 1888 he used his influence with Lobengula, who was one of his patients, to induce him to grant the concessions to the agents of Rhodes which led to the formation of the British South Africa Company; and when the company proceeded to open up Mashonaland, Jameson abandoned his medical practice and joined the pioneer expedition of 1890. From this time his fortunes were bound up with Rhodes's schemes in the north. Immediately after the pioneer column had occupied Mashonaland, Jameson, with F. C. Selous and A. R. Colquhoun, went east to Manicaland and secured the greater part of that country, to which Portugal was laying claim, for the Chartered Company. In 1891 Jameson succeeded Colquhoun as administrator of Rhodesia. At the end of 1894 "Dr. Jim" (as he was familiarly called) came to England and was fêted on all sides.

On the last day of 1895 the world was startled to learn that Jameson, with a force of 600 men, had made a raid into the Transvaal from Mafeking in support of a projected rising in Johannesburg, which had been connived at by Rhodes at the Cape (*see* RHODES, CECIL, and TRANSVAAL). Jameson's force was compelled to surrender at Doornkop, receiving a guarantee that the lives of all would be spared; he and his officers were sent to Pretoria, and, after a short delay, President Kruger, on the surrender of Johannesburg (Jan. 7), handed them over to the British government for punishment. They were tried in London under the Foreign Enlistment Act in May 1896, and Dr. Jameson was sentenced to 15 months' imprisonment at Holloway. He served a year in prison, and was then released on account of ill health. He still retained the affections of the white population of Rhodesia, and returned there in an unofficial capacity. He was the constant companion of Rhodes on his journeys up to the end of his life, and when Rhodes died in May 1902, Jameson was left one of the executors of his will. In 1903 Jameson came forward as the leader of the Progressive party in Cape Colony; and after the Progressive victory at the general election in Jan.–Feb. 1904, Jameson was prime minister. He attended the Colonial conference held in London in 1907. In September of that year the Progressives were defeated at the polls, and Jameson resigned office on Jan. 31, 1908. In 1908 he was one of the delegates from Cape Colony to the inter-colonial convention for the closer union of the South African states. The union of the South African colonies in 1909 accomplished the principal object which Jameson had set before himself as a political leader. He wished to carry the spirit of union further by forming a combination of political parties to support a non-racial government for the new Union, regarded General Botha as the natural leader of such a combination, and was completely ready to serve under him. This project of a "best man" government, however, was not accepted by Botha, who thought that the Dutch-speaking people of South Africa were not ready for it. The alternative, to which Jameson then set himself, was the formation of a new party representing the majority of the English-speaking people in the Cape, the Transvaal, the Orange Free State and Natal. The programme of the new Unionist party of South Africa showed his influence in every clause.

For two years Jameson led the Unionists in the South African house of assembly with moderation and self-restraint, but he was compelled by ill-health to retire from the leadership of the party in 1912. He returned to England and settled in London, devoting himself to business interests. He died on Nov. 26, 1917. Diffident and utterly free from self-seeking, Jameson's labours for racial reconciliation and material progress in South Africa were conspicuous, and the close friendship of Botha was a final proof of the quality of his patriotism. Jameson was created a K.C.M.G. on the inauguration of the Union in 1909 and a baronet in 1911. *See* also SOUTH AFRICA, UNION OF.

JAMESON, ROBERT (1774–1854), Scottish naturalist and mineralogist, was born at Leith on July 11, 1774. He became assistant to a surgeon in his native town. He studied natural

history under Dr. John Walker in 1792 and 1793, and went in 1800 to Freiberg to study for nearly two years under Werner. In 1804 he succeeded Walker as regius professor of natural history in Edinburgh university. He became perhaps the first eminent exponent in Great Britain of the Wernerian geological system, but was ultimately converted to the views of Hutton. His influence in the classroom gave a marked impetus to the study of geology in Britain. His energy also amassed a great part of the splendid collection in the natural history department of the Royal Scottish museum in Edinburgh. In 1819 Jameson, with Sir David Brewster, started the *Edinburgh Philosophical Journal,* and after the 10th volume edited it alone, until his death in Edinburgh on April 19, 1854.

Jameson was the author of *Outline of the Mineralogy of the Shetland Islands and of the Island of Arran* (1798), incorporated with *Mineralogy of the Scottish Isles* (1800); *Mineralogical Description of Scotland,* vol. i. pt. 1 (Dumfries, 1805); this was to have been the first of a series embracing all Scotland; *System of Mineralogy* (3 vols., 1804–08; 3rd ed., 1820); *Elements of Geognosy* (1809); *Mineralogical Travels through the Hebrides, Orkney and Shetland Islands* (2 vols., 1813); and *Manual of Mineralogy* (1821); and occasional papers, of which a list will be found in the *Edinburgh New Philosophical Journal,* July, 1854, with a portrait and biographical sketch of the author.

JAMESTOWN, city, Chautauqua county, New York, U.S.A., at the southern outlet of Lake Chautauqua, 68m. S. by W. of Buffalo. It is served by the Erie and the Jamestown, Westfield and North-western railways, by inter-urban trolley and motor-bus lines, and in summer by lake steamers. The population was 38,917 in 1920 (29% foreign-born white, largely from Sweden) and was estimated locally at over 50,000 in 1928. It has a delightful situation among the hills of Chautauqua county, in a fertile farming and dairying region. The shores of the lake are lined with summer cottages and hotels, and on the west side, near the upper end, are the grounds of the Chautauqua Institution. Jamestown has important and rapidly growing manufactures, notably of furniture (metal and wood) and building trim. The factory output in 1925 was valued at $51,805,812. Bank clearings in 1926 amounted to $78,600,000, and the assessed valuation of property in 1927 was $62,347,354. Jamestown was settled in 1810, incorporated as a village in 1827, and chartered as a city in 1886. It was named after James Prendergast, an early settler.

JAMESTOWN, a city of North Dakota, U.S.A., on the James river and Federal highway 10, midway between Fargo and Bismarck, at an altitude of 1,429 ft.; the county seat of Stutsman county. It is served by the Midland Continental and the Northern Pacific railways. The population in 1925 (State census) was 7,230. It is the trading and shipping point of a fine farming and stock-raising country. The Northern Pacific has division headquarters and repair shops here. Jamestown college, a Presbyterian institution established in 1909, has an enrolment of over 500. Just south of the city is the State hospital for the insane. Settlement began here in 1873, near Ft. Seward (established in 1872 and abandoned in 1877). The city was chartered in 1883. Between 1900 and 1920 the population increased 32 per cent.

JAMESTOWN, a former village in what is now James City county, Va., U.S.A., on Jamestown island, in the James river, about 40 m. above Norfolk. It was here that the first permanent English settlement in America was founded on May 13, 1607, that representative government was inaugurated on the American Continent in 1619, and that negro servitude was introduced into the original 13 Colonies, also in 1619. In Jamestown was the first Anglican church built in America. The settlement was in a low marshy district which proved to be unhealthy; it was accidentally burned in Jan. 1608, and was almost completely destroyed by Nathaniel Bacon in Sept. 1676. The State house and other buildings were again burned in 1698, and after the removal of the seat of Government of Virginia from Jamestown to the Middle Plantations (now Williamsburg) in 1699 the village fell rapidly into decay. Its population had never been large: it was about 490 in 1609 and 183 in 1623; the mortality was always very heavy. By the middle of the 19th century the peninsula on which Jamestown had been situated had become an island, and by 1900 the James river had worn away the shore but had hardly touched the territory of the "New Towne" (1619), immediately east of the first settlement; almost the only visible remains, however, were the tower of the brick church and a few gravestones. In 1900 the association for the preservation of Virginia antiquities, to which the site was deeded in 1893, induced the U.S. Government to build a wall to prevent the further encroachment of the river; the foundations of several of the old buildings have since been uncovered, many interesting relics have been found, and in 1907 there were erected a brick church (which is as far as possible a reproduction of the fourth one built in 1639–47), a marble shaft marking the site of the first settlement, another shaft commemorating the first house of burgesses, a bronze monument to the memory of Capt. John Smith, and another monument to the memory of Pocahontas. (For additional details concerning the early history of Jamestown, *see* VIRGINIA: *History.*)

The founding at Jamestown of the first permanent English-speaking settlement in America was celebrated in 1907 by the Jamestown Tercentennial Exposition, held on grounds at Sewell's point on the shore of Hampton Roads. About 20 foreign nations, the Federal Government and most of the States of the Union took part in the exposition.

See L. G. Tyler, *The Cradle of the Republic: Jamestown and James River* (Richmond, 2nd ed., 1906); Mrs. R. A. Pryor, *The Birth of the Nation: Jamestown 1607* (1907); and particularly S. H. Yonge, *The Site of Old "James Towne" 1607–1698* (Richmond, 1904), embodying the results of the topographical investigations of the engineer in charge of the river-wall built in 1900–01. *See* also J. T. Faris, *The Romance of Forgotten Towns* (1924).

JĀMĪ (NŪR-ED-DIN 'ABD-UR-RAHMAN IBN AHMAD) (1414–1492), Persian poet and mystic, was born at Jām in Khurasan, whence the name by which he is usually known. In his poems he mystically utilizes the connection of the name with the same word meaning "wine-cup." He was the last great classic poet of Persia, and a pronounced mystic of the Sūfic philosophy. His three *diwans* (1479–1491) contain his lyrical poems and odes; among his prose writings the chief is his *Bahāristān* ("Spring-garden") (1487); and his collection of romantic poems, *Haft Aurang* ("Seven Thrones"), contains the *Salāmān wa Absāl* and his *Yūsuf wa Zalīkha* (Joseph and Potiphar's wife) in 74 cantos.

On Jāmī's life and works *see* V. von Rosenzweig, *Biographische Notizen über Mewlana Abdurrahman Dschami* (Vienna, 1840); Gore Ouseley, *Biographical Notices of Persian Poets* (1846); W. N. Lees, *A Biographical Sketch of the Mystic Philosopher and Poet Jami* (Calcutta, 1859); E. Beauvois (*s.v.* Djami) in *Nouvelle Biographie générale;* and H. Ethé in Geiger and Kuhn's *Grundriss der iranischen Philologie,* ii. There are English translations of the *Bahāristān* by E. Rehatsek (Benares, 1887) and Sorabji Fardunji (Bombay, 1899); of *Salāmān wa Absāl* by Edward FitzGerald (1856, with a notice of Jāmī's life); of *Yūsuf wa Zalīkha* by R. T. H. Griffith (1882) and A. Rogers (1892); also selections in English by F. Hadland Davis, *The Persian Mystics: Jāmī* (1908). (*See* also PERSIA: *Literature.*)

JAMIESON, JOHN (1759–1838), Scottish lexicographer, son of a minister, was born in Glasgow on March 3, 1759. He was educated at Glasgow university and at Edinburgh. Jamieson was licensed to preach in 1789 and became pastor of an Anti-burgher congregation in Forfar; and in 1797 he was called to the Anti-burgher church in Nicolson street, Edinburgh. The union of the Burgher and Anti-burgher sections of the Secession Church in 1820 was largely due to his exertions. He retired from the ministry in 1830, and died in Edinburgh on July 12, 1838.

Jamieson's *An Etymological Dictionary of the Scottish Language ... to which is prefixed a Dissertation on the Origin of the Scottish Language* (Edinburgh, 2 vols., 1808), with *Supplement* (2 vols., 1825) was issued in a revised edition by Longmuir and Donaldson in 1879–87.

JAMIESON, ROBERT (*c.* 1780–1844), Scottish antiquary, was born in Morayshire. In 1806 he published a collection of *Popular Ballads and Songs from Tradition, Manuscript and Scarce Editions.* Two pleasing lyrics of his own were included. Scott, through whose assistance he received a Government post at Edinburgh, held Jamieson in high esteem and pointed out his skill in discovering the connection between Scandinavian and Scottish legends. Jamieson's work preserved much oral tradition which

night otherwise have been lost. He was associated with Henry Weber and Scott in *Illustrations of Northern Antiquities* (1814). He died on Sept. 24, 1844.

JAMKHANDI, a native state of India, in the Deccan division of Bombay, ranking as one of the southern Mahratta Jagirs. Area, 492 sq.m. Pop. (1921), 101,195; tribute, £1,300. The chief is a Brahman of the Patwardhan family. Cotton, wheat and millet are produced, and weaving and dyeing carried on. The town of JAMKHANDI, the capital, is situated 68 m. E. of Kolhapur. Pop. (1921), 12,620.

JAMMES, FRANCIS (1868–), French poet and novelist, was born at Tournai Dec. 2, 1868, and when still a child went to live at Orthez. He studied at the Collège de Pau and the Collège de Bordeaux, and afterwards became for a short time a notary's clerk at Orthez. There he published his first verses, in 1893, and from the countryside of Orthez he drew much of the matter of his poetical work. After that date, his poems and novels succeeded each other rapidly. The chief characteristics of his style are a great simplicity and a preoccupation with the humble manifestations of everyday life, especially of French provincial life. Much of his work is profoundly religious and Catholic. His *Oeuvres* (2 vols.) were collected in 1925.

Among his works are: *De l'Angelus de l'aube à l'Angelus du soir* (1898); *Clara d'Ellébeuse* (1899); *Les georgiques chrétiennes* (1912); *Feuilles dans le vent* (1914); *Le Rosaire au Soleil* (1916); *Le Curé d'Ozeron* (1918); *Les livres des quatrains* (1923–25); *Ma France poétique* (1926). *See* also T. Braun; *Des poètes simples: Francis Jammes* (1900); A. de Bersancourt, *Francis Jammes, poète chrétien* (1910); A. Lowell, *Six French Poets* (1915); P. Lasserre, *Les chapelles littéraires* (1920).

JAMMU or JUMMOO, capital of the state of Jammu and Kashmir in northern India, on the river Tavi (Ta-wi), a tributary of the Chenab. Pop. (1921), 36,506. The town and palace stand upon the right bank of the river; the fort overhangs the left bank, at a height of 150 ft. above the stream. The city was the seat of a Rajput dynasty. After conquest by the Sikhs, it formed part of Ranjit Singh's dominions. After his death it was acquired by Gulab Singh as the nucleus of his dominions, to which the British added Kashmir in 1846. It is connected with Sialkot in the Punjab by a railway 16 m. long.

The province of Jammu proper, consists of a submontane tract, the upper basin of the Chenab. Pop. (1921), 1,640,259.

JAMNIA, an ancient town of southern Palestine 13 m. S. of Joppa and 4 m. from the sea. The name is a Graecized form of the Jabneh, or Jabneel, of the Old Testament. The modern inheritrix of the site is a large village on a sandy hill in the midst of gardens and coppices. It has two mosques, one taking the place of an ancient church.

A Canaanite town, it was allotted to Judah, surrendered later to Dan, and passed to the Philistines. Its port, in ancient times also called Iamnia, is the modern *Minet er-Rubīn,* where Judas Maccabaeus burned the vessels (164 B.C.). Simon, Alexander Jannaeus and Pompey possessed it in turn. In A.D. 70 a rabbinic college was established there by Jochanan ben Zakkai, traditionally believed to have escaped from the siege of Jerusalem concealed in a coffin. The Great Sanhedrin transferred its activities thither and continued there until Bar Cochba had come into the open against the Romans (A.D. 132). It was erected into a bishopric at the time of Eusebius, and its bishop was present at Nicaea (A.D. 325). The Crusaders, to whom the place was known as Ibelin, built a fortress there (1144).

There was a Jabneel (mod. Yemma), 8 m. S. of Tiberias, and Josephus describes a fortress in Upper Galilee named Jamnia (*Vita* 37). (E. Ro.)

JAMRUD, a fort and cantonment in India, just beyond the border of Peshawar district, North-West Frontier Province (*q.v.*), situated at the mouth of the Khyber Pass, 9 m. W. of Peshawar on the extension of the North-Western railway to the Afghan frontier. It was occupied by Hari Singh, Ranjit Singh's commander in 1836; but in April 1837 Dost Mohammed sent a body of Afghans to attack it. The Sikhs gained a doubtful victory, with the loss of their general. During the military operations of 1878–79, Jamrud was a place of considerable importance as the frontier outpost on British territory towards Afghanistan, and it was also the base of operations for a portion of the Tirah campaign in 1897–98. It is the headquarters of the Khyber Rifles, and the collecting station for the Khyber tolls. Pop. (1921), 6,128.

JAMS AND JELLIES. In the article FOOD PRESERVATION it is pointed out that concentrated sugar solutions inhibit the growth of organisms and so have a preservative action. The preparation of jams and jellies is based upon this fact. All fresh and succulent fruit contains a large percentage of water, amounting to at least four-fifths of the whole, and a comparatively small proportion of sugar usually not exceeding 10 to 15%. Such fruit is naturally liable to decomposition unless the greater proportion of the water is removed and the percentage of sugar much increased. Jams and jellies are preserves containing about two-thirds their weight of sugar. All kinds of edible fruit can be made into jam but for the preparation of jellies only those fruits are suitable which contain a sufficient proportion of a chemical substance called pectin, on which the gelatinizing power of fruit depends. This substance is a carbohydrate of no feeding value but, being allied to the vegetable gums, after boiling has the property of solidifying to a gelatinous mass. It is present to some extent in all fresh fruit but to a larger extent in citrous fruits, red and black currants, gooseberries and apples, and certain other fruits which are capable of forming jellies. As some degree of gelatinization is aimed at in jams pectin is sometimes added in the case of strawberries, raspberries, and other fruits which do not contain sufficient pectin to make them set. Iceland moss, gelatine and agar-agar have sometimes been added to give the necessary gelatinizing power, but such additions are not desirable.

The art of jam-making, once entirely domestic, is now a large branch of manufacture. The pulped or sliced fruit, sometimes with the addition of a little water, is mixed with about an equal weight of sugar and rapidly boiled down to the required consistency. As the jellifying power of the pectin depends upon the acidity of the fruit, the consistency can often be improved by the addition of a small quantity (say one-half of 1%) of tartaric or citric acid. Manufacturers sometimes add small quantities of aniline dyes to improve the colour. Considerable experience is required to stop the boiling at the right point; too short boiling leaves an excess of water, which results in fermentation, while over-boiling may cause crystallization of the sugar. The finishing point is usually judged by rule of thumb, although in some factories it is regulated by accurate thermometric measurement. The addition of chemical preservatives, such as salicylic acid, was at one time common, but it is not now permitted in most countries. Although a jam or jelly containing 60 or 70% of sugar does not ferment or decompose it is still liable to the growth of mould on the surface, so in order to prevent this the pots into which the boiled jam is to be poured should be thoroughly cleaned and the jam or jelly sealed hermetically immediately, so that the spores of moulds may not fall upon the surface from the air.

Sometimes starch glucose and beet sugar are used to replace part of the cane sugar; the addition of glucose is not held to be an adulteration and is said to reduce the liability of the jam to crystallize and to aid gelatinization. A popular prejudice has it that beet sugar is not suitable for jam making; this is quite erroneous; large quantities of beet sugar are used and the product is indistinguishable from that made from cane sugar. The gross adulteration of jam is now a thing of the past, but sometimes there is the addition of apple-pulp, or the pulp of certain vegetables to give gelatinizing power, particularly when fruit pulp which has been long stored or which has been preserved with sulphur dioxide is used, as such is apt to be very deficient in pectin. (H. E. C.)

Jams and Jellies, Home-made.—*Jellies.* The gelatine must first be soaked about 20 minutes in water, and then melted with a small amount of water by stirring on top of a fire. Water should then be added in the proportion of about one pint to one ounce of gelatine, but certain fruits, such as the lemon, require more gelatine. The wine or other flavourings should be added while the mixture is hot; if fruit juice is to be added instead of whole fruits,

the fruit must be stewed until as much as possible of its body has gone into the juice. The mixture should be poured into a mould and left to cool.

To remove jelly from the mould, it is best to place the mould once in very hot water—not several times in lukewarm water. The jelly can then generally be removed with one sharp jerk.

In the United States jelly making from fruit is still a general home process, especially in rural communities and the smaller towns. The process is the same as for commercial jellies, cane or beet sugar being used. Paraffin is in common use for sealing. Of late years preparations of pectin have been marketed for use in the home, and these are being more and more employed.

For gelatine jellies, one pint of liquid requires about one tablespoon of the usual granulated gelatine. This is soaked five minutes in double its own quantity of cold water, and dissolved in a little hot liquid before stirring into the mixture. The use of manufactured gelatine jellies, already flavoured and needing only the addition of hot water, is wide and increasing.

Jam is made at home more generally than jelly, being easier, and if from marketed fruit, better.

Jams. Sugar should be provided in the proportion of anything from ½lb. to 1lb. for each pound of fruit, according to taste. The sugar should first be melted over the fire in a small quantity of water, and the fruit then added. The whole should be boiled in a preserving pan from 20 to 60 minutes, according to the hardness of the fruit, being stirred regularly with a wooden spoon or stick, to prevent burning.

The jam must then immediately be placed in perfectly dry pots and sealed at once.

JAMSHEDPUR, a town in British India, in the Singhbhum district of Behar and Orissa. The town is situated in an angle of the Subarnarekha and Kharkhai rivers, with a station on the Bengal-Nagpur railway. With a population of 57,041, it is the third largest town in the province, though it is less than 20 years old. It owes its creation and development to the Tata Iron and Steel company. Land on a village site was acquired here for the erection of the company's works in 1907, the foundations were laid in 1909, and iron was first produced in 1911. Since then Jamshedpur has grown rapidly with the expansion of the company's business, especially during the World War. It is an industrial town with blast furnaces, steel works and rolling mills; the out-turn in 1925–26 was 573,000 tons of pig iron, 470,000 tons of steel and 139,000 tons of rails and beams.

JANÁČEK, LEOŠ (1854–1928), Czech composer, was born in Hukvaldy, Moravia, on June 3, 1854, and educated in the monastery of the Austrian Friars in Brno under the composer, Paul Křížkovsky. After studies in Prague, Leipzig and Vienna he returned to Brno, where, in 1881, he became director of the organ school, and later professor of composition in the master school of the State conservatoire, into which the organ school developed. Janáček followed in Křížkovsky's footsteps, as a collector of folk songs, especially of Moravia, but went deeper than his master into their psychology. Among his operas, which contain some of his most original work, are *Jönuja: Její pastorkyňa,* a psychological drama of Moravian village life, first produced in Prague (1916) and later heard in Berlin, Vienna and New York; and *Katya Kabanova* (1922), based on *The Storm,* a Russian drama by Ostrovsky. In lighter mood are *The Excursions of Mr. Brouček* (1920), an operatic satire, and *Liška bystrouška* (1925), an animal opera. Janáček's remaining works include a dramatic song cycle, *The Notebook of One who Vanished;* a symphonic poem, *The Fiddler's Child;* an orchestral rhapsody, *Taras Bulba;* a string quartet; a concertino for small orchestra; a sextet for wind instruments, *Youth;* and some fine choral works. Janáček died on Aug. 13, 1928.

See F. Bartoš and L. Janáček, *Kytice z národnich písni moravských kterouž uvili F. Bartoš a L. Janáček* (1800).

JANESVILLE, a city of southern Wisconsin, U.S.A., on the Rock river, 13m. from the Illinois state line; the county seat of Rock county. It is on Federal highway 51, and is served by the Chicago, Milwaukee, St. Paul and Pacific and the Chicago and North Western railways, and by inter-urban motor bus and trolley-car lines. The population was 18,293 in 1920 (88% native white) and was estimated locally at 25,600 in 1928. The city is picturesquely situated on bluffs above the river, which furnishes abundant water-power. It has a large trade in tobacco and grain, and important manufactures, including automobiles, auto bodies and fountain pens. The aggregate output of the factories in 1925 was valued at $48,093,105. The State school for the blind, opened here in 1849 as a private institution, and taken over by the State in 1850, is Wisconsin's oldest State charitable institution. Janesville was founded about 1834 and was chartered as a city in 1853, and named after Henry F. Janes, an early settler. Its daily paper, the *Gazette,* was established in 1845.

JANET, PIERRE (1859–), French psychologist, was born on May 30, 1859, in Paris, and educated at the Ecole Normale and the Ecole de Médecine in Paris. From 1881 to 1898 he lectured on philosophy at the lycées of Chateauroux and The Hague, at the College Rollin, and at the lycées Louis-le-Grand and Condorcet. During the period 1889–93 he was at the same time director of the psychological laboratory of la Salpétrière. From 1898 to 1902 he lectured on psychology at the Sorbonne, and was then appointed *professeur suppléant* at the Collège de France, where he became professor of psychology in 1902. He is also the director of the *Journal de Psychologie normale et pathologique.*

His publications include: *L'Automatisme psychologique* (1889); *L'Etat mental des hystériques* (2 vols. 1893); *Névroses et idées fixes* (2 vols. 1898); *Les Obsessions et la Psychasténie* (2 vols. 1903); *Les Névroses* (1908); *The Major Symptoms of Hysteria* (1908); *Les Méditations psychologiques* (3 vols. 1920, Eng. trs. 2 vols.); *La Médecine psychologique* (1923, Eng. trs.); *De l'angoisse a l'extase* (vol. i., 1926).

JANEWAY, THEODORE CALDWELL (1872–1917), American physician, was born in New York city Nov. 2, 1872. He was educated at the Sheffield Scientific School, Yale university, and the College of Physicians and Surgeons, Columbia university. From 1898 to 1906 he taught medical diagnosis in New York university. In 1907 he became associate in medicine in Columbia university, and two years later professor of medicine. In 1914 he was called to Johns Hopkins university as professor of medicine, and became physician-in-chief to Johns Hopkins hospital. His investigations in the phenomena of blood pressure opened up a hitherto unexplored field of medical research. During the World War, he became major in the Medical Officers' Reserve Corps and was engaged in research in Washington (D.C.). He died at Baltimore (Md.) Dec. 27, 1917. He was a member of the board of scientific directors of the Rockefeller Institute for Medical Research. He was the author of *The Clinical Study of Blood Pressure* (1904).

JANIN, JULES GABRIEL (1804–1874), French critic, was born at St. Etienne (Loire) on Feb. 16, 1804, and died near Paris on June 19, 1874. He worked on the *Figaro,* the *Quotidienne,* etc., until in 1830 he became the dramatic critic of the *Journal des Débats.* After many years of *feuilleton* writing he collected some of his articles in the work called *Histoire de la littérature dramatique en France* (6 vols., 1853–58). In 1870 he was admitted to the Academy. One of the best of his many books is *Fin d'un monde et du neveu de Rameau* (1861), in which, under the guise of a sequel to Diderot's masterpiece, he showed his great familiarity with the late 18th century. His *Oeuvres choisies* (12 vols., 1875–78) were edited by A. de la Fitzelière.

A study on Janin with a bibliography was published by A. Piédagnel in 1874. *See* also Sainte-Beuve, *Causeries du lundi,* ii. and v., and Gustave Planche, *Portraits littéraires.*

JANINA, a town of North Epirus in Greece. Pop. (1920) 20,765. The largest ethnical groups in the population are the Albanian and Greek. The position of Janina is strikingly picturesque. At the foot of the grey limestone mass of Mount Mitzekeli (1,500 ft.), which forms part of the fine range of hills running north from the Gulf of Arta, there lies a valley (the *Hellopia* of antiquity) partly occupied by a lake; and the city is built on the slopes of a slight eminence, stretching down to the western shore. It has greatly declined from the state of barbaric prosperity which it enjoyed from 1788 to 1822, when it was the

seat of Ali Pasha (*q.v.*), and was estimated to have from 30,000 to 50,000 inhabitants. The fortress—Demir Kule or Iron Castle, which, like the principal seraglio, was built on a promontory jutting into the lake—is now in ruins. But the city is the seat of a Greek archbishop, and still possesses many mosques and churches, besides synagogues, a Greek college (gymnasium), a library and a hospital. Sayades (opposite Corfu) and Arta are the places through which it receives its imports. The rich gold and silver embroidery for which the city has long been famous is still one of the notable articles in its bazaar.

The lake of Janina (perhaps to be identified with the Pambotus or Pambotis of antiquity) is 6 m. long, and has an area of 24 sq.m., with an extreme depth of less than 35 ft. In time of flood it is united with the smaller lake of Labchistas to the north. There are no affluents of any considerable size, and the only outlets are underground passages or *katavothrai* extending for many miles through the calcareous rocks.

As Anna Comnena, in describing the capture of the town by Bohemond in 1082, speaks of the walls as being dilapidated, it may be supposed that the place existed before the 11th century. It is mentioned from time to time in the Byzantine annals, and on the establishment of the lordship of Epirus by Michael Angelus Comnenus Ducas, it became his capital. In the middle ages it was successively attacked by Serbs, Macedonians and Albanians; but it was in possession of the successors of Michael when the forces of the Sultan Murad appeared before it in 1430 (*cf.* Hahn, *Alban. Studien,* Jena [1854], pp. 319–322). Since 1431 it remained under Turkish rule but was occupied by the Greeks early in 1913 in the first Balkan war. Since then it has been the principal town of Epirus. It uses as ports Prevoza, to the South, and Santi Quaranta in Albania. Janina is still (1928) notorious as a centre for the organization of brigandage, which is rendered more easy by the proximity of the Albanian border.

See Holland's *Travels* (1815); Hughes, *Travels in Greece,* etc. (1830); H. F. Tozer, *Researches in the Highlands of Turkey* (London, 1869). *See* also ALBANIA and the authorities there cited.

JANISSARIES, an organized military force constituting, until 1826, the standing army of the Ottoman empire. The word is a corruption of the Turkish *yeni chéri,* new troops. At first Turkey possessed no standing army. It was under Orkhan that a regular paid army was first organized; but the result was unsatisfactory, as the Turcomans, from whom these troops were recruited, were unaccustomed to fight on foot or to submit to military discipline. Accordingly, in 1330, on the advice of Chendéréli Kara Khalil, the system was adopted, whereby a certain number of Christian youths (at first 1,000) were every year taken from their parents and, after undergoing a period of apprenticeship, were enrolled as *yeni chéri* or new troops. The venerable saint Haji Bektash, founder of the Bektashi dervishes, blessed the corps and promised them victory; he remained ever after the patron saint of the janissaries.

At first the corps was exclusively recruited by the forced levy of Christian children, for which purpose the officer known as *tournaji-bashi,* or head-keeper of the cranes, made periodical tours in the provinces. The fixed organization of the corps dates only from Mohammed II., and its regulations were subsequently modified by Suleiman I. In early days all Christians were enrolled indiscriminately; later those from Albania, Bosnia and Bulgaria were preferred. The recruits, while serving their apprenticeship, were instructed in the principles of the faith. Until the accession of Murad III. (1574) the total effective of the janissaries, including the *ajami* or apprentices, did not exceed 20,000. In 1582 irregularities in the mode of admission to the ranks began. Soon parents themselves begged to have their children enrolled, so great were the privileges attaching to the corps; later the privilege of enlistment was restricted to the children or relatives of former janissaries; eventually the regulations were much relaxed, and any person was admitted, only negroes being excluded. In 1591 the whole corps (*ojak*) of janissaries numbered 48,688 men. Under Ibrahim (1640–48) they were reduced to 17,000, but from this time they continually increased until at the time of their destruction in 1826 they numbered 135,000. It would perhaps be more correct to say that these are the numbers figuring on the pay-sheets. In time of peace the janissary received no pay. In time of war the commander (*aga*) of the janissaries and several of his subordinates received a percentage of the pay and allowance of the troops; they also inherited the property of deceased janissaries. Moreover, the officers profited largely by retaining the names of dead or fictitious janissaries on the pay-rolls. Rations of mutton, bread and candles were furnished by the Government, the supply of rice, butter and vegetables being at the charge of the commandant. The rations would have been entirely inadequate if the janissaries had not been allowed, contrary to the regulations, to pursue different callings, such as those of baker, butcher, boatman, etc. At first the janissaries bore no distinctive mark save the white felt cap. Soon the red cap with gold embroidery was substituted. Later a uniform was introduced, distinguished less by the colour than the cut of the coat and the shape of the head-dress. The only distinction in the costume of commanding officers was in their boots, those of the *beuluks* (who had the privilege of serving as the sultan's guard and keeping the sacred banner in their custody) being red while the others were yellow; subordinate officers wore black boots.

The fundamental laws of the janissaries, which were very early infringed, were implicit obedience to their officers; perfect accord among themselves; abstinence from luxury, extravagance and practices unseemly for a soldier and a brave man; observance of the rules of Haji Bektash and of the religious law; exclusion from the ranks of all save those properly levied; special rules for the infliction of the death-penalty; promotion to be by seniority; janissaries to be admonished or punished by their own officers only; the infirm and unfit to be pensioned. Janissaries were not to let their beards grow, not to marry, nor to leave their barracks, nor to engage in trade; but were to spend their time in drill and in practising the arts of war.

In time of peace the State supplied no arms, and the janissaries on service in the capital were armed only with clubs; they were forbidden to carry any arms save a cutlass, the only exception being at the frontier-posts. In time of war they provided their own arms, and these might be any which took their fancy. However, they were induced by rivalry to procure the best obtainable and to keep them in perfect order. The banner of the janissaries was of white silk, on which verses from the Koran were embroidered in gold. This banner was planted beside the *aga's* tent in camp, with four other flags in red cases, and his three horse-tails. Each unit (*orta*) had its flag, half-red and half-yellow, placed before the tent of its commander. Two or three great cauldrons used for boiling the soup and pilaw were under the guard of subordinate officers. A particular superstition attached to them: if they were lost in battle all the officers were disgraced, and the *orta* was no longer allowed to parade with its cauldrons in public ceremonies.

At first a source of strength to Turkey as being the only well-organized force in the country, the janissaries soon became its bane. One frequent means of exhibiting their discontent was to set fire to Constantinople; 140 such fires are said to have been caused during the 28 years of Ahmed III.'s reign. The janissaries were at all times distinguished for their want of respect towards the sultans; their outbreaks were never due to a real desire for reforms, but solely to obtain the downfall of some obnoxious minister. The first recorded revolt of the janissaries is in 1443, on the occasion of the second accession of Mohammed II., when they broke into rebellion at Adrianople. A similar revolt happened at his death, when Bayazid II. was forced to yield to their demands and thus the custom of the accession-bakshish was established. In the 17th century they had become a praetorian guard in the worst sense of the word. Sultan Selim III. in despair endeavoured to organize a properly drilled and disciplined force to take their place; whereupon the janissaries dethroned him and obtained the abolition of his force. But after the successful revolution of Bairakdar Pasha of Widdin, the new troops were re-established and drilled; the resentment of the janissaries rose to such a height that they attacked the grand

vizier's house, and after destroying it marched against the sultan's palace. They were repulsed by cannon, losing 600 men in the affair (1806). But such was the alarm caused at Constantinople that the new troops had to be suppressed. During the next 20 years the turbulence of the janissaries knew no bounds. Sultan Mahmud II., powerfully impressed by their violence and lawlessness at his accession, determined to rid the State of this scourge. In 1825 he decided to form a corps of regular drilled troops known as *eshkenjis.* A *fetva* was obtained from the Sheikh-ul-Islam to the effect that it was the duty of Muslims to acquire military science. The imperial decree announcing the formation of the new troops was promulgated at a grand council, and the high dignitaries present (including certain of the principal officers of the janissaries, who concurred) undertook to comply with its provisions. But the janissaries rose in revolt, and on June 10, 1826, began to collect on the Et Meidan square at Constantinople; at midnight they attacked the house of the *aga* of janissaries, and, finding he had made good his escape, proceeded to overturn the cauldrons of as many *ortas* as they could find, thus forcing the troops of those *ortas* to join the insurrection. Then they pillaged and robbed throughout the town. Meanwhile the Government was collecting its forces; the sacred standard of the prophet was unfurled, and war was formally declared against the rioters. Cannon were brought against the Et Meidan, which was surrounded by troops. Ibrahim Aga, the commander of the artillery, made a last appeal to the janissaries to surrender; they refused, and fire was opened upon them. Such as escaped were shot down as they fled; the barracks, where many found refuge, were burnt; those who were taken prisoner were brought before the grand vizier and hanged. Before many days were over the corps had ceased to exist.

See M. d'Ohsson, *Tableaux de l'empire ottoman* (Paris, 1787–1820); A. Djévad Bey, *État militaire ottoman* (1885).

JANIUAY, a municipality (with administration centre and 74 *barrios* or districts) of the province of Iloilo, island of Panay, Philippine islands, about 20 m. W.N.W. of Iloilo, the provincial capital. Pop. (1918), 24,641. Excellent motor roads connect it with other centres. The surrounding country, although hilly, is fertile and well cultivated, producing rice, sugar, tobacco, vegetables, abacá and corn. Fabrics of *piña,* silk, abacá and cotton are woven. In 1918, it had 92 household industry establishments with output valued at 25,400 pesos; and 19 sugar mills. Of the 17 schools 12 were public. The language spoken is a dialect of Bisayan. Janiuay was founded in 1578.

JANJIRA, a native state of India (Kolaba agency), in the Konkan division of Bombay, situated along the coast among the spurs of the Western Ghats, 40 m. S. of Bombay city. Area, 324 sq. m. Pop. (1921) 87,534. There is a small military force; no tribute. The chief, whose title is nawab sahib, is by descent a Sidi or Abyssinian Mohammedan; and his ancestors were for many generations admirals of the Mohammedan rulers of the Deccan. The nawab being a minor, the state was under British administration in 1927. The state, popularly known as Habsan (=Abyssinian), did not come under direct subordination to the British until 1870. It supplies firewood to Bombay, with which it is in regular communication by steamer. The capital is Murad: the name Janjira, apart from the state, is confined to an island fort.

The nawab of Janjira is also chief of the state of JAFARABAD (*q.v.*).

JAN MAYEN, an Arctic island between Greenland and the north of Norway, about 71° N., 8° W. It is 34 m. long and 9 m. in greatest breadth, and is divided into two parts by a low, narrow isthmus. The island is of quaternary volcanic formation and mountainous, the highest summit being the extinct volcano of Beerenberg (8,094 ft.). Eruptions of ashes and steam have been observed. Glaciers are fully developed. Henry Hudson discovered the island in 1607 and called it Hudson's Tutches. Thereafter it was several times observed by navigators who successively claimed its discovery and renamed it. Thus, in 1611 or 1612 Hull whalers named it Trinity Island; in 1612 Jean Vrolicq, a French whaler, called it Ile de Richelieu; and in 1614 Joris Carolus, mate of the Dutch ship of Captain Jan May named it Joris Eylandt. The climate is cold and foggy. There is a little tundra and a few foxes exist on the island. The island has been frequently visited by explorers, sealers, trappers and whalers; and an Austrian observatory was maintained here for a year in 1882–83. J. M. Wordie and P. L. Mercanton completed the exploration in 1921. A Norwegian observatory, with wireless communication, has been working since 1921.

See E. von Wohlgemuth, *Osterreichische Polarstation Jan Mayen* (Vienna, 1886); J. M. Wordie, *Geographical Journal* (March 1912), and *Trans. Royal Soc. Edin.,* 54 (1926).

JANSEN, CORNELIUS (1585–1638), bishop of Ypres, and father of the religious revival known as Jansenism (*q.v.*), was born of humble Catholic parentage at Accoy in the province of Utrecht on Oct. 28, 1585. In 1602 he entered the university of Louvain, then in the throes of a violent conflict between the Jesuit, or scholastic, party and the Augustinians, followers of Michael Baius. Jansen joined the latter party. He made a momentous friendship with a like-minded fellow-student, Du Vergier de Hauranne, afterwards abbot of Saint Cyran. After taking his degree he went to Paris, partly to recruit his health by a change of scene, partly to study Greek. Eventually he joined Du Vergier at his country home near Bayonne, and spent some years teaching at the bishop's college. His spare time was spent in studying the early Fathers with Du Vergier, and laying plans for a reformation of the Church. In 1616 he returned to Louvain, to take charge of the college of St. Pulcheria, a hostel for Dutch students of theology. Pupils found him a somewhat choleric and exacting master and academic society a great recluse. He took part in the university's resistance to the Jesuits, who had established a theological school of their own in Louvain, which was a formidable rival to the official faculty of divinity. Jansen was sent twice to Madrid, in 1624 and 1626; the second time he narrowly escaped the Inquisition. He warmly supported the Catholic missionary bishop of Holland, Rovenius, in his contests with the Jesuits. He also crossed swords more than once with the Dutch Presbyterian champion, Voetius, still remembered for his attacks on Descartes.

Antipathy to the Jesuits brought Jansen no nearer Protestantism; he desired to prove to them that Catholics could interpret the Bible in a manner quite as mystical and pietistic as theirs. This became the great object of his lectures, when he was appointed regius professor of scriptural interpretation at Louvain in 1630. Still more was it the object of his *Augustinus,* a bulky treatise on the theology of St. Augustine, barely finished at the time of his death. Its preparation had been his chief occupation ever since he went back to Louvain. But Jansen, as he said, did not mean to be a school-pedant all his life; and there were moments when he dreamed political dreams. He looked forward to a time when Belgium should throw off the Spanish yoke and become an independent Catholic republic on the model of Protestant Holland. These ideas became known to his Spanish rulers, and to assuage them he wrote a philippic called the *Mars gallicus* (1635), a violent attack on French ambitions generally, and on Richelieu's indifference to international Catholic interests in particular. The *Mars gallicus* did not help Jansen's friends in France, but it appeased the wrath of Madrid against Jansen, and in 1636 he was appointed bishop of Ypres. He died on May 6, 1638; the *Augustinus,* the book of his life, was published posthumously in 1640.

Full details as to Jansen's career will be found in Reuchlin's *Geschichte von Port Royal* (Hamburg, 1839), vol i. *See* also *Jansénius* by the Abbés Callawaert and Nols (Louvain, 1893).

JANSENISM, the religious principles laid down by Cornelius Jansen in his *Augustinus.* This was simply a digest of the teaching of St. Augustine, drawn up with a special eye to the needs of the 17th century. In Jansen's opinion the church was suffering from three evils. The official scholastic theology was anything but evangelical. Having set out to embody the mysteries of faith in human language, it had fallen a victim to the excellence of its own methods; language proved too strong for mystery. Theology sank into a branch of dialectic; whatever would not fit

in with a logical formula was cast aside as useless. But average human nature does not take kindly to a syllogism, and theology had ceased to have any appreciable influence on popular religion. Simple souls found their spiritual pasture in little mincing "devotions"; while robuster minds built up for themselves a natural moralistic religion, quite as close to Epictetus as to Christianity. All these three evils were attacked by Jansen. As against the theologians, he urged that in a spiritual religion experience, not reason, must be our guide. As against the stoical self-sufficiency of the moralists, he dwelt on the helplessness of man and his dependence on his maker. As against the ceremonialists, he maintained that no amount of church-going will save a man, unless the love of God is in him. But this capacity for love no one can give himself. If he is born without the religious instinct, he can only receive it by going through a process of "conversion." And whether God converts this man or that depends on his good pleasure. Thus Jansen's theories of conversion melt into predestination; although, in doing so, they somewhat modify its grimness. Even for the worst miscreant there is hope—for who can say but that God may yet think fit to convert him?

Such doctrines have a marked analogy to those of Calvin; but in many ways Jansen differed widely from the Protestants. He vehemently rejected their doctrine of justification by faith; conversion might be instantaneous, but it was only the beginning of a long and gradual process of justification. Secondly, although the one thing necessary in religion was a personal relation of the human soul to its maker, Jansen held that that relation was only possible in and through the Roman Church. Nevertheless, Jansen's principles inevitably brought him into conflict with the Jesuits, whom he accused of giving absolution much too easily, without any serious inquiry into the dispositions of their penitent, and of excessive reliance on sacramental grace. His views were expounded at length by his disciple, Antoine Arnauld, in a book on *Frequent Communion* (1643). This book was the first manifestation of Jansenism to the general public in France, and raised a violent storm. With the support of the government, representations were made to Rome, and in 1653 Innocent X. declared heretical five propositions from Jansen's book. In 1656 Arnauld was deprived of his degree, in spite of Pascal's *Provincial Letters* (1656–1657), begun in an attempt to save him (*see* PASCAL; JESUITS). In 1661 a formulary, or solemn renunciation of Jansen, was imposed on all his suspected followers; those who would not sign it went into hiding, or to the Bastille.

The Jansenists had set out to reform the Church of Rome; they ended by having to fight hard for a doubtful foothold within it. Even that foothold soon gave way. Louis XIV. was a fanatic for uniformity, civil and religious. During the lifetime of his cousin, Madame de Longueville, the great protectress of the Jansenists, Louis stayed his hand; on her death (1679) the reign of severity began. That summer Arnauld, who had spent the greater part of his life in hiding, was forced to leave France for good. Six years later he was joined in exile by Pasquier Quesnel who succeeded him as leader of the party. Long before his flight from France Quesnel had published a devotional commentary—*Réflexions morales sur le Nouveau Testament*—which had gone through many editions without exciting official suspicion. But the Jesuits determined to make an end of Jansenism. They played upon the king's superstitions, and at their instigation he wrote to the pope asking for a bull that would tear up Jansenism by the roots. This was forthcoming in 1713, in the bull *Unigenitus*, anathematising no less than 101 propositions from Quesnel's *Réflexions*. Indeed, in his zeal against the Jansenists the pope condemned various practices in no way peculiar to their party; thus, for instance, many orthodox Catholics were exasperated at the heavy blow he dealt at popular Bible reading. During the following 10 years, however, the opposition was slowly crushed, and in 1730 the *Unigenitus* was proclaimed part and parcel of the law of France. This led to a great quarrel with the judges, who were intensely Gallican in spirit (*see* GALLICANISM), and had always regarded the *Unigenitus* as a triumph of ultramontanism. The quarrel dragged indefinitely on through the 18th century, though the questions at issue were really constitutional and political rather than religious.

Meanwhile the most ardent Jansenists had followed Quesnel to Holland. Here they met with a warm welcome from the Dutch Catholic body, which had always been in close sympathy with Jansenism, although without regarding itself as formally pledged to the *Augustinus*. But it had broken loose from Rome in 1702, and was now organizing itself into an independent church (*see* UTRECHT). The Jansenists who remained in France had meanwhile fallen on evil days. Persecution usually begets hysteria in its victims; and the more extravagant members of the party were far advanced on the road which leads to apocalyptic prophecy and "speaking with tongues." They were eventually disowned by the more reputable Jansenists, and were severely repressed by the police. Meanwhile genuine Jansenism survived in many quiet country parsonages and convents.

BIBLIOGRAPHY.—For an instructive survey of the whole movement *see* St. Cyr's art. "Jansenism" in Hastings' *Encyclopaedia of Religion and Ethics;* for bibliography, *Cambridge Modern History*, vol. v. ch. 4. Here the following titles may be mentioned: Beard, *Port-Royal*, 1861; J. de Maistre, *De l'église gallicane*, 1881. Séché, *Les derniers Jansénistes*, 1891; Paquier, *Le Jansénisme*, 1909.

(ST. C.; X.)

JANSSEN, JOHANNES (1829–1891), German historian, was born at Xanten on April 10, 1829, was ordained priest in 1860, became a member of the Prussian Chamber of Deputies in 1875, and in 1880 was made domestic prelate to the pope and apostolic pronotary. He died at Frankfort on Dec. 24, 1891. Janssen was a stout champion of the Ultramontane party in the Roman Catholic Church. His great work is his *Geschichte des deutschen Volkes seit dem Ausgang des Mittelalters* (8 vols., Freiburg, 1878–94), in which he attempts to prove that the Protestants were responsible for the general unrest in Germany during the 16th and 17th centuries.

The *Geschichte*, which reached its 20th ed. in 1926, has been continued and improved by Ludwig Pastor, and the greater part of it has been translated into English by M. A. Mitchell and A. M. Christie (1896, fol.). Of his other works perhaps the most important are: the editing of *Frankfurts Reichskorrespondenz, 1376–1519* (Freiburg, 1863–1872); and of the *Leben, Briefe und kleinere Schriften* of his friend J. F. Böhmer (Leipzig, 1868); a monograph, *Schiller als Historiker* (Freiburg, 1863); and *Zeit- und Lebensbilder* (Freiburg, 1875).

See L. Pastor, *Johannes Janssen* (Freiburg, 1893); F. Meister, *Erinnerung an Johannes Janssen* (Frankfort, 1896); Schwann, *Johannes Janssen und die Geschichte der deutschen Reformation* (Munich, 1892).

JANSSEN, PIERRE JULES CESAR (1824–1907), French astronomer, was born in Paris on Feb. 22, 1824, and studied mathematics and physics at the faculty of sciences. Various scientific missions were entrusted to him. In 1857 he went to Peru in order to determine the magnetic equator; in 1861–62 and 1864, he studied telluric absorption in the solar spectrum in Italy and Switzerland; in 1867 he carried out optical and magnetic experiments at the Azores; he successfully observed both transits of Venus, that of 1874 in Japan, that of 1882 at Oran in Algeria; and he took part in a long series of solar eclipse-expeditions. At the great Indian eclipse of 1868 he demonstrated the gaseous nature of the red prominences, and devised a method of observing them spectroscopically under ordinary daylight conditions. One main purpose of his spectroscopic enquiries was to answer the question whether the sun contains oxygen or not. For this, he perceived the advantage of reducing the thickness of air through which observations have to be made, and established an observatory on Mont Blanc (1893). In 1875 he was appointed director of the new astrophysical observatory established by the French Government at Meudon, and set on foot there in 1876 the remarkable series of solar photographs collected in his great *Atlas de photographies solaires* (1904). The first volume of the *Annales de l'observatoire de Meudon* was published by him in 1896. He died at Paris on Dec. 23, 1907.

See A. M. Clerke, *Hist. of Astronomy during the 19th Century* (1903); H. Macpherson, *Astronomers of To-Day* (1905).

JANSSENS or **JANSENS, VICTOR HONORIUS** (1658–1736), Flemish painter, was born at Brussels. After seven years in the studio of L. Volders, he spent four years in the household of the duke of Holstein. The next 11 years Janssens passed in Rome, where he studied the antique and the works of Raphael

and Albani. He painted a large number of cabinet historical scenes; but, on his return to Brussels, the claims of his increasing family restricted him almost entirely to the larger and more lucrative size of picture, of which very many of the churches and palaces of the Netherlands contain examples. In 1718 Janssens went to Vienna for three years, and was made painter to the emperor. The statement that he visited England is based upon the fact that certain fashionable interiors of the time in that country have been attributed to him. Janssens was a classicist in the style of Nicolas Poussin.

JANSSENS or **JANSENS, VAN NUYSSEN, ABRAHAM** (*c.* 1575–1632), Flemish painter, was born at Antwerp. He studied under Jan Snellinck, was a "master" in 1601, and in 1607 was dean of the master-painters. Till the appearance of Rubens he was considered the best historical painter of his time. Janssens excelled in correctness of drawing, in bold composition and in treatment of the nude. A master of chiaroscuro, he gratified his taste for strong contrasts of light and shade in his torchlights and similar effects. Good examples of this master are to be seen in the Antwerp museum and the Vienna gallery. The stories of his jealousy of Rubens and of his dissolute life are unfounded. He died at Antwerp in 1632.

JANUARIUS, ST., or SAN GENNARO, the patron saint of Naples. According to the legend, he was bishop of Benevento, and flourished towards the close of the 3rd century. On the outbreak of the persecution by Diocletian and Maximian, he was taken to Nola and brought before Timotheus, governor of Campania, on account of his profession of the Christian religion. After various assaults upon his constancy, he passed through a fiery furnace unharmed, was thrown, in vain, to the wild beasts, healed his judge of blindness, and was finally despatched, by the same ungrateful judge, by the sword. The relics of the saint were cherished by the Neapolitans as a safeguard against the eruptions of Vesuvius. The cult of St. Januarius, bishop and martyr, is attested historically at Naples as early as the 5th century (*Biblioth. hagiog. latina*, No. 6558). Two phials preserved in the cathedral are believed to contain the blood of the martyr. The relic is shown twice a year—in May and September. On these occasions the substance contained in the phial liquefies, and the Neapolitans see in this phenomenon a supernatural manifestation. The "miracle of St. Januarius" did not occur before the middle of the 15th century.

Other saints of the name of Januarius are the Roman martyr (festival July 10), whose epitaph was written by Pope Damasus (De Rossi, *Bullettino*, p. 17, 1863), and the martyr of Cordova, who forms along with Faustus and Martialis the group designated by Prudentius (*Peristephanon*, iv. 20) by the name of *tres coronae*. The festival of these martyrs is celebrated on Oct. 13.

See *Acta sanctorum*, September, vi. 761–891; G. Scherillo, *Esame di un codice greco pubblicato nel tomo secondo della bibliotheca casinensis* (Naples, 1876); G. Taglialatela, *Memorie storico-critiche del culto del sangue di S. Gennaro* (Naples, 1893), which contains many facts, but little criticism; G. Albini, *Sulla mobilità dei liquidi viscosi non omogenei* (*Società reale di Napoli, Rendiconti*, 2nd series, vol. iv., 1890); *Acta sanctorum*, October, vi. 187–193.

JANUARY, the first month in the modern calendar, consisting of 31 days. The name (Lat. *Ianuarius*) is derived from the two-faced Roman god Janus, to whose care the month was dedicated as looking both into the past and the future, and as the deity who busied himself with the beginnings of all enterprises. The consecration of the month took place by an offering of meal, salt, frankincense and wine, each of which was new. The Anglo-Saxons called January *Wulfmonath*, in allusion to the fact that hunger then made the wolves bold enough to come into the villages (*see* CALENDAR).

JANUS, in Roman cult, the god of doorways (*Ianua*). *See* ROMAN RELIGION. The rationalists explained him as an old king of Latium, who built a citadel for himself on the Janiculum. It was believed that his worship, which existed as a local cult before the foundation of Rome, was introduced there by Romulus, and that the famous *Ianus geminus* facing east and west, at the north-east end of the forum, was dedicated by Numa. It was simply a double barbican gate, open during war and closed during peace (Livy i. 19); it was shut only four times before the Christian era. Probably its use is connected with war-magic; it provided the outgoing and incoming armies with a lucky way in and out. (*Cf.* Warde Fowler, *Religious Experience*, p. 126; Rose, *Prim. Culture in Italy*, p. 48). There was also a Janus, *i.e.*, an archway, near the theatre of Marcellus, in the forum holitorium, erected by Gaius Duilius (Tacitus, *Ann.*, ii. 49), if not earlier.

The beginning of the day (hence his epithet Matutinus), of the month, and of the year (January) was sacred to Janus; on Jan. 9, the festival called Agonia was celebrated in his honour. He was invoked before any other god at the beginning of any important undertaking; his priest was the Rex Sacrorum, the representative of the ancient king in his capacity as religious head of the State. All gateways, housedoors, and entrances generally were under his protection; and indeed all beginnings; hence his title *Consivius*, "sower," that being the beginning of farm-work. He was worshipped on the Janiculum ("door hill"); his head is found on the *as*, together with the prow of a ship. He is usually represented on the earliest coins with two bearded faces, looking in opposite directions; in the time of Hadrian the number of faces is increased to four. In his capacity as porter or doorkeeper he holds a staff in his right hand, and a key (or keys) in his left; as such he is called *Patulcius* ("opener") and *Clusius* ("closer"). His titles *Curiatius, Patricius, Quirinus* originate in his worship in the gentes, the curiae, and the State, and have no reference to any special functions or characteristics. In late times he is both bearded and unbearded; in place of the staff and keys the fingers of his right hand show the number 300 (CCC.), those of his left show the number of the remaining days of the year 65 (LXV.).

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JAORA, an Indian State in the Malwa agency, Central India. It consists of two isolated tracts, between Ratlam and Neemuch. Area, with the dependencies of Piplauda and Pant Piplauda, 601 sq.m. Pop. (1921), 85,778. The chief, whose title is nawab and who enjoys a salute of 13 guns, is a Mohammedan of Afghan descent. The state was confirmed by the British government in 1818 by the Treaty of Mandsaur. The chief crops are millet, cotton and maize. The town of JAORA is on the Rajputana-Malwa railway, 20 m. N. of Ratlam. Pop. (1921), 17,151. It is well laid out, with many good modern buildings.

JAPAN, an empire of Eastern Asia, and one of the great powers of the world. The following article is divided for convenience into Sections as under: GEOGRAPHY; GEOLOGY; CLIMATE; FLORA; FAUNA; THE PEOPLE; COMMUNICATIONS; AGRICULTURE AND INDUSTRIES; GOVERNMENT AND ADMINISTRATION; DEFENCE; EDUCATION; RELIGION; HISTORY.

GEOGRAPHY

Position and Extent.—The continent of Asia stretches two arms into the Pacific Ocean, Kamstchatka in the north and Malacca in the south, between which lies a long cluster of islands constituting the Japanese empire, which covers 37° 14′ of longitude and 29° 11′ of latitude. On the extreme north are the Kuriles (called by the Japanese *Chishima*, or the "myriad isles"), which extend to 156° 32′ E. and to 50° 56′ N.; on the extreme south is Formosa (called by the Japanese *Taiwan*), which extends to 119° 18′ E., and to 21° 45′ N. There are six large islands, namely Sakhalin (called by the Japanese *Karafuto*); Yezo or Ezo (which, with the Kuriles, is designated *Hokkaidō*, or the north-sea district); Honshū or Hondo, the main island; Shikoku (the "four provinces"), Kyūshū (the "nine provinces") and Formosa, the most southerly link of the chain. Formosa and the Pescadores were ceded to Japan by China after the war of 1894–1895, and the southern half of Sakhalin—the part south of 50° N.—was

added to Japan by cession from Russia in 1905.

Area.—The following table, compiled from the "Résumé Statistique de l'Empire du Japon" for the year 1928, shows the area of the various parts of the Empire:—

	Number of islands adjacent	Area in square miles
Honshu	192	91,277·8
Shikoku	75	7,246·3
Kyūshū	213	14,718·7
Hokkaido	44	34,084·4
Total	524	147,327·2
Korea (annexed in 1910)	1,018	85,228·1
Formosa with Pescadores	77	13,889·8
Sakhalin	2	13,934·2
Total	1,621	260,379·3
Leased territory of the Liaotung Peninsula	123	1,435·6

This table does not include islands having a coast-line of less than 2·4 miles, unless they are inhabited or serve as guides to navigation.

The coast-line is very long in proportion to the area, the ratio being 1 m. of coast to every 9·5 m. of area. The Pacific Ocean, which washes the eastern shores, moulds their outline into much greater diversity than does the Sea of Japan which washes the western shores. Thus the Pacific sea-board measures 10,562 m. against 2,887 m. for that of the Japan sea. In depth of water, too, the advantage is on the Pacific side. There the bottom slopes very abruptly, descending precipitously at a point not far from the north-east coast of the main island, where soundings have shown 4,655 fathoms. This, the deepest sea-bed in the world, is called the Tuscarora Deep, after the name of the United States' man-of-war which made the survey. The configuration seems to point to a colossal crater under the ocean, and many of the earthquakes which visit Japan appear to have their origin in this submarine region. On the other hand, the average depth of the Japan sea is only 1,200 fathoms, and its maximum depth is 3,200. The east coast, from Cape Shiriya (Shiriyazaki) in the north to Cape Inuboye (Inuboesaki) near Tōkyō Bay, though abounding in small indentations, has only three large bays, those of Sendai, Matsushima and Yamada; but southward from Tōkyō Bay to Cape Satta (Satanomisaki) in Kyūshū there are many capacious inlets which offer excellent anchorage, as the Gulf of Sagami (Sagaminada), the Bays of Suruga (Surugawan), Ise (Isenumi) and Osaka, the Kii Channel, the Gulf of Tosa (Tosonada), etc. Opening into both the Pacific and the Sea of Japan and separating Shikoku and Kyūshū from the main island as well as from each other, is the celebrated Inland sea, one of the most picturesque sheets of water in the world. There are four narrow avenues connecting this remarkable body of water with the Pacific and the Japan sea, the Shimonoseki strait, the Hayamoto Strait and the Yura and Naruto Straits. It need scarcely be said that these restricted approaches give little access to the storms which disturb the seas outside. The western side of the island of Kyūshū is more indented than any other part of the coast of Japan. Between the coast of Kyūshū and the southern extremity of the Korean peninsula are situated the islands of Iki and Tsushima, the latter being only 30 m. distant from the peninsula. Passing farther north, the shoreline of the main island along the Japan Sea is found to be comparatively straight and monotonous, there being only one noteworthy indentation, that of Wakasa-wan, and one considerable projection, the Noto peninsula. From the harbour of Tsuruga, or Wakasa bay, to Osaka Japan's waist measures only 77 m. Yezo is not rich in anchorages. Uchiura (Volcano Bay), Nemuro (Walfisch) Bay and Ishikari Bay are the only remarkable inlets. As for Formosa, the peculiarity of its outline is that the eastern coast falls precipitously into deep water, while the western slopes slowly to shelving bottoms and shoals. The Pescadores islands afford the best anchorage in this part of Japan.

Mountains.—The Japanese islands are traversed from north to south by a range of mountains which sends out various lateral branches. Lofty summits are separated by comparatively low passes, which lie at the level of crystalline rocks and schists constituting the original uplands upon which the summits have been piled by volcanic action. The scenery among the mountains except perhaps in some parts of Hida and Shinshū, is generally soft. Climatic agencies have smoothed and modified everything rugged or abrupt, until an impression of gentle undulation rather than of grandeur is suggested. Nowhere is the region of eternal snow reached, and masses of foliage enhance the gentle aspect of the scenery and glorify it in autumn with tints of striking brilliancy. Mountain alternates with valley, so that not more than one-eighth of the country's entire area is cultivable.



COURTESY OF THE PRESBYTERIAN BOARD OF FOREIGN MISSIONS

THE FORMER EMPEROR TAISHO OF JAPAN

The king of Japanese mountains is Fuji-yama or Fuji-san, of which the highest point (Ken-ga-mine) is 12,395 ft. above sea-level. Great streams of lava flowed from the crater in ancient times. The course of one is still visible to a distance of 15 m. from the summit, but the rest are covered, for the most part, with deep deposits of ashes and scoriae. On the south Fuji slopes unbroken to the sea, but on the other three sides the plain from which it rises is surrounded by mountains, among which, on the north and west, a series of picturesque lakes has been formed in consequence of the rivers having been dammed by ashes ejected from Fuji's crater. To a height of some 1,500 ft. the slopes of the mountain are cultivated; a grassy moorland stretches up the next 2,500 ft.; then follows a forest, the upper edge of which climbs to an altitude of nearly 8,000 ft., and finally there is a wide area of ashes and scoriae. There is entire absence of the Alpine plants found abundantly on the summits of other high mountains in Japan, a fact due, doubtless, to the comparatively recent activity of the volcano. The ascent of Fuji presents no difficulties. A traveller can reach the usual point of departure, Gotemba, by rail from Yokohama, and thence the ascent and descent may be made in one day by a pedestrian.

The Japanese Alps.—The provinces of Hida and Etchū are bounded on the east by a chain of mountains including, or having in their immediate vicinity, the highest peaks in Japan after Fuji. Six of these summits rise to a height of 9,000 ft. or upwards, and constitute the most imposing assemblage of mountains in the country. The ridge runs due north and south through 60 to 70 m., and has a width of 5 to 10 m. It is mostly of granite, only two of the mountains—Norikura and Tateyama—showing clear traces of volcanic origin. Its lower flanks are clothed with forests of beech, conifers and oak. Farther south, in the same range, stands Ontake (10,450 ft.), the second highest mountain in Japan proper (as distinguished from Formosa); and other remarkable though not so lofty peaks mark the same regions. This group of mountains has been well called the "Alps of Japan," and a good account of them may be found in *The Japanese Alps* (1896) by the Rev. W. Weston.

Almost equally picturesque, though less lofty than the Alps of Japan, are the Nikko mountains. The highest of these are Shirane-san (7,422 ft.), Nantai-san (8,169 ft.), Nyohō-zan (8,100 ft.), and Omanago (7,546 ft.). They are clothed with magnificent vegetation, and everywhere they echo the voices of waterfalls and rivulets.

Mountains of North and Central Japan.—In the north of the main island there are no peaks of remarkable height. The best known are Chōkai-zan, a volcano 7,077 ft. high, which was active as late as 1861; Ganju-san (6,791 ft.), Iwaki-san (5,230 ft.) and the twin mountains Gassan (6,447 ft.) and Haguro-san (5,600 ft.). A little farther south, enclosing the fertile plain of Aizu, several important peaks are found, among them being Iide-san (6,332 ft.); Azuma-yama (7,733 ft.), which, after a long interval of quiescence, has given many evidences of volcanic activity during recent years; Nasu-dake (6,296 ft.), an active volcano; and Bandai-san (6,037 ft.). A terrible interest attaches



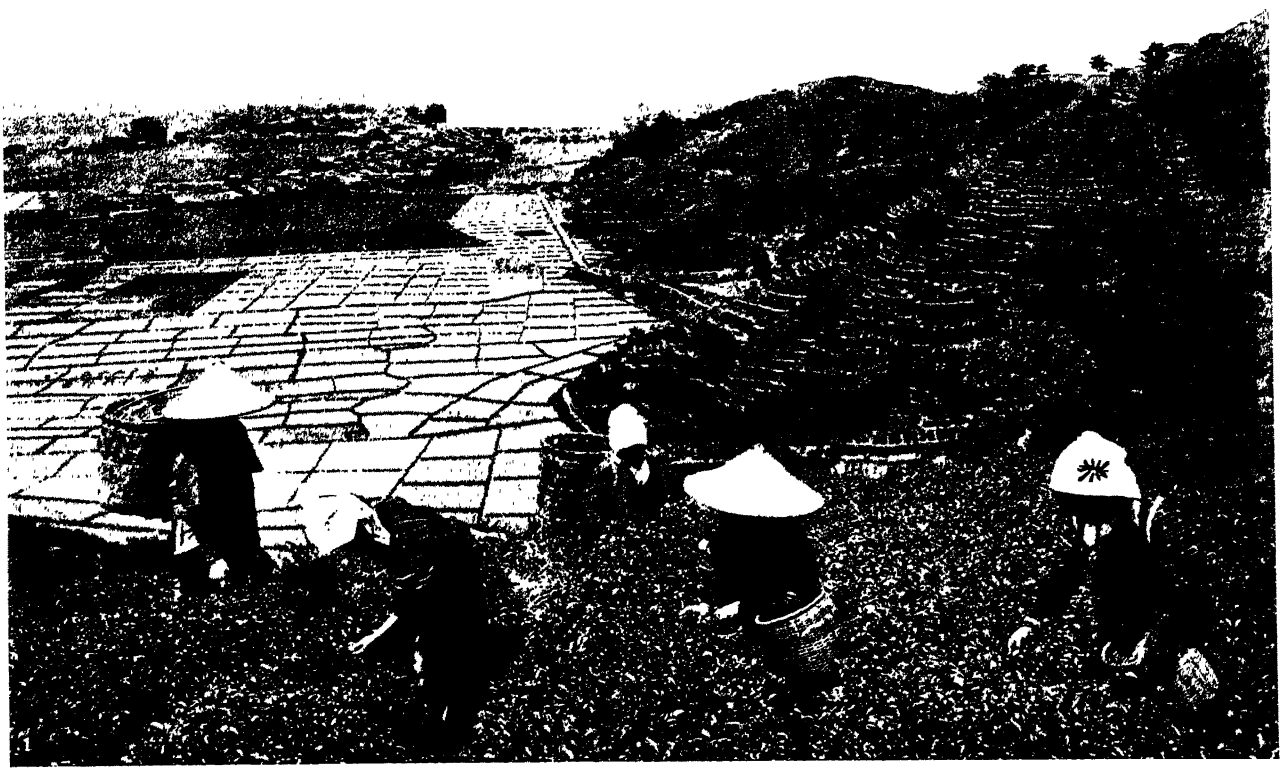


BY COURTESY OF HERBERT G. PONTING, F.R.P.S.

THE GROUNDS OF TWO JAPANESE TEMPLES

1. Wistaria garden in Kameido (in the environs of Tokyo). The gardens are part of the grounds of a Shinto temple dedicated to Sugawarano-Michizano, a court minister who died in A.D. 903. The photograph shows the Taikobashi or "drum bridge" in front of the temple.
2. The pine-clad sands of the peninsula Mio-no-Matsubara, near Shizuoka, where the Shrine of Mio stands

JAPAN





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ASPECTS OF JAPANESE LIFE

1. A tea-bearing hillside and a plain chequered with rice fields. About two-thirds of the tea-crop of Japan is consumed in the country. Rice is cultivated extensively on irrigable ground

2. Japanese ladies travelling in 'Kago.' The bearers' wide straw hats are typical of Japanese dress as are the sandals, held by a cord between the great and second toe

to the last-named mountain, for, after having remained quiet so long as to lull the inhabitants of the neighbouring district into complete security, it suddenly burst into fierce activity on the 15th of July 1888, discharging a vast avalanche of earth and rock, which dashed down its slopes like an inundation, burying four hamlets, partially destroying seven villages, killing 461 people and devastating an area of 27 square miles.

In the province of Kotsuke, which belongs to the central part of the main island, the noteworthy mountains are Asama-yama (8,136 ft.), one of the best known and most violently active volcanoes of Japan; Akagi-san, a circular range of peaks surrounding the basin of an old crater and rising to a height of 6,210 ft.; the Haruna group, celebrated for scenic beauties; and Myogi-san, a cluster of pinnacles which, though not rising higher than 3,880 ft., offer scenery reminiscent of the classical landscape paintings (bunjingwa) of China and Japan. Farther south, in the province of Kai (Kōshū), and separating two great rivers, the Fuji-kawa and the Tenryu-gawa, there lies a range of hills with peaks second only to those of the Japanese Alps spoken of above. The principal elevations in this range are Shiranesan—with three summits, Nōdori (9,970 ft.), Ai-no-take (10,200 ft.) and Kaigane (10,330 ft.)—and Hōōzan (9,550 ft.). It will be observed that all the highest mountains of Japan form a species of belt across the widest part of the main island, beginning on the west with the Alps of Etchū, Hida and Shinano, and ending on the east with Fuji-yama. In all the regions of the main island southward of this belt the only mountains of conspicuous altitude are Omine (6,169 ft.) and Odai-ga-hara (5,540 ft.) in Yamato and Daisen or Oyama (5,951 ft.) in Hōki.

The island of Shikoku has no mountains of notable magnitude. The highest is Ishizuchi-zan (7,727 ft.), but there are several peaks varying from 3,000 to 6,000 ft.

Kyūshū, though abounding in mountain chains, independent or connected, is not remarkable for lofty peaks. In the neighbourhood of Nagasaki, over the celebrated solfataras of Unzen-take (called also Onsen) stands an extinct volcano, whose summit, Fugen-dake, is 4,865 ft. high. More notable is Aso-take, some 20 m. from Kumamoto; for, though the highest of its five peaks has an altitude of only 5,545 ft., it boasts the largest crater in the world, with walls nearly 2,000 ft. high and a basin from 10 to 14 m. in diameter. Aso-take is still an active volcano, but its eruptions during recent years have been confined to ashes and dust. Only two other mountains in Kyūshū need be mentioned—a volcano (3,743 ft.) on the island Sakura-jima, in the harbour of Kagoshima, which erupted with great violence in 1914; and Kirishima-yama (5,538 ft.), on the boundary of Hyūga, a mountain specially sacred in Japanese eyes, because on its eastern peak (Takachiho-dake) the god Ninigi descended as the forerunner of the first Japanese sovereign, Jimmu.

Volcanoes.—Among the mountains of Japan there are three volcanic ranges, namely, that of the Kuriles, that of Fuji, and that of Kirishima. They contain about 200 volcanoes, of which about 50 are more or less active. Fuji is the most remarkable volcanic peak. The Japanese regard it as a sacred mountain, and numbers of pilgrims make the ascent in midsummer. From 500 to 600 ft. is supposed to be the depth of the crater. There are neither sulphuric exhalations nor escapes of steam at present, and it would seem that this great volcano is permanently extinct. But experience in other parts of Japan shows that a long quiescent crater may at any moment burst into disastrous activity. Within the period of Japan's written history several eruptions are recorded, the last having been in 1707, when the whole summit burst into flame, rocks were shattered, ashes fell to a depth of several inches even in Yedo (Tōkyō), 60 m. distant, and the crater poured forth streams of lava. Among still active volcanoes the following are the best known:— Tarumai (Yezo) 2,969 ft.; Noboribetsu (Yezo) 1,148 ft.; Komagatake (Yezo) 3,822 ft.; Esan (Yezo) 2,067 ft.; Agatsuma (Iwaki) 5,230 ft. (erupted in 1903); Bandai-san (Iwashiro) 6,037 ft. (erupted in 1888, devastating an area of over 27 sq.m. and causing the loss of 461 lives); Adzuma-yama (Fiekushima) 7,733 ft. (its last eruption was in 1900 when 82 sulphur-diggers were killed or injured); Nasu (Tochigi) 6,296 ft.; Shitane (Nikko district) 7,422 ft. (its last eruption was in 1889); Shirane (Kai) 10,330 ft. (erupted in 1905, when the main crater was enlarged to a length of 3,000 ft.); Unzen (Hizen) 4,865 ft. (this volcano is in the solfatara stage); Aso-san (Higo) 5,545 ft. (the crater of this volcano, which measures 10 by 15 m. and rises almost symmetrically to a height of about 2,000 ft., is the largest in the world); Kaimon (Kagoshima) 3,041 ft. (almost extinct); Sakurajima (Kagoshima) 3,743 ft. (erupted violently in 1914); Kirishima (Kagoshima) 5,538 ft.; Mihara (Vries Island) 2,461 ft. (continuously active); and Asama (Shinshū) 8,136 ft. (continuously active).

Earthquakes.—Japan is subject to marked displays of seismic violence. One steadily exercised influence is constantly at work, for the shores bordering the Pacific Ocean are slowly though appreciably rising, while on the side of the Japan Sea a corresponding subsidence is taking place. Japan also experiences a vast number of petty vibrations not perceptible without the aid of delicate instruments. But of earthquakes proper, large or small, she has an exceptional abundance. Thus in the thirteen years ending in 1897—that is to say, the first period when really scientific apparatus for recording purposes was available—she was visited by no fewer than 17,750 shocks, being an average of something over 3½ daily. The frequency of these phenomena is in some degree a source of security, for the minor vibrations are believed to exercise a binding effect by removing weak cleavages. Nevertheless the annals show that during the three centuries before 1897 there were 108 earthquakes sufficiently disastrous to merit historical mention. If the calculation be carried farther back—as has been done by the seismic disaster investigation committee of Japan, a body of scientists constantly engaged in studying these phenomena under government auspices,—it is found that, since the country's history began to be written in the 8th century A.D., there have been 2,006 major disturbances; but inasmuch as 1,489 of these occurred before the beginning of the Tokugawa administration (early in the 17th century, and therefore in an era when methods of recording were comparatively defective), exact details are naturally lacking. The following table gives particulars of the most serious earthquakes during the last two centuries:—

Date A.D.	Region	Houses destroyed	Deaths
1703 (30/12)	Tōkyō	20,162	5,233
1707 (28/10)	Pacific Coast of Kyūshu and Shikoku	20,000	4,900
1751 (20/5)	Echigo	9,100	1,700
1766 (8/3)	Hirosaki	7,500	1,335
1792 (10/2)	Hizen and Higo	12,000	15,000
1828 (18/2)	Echigo	11,750	1,443
1844 (8/5)	Echigo	34,000	12,000
1854 (6/7)	Yamato, Iga, Ise	5,000	2,400
1854 (23/12)	Tōkaidō (Shikoku)	60,000	3,000
1855 (11/11)	Yedo (Tōkyō)	50,000	6,700
1891 (28/10)	Mino, Owari	222,501	7,273
1894 (22/10)	Shōnai	8,403	726
1896 (15/6)	Sanriku	13,073	27,122
1896 (31/8)	Ugo, Rikuchu	8,996	209
1906 (12/2)	Formosa	5,556	1,228
1923 (1/9)	Sagami Bay	558,049	91,344*
1925 (23/5)	Tajima	3,668	381
1927 (7/3)	Tango	7,367	2,900

*Over a third of Tōkyō and the whole of Yokohama were destroyed either by the earthquake or by the fires which burst out in its wake. This is the most disastrous earthquake which has occurred since that of the Ansei era in 1855. Apart from the loss of life, which was exceedingly great, the damage to property and the destruction of works of art and antique treasures, which cannot be replaced, was enormous and cannot possibly be estimated correctly in terms of money.

The Pacific coast of the Japanese islands is more liable than the western shore to shocks disturbing a wide area. Apparent proof has been obtained that the shocks occurring in the Pacific districts originate at the bottom of the sea—the Tuscarora Deep is supposed to be the centre of seismic activity—and they are accompanied in most cases by tidal waves. It would seem that of late years Hida, Kotsuke and some other regions in central Japan have enjoyed the greatest immunity, while Musashi (in

which province Tōkyō is situated) and Sagami have been most subject to disturbance.

Plains.—Japan, though very mountainous, has many extensive plains. The northern island—Yezo—contains seven, and there are as many more in the main and southern islands, to say nothing of flat lands of minor dimensions. Those in the North Island, covering altogether an area of 3,373,000 ac. are:—Tokachi, Ishikari, Kushiro, Nemuro, Kitami, Hidaka and Teshio; in the Main Island—Echigo, Sendai, Kwantō (in which lies Tōkyō, the capital), Mino-Owari, Kinai (containing the cities of Osaka, Kyōtō, and Kobe), and Tsukushi in the island of Kyūshū. The most extensive plains are those of Kushiro, Tokachi and Ishikari, which have an area of 1,229,000, 744,000 and 480,000 ac., respectively.

Rivers.—Japan is abundantly watered. But the quantity of water carried seawards varies within wide limits; for whereas, during the rainy season in summer and while the snows of winter are melting in spring, great volumes of water sweep down from the mountains, these broad rivers dwindle at other times to petty rivulets trickling among a waste of pebbles and boulders. Nor are there any long rivers, and all are so broken by shallows and rapids that navigation is generally impossible except by means of flat-bottomed boats drawing only a few inches. The chief rivers are the Ishikari (275 m.), Teshio (192 m.) and Tokachi (120 m.) in the North Island; Shinano (229 m.), Tone (200 m.), Kitakami (152 m.), Kiso (144 m.), Tenryū (134 m.), Mogami (134 m.), Gono (124 m.), Abukuma (122 m.) and Agano (105 m.) in the Main Island, and the Yoshino (146 m.) in Shikoku.

Lakes and Waterfalls.—Japan has many lakes, remarkable for the beauty of their scenery rather than for their extent. Some are contained in alluvial depressions in the river valleys; others have been formed by volcanic eruptions, the ejecta damming the rivers until exits were found over cliffs or through gorges. Some of these lakes have become favourite summer resorts for foreigners. To that category belong especially the lakes of Hakone, Chūzenji, Shōji, Inawashiro (formed by the eruption of Bandaisan in 1888), Biwa, Nojiri and Yumoto. Of these the last is the highest. Next in altitude comes Lake Chūzenji which is 4,375 ft. above sea-level, has a maximum depth of 93 fathoms, and empties itself at one end over a fall (Kegon) 250 ft. high. The lakes about Mt. Fuji, of which Shōji is the best known, lie at a height of 3,160 ft., and their neighbourhood abounds in scenic charms. Lake Hakone is at a height of 2,428 ft.; Inawashiro, at a height of 1,920 ft. and Biwa at a height of 328 ft. The Japanese associate Lake Biwa (Omi) with eight views of special loveliness (*Omi-no-hakkei*). Lake Suwa, in Shinano, which is emptied by the Tenryugawa, has a height of 2,624 ft. In the vicinity of many of these mountain lakes thermal springs, with remarkable curative properties, are to be found. (F. By.)

GEOLOGY

It is a popular belief that the islands of Japan consist for the most part of volcanic rocks. But although this conception might reasonably be suggested by the presence of many active and extinct volcanoes, Professor J. Milne has pointed out that it is literally true of the Kuriles alone, partially true for the northern half of the Main Island and for Kyūshū, and quite incorrect as applied to the southern half of the Main Island and to Shikoku. This authority sums up the geology of Japan briefly and succinctly as follows (in *Things Japanese;* by Professor Chamberlain): "The backbone of the country consists of primitive gneiss and schists. Amongst the latter, in Shikoku, there is an extremely interesting rock consisting largely of piedmontite. Overlying these amongst the Palaeozoic rocks, we meet in many parts of Japan with slates and other rocks possibly of Cambrian or Silurian age. Trilobites have been discovered in Rikuzen. Carboniferous rocks are represented by mountain masses of *Fusulina* and other limestones. There is also amongst the Palaeozoic group an interesting series of red slates containing Radiolaria. Mesozoic rocks are represented by slates containing *Ammonites* and *Monotis,* evidently of Triassic age, rocks containing *Ammonites Bucklandi* of Liassic age, a series of beds rich in plants of Jurassic age, and beds of Cretaceous age containing *Trigonia* and many other fossils.

The Cainozoic or Tertiary system forms a fringe round the coasts of many portions of the empire. It chiefly consists of stratified volcanic tuffs rich in coal, lignite fossilized plants and an invertebrate fauna. Diatomaceous earth exists at several places in Yezo. . . . The most common eruptive rock is andesite. Such rocks as basalt, diorite and trachyte are comparatively rare. Quartz porphyry, quartzless porphyry, and granite are largely developed." Drs. von Richthofen and Rein discuss the subject in greater detail. They have pointed out that in the mountain system of Japan there are three main lines. One runs from south-west to north-east; another from south-south-west to north-north-east, and the third is meridional. These they call respectively the "southern schist range," the "northern schist range," and the "snow range," the last consisting mainly of old crystalline massive rocks. The rocks predominating in Japan fall also into three groups. They are, first, plutonic rocks, especially granite; secondly, volcanic rocks, chiefly trachyte and dolerite; and thirdly, palaeozoic schists. On the other hand, limestone and sandstone, especially of the Mesozoic strata, are strikingly deficient. The strike of the old crystalline rocks follows, in general, the main direction of the islands (south-west to north-east). They are often overlain by schists and quartzites, or broken through by volcanic masses. The basis of the islands, according to Rein, consists of granite, syenite, diorite, diabase, and related kinds of rock. Porphyry appears comparatively rarely. Conditions suggest the presence of tertiary formations, yet only the younger groups of that formation appear to be developed. Nor is there any sign of moraines, glacier-scorings or other traces of the ice-age.

The oldest beds which have yielded fossils in any abundance belong to the Carboniferous System. The Trias proper is represented by truly marine deposits, while the Rhaetic beds contain plant remains. The Jurassic and Cretaceous beds are also in part marine and in part terrestrial. During the whole of the Mesozoic era Japan appears to have lain on or near the margin of the Asiatic continent, and the marine deposits are confined for the most part to the eastern side of the islands.

The igneous rocks occur at several geological horizons; but the great volcanic eruptions did not begin until the Tertiary period. The existing volcanoes belong to four separate arcs or chains. On the south is the arc of the Luchu islands, which penetrates into Kyūshū. In the centre is the arc of the islands of Idzu, which is continued into Hondo along the Fossa Magna. In North Hondo the great Bandai arc forms the axis of the island and stretches into Yezo (Hokkaidō). Finally in the east of Yezo rise the most westerly volcanoes of the Kurile chain. The lavas and ashes ejected by these consist of liparite, dacite, andesite and basalt.

Structurally Japan is divided into two regions by a depression (the "Fossa Magna" of Naumann) which stretches across the island of Hondo from Shimoda to Nagano. The depression is marked by a line of volcanoes, including Fuji, and is in part buried beneath the products of their eruptions. It is supposed to be due to a great fault along its western margin. South and west of the Fossa Magna the beds are thrown into folds which run approximately parallel to the general direction of the coast, and two zones may be recognized—an outer, consisting of Palaeozoic and Mesozoic beds, and an inner, consisting of Archaean and Palaeozoic rocks, with granitic intrusions. Nearly along the boundary between the two zones lie the inland seas of south Japan. Towards the Fossa Magna the folds bend northwards.

North and east of the Fossa Magna the structure is concealed, to a very large extent, by the outpourings of the volcanoes which form so marked a feature in the northern part of Hondo. But the foundation on which the volcanoes rest is exposed along the east coast of Hondo (in the Kwantō, Abukuma and Kitakami hills), and also in the island of Yezo. This foundation consists of Archaean, Palaeozoic and Mesozoic beds folded together, the direction of the folds being north by west to south by east, that is to say, slightly oblique to the general direction of this part of the island. Towards the Fossa Magna the folds bend sharply round until they are nearly parallel to the Fossa itself.

(P. La.; X.)

CLIMATE

The large extension of the Japanese islands in a northerly and southerly direction causes great varieties of climate. General characteristics are hot and humid though short summers, and long, cold and clear winters. The equatorial currents produce conditions differing from those existing at corresponding latitudes on the neighbouring continent. In Kyūshiū, Shikoku and the southern half of the main island, the months of July and August alone are marked by oppressive heat at the sea-level, while in elevated districts a cool and even bracing temperature may always be found, though the direct rays of the sun retain distressing power. Winter in these districts does not last more than two months, from the end of December to the beginning of March; for, although the latter month is not free from frost and even snow, the balminess of spring makes itself plainly perceptible. In the northern half of the main island, in Yezo and in the Kuriles, the cold is severe during the winter, which lasts for at least four months, and snow falls sometimes to great depths. Whereas in Tōkyō the number of frosty nights during a year does not average much over 60, the corresponding number in Sapporo on the north-west of Yezo is 145. But the variation of the thermometer in winter and summer being considerable—as much as 72° F in Tōkyō—the climate proves somewhat trying to persons of weak constitution. On the other hand, the mean daily variation is in general less than that in other countries having the same latitude: it is greatest in January, when it reaches 18° F, and least in July, when it barely exceeds 9° F. The monthly variation is very great in March, when it usually reaches 43° F.

Meteorology.—There are 19 meteorological stations in the Japanese dominions, including one at Dairen in South Manchuria and one at Paras in the mandated islands; and reports are constantly forwarded from them by telegraph to the central observatory in Tōkyō, which issues daily statements of the climatic conditions during the previous twenty-four hours, as well as forecasts for the next twenty-four. The whole country is divided into districts for meteorological purposes, and storm-warnings are issued when necessary. At the most important stations observations are taken every hour; at the less important, six observations daily; and at the least important, three observations. The following is a record of the mean annual temperature, which was in most cases a few fractions of a degree below the average, in 1926:—

	F°		F°
Nemuro (Hokkaidō)	40·8	Hiroshima (Main Island)	57·9
Sapporo (Hokkaidō)	44·3	Kōchi (Shikokes)	59·1
Aomori (Hokkaidō)	48·5	Nagasaki (Kyūshù)	59·3
Tōkyō (Main Island)	56·4	Naha (Luchu Is.)	60·7
Niigata (Main Island)	53·9	Seoul (Korea)	51·1
Nojano (Main Island)	50·0	Taipeh (Formosa)	60·7
Nagoya (Main Island)	56·3	Odomari (Saghalin)	36·8
Kyōto (Main Island)	55·9	Darien (S. Manchuria)	50·3
Osaka (Main Island)	58·4	Parao (Mandated Is.)	80·2
Sakai (Main Island)	56·8		

Rainfall and Wind.—There are three wet seasons in Japan: the first, from the middle of April to the beginning of May; the second, from the middle of June to the beginning of July; and the third, from early in September to early in October. The dog days (*doyō*) are from the middle of July till the second half of August. September is the wettest month; January the driest. During the four months from November to February, inclusive, only about 18% of the whole rain for the year falls. In the district on the east of the main island the snowfall is insignificant, seldom attaining a depth of more than four or five inches and generally melting in a few days, while bright, sunny skies are usual. But in the mountainous provinces of the interior and in those along the western coast, deep snow covers the ground throughout the whole winter, and the sky is usually wrapped in a veil of clouds. These differences are due to the action of the north-westerly wind that blows over Japan from Siberia. The intervening sea being comparatively warm, this wind arrives in Japan having its temperature increased and carrying moisture which it deposits as snow on the western faces of the Japanese mountains. Crossing the mountains and descending their eastern slopes, the wind becomes less saturated and warmer, so that the formation of clouds ceases. Japan is emphatically a wet country so far as quantity of rainfall is concerned, the average for the whole country being 1,570 mm. per annum. Still there are about four sunny days for every three on which rain or snow falls, the actual figures being 150 days of snow or rain and 215 days of sunshine.

During the cold season, which begins in October and ends in April, northerly and westerly winds prevail throughout Japan. They come from the adjacent continent of Asia, and they develop considerable strength owing to the fact that there is an average difference of some 22 mm. between the atmospheric pressure (750 mm.) in the Pacific and that (772 mm.) in the Japanese islands. But during the warm season, from May to September, these conditions of atmospheric pressure are reversed, that in the Pacific rising to 767 mm. and that in Japan falling to 750 mm. Hence throughout this season the prevailing winds are light breezes from the west and south. A calamitous atmospheric feature is the periodical arrival of storms called "typhoons" (Japanese *tai-fu* or "great wind"). These have their origin, for the most part, in the China sea, especially in the vicinity of Luzon. Their season is from June to October, September being generally the month when they are most frequent. But they occur in other months also, and they develop a velocity of 45 to 75 m. an hour. It is particularly unfortunate that September should be the season of greatest typhoon frequency, for the earlier varieties of rice flower in that month and a heavy storm does much damage not only to crops but also to life and property.

FLORA

In actual wealth of blossom the Japanese islands cannot claim any special distinction. The spectacles most admired by all classes are the tints of the foliage in autumn and the glory of flowering trees in the spring. Oaks and wild prunus, wild vines and sumachs, various kinds of maple, the *dōdan* (*Enkianthus Japonicus* Hook.), birches and other trees, all add multitudinous colours to the brilliancy of a spectacle which is further enriched by masses of feathery bamboo. The one defect is lack of green sward. The grass used for Japanese lawns loses its verdure in autumn and remains from November to March a greyish-brown blot upon the scene. Spring is supposed to begin in February; but the only flowers then in bloom are the *camellia japonica*, the narcissus, and some kinds of daphne. The first—called by the Japanese *tsubaki*—may often be seen glowing fiery red amid snow, but the pink (*otome tsubaki*), white (*shiro-tsubaki*) and variegated (*shibori-no-tsubaki*) kinds do not bloom until March or April. The queen of spring flowers is the plum (*ume*), the pure white or rose-red blossoms of which are regarded with special favour and accounted the symbol of unassuming hardihood. The cherry (*sakura*) is even more esteemed. It will not suffer any training, nor does it, like the plum, improve by pruning; but the sunshine that attends its brief period of bloom in April, the magnificence of its flower-laden boughs and the picturesque flutter of its falling petals, inspired an ancient poet to liken it to the "soul of Yamato" (Japan), and it has ever since been thus regarded. The wild peach (*momo*) blooms at the same time, but attracts little attention. All these trees—the plum, the cherry and the peach—bear no fruit worthy of the name, nor do they excel their Occidental representatives in wealth of blossom; but the admiring affection they inspire in Japan is unique. Scarcely has the cherry season passed when that of the wistaria (*fuji*) comes, followed by the azalea (*tsutsuji*) and the iris (*shōbu*), the last being almost contemporaneous with the peony (*botan*), which is regarded by many Japanese as the king of flowers and is cultivated assiduously. Summer sees the lotus (*renge*) convert wide expanses of lake and river into sheets of white and red blossoms; a comparatively flowerless interval ensues until, in October and November the chrysanthemum arrives to furnish an excuse for fashionable gatherings. With the exception of the dog-days and the dead of winter, there is no season when flowers cease to be an object of attention to the Japanese, nor does any class fail to participate in the sentiment. There is similar enthusiasm in the matter of gardens. From the 10th century onwards the art of landscape gardening steadily grew into a science, with esoteric as well as

exoteric aspects and with a special vocabulary. The underlying principle is to reproduce nature's scenic beauties, all the features being drawn to scale, so that however restricted the space, there shall be no violation of proportion. But it has to be clearly understood that the flower-garden in the Occidental sense of the term scarcely exists in Japan. Flowers are cultivated, but for their own sakes, not as a feature of the landscape garden. If they are present, it is only as an incident. This of course does not apply to shrubs which blossom at their seasons and fall always into the general scheme of the landscape. There is another remarkable feature of the Japanese gardener's art. He dwarfs trees so that they remain measurable only by inches after their age has reached scores, even hundreds, of years, and the proportions of leaf, branch and stem are preserved with fidelity. The pots in which these wonders of patient skill are grown have to be themselves fine specimens of the keramist's craft, and hundreds of pounds are sometimes paid for a notably well trained tree.

There exists among many foreign observers an impression that Japan is comparatively poor in wild-flowers; an impression probably due to the fact that there are no flowery meadows or lanes. Besides, the flowers are curiously wanting in fragrance. Almost the only notable exceptions are the *mokusei* (*Osmanthus fragrans*), the daphne and the magnolia. But if some familiar European flowers are absent, they are replaced by others strange to Western eyes—a wealth of *lespedeza* and *Indigo-fera;* a vast variety of lilies; graceful grasses like the eulalia and the *ominameshi* (*Patrina scabioesaefolia*); the richly-hued *Pyrus japonica;* azaleas, diervillas and deutzias; the *kikyo* (*Platycodon grandiflorum*), the *gibōshi* (*Funkia ovata*), and many another. The same is true of Japanese forests. It has been well said that "to enumerate the constituents and inhabitants of the Japanese mountain-forests would be to name at least half the entire flora." According to a statement in the Japan Year Book (1928) the flora of Japan consists of about 17,087 species, classified as follows:—Flowering plants (9,000); Ferns (700); Mosses (2,000); Fungi (3,500); Lichens (700); Marine algae (691); Fresh-water algae (323); and Mycetozoa (173).

While there can be no doubt that the luxuriance of Japan's flora is due to rich soil, to high temperature and to rainfall not only plentiful but well distributed over the whole year, the wealth and variety of her trees and shrubs must be largely the result of immigration. Japan has four insular chains which link her to the neighbouring continent. In the south, the Luchu Islands bring her within reach of Formosa and the Malayan archipelago; on the west, Oki, Iki, and Tsushima bridge the sea between her and Korea; on the north-west Sakhalin connects her with the Amur region; and on the north, the Kuriles form an almost continuous route to Kamstchatka. By these paths the germs of Asiatic plants were carried over to join the endemic flora of the country, and all found suitable homes amid greatly varying conditions of climate and physiography.

FAUNA

Japan is an exception to the general rule that continents are richer in fauna than are their neighbouring islands. It has been said with truth that "an industrious collector of beetles, butterflies, neuroptera, etc., finds a greater number of species in a circuit of some miles near Tōkyō than are exhibited by the whole British Isles."

Of mammals 50 species have been identified and catalogued. Neither the lion nor the tiger is found. The true Carnivora are three only, the bear, the dog and the marten. The wolf is now extinct. Three species of bears are scientifically recognized, but one of them, the ice-bear (*Ursus maritimus*), is only an accidental visitor, carried down by the Arctic current. In the main island the black bear (*kuma, Ursus japonicus*) alone has its habitation, but the island of Yezo has the great brown bear (called *shi-guma, oki-kuma* or *aka-kuma*), the "grizzly" of North America. The bear does not attract much popular interest in Japan. Tradition centres rather in the fox (*kitsune*) and the badger (*mujina*), which are credited with supernatural powers. Next to these comes the monkey (*saru*), which dwells equally among the snows of the north and in the mountainous regions of the south. There are ten species of bat (*komori*) and seven of insect-eaters, and prominent in this class are the mole (*mugura*) and the hedgehog (*hari-nezumi*). There is a weasel (*itachi*), a river-otter (*kawauso*), and a sea-otter (*rakko*). The rodents are represented by an abundance of rats, with comparatively few mice, and by the ordinary squirrel (*ki-nezumi*), as well as the flying squirrel (*momodori,* or *bantori*). There are no rabbits, but hares (*usagi*) are to be found in very varying numbers, and those of one species put on a white coat during winter. The wild boar (*shishi* or *i-no-shishi*) does not differ appreciably from its European congener. A very beautiful stag (*shika*), with eight-branched antlers, inhabits the remote woodlands, and there is a species of antelope (*kamoshika*) which is found in the highest and least accessible parts of the mountains. All the European domestic animals are also represented.

Although so-called singing birds exist in tolerable numbers, those worthy of the name of songster are few. Eminently first is a species of nightingale (*uguisu*), which, though smaller than its congener of the West, is gifted with exquisitely modulated flute-like notes of considerable range. A variety of the cuckoo called *hototogisu* (*Cuculus poliocephalus*) in imitation of the sound of its voice, is heard as an accompaniment of the *uguisu,* and there are also three other species, the *kakkōdori* (*Cuculus canorus*), the *tsutsu-dori* (*C. himalayanus*), and the *masuhakari,* or *juichi* (*C. hyperythrus*). To these the lark, *hibari* (*Alauda japonica*), joins its voice, and the cooing of the pigeon (*hato*) is supplemented by the twittering of the ubiquitous sparrow (*suzume*), while over all are heard the raucous caw of the raven (*karasu*) and the harsh scream of the kite (*tombi*). There are also several varieties of falcon; but the eagle is comparatively rare. Two English ornithologists, Blakiston and Pryer, are the recognized authorities on the birds of Japan, and in a contribution to the *Transactions of the Asiatic Society of Japan* (vol. x.) they have enumerated 359 species. Starlings (*muku-dori*) are numerous, and so are the wagtail (*sekirei*), the swallow (*tsubame*) the martin (*ten*), the shrike (*mozu*) and the jay (*kakesu* or *kashi-dori*). Blackbirds and singing thrushes are absent; the other members of the species *Turdus* are common. So too are the wren (*miso-sazai*), various kinds of finches (*hiwa*), and warblers (*Kara*) as well as the water-ouzel (*kawagarasu*), the wood-pecker (*kitataki*), the kingfisher (*kawasemi*), and the brown-eared bulbul (*kiyodori*). Among game-birds there are the quail (*uzura*), the willow-grouse (*ezo-raichō*), the ptarmigan (*raichō*), the woodcock (*hodoshigi*), the snipe (*tashigi*)—with two special species, the solitary snipe (*yamashigi*) and the painted snipe (*tama-shigi*)—and the pheasant (*kiji*). Of the last there are two species, the *kiji* proper, a bird presenting no remarkable features, and the copper pheasant (*yamadori*), a magnificent bird with plumage of dazzling beauty. Of cranes there are seven species, the *Grus japonensis* (*tanchō* or *tanchō-zuru*), the demoiselle crane (*anewa-zuru*), the black crane (*kuro-zuru* or *nezumi-zuru,* i.e., *Grus cinerea*), the *Grus leucauchen* (*mana-zuru*), the *Grus monachus* (*nabe-zuru*), and the white crane (*shiro-zuru*). The little egret (*shira-sagi*) is a familiar feature of the Japanese landscape; so is the night-heron (*goi-sagi*). Besides these waders there are plover (*chidori*); golden (*mana-guro* or *aiguro*); gray (*daizen*); ringed (*shiro-chidori*); spur-winged (*keri*) and Harting's sand-plover (*ikaru-chidori*); sand-pipers—green (*ashiro-shigi*) and spoon-billed (*hera-shigi*)—and water-hens (*ban*). Among swimming birds the most numerous are the gull (*kamome*), of which many varieties are found; the cormorant (*u*)—which is trained by the Japanese for fishing purposes—and multitudinous flocks of wild-geese (*gan*) and wild-ducks (*kamo*), from the beautiful mandarin-duck (*oshi-dori*), to teal (*kogamo*), pintail (*ōnaga*); dusky mallard (*karugamo*), widgeon (*akagashira*) and sea-ducks of various species.

Of reptiles Japan has 90 species, and among them is included the marine turtle (*umi-game*) which is however seen only at rare intervals on the southern coast. Even rarer is the larger species (*shōgakubo,* i.e., *Chelonia cephalo*). Both are highly valued for the sake of the shell. Of the fresh-water tortoise there are two kinds, the *suppon* (*Trionyx japonica*) and the *kame-no-ko* (*Emys vulgaris japonica*), one of the Japanese emblems of longevity.

Sea-snakes occasionally make their way to Japan, being carried thither by the Black Current (Kuro Shiwo) and the monsoon, but they must be regarded as merely fortuitous visitors. There are 10 species of land-snakes (*hebi*), among which only two (the *mamushi*, or *Trigonocephalus Blomhoffi*) and the *Labu* are venomous reptiles. The largest snake is the *aodaisho* (*Elaphis virgatus*), which sometimes attains a length of 5 ft., but is quite harmless. Lizards (*tokage*), frogs (*kawazu* or *kaeru*), toads (*ebogayeru*) and newts (*imori*) are plentiful, and much curiosity attaches to a giant salamander (*sansho-uwo*, called also *hazekai* and other names according to localities), which reaches to a length of 5 ft., and (according to Rein) is closely related to the *Andrias Scheuchzeri* of the Oeningen strata.

The seas surrounding the Japanese islands may be called a resort of fishes, for, in addition to numerous species which abide there permanently, there are migratory kinds, coming and going with the monsoons and with the great ocean streams that set to and from the shores. In winter, for example, when the northern monsoon begins to blow, numbers of denizens of the Sea of Okhotsk swim southward to the more genial waters of north Japan; and in summer the Indian Ocean and the Malayan archipelago send to her southern coasts a crowd of emigrants which turn homeward again at the approach of winter. It thus falls out that in spite of the enormous quantity of fish consumed as food or used as fertilizers year after year by the Japanese, the seas remain as richly stocked as ever. Nine orders of fishes have been distinguished as the piscifauna of Japanese waters. They may be found carefully catalogued with all their included species in Rein's *Japan*, and highly interesting researches by Japanese physiographists are recorded in the Journal of the College of Science of the Imperial University of Tōkyō. Briefly, the chief fish of Japan are the porgy (*tai*), the *suzuki* (*percalabeax japonicus*), the mullet (*bora*), the rock-fish (*hatatate*), the grunter (*oni-o-koze*), the mackerel (*saba*), the goby (*kaze*), the sword-fish (*tachi-uwo*), the wrasse (*kusabi*), the cod-fish (*tara*), the flounder (*karei*), and its congeners the sole (*hirame*) and the turbot (*ishi-garei*), the shad (*namazu*), the salmon (*shake*), the *masu*, the carp (*koi*), the *funa* (*Carassius auratus*), the gold-fish (*kingyo*), the gold carp (*higoi*), the loach (*dojō*), the herring (*nishin*), the sardine (*iwashi*), the eel (*unagi*), the conger eel (*anago*), the coffer-fish (*hako-uwo*), the *fugu* (*Tetrodon*), the *ayu* (*Plecoglossus altivelis*), the *sayori* (*Hemiramphus sayori*), the shark (*same*), the dogfish (*manuka-same*), the ray (*e*), the bonito (*katsuo*), the *maguro* (*Thynnus sibi*) and two forms of trout, the *yamame* and the *iwana*. The American brook trout (*salochinus fontinelis*) and the rainbow trout have been introduced from the United States.

The insect life of Japan broadly corresponds with that of temperate regions in Europe. But there are also a number of tropical species, notably among butterflies and beetles. The latter —for which the generic term in Japan is *mushi* or *kaichū*—include some beautiful species, from the "jewel beetle" (*tamamushi*), the "gold beetle" (*kogane-mushi*) and the *Chrysochroa fulgidissima*, which glow and sparkle with the brilliancy of gold and precious stones, to the jet black *Melanauster chinensis*, which seems to have been fashioned out of lacquer spotted with white. There is also a giant nasicornous beetle. Among butterflies (*chōchō*) Rein gives prominence to the broad-winged kind (*Papilio*), which recall tropical brilliancy. One (*Papilio macilentus*) is peculiar to Japan. Many others seem to be practically identical with European species. That is especially true of the moths (*yachō*), 100 species of which have been identified with English types. There are seven large silk-moths, of which two only (*Bombyx mori* and *Antheraea yama-mai*) are employed in producing silk. Fishing lines are manufactured from the cocoons of the *genjiki-mushi* (*Caligula japonica*), which is one of the commonest moths in the islands. Wasps, bees and hornets, generically known as *hachi*, differ little from their European types, except that they are somewhat larger and more sluggish. The gad-fly (*abu*), the housefly (*hai*), the mosquito (*ka*), the flea (*nomi*) and occasionally the bedbug (called by the Japanese *karamushi* because it is believed to be imported from China), are all fully represented, and the dragon-fly (*tombō*) presents itself in immense numbers at certain seasons. Grasshoppers (*batta*) are abundant, and one kind (*inago*), which frequent the rice-fields when the cereal is ripening are caught and fried in oil as an article of food. On the moors in late summer the mantis (*kamakiri-mushi*) is commonly met with, and the cricket (*kūrogi*), and the cockroach abound. Particularly obtrusive in the summer is the cicada (*semi*), of which there are many species. Spiders abound, from a giant species to one of the minutest dimensions, and ticks are very common in the long bamboo grass.

Japanese rivers and lakes are the habitation of several—seven or eight—species of freshwater crab (*kani*), which live in holes on the shore and emerge in the day-time, often moving to considerable distances from their homes. Cray-fish (*kawa-ebi*) also are found in the rivers and rice-fields. These, as well as a large species of crab—*mokuzō-gani*—serve the people as an article of food; but the small crabs which live in holes have no recognized *raison d' être*. In Japan, as elsewhere, the principal crustacea are found in the sea. Flocks of *lupa* and other species swim in the wake of the tropical fishes which move towards Japan at certain seasons. Naturally these migratory crabs are not limited to Japanese waters. Milne Edwards has identified ten species which occur in Australian seas also, and Rein mentions, as belonging to the same category, the "helmet-crab" or "horse-shoe crab" (*kabuto-gani; Limulus longispina* Hoeven). Very remarkable is the giant *Taka-ashi*—long legs (*Macrocheirus Kaempferi*), which has legs 1½ metres long and is found in the seas of Japan and the Malay archipelago. There is no lobster on the coasts of Japan, but there are various species of cray-fish (*Palinurus* and *Scyllarus*) the principal of which, under the names of *ise-ebi* (*Palinurus japonicus*) and *kuruma-ebi* (*Penaeus canaliculatus*) are greatly prized as an article of diet.

Already in 1882, Dunker in his *Index Molluscorum Maris Japonici* enumerated nearly 1,200 species of marine molluscs found in the Japanese archipelago, and several others have since been added to the list. As for the land and fresh-water molluscs, some 200 of which are known, they are mainly kindred with those of China and Siberia, tropical and Indian forms being exceptional. There are 57 species of *Helix* (*naimaitsuburi, dedemushi, katatsumuri* or *kwagyū*) and 25 of *Clausilia* (*kiseru-gai* or pipe-snail), including the two largest snails in Japan, namely the *Cl. Martensi* and the *Cl. Yokohamensis*, which attain to a length of 58 mm. and 44 mm. respectively. The mussel (*i-no-kai*) is well represented by the species *numa-gai* (marsh-mussel), *karasu-gai* (raven-mussel), *kamisori-gai* (razor-mussel), *shijimi-nokai* (*Corbicula*), of which there are nine species, etc. Unlike the land-molluscs, the great majority of Japanese sea-molluscs are akin to those of the Indian Ocean and the Malay archipelago. Some of them extend westward as far as the Red Sea. The best known and most frequent forms are the *asari* (*Tapes philippinarum*), the *hamaguri* (*Meretrix lusoria*), the *baka* (*Mactra sulcataria*), the *aka-gai* (*Scapharca inflata*), the *kaki* (oyster), the *awabi* (*Haliotis japonica*), the *sazae* (*Turbo cornutus*), the *hora-gai* (*Tritonium tritonius*), etc. Among the cephalopods several are of great value as articles of food, *e.g.*, the *surume* (*Onychotheuthis Banksii*), the *tako* (octopus), the *shidako* (*Eledone*), the *ika* (Sepia), the *tako-fune* (Argonauta), and the *Opisthoteuthis* a remarkable flat octopus looking like a badly poached egg.

Greeff enumerates, as denizens of Japanese seas, 26 kinds of sea-urchins (*gaze* or *uni*) and 12 of starfish (*hitode* or *tako-no-makura*). These, like the mollusca, indicate the influence of the Kuro Shiwo and the south-west monsoon, for they have close affinity with species found in the Indian and Pacific Oceans. For edible purposes the most valuable of the Japanese echinoderms is the sea-slug or *bêche de mer* (*namako*), which is greatly appreciated and forms an important staple of export to China.

Japan is not rich in corals and sponges. Her most interesting contributions are crust-corals (*Gorgonidae, Corallium, Isis*, etc.), and especially flint-sponges, called by the Japanese *hoshi-gai* and known as "glass-coral" (*Hyalonema sieboldi*). These last have not been found anywhere except at the entrance of the Bay of Tōkyō at a depth of some 200 fathoms.

THE PEOPLE

Population.—The population of the Empire on the 1st of tober, 1925, when the last census was taken, was as follows:—

Population	Males	Females	Total
apan proper . . .	30,013,109	29,723,713	59,736,822
Corea.	10,020,943	9,502,002	19,522,945
Formosa	2,052,669	1,940,739	3,993,408
Saghalin	122,379	81,375	203,754
Total	42,209,100	41,247,829	83,456,929
eased territory of the Liaotung Peninsula .	644,491	409,583	1,054,074

cording to the "Japan Year Book" the density of population, shown by the census of 1925 was 60·6 per sq. mile or 374·1 r sq. mile of cultivated area.

The following comparative tables may be of interest as show- the rate at which the population has increased in recent years. should however be borne in mind that the term population in e case of Japan proper includes all persons having their regis- ed domicile in Japan.

Year	Males	Females	Total
Japan			
872	16,796,144	16,314,652	33,110,796
893	20,906,465	20,481,848	41,388,313
913	26,964,586	26,398,096	53,362,682
923	30,445,661	29,812,281	60,257,942
Korea			
910	6,862,650	6,071,632	12,934,282
917	8,552,392	8,065,039	16,617,431
924	9,045,641	8,573,899	17,619,540
Formosa			
898	1,373,240	1,214,608	2,587,848
908	1,596,282	1,440,573	3,036,855
918	1,757,498	1,655,916	3,413,414

According to quasi-historical records, the population of the pire in the year A.D. 610 was 4,988,842, and in 736 it had own to 8,631,770. It is impossible to say how much reliance ay be placed on these figures, but from the 18th century, when e name of every subject had to be inscribed on the roll of a mple as a measure against his adoption of Christianity, a toler- ly trustworthy census could always be taken. The returns us obtained show that from the year 1723 until 1846 the popu- tion remained almost stationary, the figure in the former year ing 26,065,422, and that in the latter year 26,907,625. But ter 1872, when the census showed a total of 33,110,825, the opulation grew steadily, its increment between 1872 and 1898, clusive, a period of 27 years, being 10,649,990. The annual rate increase is now estimated at something over 700,000, a figure hich naturally invests the question of subsistence with great portance. It was hoped at one time that colonization in Man- uria and Korea would materially help to solve the problem of ver population; but the Japanese does not like extremes of imate, as is shown by the slowness with which the Hokkaido is eing developed, nor does he thrive in countries, such as Man- uria, in which the standard of living is lower than his own. olonization therefore will not solve the population problem, or will emigration, for reasons which it is unnecessary to discuss ere. It is true that in Japan itself there is still a certain amount f waste land, probably about 5,000,000 acres, of which about ,700,000 acres can be used for the cultivation of rice. The size f the crops can also be increased by the intensive use of fertil- zers, and by these two methods the difficulties attending over- opulation can be postponed for the moment. The question has lready been the subject of discussion in many quarters, and apanese authorities suggest three remedies,—(*a*) the expansion f industry, (*b*) the increase of the foreign trade, and (*c*) the dvancement of agriculture. Birth-control is advocated in some uarters, but has not been seriously considered, nor is it likely o be. The birth-rate during the last 20 years has been about 3·05% of the population and the death-rate about 2·05%. Infant mortality is still heavy. The male birth-rate is about 4% in excess of the female. As compared with the inhabitants of Western Europe the Japanese are of low stature; but the rise in the standard of living and the cultivation of the physique in schools and colleges has resulted in a marked improvement in this direction in recent years.

Towns.—According to the "Japan Year Book" for 1928 there are in Japan 21 towns with a population of over 100,000 and 34 with a population of over 50,000. The only two cities with over a million inhabitants are: Osaka (2,114,804) and Tōkyō (1,995,-567). Nagoya, Kyōto and Kobe come next with populations exceeding half a million. The number of households in Japan proper, when the last census was taken in 1925 was 11,999,609 and the average number in each household 5·0.

Physical Characteristics.—The best authorities are agreed that the Japanese people do not differ physically from their Korean and Chinese neighbours as much as the inhabitants of northern Europe differ from those of southern Europe. It is true that the Japanese are shorter in stature than either the Chinese or the Koreans. Thus the average height of the Japanese male is only 5 feet 3½ in., and that of the female 4 ft. 10½ in., whereas in the case of the Koreans and the northern Chinese the corresponding figures for males are 5 ft. 5¾ in. and 5 ft. 7 in., respectively. Yet in other physical characteristics the Japanese, the Koreans and the Chinese resemble each other so closely that, under similar conditions as to costume and coiffure, no appreciable difference is apparent. The late Dr. E. Baelz (Emeritus Professor of Medicine in the Imperial University of Tōkyō), who made an exhaustive anthropological study of the Japanese, divides the race inhabiting the Japanese islands into three distinct types:—(*a*) Manchu-Korean, (*b*) Mongol, and (*c*) Malay or Indonesian.

The first is more common among the upper classes, and its characteristics are exceptional tallness combined with slenderness, a face somewhat long and having more or less oblique eyes, an aquiline nose, a slightly receding chin and delicately shaped hands. The most plausible hypothesis is that men of this type are descendants of Korean colonists who, in prehistoric times, settled in the province of Izumo, on the west coast of Japan, having made their way thither from the Korean peninsula by the island of Oki. The second type is the Mongol. It is not very frequently found in Japan, perhaps because, under favourable social conditions, it tends to pass into the Manchu-Korean type. Its representative has a broad face, with prominent cheek-bones, oblique eyes, a nose more or less flat and a wide mouth. The figure is strongly and square built; but this last characteristic can scarcely be called typical. There is no satisfactory theory as to the route by which the Mongols reached Japan, but it is scarcely possible to doubt that they found their way thither at one time. More important than either of these types as an element of the Japanese nation is the Malay or Indonesian. Small in stature, with a well-knit frame, the cheek-bones prominent, the face generally round, the nose and neck short, a marked tendency to prognathism, the chest broad and well developed, the trunk long, the hands small and delicate—this type is found in nearly all the islands along the east coast of the Asiatic continent as well as in southern China and in the extreme south-west of the Korean peninsula. Carried northward by the warm current known as the Kuro Shiwo, this type seems to have landed in Kyūshū—the most southerly of the main Japanese islands—whence it ultimately pushed northward and conquered its Manchu-Korean predecessors, the Izumo colonists. None of the above three, however, can be regarded as the earliest settlers in Japan. Before them all was a tribe of immigrants who appear to have crossed from north-eastern Asia at an epoch when the sea had not yet dug broad channels between the continent and the adjacent islands. These people—the Ainu—are usually spoken of as the aborigines of Japan. They once occupied the whole country, but were gradually driven northward by the Manchu-Koreans and the Malays or Indonesians, until only a mere handful of them survived in the northern island of Yezo. Like the second and third types they are short and

thickly built, but unlike either they have prominent brows, bushy locks, round deep-set eyes, long divergent lashes, straight noses and much hair on the face and the body. In short, the Ainu suggest much closer affinity with Europeans than does any other of the types that go to make up the population of Japan. It is not to be supposed, however, that these traces of different elements indicate any lack of homogeneity in the Japanese race. Amalgamation has been completely effected in the course of long centuries, and even the Ainu, though the small surviving remnant of them now live apart, have left distinct traces upon their conquerors.

The typical Japanese of the present day has certain marked physical peculiarities. In the first place, the ratio of the height of his head to the length of his body is greater than it is in Europeans. The Englishman's head is often one-eighth of the length of his body or even less, and in continental Europeans, as a rule, the ratio does not amount to one-seventh; but in the Japanese it exceeds the latter figure. Another striking feature is shortness of legs relatively to length of trunk. This special feature has been attributed to the Japanese habit of kneeling instead of sitting, but investigation shows that it is equally marked in the working classes who pass most of their time standing. In Europe the same physical traits—relative length of head and shortness of legs—distinguish the central race (Alpine) from the Teutonic, and seem to indicate an affinity between the former and the Mongols. It is in the face, however, that we find specially distinctive traits, namely, in the eyes, the eyelashes, the cheekbones and the beard. Not that the eyeball itself differs from that of an Occidental. The difference consists in the fact that "the socket of the eye is comparatively small and shallow, and the osseous ridges at the brows being little marked, the eye is less deeply set than in the European. In fact, seen in profile, forehead and upper lip often form an unbroken line." Then, again, the shape of the eye, as modelled by the lids, shows a striking peculiarity. For whereas the open eye is almost invariably horizontal in the European, it is often oblique in the Japanese on account of the higher level of the upper corner. "But even apart from obliqueness, the shape of the corners is peculiar in the Mongolian eye. The inner corner is partly or entirely covered by a fold of the upper lid continuing more or less into the lower lid. This fold often covers also the whole free rim of the upper lid, so that the insertion of the eyelashes is hidden" and the opening between the lids is so narrowed as to disappear altogether at the moment of laughter. As for the eye-lashes, not only are they comparatively short and sparse, but also they converge instead of diverging, so that whereas in a European the free ends of the lashes are further distant from each other than their roots, in a Japanese they are nearer together. Prominence of cheekbones is another special feature; but it is much commoner in the lower than in the upper classes. Finally, there is marked paucity of hair on the face of the average Japanese—apart from the Ainu—and what hair there is is nearly always straight.

Moral Characteristics.—The Japanese are essentially a kindly-hearted, laughter-loving people, taking life easily and not allowing its petty ills unnecessarily to disturb their equanimity. Suicide is, it is true, by no means uncommon; but by far its most frequent victims are students and lovers. The latter take refuge in it because circumstances prevent their being united in this world, and they go therefore to what they believe to be a union beyond the grave; in the case of the students the cause is generally to be found in the stress of modern conditions and the unduly heavy mental and physical strain imposed upon them by the existing system of education. Neither of these types, however, is normal; and the average Japanese, while lacking that sense of humour which is conspicuous among some other races, is nevertheless a light-hearted and buoyant individual. It is rare to see a grown-up person, particularly among the educated classes, indulge in displays of temper. The Japanese is imperturbable in the face of provocation or trouble and, as a rule, completely stoical in the face of pain or death. This faculty of self-control is in a sense hereditary, the result of long centuries of rigid training and example. It has also been driven into him that personal cowardice is the most despicable of vices and loyalty, particularly loyalty to the Throne and to his country, the supreme virtue. The finished product of these teachings is a person imbued with a pride of race and a patriotism so intense that it not infrequently verges on fanaticism. There is a limit, too, to imperturbability, and when that limit is reached the resulting passion is correspondingly violent. It will therefore easily be realized from this description of the Japanese character how formidable are the potentialities of this people as an enemy. Kaempfer, that most acute of observers, wrote of the Japanese that "their pride and warlike humour being set aside," they are "as civil, as polite and as curious a nation as any in the world, naturally inclined to commerce and familiarity with foreigners, and desirous, to excess, to be informed of their histories, arts and sciences," and what Kaempfer wrote in the Dutch factory at Nagasaki more than 200 years ago is almost equally true to-day. Contact with a ruder outside world may perchance since have blunted a little the fine edge of the national courtesy; but, if so, it is hardly perceptible; the intellectual curiosity to which he refers remains as strong as ever. Pride of race can naturally be carried to excess, and there have not been wanting critics, not necessarily biassed, to charge the Japanese with excessive self-confidence and self-esteem; others too have noted a certain fickleness of temperament, a tendency to quick enthusiasms easily dropped, and considerable secretiveness. But no nation is free from failings, and when due account has been taken of those of the Japanese, there still remains a people of remarkable energy and intelligence, of marvellous achievement, and of great attractiveness. It must not be inferred from the remark made above with regard to suicide among lovers that love as a prelude to marriage plays an important part in Japanese ethics. As a matter of fact in the vast majority of cases marriages are arranged by the parents or in the family councils of the parties concerned without any particular regard to the feelings of the two people most directly interested. It might be supposed that conjugal fidelity would suffer from such a custom, and in the case of the husband it undoubtedly does; but in the case of the wife it emphatically does not. Even though she be cognizant—as she often is—of her husband's extra-marital relations, she abates nothing of the duty which she has been taught to regard as the first canon of female ethics. From many points of view, indeed, there is no more beautiful type of character than that of the Japanese woman. She is entirely unselfish; exquisitely modest without being anything of a prude; abounding in intelligence which is never obscured by egoism; patient in the hour of suffering; strong in time of affliction; a faithful wife; a loving mother; a good daughter; and capable, as history shows, of heroism rivalling that of the stronger sex. As to the question of sexual virtue and morality in Japan, grounds for a conclusive verdict are hard to find. In the interests of hygiene prostitution is licensed, and that fact is by many critics construed as proof of tolerance; but licensing is associated with strict segregation, and the result is that the great cities are conspicuously free from evidences of vice. The ratio of marriages is approximately 8·31 per thousand units of the population, and the ratio of divorces is 0·83 per thousand. Divorces take place chiefly among the lower orders, who frequently treat marriage merely as a test of a couple's suitability to be helpmates in the struggles of life.

Concerning the virtues of truth and probity, extremely conflicting opinions have been expressed. The Japanese *samurai* always prided himself on having "no second word." He never drew his sword without using it; he never gave his word without keeping it. Yet it may be doubted whether the value attached in Japan to the abstract quality, truth, is as high as the value attached to it in England, or whether the consciousness of having told a falsehood weighs as heavily on the heart. Much depends upon the motive. Whatever may be said of the upper class, it is probably true that the average Japanese will not sacrifice expediency on the altar of truth. He will be veracious only so long as the consequences are not seriously injurious. In the matter of probity, however, it is possible to speak with more assurance. There are undoubtedly among the merchants and tradesmen a

large number of persons whose standard of commercial morality is defective. They are relics of the feudal days when the merchant and the tradesman, being despised, lost their self-respect. But this blemish is in gradual process of correction, and there are now many merchant houses in Japan which maintain as high a standard of probity as can be found anywhere.

COMMUNICATIONS

There is no reliable information regarding the state of communications in very early times in Japan; but in the Taika period (A.D. 645–650), the first great era of Japanese reform, a system of post-stations was established, provision was made for post-horses along the great roads, which doubtless has long been in existence in the more populous districts, and a system of bells and checks was devised for distinguishing official carriers. In those days ordinary travellers were required to carry passports, nor had they any share in the benefits of the official organization, which was entirely under the control of the minister of war. Great difficulties attended the movements of private persons. Even the task of transmitting to the central government provincial taxes paid in kind had to be discharged by specially organized parties, and this journey from the north-eastern districts to the capital generally occupied three months. Owing to the anarchy which prevailed during the 10th, 11th and 12th centuries, facilities of communication disappeared almost entirely; even for men of rank a long journey involved danger of starvation or fatal exposure, and the pains and perils of travel became a household word among the people. Not until the Tokugawa family obtained military control of the whole empire (1603), and, fixing its capital at Yedo, required the feudal chiefs to reside there every second year, did the problem of roads and post-stations force itself once more on official attention. Regulations were now strictly enforced, fixing the number of horses and carriers available at each station, the loads to be carried by them and their charges, as well as the transport services that each feudal chief was entitled to demand and the fees he had to pay in return. Tolerable hostelries now came into existence; but they furnished only shelter, fuel and the coarsest kind of food. By degrees, however, the progresses of the feudal chiefs to and from Yedo, which at first were simple and economical, developed features of competitive magnificence, and the importance of good roads and suitable accommodation received increased attention.

It is not too much to say, indeed, that when Japan opened her doors to foreigners in the middle of the 19th century, she possessed a system of roads, some of which bore a striking testimony to her mediaeval greatness. The most remarkable was the Tōkaidō (eastern-sea way), so called because it ran eastward along the coast from Kiōto. This great highway, 345 m. long, connected Osaka and Kiōto with Yedo. The date of its construction is not recorded; but it certainly underwent signal improvement in the 12th and 13th centuries, and during the two and a half centuries of Tokugawa sway in Yedo. A wide, well-made and well-kept avenue, it was lined throughout the greater part of its length by giant pine-trees, rendering it the most picturesque highway in the world. Second only to the Tōkaidō is the Nakasendō (mid-mountain road), which also was constructed to join Kiōto with Yedo, but follows an inland course through the provinces of Yamashiro, Omi, Mino, Shinshū, Kōtzuke and Musashi. Its length is 340 m., and though not flanked by trees or possessing so good a bed as the Tōkaidō, it is nevertheless a sufficiently remarkable highway. A third road, the Oshūkaidō, runs northward from Yedo (now Tōkyō) to Aomori on the extreme north of the main island, a distance of 445 m., and several lesser highways give access to other regions.

Modern Superintendence of Roads.—The question of road superintendence received early attention from the government of the restoration. At a general assembly of local prefects held at Tōkyō in June 1875 it was decided to classify the different roads throughout the empire, and to determine the several sources from which the sums necessary for their maintenance and repair should be drawn. As a result of the discussions which then took place it was decided that all roads should be divided into three classes: —national, prefectural and village—and that the first should be maintained at the national expense, the second by joint contributions from the government and the particular prefecture concerned, and the third by the districts through which the roads ran. The width of national roads was determined at 42 ft. for class 1, 36 ft. for class 2 and 30 ft. for class 3; the prefectural roads were to be from 24 to 30 ft., and the dimensions of the village roads were optional, according to the necessity of the case.

Vehicles.—The vehicles chiefly employed in ante-Meiji days were ox-carriages, *norimono, kago* and carts drawn by hand. Ox-carriages, beautifully made and decorated, were used only by people of the highest rank. The norimono resembled a miniature house slung by its roof-ridge from a massive pole which projected at either end sufficiently to admit the shoulders of a carrier. It, too, was frequently of very ornamental nature and served to carry aristocrats or officials of high position. The kago was the humblest of all conveyances recognized as usable by the upper classes. It was an open palanquin, V-shaped in cross section, slung from a pole which rested on the shoulders of two bearers. Extraordinary skill and endurance were shown by the men who carried the norimono and the kago; but none the less these vehicles were both profoundly uncomfortable. They have now been relegated to the warehouses of undertakers, where they serve as bearers for folks too poor to employ catafalques, their place on the roads and in the streets having been completely taken by the *jinrikisha,* a two-wheeled vehicle pulled by one or two men who think nothing of running 20 m. at the rate of 6 m. an hour. The jinrikisha is, however, fast disappearing and its place is being taken, both in the towns and in the country, by the motor-car, though it must be confessed that Japanese roads are not yet by any means suitable for motor traffic. Luggage, of course, could not be carried by norimono or kago. It was necessary to have recourse to packmen, packhorses or baggage-carts drawn by men or horses. All these still exist and are as useful as ever within certain limits. In the cities and towns horses used as beasts of burden are now shod with iron, but in rural or mountainous districts straw shoes are substituted, a device which enables the animals to traverse rocky or precipitous roads with safety.

Railways.—It is easy to understand that an enterprise like railway construction, requiring a great outlay of capital with returns long delayed, did not at first commend itself to the Japanese, who were almost entirely ignorant of co-operation as a factor of business organization. Moreover, long habituated to snail-like modes of travel, the people did not rapidly appreciate the celerity of the locomotive. Neither the ox-cart, the norimono, nor the kago covered a daily distance of over 20 m. on the average, and the packhorse was even slower. Amid such conditions the idea of railways would have been slow to germinate had not a catastrophe furnished some impetus. In 1869, a rice-famine occurred in the southern island, Kyūshū, and while the cereal was procurable abundantly in the northern provinces, people in the south perished of hunger owing to lack of transport facilities. Sir Harry Parkes, British representative in Tōkyō, seized this occasion to urge the construction of railways. Ito and Okuma, then influential members of the government, at once recognized the wisdom of his advice. Arrangements were made for a loan of a million sterling in London on the security of the customs revenue, and English engineers were engaged to lay a line between Tōkyō and Yokohama (18 m.) Vehement voices of opposition were at once raised in private and official circles alike, all persons engaged in transport business imagined themselves threatened with ruin, and conservative patriots detected loss of national independence in a foreign loan. So fierce was the antagonism that the military authorities refused to permit operations of survey in the southern suburb of Tōkyō, and the road had to be laid on an embankment constructed in the sea. Ito and Okuma, however, never flinched, and they were ably supported by Marquis M. Inouye and M. Mayejima.

September 1872 saw the first official opening of a railway (the Tōkyō-Yokohama line) in Japan, the ceremony being performed by the emperor himself, a measure which effectually silenced all further opposition. Eight years from the time of turning the first

sod saw 71 m. of road open to traffic, the northern section being that between Tōkyō and Yokohama, and the southern that between Kyōto and Kobe. A period of interruption now ensued, owing to domestic troubles and foreign complications, and when, in 1878, the government was able to devote attention once again to railway problems, it found the treasury empty. Then for the first time a public works loan was floated in the home market, and about £300,000 of the total thus obtained passed into the hands of the railway bureau, which at once undertook the building of a road from Kyōto to the shore of Lake Biwa, a work memorable as the first line built in Japan without foreign assistance, save for advisers. During all this time private enterprise had remained wholly inactive in the matter of railways, and it became a matter of importance to rouse the people from this apathetic attitude. For the ordinary process of organizing a joint-stock company and raising share-capital the nation was not yet prepared. But shortly after the abolition of feudalism there had come into the possession of the former feudatories state loan-bonds amounting to some 18 millions sterling, which represented the sum granted by the treasury in commutation of the revenues formerly accruing to these men from their fiefs. Already events had shown that the feudatories, quite devoid of business experience, were not unlikely to dispose of these bonds and devote the proceeds to unsound enterprises. Prince Iwakura, one of the leaders of the Meiji statesmen, persuaded the feudatories to employ a part of the bonds as capital for railway construction, and thus the first private railway company was formed in Japan under the name *Nippon tetsudo kaisha* (Japan railway company), the treasury guaranteeing 8% on the paid-up capital for a period of 15 years. Some time elapsed before this example found followers, but ultimately a programme was elaborated and carried out having for its basis a grand trunk line extending the whole length of the main island from Aomori on the north to Shimonoseki on the south, a distance of 1,153 m.; and a continuation of the same line throughout the length of the southern island of Kyūshū, from Moji on the north—which lies on the opposite side of the strait from Shimonoseki—to Kagoshima on the south, a distance of 232¾ m.; as well as a line from Moji to Nagasaki, a distance of 163½ m. Of this main road the state undertook to build the central section (376 m.), between Tōkyō and Kōbe (via Kyōto); the Japan railway company undertook the portion (457 m.) northward of Tōkyō to Aomori; the Sanyō railway company undertook the portion (320 m.) southward of Tōkyō to Shimonoseki; and the Kyūshū railway company undertook the lines in Kyūshū. The first project was to carry the Tōkyō-Kyōto line through the interior of the island so as to secure it against enterprises on the part of a maritime enemy. Such engineering difficulties presented themselves, however, that the coast route was ultimately chosen, and though the line through the interior was subsequently constructed, strategical considerations were not allowed completely to govern its direction.

When this building of railways began in Japan, much discussion was taking place in England and India as to the relative advantages of the wide and narrow gauges, and so strongly did the arguments in favour of the latter appeal to the English advisers of the Japanese government that the metre gauge was chosen. Some fitful efforts made in later years to change the system proved unsuccessful. The lines are single, for the most part; and as the embankments, the cuttings, the culverts and the bridge-piers have not been constructed for a double line, any change now would be very costly. The average speed of passenger trains in Japan is 18 m. an hour, the corresponding figure over the metre-gauge roads in India being 16 m., and the figure for English parliamentary trains from 19 to 28 m. British engineers surveyed the routes for the first lines and superintended the work of construction, but within a few years the Japanese were able to dispense with foreign aid altogether, both in building and operating their railways. They also now construct carriages, wagons and locomotives, and therefore are entirely independent in the matter of railway construction.

Nationalization of Private Railways.—The total length of lines open for traffic in March 1906 was 4,746 m. Of these 1,470 m. had been built by the State at a cost of sixteen million pounds sterling, and 3,276 m. by private companies at a cost of twenty-five millions. The difference in cost is explained by the fact that the state lines frequently ran through very difficult country and that portions of them were built before experience indicated cheaper methods. Private companies, coming later into the field, naturally avoided districts presenting great engineering difficulties, and had the additional advantage of being able to profit from the experience bought at a price by the state. When the fiscal year 1906–07 opened, the number of private companies was no less than 36, owning and operating 3,276 m. of railway. Anything like efficient co-operation, an important matter in time of war, was impossible in such circumstances, and constant complaints were heard about delays in transit and undue expense. The defects of divided ownership had long suggested the expediency of nationalization; but not until 1906 could the Diet be induced to give its consent. On March 31 of that year, a railway nationalization law was promulgated. It enacted that, within a period of 10 years from 1906 to 1915, the state should purchase the 17 principal private roads, which had a length of 2,812 m., and whose cost of construction and equipment had been 23½ millions sterling. The original scheme included 15 other railways, with an aggregate mileage of only 353 m.; but these were eliminated as being lines of local interest only. The actual purchase price of the 17 lines was calculated at 43 millions sterling (about double their cost price), and the Government agreed to hand over the purchase money within 5 years from the date of the acquisition of the lines, in public loan-bonds bearing 5% interest calculated at their face value; the bonds to be redeemed out of the net profits accruing from the purchased railways. The accounts for the state railways figure as a separate account independent of the budget.

South Manchuria Railways.—As a result of the war of 1904–05 Japan, with the acquiescence of China, took over from Russia the lease of the portion of the Chinese Eastern Railway between Kwang-cheng-tzu (Changchun) in the north and Dairen (Dalny), Port Arthur and Newchwang in the south. China at the same time agreed to lease to Japan the line between Mukden and Antung, which the latter had laid temporarily for military purposes during the war, but now proposed to convert into an ordinary commercial railway. A company called the South Manchuria Railway was formed with a capital of 20 million yen, half of which was contributed by the Japanese Government in the shape of the road itself and its associated properties, the other half thrown open for subscription to Japanese and Chinese subjects, and to it the railway was handed over. Debentures, the interest on which was guaranteed by the Japanese Government, were also issued in London to the amount of 8 million pounds sterling. The capital has since been raised to 44 million pounds and the amount of debentures increased till they now stand at 22 million. The total length of the railway with its various branches is 693 miles. The company's activities are not limited to its lines only. It works extensive coal mines at Fushun and Yentai, has a line of steamers plying between Dairen and Shanghai and an iron foundry at Anshan, and engages in enterprises connected with warehousing, electricity, hotels, hospitals, schools and the general management of houses and lands within the railway zone. Under the terms of a treaty made with China in 1915 the lease of the Changchun-Dairen section has been extended to A.D. 2002 and that of the Mukden-Antung section to A.D. 2007. Construction work has been well maintained since 1907 when nationalization took place. In 1917 the total railway mileage was 7,690 m., of which 5,856 m. represented State railways and 1,834 m. private lines. In 1927 the total was 10,884 m., of which 7,837 m. were state-owned and 3,047 m. the property of private companies. No recent figures are available of the cost of construction of state lines; but the total given in 1927 for the private lines was close on 40 million pounds sterling. The total receipts in that year for both state and private lines from passenger traffic was over 26 million pounds and from freight 22 millions.

Electric Railways.—The first electric railway in Japan was a short one, 8 miles long, built in Kyōto for the purposes of a

domestic exhibition held in that city. This class of enterprise has since rapidly grown in favour, and in 1926 108, belonging either to municipalities or private companies, were in operation. Their total authorized capital is estimated at about 168 million pounds, their net earnings in 1926 about 14 million pounds, and the number of passengers carried about 18 hundred millions. Dividends varied from 7 to 14 per cent.

Maritime Communications.—The traditional story of prehistoric Japan indicates that the first recorded emperor was an over-sea invader, whose followers must therefore have possessed some knowledge of ship-building and navigation, and historical records in fact show that the Japanese of the earliest era navigated the high sea with some skill. At later dates down to mediaeval times they are found occasionally sending forces to Korea and constantly visiting China in vessels which seem to have experienced no difficulty in making the voyage, while in the 16th century maritime activity was so marked that, had not artificial checks been applied, the Japanese, in all probability, would have obtained partial command of Far-Eastern waters. They invaded Korea; their corsairs harried the coast of China; two hundred of their vessels, sailing under authority of the Taikō's vermilion seal, visited Siam, Luzon, Cochin China and Annam, and they built ships in European style which crossed the Pacific to Acapulco. But this spirit of adventure was chilled at the close of the 16th century and early in the 17th, when events connected with the propagation of Christianity taught the Japanese to believe that national safety could not be secured without international isolation. In 1638 the ports were closed to all foreign ships except those flying the flag of Holland or of China, and a strictly enforced edict forbade the building of any vessel having a capacity of more than 500 *koku* (150 tons) or constructed for purposes of ocean navigation. Thenceforth, with rare exceptions, Japanese craft confined themselves to the coastwise trade. Ocean-going enterprise ceased altogether.

Things remained thus until the middle of the 19th century, when a growing knowledge of the conditions existing in the West warned the Tokugawa administration that continued isolation would be suicidal. In 1853 the law prohibiting the construction of sea-going ships was revoked and the Yedo government built at Uraga a sailing vessel of European type aptly called the "Phoenix" ("Hōo Maru"). In the same year Commodore Perry made his appearance, and thenceforth everything conspired to push Japan along the new path. The Dutch, who had been proximately responsible for the adoption of the seclusion policy in the 17th century, now took a prominent part in promoting a liberal view. They sent to the Tokugawa a present of a man-of-war and urged the vital necessity of equipping the country with a navy. Then followed the establishment of a naval college at Tsukiji in Yedo, the building of iron-works at Nagasaki, and the construction at Yokosuka of a dockyard destined to become one of the greatest enterprises of its kind in the East. The policy thus initiated by the Tokugawa was continued with increased energy after their downfall in 1867 and the restoration of the emperor to real power.

The various maritime carriers which had come into existence were made to amalgamate into one association called the *Nippon-koku yubin jōkisen kaisha* (Mail SS. Company of Japan), to which were transferred, free of charge, the steamers, previously the property of the Tokugawa or the feudatories, and a substantial subsidy was granted by the state. This, the first steamship company ever organized in Japan remained in existence only four years. Defective management and incapacity to compete with foreign-owned vessels plying between the open ports caused its downfall (1875). Already, however, an independent company had appeared upon the scene. Organized and controlled by a man (Iwasaki Yataro) of exceptional enterprise and business faculty, this *Mitsubishi kaisha* (three diamonds company, so called from the design on its flag), working with steamers chartered from the former feudatory of Tosa, to which clan Iwasaki belonged, proved a success from the outset, and grew with each vicissitude of the state. For when (1874) the Meiji government's first complications with a foreign country necessitated the despatch of a military expedition to Formosa, the administration had to purchase 63 foreign steamers for transport purposes, and these were subsequently transferred to the Mitsubishi company together with all the vessels (17) hitherto in the possession of the Mail SS. Company, the Treasury further granting to the Mitsubishi a subsidy of £50,000 annually. Shortly afterwards it was decided to purchase a service maintained by the Pacific Mail SS. Company with 4 steamers between Yokohama and Shanghai, and money for the purpose having been lent by the state to the Mitsubishi, Japan's first line of steamers to a foreign country was firmly established, just 20 years after the law interdicting the construction of ocean-going vessels had been rescinded.

A further purchase of foreign steamers was made in 1877 in connection with the suppression of the Satsuma rebellion, and these vessels, 10 in number, were handed over to the Mitsubishi, which, in 1880, found itself possessed of 32 ships aggregating 25,600 tons, whereas all the other vessels of foreign type in the country totalled only 27 with a tonnage of 6,500. In the following year the formation of a new company was officially promoted. It had the name of the *kyōdō unyu kaisha* (Union Transport Company); its capital was about a million sterling; it received a large subsidy from the state, and its chief purpose was to provide vessels for military uses and as commerce-carriers. Japan had now definitely embraced the policy of entrusting to private companies rather than to the state the duty of acquiring a fleet of vessels capable of serving as transports or auxiliary cruisers in time of war. But there was now seen the curious spectacle of two companies (the Mitsubishi and the Union Transport) competing in the same waters and both subsidized by the treasury. After this had gone on for four years, the two companies were amalgamated (1885) into the *Nippon yusen kaisha* (Japan Mail SS. Company) with a capital of £1,100,000 and an annual subsidy of £88,000, fixed on the basis of 8% of the capital. Another company had come into existence a few months earlier. Its fleet consisted of 100 small steamers, totalling 10,000 tons, which had hitherto been competing in the Inland Sea.

Japan now possessed a substantial mercantile marine, the rate of whose development is indicated by the following figures:—

Year	Steamers		Sailing vessels		Totals	
	Number	Tons	Number	Tons	Number	Tons
1870 . .	35	15,498	11	2,454	46	17,952
1892 . .	642	122,300	780	46,065	1,422	168,365

Nevertheless, only 23% of the exports and imports was transported in Japanese bottoms in 1892, whereas foreign steamers took 77%. This discrepancy was one of the subjects discussed in the first session of the Diet, but a bill presented by the government for encouraging navigation failed to obtain parliamentary consent, and in 1893 the Japan Mail SS. Company, without waiting for state assistance, opened a regular service to Bombay mainly for the purpose of carrying raw cotton from India to supply the spinning industry which had now assumed great importance in Japan. Thus the rising sun flag flew for the first time outside Far-Eastern waters. Almost immediately after the establishment of this line, Japan had to engage in war with China, which entailed the despatch of some two hundred thousand men to the neighbouring continent and their maintenance there for more than a year. All the country's available shipping resources did not suffice for this task. Additional vessels had to be purchased or chartered, and thus, by the beginning of 1896, the mercantile marine of Japan had grown to 899 steamers of 373,588 tons, while the sailing vessels had diminished to 644 of 44,000 tons. In the same year the Government, awake to the increasing menace of conflict with Russia on the mainland of Asia and determined in that event to be adequately supplied with transport facilities, passed, with the consent of the Diet, laws for the liberal encouragement of ship-building and navigation. The law for the encouragement of ship-building was abolished in 1920; that for navigation, after having been twice amended, still exists. According to this certain Japanese steamship companies are given mail

subsidies for maintaining regular services to various parts of the world on a 5 year contract. Ships entitled to this subsidy must be of over 3,000 tons, with a speed of 12 knots or more, and not over 15 years old. The subsidy itself is at the rate of a maximum of 50 sen (1s.) per 1,000 miles for a vessel of 12 knots speed and an additional 10% for every knot in excess of that limit. The effect of the legislation alluded to above was marked. In the period of six years ended 1902, no less than 835 vessels of 455,000 tons were added to the mercantile marine, and the treasury found itself paying encouragement money which totalled six hundred thousand pounds annually. Ship-building underwent remarkable development. Thus, while in 1870 only 2 steamers aggregating 57 tons had been constructed in Japanese yards, 53 steamers totalling 5,380 tons and 193 sailing vessels of 17,873 tons were launched in 1900. By the year 1907 Japan had 216 private shipyards and 42 private docks, and while the government yards were able to build first-class line-of-battle ships of the largest size, the private docks were turning out steamers of 9,000 tons burden. When war broke out with Russia in 1904, Japan had 567,000 tons of steam shipping, but that stupendous struggle obliged her to materially augment even this great total. In operations connected with the war she lost 71,000 tons, but on the other hand, she built 27,000 tons at home and bought 177,000 abroad, so that the net increase to her mercantile fleet of steamers was 133,000 tons. At that time Japan was practically still in her infancy as a maritime carrying power; but she has since then made great strides, and in 1927 the gross total of her steamer tonnage was well over 3 million tons and that of her sailing-ship tonnage over a million tons. During the Great War her shipping was able, thanks to her remoteness from the scene of conflict and to the preoccupation of the Allied Powers, to reap a very rich harvest. The following table shows the growth of the mercantile marine during the last 20 years:—

Year	Steamers		Sailing vessels		Total	
	No.	Gross tonnage	No.	Gross tonnage	No.	Gross tonnage
1905 . .	1,988	939,749	4,132	336,571	6,170	1,276,320
1925 . .	7,323	3,546,941	40,679	1,369,560	48,002	4,916,501

These figures do not include steam-vessels which are not registered or sailing-ships of "koku" burden.

The principal shipping companies are the Nippon Yūsen Kaisha (605,548 tons gross), the Ōsaka Shōsen Kaisha (459,588 tons gross), the Kukusui Kisen Kaisha (259,850 tons gross), the Tōyō Kisen Kaisha (58,367 tons gross), now run by the Nippon Yusen Kaisha, the Kawasaki Steamship Co. (211,166 tons gross), the Mitsui Bussan Kaisha (101,844 tons gross) and the Kinkai Yusen Kaisha (104,415 tons gross).

The total number of seamen in 1925 was 4,379,615, of whom 3,496,066 were employed on steamships and 883,549 on sailing vessels. The number of Japanese qualified officers in the same year was 56,813. Originally quite a number of foreigners, mostly British subjects, were employed by Japanese steamship companies either as navigating officers or engineers; but in 1925 there were only 132—all engineers.

In accordance with a resolution passed at the International Labour Congress of 1926 a Japan Shipping Union was established in the winter of that year to act as a seamen's employment agency and generally to attend to their interests. This took the place of the former Japan Seamen's Relief Society, and the expense of its maintenance is borne in suitable proportions by the Government, shipowners and seamen themselves.

Maritime Administration.—The duty of overseeing all matters relating to the maritime carrying trade devolves on the Ministry of State for Communications, and is delegated by the latter to one of its bureaus (the *Kwansen-kyoku,* or ships superintendence bureau), which, again, is divided into three sections: one for inspecting vessels, one for examining mariners and one for the general control of all shipping in Japanese waters. For the better discharge of its duties this bureau parcels out the empire into 4 districts, having their headquarters at Tōkyō, Osaka, Nagasaki and Hakodate; and these four districts are in turn subdivided into 18 sections, each having an office of marine affairs (*kwaiji-kyoku*).

Japan now stands third on the list of the principal maritime countries of the world.

Open Ports.—There are 41 ports in Japan open as places of call for foreign ships. The principal of these (with the dates of their opening in brackets) are Yokohama (1859), Kobe (1868), Osaka (1899), Dairen (1906), Nagasaki (1859), Shimonoseki (1899), Moji (1899), Ōtaru (1899), Muroran (1899), Hakodate (1865), Yokkaichi (1899), Tsuruga (1899), Karatsu (1899), Kuchinotsu (1899), Keelung (1899), Tamsui (1899), Niigata (1867), Aomori (1906), Kushiro (1899), Takow (1899), and Anping (1899), Chemulpho (1883), and Fusan (1883).

Emigration.—Although the Japanese are by nature an adventurous race it can hardly be said that they make perfect material as colonists. There are wide spaces in their own North Island which have long been awaiting development; but it appears singularly difficult to find settlers to migrate to them. Hopes too were expressed after the Russo-Japanese war that South Manchuria would become an attractive field for the colonist. But this has not proved to be the case. Small traders have certainly flocked there in numbers; but agriculturists practically not at all. There are various explanations for this phenomenon. In the first place while the Japanese thrives in countries in which the standard of living is higher than his own he cannot do so in countries in which it is lower. In Manchuria in consequence he is quite unable to compete with the hardy Northern Chinese. Again, to the vast majority of Japanese farming means the cultivation of rice,—a cereal for which neither Manchuria nor the Hokkaido is really suited. Moreover, the Japanese does not like extremes of temperature, for which reason neither the bitter cold of the Hokkaido and Manchuria in the north nor the moist heat of Formosa in the south is really to his taste. He flourishes best in temperature of moderately warm regions,—North America for instance. But in such places a disposition to exclude him frequently manifests itself, in the form of legislation or otherwise. For this racial prejudice is partly responsible, the Japanese being for various reasons not easily assimilable; but economic causes are an equally important factor. Native labour looks at him with an unfriendly eye because it fears that his superior industry and his lower standard of living will work to its own prejudice. Whatever the causes, there is no question that the result is a blow to Japanese pride; but since one nation cannot force its society on another at the point of the sword, this anti-Asiatic prejudice has to be respected.

The following figures show the number of Japanese living abroad in 1926:—

Liaotung leased territory	93,354
China	147,263
Straits Settlements	6,964
Philippine Islands	9,807
Dutch East Indies	4,533
Europe	3,360
United States	133,605
Canada	19,885
Mexico	4,018
Brazil	55,481
Peru	11,786
Argentine	2,731
Australia	3,752
Sandwich Islands	127,951
Other countries	15,609
Total	640,099

Foreign Residents.—The total number of foreigners residing in Japan in 1926 was 31,140, of whom 22,272 were Chinese. The chief other nationalities represented were:—

British (including British Indians)	2,460
U.S. citizens	2,134
Germans	1,139
French	461

There are also small numbers of Dutch, Swiss, Italians, Danes, Portuguese, Norwegians, etc.

Posts and Telegraphs.—The government of the Restoration did not wait for the complete abolition of feudalism before

administration, in pursuance of a policy of isolation, interdicted the construction of ocean-going ships, and the people's enterprise in the matter of deep-sea fishing suffered a severe check. But shortly after the Restoration in 1867, not only was this veto rescinded, but also the government, organizing a marine bureau and a marine products examination office, took vigorous measures to promote pelagic industry. Then followed the formation of the marine products association under the presidency of an imperial prince. Fishery training schools were the next step; then periodical exhibitions of fishery and marine products; then the introduction and improvement of fishing implements; and then by rapid strides the area of operations widened until Japanese fishing boats of improved types came to be seen in Australasia, in Canada, in the seas of Sakhalin, the Maritime Province, Korea and China; in the waters of Kamchatka and in the Sea of Okhotsk. Considerable progress has also been made in the artificial rearing of eels, shellfish, snapping turtles, and salmonidae. Pelagic fishing is encouraged by the grant of small subsidies to owners of fishing craft of the type approved under the Pelagic Fishery Encouragement Law. The fishing population in 1925 numbered close on 1,200,000, of whom 620,000 were regular fishermen by calling and over 490,000 what is called "occasional" fishermen, that is persons having some other calling in addition to fishing. In 1893, the total value of Japanese marine products and fish captured did not exceed 1¼ millions sterling, whereas in 1925 the figure had grown to over 18 millions. Fourteen kinds of fish represent more than 50% of the whole catch, namely (in the order of their importance) bonito (*katsuo*), sardines (*iwashi*), pagrus (*tai*), cuttle-fish and squid (*tako* and *ika*), mackerel (*saba*), yellow tail (*buri*), tunny-fish (*maguro*), prawns (*ebi*), sole (*karei*), grey mullet (*bora*), eels (*unagi*), salmon (*shake*), sea-ear (*awabi*) and carp (*koi*). Altogether 700 kinds of aquatic products are known in Japan, and 400 of them constitute articles of diet. Among manufactured aquatic products the chief are dried bonito, fish guano, dried cuttle-fish, dried and boiled sardines, dried herring, salt and smoked salmon and dried prawns. The export of marine products amounted in 1926 to 23 million pounds in value as against nine hundred thousand in 1906. China is the chief market. With the extension of the fisheries in the north, particularly along the Siberian littoral, where the Japanese hold valuable fishing rights from the Soviet Government, there has been of recent years a great development in the fishing industry, particularly as regards various forms of salmonidae. Considerable quantities of shellfish are caught and tinned, and Japanese tinned crab is now well known in the markets of Europe and the United States.

Minerals.—Crystalline schists form the axis of Japan. They run in a general direction from south-west to north-east, with chains starting east and west from Shikoku. On these schists rocks of every age are superimposed, and amid these somewhat complicated geological conditions numerous minerals occur. Precious stones, however, are not found, though crystals of quartz and antimony as well as good specimens of topaz and agate are not infrequent.

Gold occurs in quartz veins among schists, paleozoic or volcanic rocks and in placers; but the quantity obtained is not large. Its value for 1926 was about £1,200,000.

The value of the silver mined is approximately equal to that of the gold. It is found chiefly in volcanic rocks (especially tuff), in the form of sulphide, and it is usually associated with gold, copper, lead or zinc.

Much more important in Japan's economics than either of the precious metals is copper. Veins often showing a thickness of from 70 to 80 ft., though of poor quality (2 to 8%), are found bedded in crystalline schists or paleozoic sedimentary rocks, but the richest (10 to 30%) occur in tuff and other volcanic rocks.

Notwithstanding careful and prolonged search no evidences have been found that Japan is rich in iron ores. Her largest known deposit (magnetite) occurs at Kamaishi in Iwate prefecture, but the quantity of pig-iron produced from the ore mined there does not exceed 37,000 tons annually, and Japan is obliged to import from the neighbouring continent the greater part of the iron needed by her for ship-building and armaments. Of recent years the Government has done its best in various ways to protect and encourage the iron industry; but notwithstanding the big demand in the country for pig-iron and steel, the native product is still unable to compete with that coming from India and the United States. Considerable deposits of coal, mainly bituminous are found in Kyūshū, the Hokkaido, and in the provinces of Iwaki and Hitachi in the Main Island. There were in existence in 1925 ninety-one coal mining companies with a paid-up capital of about 26 million pounds; mines in actual operation numbered 573, and the quantity of coal produced was over 31 million metric tons. Large quantities are also mined yearly in the coal-fields about Fushur in Manchuria, which came into Japan's possession after the war with Russia in 1905.

Petroleum.—Petroleum, but not of a very high quality, is found in the provinces of Echigo and Akita, on the coast of the Sea of Japan. It was not, however, till 1900 that these deposits attracted much attention, and fears are now expressed that they are being exhausted. There is certainly a steady diminution in the annual output. In 1922 this amounted to over 71 million Imperial gallons; but in 1926 it had decreased to about 50 million gallons.

Mines.—The total number of mines in operation at the end of 1926 was 1,195, coal and petroleum representing nearly two-thirds, the number of miners employed was 293,562, and the value of the minerals and metals produced close on 43 million pounds.

The following table shows the progress of the mining industry during the last 20 years:

	1906		1926	
	Quantity	Value	Quantity	Value
		£		£
Gold . . oz.	90,842	363,715	292,290	1,303,314
Silver . . ,,	2,623,212	243,914	4,285,897	437,518
Copper . . tons	37,254	3,007,992	66,608	5,182,435
Lead . . ,,	2,721	49,690	3,545	126,424
Iron . . ,,	85,203	268,911	492,808*	1,073,830
Steel . . ,,	..	..	790,735†	8,394,635
Antimony . ,,	293	22,862	..	..
Coal . . ,,	12,980,103	6,314,400	31,426,549†	23,585,565
Sulphur . . ,,	27,406	61,386	47,775† / 47,292† (ore)	263,902 / 33,564
Petroleum . gal.	55,135,880	314,550	59,419,186	1,527,549
Manganese . tons	12,322	51,365	..	..
Others . . .	..	41,338	..	43,482,840
Total values .	..	10,740,123	..	85,411,576

*Including iron pyrites, 487,000 tons.
†Metric tons.

Industries.—In the beginning of the Meiji era Japan was practically without any manufacturing industries, as the term is understood in the Occident, and she had not so much as one joint-stock company. At the end of 1925, her joint-stock companies and partnerships totalled 34,345, their paid up capital exceeded 1,115 millions sterling, and their reserves totalled over 249 millions. The number of co-operative societies in existence in the same year was 14,517. It is not to be inferred, however, from the absence of manufacturing organizations 50 years ago that such pursuits were deliberately eschewed or despised in Japan. On the contrary, at the very dawn of the historical epoch we find that sections of the people took their names from the work carried on by them, and that specimens of expert industry were preserved in the sovereign's palace side by side with the imperial insignia. Further, skilled artisans from the neighbouring continent always found a welcome in Japan, and when Korea was successfully invaded in early times, one of the uses which the victors made of their conquest was to import Korean weavers and dyers. Subsequently the advent of Buddhism, with its demand for images, temples, gorgeous vestments and rich paraphernalia, gave a marked impulse to the development of artistic industry, which at the outset took its models from China, India and Greece. From the 9th century luxurious habits prevailed in Kyōto under the sway of the Fujiwara regents, and the imperial city's munificent patronage drew to its precincts a crowd of artisans. But these were not

industrials, in the Western sense of the term, and, further, their organization was essentially domestic, each family selecting its own pursuit and following it from generation to generation without co-operation or partnership with any outsider. The establishment of military feudalism in the 12th century brought a reaction from the effeminate luxury of the metropolis, and during nearly 300 years no industry enjoyed large popularity except that of the armourer and the sword-smith. No sooner, however, did the prowess of Oda Nobunaga and, above all, of Hideyoshi, bring within sight a cessation of civil war and the unification of the country, than the taste for beautiful objects and artistic utensils recovered vitality. By degrees there grew up among the feudal barons a keen rivalry in art industry, and the Shōgun's court in Yedo set a standard which the feudatories constantly strove to attain. Ultimately, in the days immediately antecedent to its fall, the Shōgun's administration sought to induce a more logical system by encouraging local manufacturers to supply local needs only, leaving to Kyōto and Yedo the duty of catering to general wants.

But before this reform had approached maturity, the second advent of Western nations introduced to Japan the products of an industrial civilization centuries in advance of her own from the point of view of utility, though nowise superior in the application of art. Immediately the nation became alive to the necessity of correcting its own inferiority in this respect. But the people being entirely without models for organization, without financial machinery and without the idea of joint stock enterprise, the government had to choose between entering the field as an instructor, and leaving the nation to struggle along an arduous and expensive way to tardy development. There could be no question as to which course would conduce more to the general advantage, and thus, in days immediately subsequent to the resumption of administrative power by the Emperor, the spectacle was seen of official excursions into the domains of silk-reeling, cement-making, cotton and silk spinning, brick-burning, printing and book-binding, soap-boiling, type-casting and ceramic decoration, to say nothing of their establishing colleges and schools where all branches of applied science were taught. Domestic exhibitions also were organized, and specimens of the country's products and manufactures were sent under government auspices to exhibitions abroad. Steps were also taken for training women as artisans, and the government printing bureau set the example of employing female labour, an innovation which soon developed large dimensions. In short, the authorities applied themselves to educate an industrial disposition throughout the country, and as soon as success seemed to be in sight, they gradually transferred from official to private direction the various model enterprises, retaining only such as were required to supply the needs of the state.

The result of all this effort was that, whereas at the beginning of the Meiji era, Japan had virtually no industries worthy of the name, she possessed in 1896,—that is to say, after an interval of 25 years of effort,—no less than 4,595 industrial and commercial companies with a paid-up capital of 40 millions sterling. To-day, as has already been said, her companies number over 34,000 with a paid-up capital of 1,115 millions sterling. What effect this development has exercised on the country's over-seas trade may be inferred from the fact that, whereas in 1870 there were no manufactured goods to export, in 1901 8 million pounds worth were sent abroad, and that in 1925 the total value of the export trade amounted to over 230 million pounds, of which over 41% represented fully manufactured goods and about 50% goods partly manufactured.

The following table gives the values of some of the more important manufactured articles exported in 1926:

	£
Marine Products	2,314,124
Sugar and Sweetmeats	3,731,928
Beverages and Comestibles	4,033,715
Drugs, Chemicals, etc.	4,787,800
Silk Tissues, Yarns, etc.	90,831,594
Cotton Tissues, Yarns, etc.	50,993,903
Porcelain, Earthenware, Glass	4,842,943
Clothing	6,537,365

Japan's chief markets at present are in the Far East, and it is her proximity to them, the abundance of cheap and comparatively efficient labour she possesses, and in certain directions, particularly the cotton trade, better organization in marketing her goods, which give her an advantage over Occidental competitors. It has been said that the advantage derived from cheap labour is not likely to be permanent owing to the continuous increase in the price of labour and the cost of living. There is force in this contention. In 1890 the average daily wage of an ordinary labourer was about 6d, in 1900 it was a little over a shilling, in 1921 it was about 1s. 10d., and in 1926 it was about 25·3d. The cost of living has also increased enormously, but not in the same proportion. Another disquieting feature is that labour is becoming more articulate and less disposed to allow itself to be exploited. On the other hand it must be remembered that if wages and the cost of living have increased enormously in Japan, the same thing has happened in other countries since the Great War and also that as far as the cotton industry is concerned, the majority of the operatives are women, whose scale of wages is still very low and probably less likely to increase at the same rate as that of male operatives. That conditions, however, are become less inviting, for the manufacture of cotton goods, would seem fairly clear from the fact that a tendency is now manifest to transfer spinning enterprises to China, where labour is still really cheap. In 1926 there were, for instance, nearly a million and a half spindles working in Japanese-owned mills in that country. Nevertheless on the whole Japanese industries seem to have a promising future before them. The nation is full of energy and determination, there are abundant supplies of coal, and steps are being taken to utilize the excellent opportunities which the country offers for developing electricity by water power.

The official returns for 1925 show that the total number of factories in Japan was 49,161, and the number of operatives employed in them 1,808,381, of whom 852,554 were male hands and 955,827 female. By far the largest number were to be found in textile factories, where 972,631 were employed. Machine and tool factories followed next with 224,177. The mean average daily wages for operatives in that year were yen 1·94 (3s. 10d.) for male hands and yen 0·96 (1od.) for female, while the mean average working hours were 10·34 during the second half of the year.

Commerce in Tokugawa Times.—The conditions existing in Japan during the two hundred and fifty years prefatory to the modern opening of the country were unfavourable to the development alike of national and of international trade. As to the former, the system of feudal government exercised a crippling influence, for each feudal chief endeavoured to check the exit of any kind of property from his fief, and free interchange of commodities was thus prevented so effectually that cases are recorded of one feudatory's subjects dying of starvation while those of an adjoining fief enjoyed abundance. International commerce, on the other hand, lay under the veto of the central government, which punished with death anyone attempting to hold intercourse with foreigners. Thus the fiefs practised a policy of mutual seclusion at home, and united to maintain a policy of general seclusion abroad. Yet it was under the feudal system that the most signal development of Japanese trade took place, and since the processes of that development have much historical interest they invite close attention.

As the bulk of a feudal chief's income was paid in rice, arrangements had to be made for sending the grain to market and transmitting its proceeds. This was effected originally by establishing in Osaka stores (*kura-yashiki*), under the charge of samurai, who received the rice, sold it to merchants in that city and remitted the proceeds by official carriers. But from the middle of the 17th century these stores were placed in the charge of tradesmen to whom was given the name of *kake-ya* (agent). They disposed of the products entrusted to them by a fief and held the money, sending it by monthly instalments to an appointed place, rendering yearly accounts and receiving commission at the rate of from 2 to 4%. They had no special licence, but they were honourably regarded and often distinguished by an official title or an hereditary pension. In fact a kake-ya, of such standing as the Mitsui and the

Konoike families, was, in effect, a banker charged with the finances of several fiefs. In Osaka the method of sale was uniform. Tenders were invited, and these having been opened in the presence of all the store officials and kake-ya, the successful tenderers had to deposit bargain-money, paying the remainder within ten days, and thereafter becoming entitled to take delivery of the rice in whole or by instalments within a certain time, no fee being charged for storage. A similar system existed in Yedo, the shōgun's capital. Out of the custom of deferred delivery developed the establishment of exchanges where advances were made against sale certificates, and purely speculative transactions came into vogue. There followed an experience common enough in the West at one time: public opinion rebelled against these transactions in margins on the ground that they tended to enhance the price of rice. Several of the brokers were arrested and brought to trial; marginal dealings were thenceforth forbidden, and a system of licences was inaugurated in Yedo, the number of licensed dealers being restricted to 108.

The system of organized trading companies had its origin in the 12th century, when, the number of merchants admitted within the confines of Yedo being restricted, it became necessary for those not obtaining that privilege to establish some mode of co-operation, and there resulted the formation of companies with representatives stationed in the feudal capital and share-holding members in the provinces. The Ashikaga shōguns developed this restriction by selling to the highest bidder the exclusive right of engaging in a particular trade, and the Tokugawa administration had recourse to the same practice. But whereas the monopolies instituted by the Ashikaga had for sole object the enrichment of the exchequer, the Tokugawa regarded it chiefly as a means of obtaining worthy representatives in each branch of trade. The first licences were issued in Yedo to keepers of bath-houses in the middle of the 17th century. As the city grew in dimensions these licences increased in value, so that pawnbrokers willingly accepted them in pledge for loans. Subsequently almanack-sellers were obliged to take out licences, and the system was afterwards extended to money-changers.

It was to the fishmongers, however, that the advantages of commercial organization first presented themselves vividly. Early in the 17th century one Sukegoro of Yamato province went to Yedo, where the greatest fish market in Japan exists, and organized the fishmongers of the city into a great guild. He contracted for the sale of all the fish obtained in the neighbouring seas, advanced money to the fishermen on the security of their catch, constructed preserves for keeping the fish alive until they were exposed in the market, and enrolled all the dealers in a confederation which ultimately consisted of 391 wholesale merchants and 246 brokers. The main purpose of Sukegoro's system was to prevent the consumer from dealing direct with the producer. Thus in return for the pecuniary accommodation granted to fishermen to buy boats and nets they were required to give every fish they caught to the wholesale merchant from whom they had received the advance; and the latter, on his side, had to sell in the open market at prices fixed by the confederation. A somewhat similar system applied to vegetables, though in this case the monopoly was never so close.

It will be observed that this federation of fishmongers approximated closely to a trust, as the term is now understood; that is to say, an association of merchants engaged in the same branch of trade and pledged to observe certain rules in the conduct of their business as well as to adhere to fixed rates. The idea was extended to nearly every trade, 10 monster confederations being organized in Yedo and 24 in Osaka. These received official recognition, and contributed a sum to the exchequer under the euphonious name of "benefit money," amounting to nearly £20,000 annually. They attained a high state of prosperity, the whole of the cities' supplies passing through their hands. The guild system extended to maritime enterprise also. In the beginning of the 17th century a merchant of Sakai (near Osaka) established a junk service between Osaka and Yedo, but this kind of business did not attain any considerable development until the close of that century, when 10 guilds of Yedo and 24 of Osaka combined to organize a marine-transport company for the purpose of conveying their own merchandise. Here also the principle of monopoly was strictly observed, no goods being shipped for unaffiliated merchants. This carrying trade rapidly assumed large dimensions, and the number of junks entering Yedo rose to over 1,500 yearly.

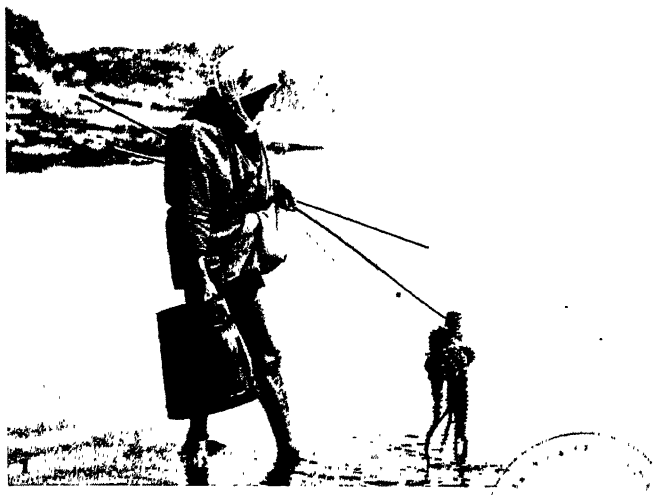
Operations relating to the currency also were brought under the control of guilds. The business of money-changing was originally in the hands of pedlars; but in the early part of the 17th century exchanges were opened in Yedo, and in 1718 the men engaged in this business formed a guild, six hundred of them receiving licences, and no unlicensed person being permitted to purchase the avocation. The rates of exchange were fixed daily by representatives of the guild in consultation with, or with the approval of, the shōgun's officials.

The exchanges in their ultimate form approximated very closely to the Occidental idea of banks. They not only bought gold, silver and copper coins, but they also received money on deposit, made loans and issued vouchers which played a very important part in commercial transactions. The voucher system did not, however, obtain official recognition until 1636, when the third Tokugawa shōgun selected 30 substantial merchants and divided them into 3 guilds, each authorized to issue vouchers, provided that a certain sum was deposited by way of security. Such vouchers were obviously a form of bank-note, and the advantages of the system were so obvious that ultimately it was adopted by the Tokugawa Government, which appointed a number of the members of the guild to act as its bankers subject to certain specified conditions and with certain privileges. A similar state of affairs ruled in Osaka, a city which has always exhibited a remarkable aptitude for trade. In this way a regular system of banking was gradually evolved, with the result that in the middle of the 18th century in Osaka bills of exchange, promissory notes, storage delivery orders, deposit notes redeemable on the demand or order of an indicated person, and various descriptions of money orders were being issued. Storage delivery orders passed current as readily as coin and advances could always be obtained against them from pawn brokers.

All these documents, indicating a well-developed system of credit, were duly protected by law, severe penalties being inflicted for any failure to implement the pledges they embodied. This system, which in its various ramifications was practically a trust in favour of the more important merchants in Yedo and Osaka, resulted, as was inevitable, in the acquisition of great wealth by those interested in it. This in its turn led to habits of gross extravagance and luxury, and popular feeling against the so-called "official merchants" who, under government auspices, monopolized every branch of trade, ultimately became so strong that finally, in 1841 the guilds were dissolved, the trading privileges which "official merchants" had enjoyed withdrawn, and it was declared that henceforth every person should be free to engage in commerce without let or hindrance.

This recklessly drastic measure, vividly illustrating the arbitrariness of feudal officialdom, not only included the commercial guilds, the shipping guilds, the exchange guilds and the land transport guilds, but was also carried to the length of forbidding any company to confine itself to wholesale dealings. The authorities further declared that in times of scarcity wholesale transactions must be abandoned altogether and retail business alone carried on, their purpose being to bring retail and wholesale prices to the same level. The custom of advancing money to fishermen or to producers in the provincial districts was interdicted, and even the bath-house keepers and hairdressers were forbidden to combine for the purpose of adopting uniform rates of charges. But this ill-judged interference produced evils greater than those it was intended to remedy, and ten years' experience showed that a modified form of the old system would conduce to public interests. The guilds accordingly were reestablished; but licence fees were abolished, and no limit was set to the number of firms in a guild. Things remained thus until the beginning of the Meiji era (1867), when the guilds shared the cataclysm that overtook all the country's old institutions.

It will be apparent from the above that commercial transactions on a large scale in pre-Meiji days were practically limited to the













BY COURTESY OF (1, 3) CANADIAN PACIFIC STEAMSHIPS, (2) HENRY MILLER, (4, 6) HERBERT G. PONTING, F.R.P.S., (5) THE NATIONAL BOARD OF THE Y.W.C.A.

ASPECTS OF LIFE IN JAPAN

1. Fisherman with a newly-caught octopus. Note characteristic loose robes
2. Memorial service for victims torpedoed on a transport in the Russo-Japanese War
3. Women (near Shizuoka) picking tea
4. Abbot of Buddhist temple at Ikegami, where the Buddhist Saint, Nichiren, died
5. The bow, a ceremony requiring long training
6. An avenue of torii (gateways) at a Temple



BY COURTESY OF THE CONSULATE GENERAL OF JAPAN, NEW YORK

NATURAL SCENERY IN JAPAN

1. Amanchashidate or "Heavenly Bridge," a sand bar nearly two miles in length, covered with pine trees, at the mouth of Miazuru Bay on the west coast of Japan. It is one of the "Scenic Trio of Japan," the others being Matshushima and Miyajima (fig. 9). 2. Tomona Ura, a small fishing port of Seto Island on the Inland Sea. 3. The shore of Setonaikai, the inland sea of Japan, near the city of Tomonutsu. A shrine or small temple is situated at the edge of the cliff. 4. Poling the rapids on the Kiso River. 5. Fujiyama, the most celebrated of Japanese volcanic peaks, rising to a height of 12,395 ft., with a crater from 500 to 600 ft. deep. The last recorded eruption was in the latter part of 18th century. It is regarded as a sacred mountain, and many pilgrims make the ascent each year. 6. Ranzan, near Kyoto, as it appears in spring time with cherry trees in full bloom (background). 7. Herds of tame deer in the temple park at Nara, near Osaka. 8. Hakone Lake, a resort near Yokohama, famous for its hot springs. 9. Shrine island on the Inland Sea (*see* fig. 3). The pavilions, in which dancing festivals are held, are built at the level of high tide, so that they appear to be floating on surface of the water

two great cities of Yedo and Osaka, the people in the provincial fiefs having no direct association with the guild system, confining themselves, for the most part, to domestic industries on a small scale, and not being allowed to extend their business beyond the boundaries of the fief to which they belonged.

Foreign Commerce During the Meiji Era.—If Japan's industrial development in modern times has been remarkable, the same may be said even more emphatically about the development of her over-sea commerce. This was checked at first not only by the unpopularity attaching to all intercourse with outside nations, but also by embarrassments resulting from the difference between the silver price of gold in Japan and its silver price in Europe, the precious metals being connected in Japan by a ratio of 1 to 8, and in Europe by a ratio of 1 to 15. This latter fact was the cause of a sudden and violent appreciation of values; for the government, seeing the country threatened with loss of all its gold, tried to avert the catastrophe by altering and reducing the weights of the silver coins without altering their denominations, and a corresponding difference exhibited itself, as a matter of course, in the silver quotations of commodities. Another difficulty was the attitude of officialdom. During several centuries Japan's over-sea trade had been under the control of officialdom, to whose coffers it contributed a substantial revenue. But when the foreign exporter entered the field under the conditions created by the new system, he diverted to his own pocket the handsome profit previously accruing to the government; and since the latter could not easily become reconciled to this loss of revenue, or wean itself from its traditional habit of interference in affairs of foreign commerce, and since the foreigner, on his side, not only desired secrecy in order to prevent competition, but was also tormented by inveterate suspicions of Oriental espionage, not a little friction occurred from time to time. Thus the scanty records of that early epoch suggest that trade was beset with great difficulties, and that the foreigner had to contend against most adverse circumstances, though in truth his gains amounted to 40 or 50%.

Japan is not a country rich in natural resources or in mineral wealth, if coal and copper are excepted, and such articles as she manufactured in the days of her seclusion were not of a nature to command a market abroad. Her position, therefore, when she reentered the comity of nations, was not promising. She was dependent on foreign countries for practically all manufactured goods, such, for instance, as flour, sugar, leather, medicines, dyes, paints, hardware, drapery, machinery, etc.—and all she had to offer in exchange was some silk, tea, porcelain, curios, copper and marine products. The last found a ready market in China; tea was equally successful in the United States, and a keen demand sprang up immediately in Europe for her raw silk, which happened to be available for export at a moment when the production of that article in France and Italy had been considerably curtailed by the appearance of disease in the European silkworm. These articles and copper were practically all the foreign merchant wanted to buy. But the statesmen in charge of Japan's destinies were farsighted and ambitious for the progress of their country, and, seeing the disadvantage under which Japanese merchants were labouring, they started manufacturing enterprises and commercial undertakings under official management, handing them over to private enterprise when a satisfactory advance had been made. Progress was naturally slow at first, as may be seen from the fact that the export trade of the country, which amounted to only about 1½ million pounds sterling in 1870 had increased to little more than 5½ millions in 1890. There were two main reasons for this tardy advance. Several years necessarily elapsed before the nation's material condition began to respond perceptibly to the improvements effected by the Restoration government in matters of taxation, administration, and transport facilities. Financial burdens had been reduced and security of property and life obtained; but railway building and road-making, harbour construction, the growth of posts, telegraphs, exchanges and banks, and the development of a mercantile marine did not begin to exercise a sensible influence on the nation's prosperity till about 1885. It was then that a period of steadily growing prosperity began, and it was then that private enterprise may be said to have started finally upon a career of independent activity. How enormous has been the progress made since then may be seen on reference to the values of the export trade in 1910 and 1920, which were respectively 46 and 195 million pounds sterling. The articles Japan imported in 1870,—flour, sugar, leather, dyes, paints, hardware, clothing, etc.—she now exports herself, and, whereas, 30 years ago she was a good customer for Lancashire cotton piece goods and the like, she now not only does not import them but is competing with them vigorously in the Chinese market and with Indian cotton goods in that of India. The same is true of many other commodities, and although her products may frequently be inferior to those of Europe or America, their greater cheapness appeals to customers to whom price is of more importance than quality. The phenomenal difference between the figures for 1910 and 1920 is partly accounted for by the appreciation in values and by the fact that during the World War Japan was able, owing to the preoccupation of the other nations more directly engaged in the conflict, to extend her markets enormously. But this advantage she has not been able to maintain in peace, and she herself has for some years past been suffering from severe commercial depression and from financial crisis, with the result that the value of her export trade in 1926 was only about 9 million pounds sterling higher than it was in 1920. Nevertheless an increase from 46 millions in 1910 to 205 millions in 1926 is remarkable. Pari passu with this increase in the export trade there has been a corresponding increase in the import, a fact which causes considerable anxiety in many quarters. But reference to official statistics will show that a very large proportion of these imports is represented by raw material, partly manufactured goods or machinery,—the last to be used itself for productive purposes. The following figures show the periods during which either imports or exports have been in excess:—

1868–82. Imports: material was being purchased for industrial development.

1883–95. Exports: home industries were developing, and silver had fallen in value.

1896–1913. Imports: this was a period of inflation and of national extravagance after the war with China.

1914–18. Exports: this was the period of the World War.

1919–27. Imports: the war markets had been lost; the period was one of general commercial depression; and the nation had suffered enormous losses owing to the earthquake of 1923.

It is estimated that the total excess of imports over exports for 60 years amounts to over 261 million pounds sterling. In connection with the phenomenal commercial and industrial progress of Japan the following comments, taken from a Report prepared at the British Embassy in Tōkyō on economic conditions in Japan, are worthy of attention:—

"By external circumstances and by the ambitious temperament of her own people, Japan has been obliged to attempt to compress into a few decades an economic development which most other industrialized countries have spread over at least a century. This late and concentrated development has been of advantage to her in some respects, because she has been able to profit by knowledge gained by her rivals in long and often painful processes of trial and error. In other respects it has operated to her disadvantage, because there is certain necessary knowledge which can be acquired only by experience. The economic history of Japan in the past few years provides a striking illustration of this truth. Where the prime essentials are energy and technical knowledge she has made rapid progress, as is evident to anybody who compares the volume and range of her manufactures to-day and 20 years ago. But where advance depends not only upon the skill and knowledge of the leaders, but also on such imponderable elements as the commercial and financial experience of the community as a whole, success has not been so uniform; and this is only too plainly apparent from the series of financial upheavals which have marked the period from 1920 to the present time."

Japan's trade with the outer world was built up chiefly by the energy and enterprise of the foreign middleman. He acted the part of an almost ideal agent. As an exporter, his command of cheap capital, his experience, his knowledge of foreign markets, and his connections enabled him to secure sales such as must have

been beyond reach of the Japanese working independently. Moreover, he paid to native consumers ready cash for their staples, taking upon his own shoulders all the risks of finding markets abroad. As an importer, he enjoyed, in centres of supply, credit which the Japanese lacked, and he offered to native consumers foreign produce brought to their doors with a minimum of responsibility on their part. Finally, whether as exporters or importers, foreign middlemen always competed with each other so keenly that their Japanese clients obtained the best possible terms from them. It has, however, always been the aim of the Japanese to dispense with his help and to deal directly themselves with the foreign producer, and they have worked hard for the attainment of this object during many years. It must be admitted that a great measure of success has attended their efforts and that the middleman, so familiar a figure in the open ports in the early days of Japan's intercourse with foreign countries, is now slowly but surely disappearing.

Trade with Various Countries.—The following is a list of the countries most interested in trade with Japan, with the values in round numbers of her exports to and imports from them in 1926.

	Exports	Imports
	£	£
United States	87,880,000	69,436,000
China	43,060,000	24,440,000
British India	15,920,000	39,928,000
Dutch East Indies	7,630,000	10,522,000
Great Britain	6,073,000	17,382,000
Hongkong	5,407,000	104,000
Germany	830,000	14,824,000
Australia	5,268,000	13,107,000
France	4,329,000	2,594,000
Straits Settlements	4,236,000	4,070,000
Canada	2,526,000	6,532,000
Egypt	2,358,000	3,262,000

Kobe has now the first place in the matter of foreign trade; Osaka the second, and Yokohama the third.

The total tonnage of the steamships which entered the various ports of Japan from abroad during 1926 was 49,186,029 tons, of which 31,873,523 tons represented Japanese shipping, 9,363,245 British and 3,960,342 American.

According to the "Financial and Economic Annual of Japan" the invisible trade of Japan for the years 1923–25 is estimated to be as follows:—

	1923	1924	1925
	£	£	£
Invisible exports (assets)	95,300,000	120,800,000	81,100,000
Invisible imports (liabilities)	56,800,000	78,900,000	60,000,000

National Debt.—The total amount of the National Debt of Japan in March 1927 was a little over 503 million pounds sterling, of which about 354 million pounds represented internal loans and 149 million external loans.

The Labour Movement.—The earliest labour organization in Japan is believed to have come into existence in 1890, when the printers formed an association called the Doshikwai (Community of Sentiment Society). This was followed in 1898 by a somewhat similar organization among railway employees. In each case the objects aimed at were the improvement of working conditions and wages and the securing of a greater measure of freedom. But both were small and of no importance, and it was not till the Yuaikwai (Labourers' Friendly Society) was formed in 1912 that the Labour movement can be said really to have started in Japan. Even the Yuaikwai was only a fore-runner of the real trade-union. Its membership, compared with the numerical strength of the class it was supposed to represent, was paltry,—not more than 50,000, and, although its President, Mr. Bunji Suzuki, was a genuine representative of Labour, capitalists also lent the society their support and patronage, hoping, apparently, that by adopting a conciliatory attitude they might succeed in guiding the movement into moderate channels. The Yuaikwai had been in existence hardly two years when the World War broke out, and it was from this moment that Labour became truly articulate in Japan. As has been said elsewhere, the greater part of the rest of the world was, or eventually became, so preoccupied with the conflict that it had neither leisure nor means to attend to the ordinary affairs of commerce, with the result that an extraordinary demand was made on Japan,—more fortunately situated, by reason of her remoteness,—for manufactured goods of all descriptions. This gave Labour an opportunity of which it was quick to avail itself. Higher wages were demanded, and if they were not granted a strike promptly followed. In the great majority of cases these strikes were successful; but as the price of commodities also rose out of proportion to the increase in wages, Labour was still discontented. In 1918, just before the conclusion of the Armistice, there were serious rice riots in Tōkyō, and similar disturbances with strikes took place in other parts of the country. It is true that they were stopped without difficulty because the Authorities were too strong; but they nevertheless gave a strong impetus to the Labour movement, and the Government, which had hitherto frowned on anything in the nature of serious organization on the part of Labour, decided that the moment had arrived when this attitude demanded some modification. Accordingly, while still refusing officially to recognize trade-unions, it began to wink at their existence, thinking possibly that open organization was better on the whole than an underground movement. A large increase in the number of labour associations at once took place. The capitalists on their side organized a society called the Rōshi-Kyōchōkwai (Society for the Harmonization of Labour and Capital) and withdrew their support from the Yuaikwai; but the society was not a success because Labour viewed it with suspicion. In the meanwhile the Yuaikwai changed its name to Nihon-Rōdō-Sōdōmei (Japan Federation of Labour) and became a regular federation of trade and industrial unions with Mr. Bunji Suzuki as its President and a Board of Control under him to prevent his exercising the powers of a dictator. Its platform was much like that of a moderate labour organization in the West,—an eight-hour day, a six-day week and universal suffrage. Japan was at the moment preparing to select her delegates to the International Labour Conference at Washington (1919); but the Government so manipulated matters that Labour had no voice in the choice of its own representative, an official nominee being sent instead. Loud protests followed; but they were of no avail. Similar methods were followed at the second, third, and fourth Conferences; but the attitude of Labour became at last so hostile and the protests so vociferous that the Authorities were forced to give way, and at the later Conferences real representatives attended (Mr. Suzuki of the Japan Labour Federation or Mr. Narazaki of the Seamen's Union). It will thus be seen that the movement is growing steadily in strength, and, although Trades Unions are still not officially recognized by law, recognition cannot long be delayed. Attempts have also been made to form a regular party for parliamentary purposes; but owing to the continual dissension between the moderate and the extreme elements in the labour organizations, no success has yet attended them. In 1925 matters had, it is true, so far advanced that a meeting for the formal inauguration of a party actually took place in Tōkyō. Delegates from the various labour and agricultural associations, for the tenant farmers and small holders are also now forming unions, were present; but in the course of the proceedings the representatives of the Japan Labour Federation and of the other moderate and conservative elements seceded, and, although the extremists left behind proceeded to form a party of their own called the Nōmin-Rōdō-tō (Farmer-Labour party) it was promptly suppressed the same evening by the Authorities on the ground that its programme contained items regarded as dangerous to the State. Labour is, however, now represented in the Diet, 8 "proletarians," representing various labour associations, having been successful in obtaining seats in the first Diet elected under the new Manhood Suffrage Law in 1928.

In 1926 the number of labour associations in Japan was 408 and their membership 260,348. The three bodies numerically

strongest are the Naval Workers' Union (42,513), the Japan Seamen's Union (37,000), and the Japan Labour Federation (23,305). (The above information is drawn mainly from the Japan Year Book.)

Labour Legislation.—Japan is now falling into line with other countries in labour legislation. A Factory Law was passed in 1911 and came into operation in 1916; but as a result of the First International Labour Conference held at Washington in 1919 it was revised in 1923 and, finally, after further amendment, put into force in 1926. Its principal features are as follows:—

1. With certain exceptions it applies to all factories employing 10 or more operatives and to those engaged in industries which are regarded as dangerous or injurious to health.

2. While containing no restrictions as to the hours of work of adult male operatives, it fixes a maximum of 11 hours' work a day for boys under 16 or female operatives, and, in the latter case, further prescribes that a recess (varying from half an hour to an hour) must be allowed and that at least two days' holiday must be given to the operatives every month.

3. Boys under 16 and female operatives may not be employed on night-work (10 P.M. to 5 A.M.).

4. Female operatives may not be employed 4 weeks before and 6 weeks after child-birth; but the latter period may be reduced to 4 at the request of the operative and with the consent of a doctor.

5. Operatives who fall ill or are injured while working are entitled to compensation in the shape of medical treatment and allowances for temporary disablement. In the latter case the amount is fixed at a minimum of 60% of the operative's daily wages for a period of 180 days and not less than 40% after that.

6. Should the accident or illness result in permanent disablement the operative is entitled to a gratuity varying in amount from 180 to 540 times the rate of his (or her) daily wages.

7. Should an operative die as the result of an accident or illness while working a compensation allowance of not less than 360 times the amount of his (or her) daily wages must be paid to the family or dependents of the deceased.

8. In addition an allowance must be paid for funeral expenses. This is fixed at a maximum of 20 times the operative's daily wages with a minimum of not less than 20 yen (about £2).

The Government has also established a Bureau of Social Affairs under the control of the Ministry of the Interior to deal with matters relating to labour and social undertakings, and in 1926 the Health Insurance Law was passed, the Law for the settling of Labour Disputes enforced, and Art. 17 of the Police Regulations for the maintenance of Public Safety and Order, which made the organization of strikes a penal offence, abolished. The Health Insurance Law prescribes for two forms of insurance,—compulsory, applicable to all workers to whom the Factory Law or the Mining Law are applicable and voluntary, applicable to workers who at the request of employers and with the consent of the Authorities are allowed to benefit by the terms of the law. The insurers are the Government and the Labour Associations organized as juridical persons by the employers and workers concerned. The revenue for the administration of the law comes from State subsidies and premia, and in principle the latter are payable in equal shares by employers and employed. The number of persons insured in 1927 was about 1,927,000, of whom some 27,000 were voluntary, and further it was estimated that the total receipts from premia and subsidies during the year would amount to a little over 5 million pounds sterling, while the benefits payable would be about 3 million.

GOVERNMENT AND ADMINISTRATION

Emperor and Princes.—At the head of the Japanese State stands the Emperor, who is called by his own subjects *tenshi* (son of heaven) or *tennō* (heavenly king). The emperor Hirohito is the 124th of his line, according to Japanese history, which reckons from 660 B.C., when Jimmu ascended the throne. But as written records do not carry us back farther than A.D. 712, the reigns and periods of the very early monarchs are more or less apocryphal. There are 3 families of princes of the blood, from any one of which a successor to the throne may be taken in default of a direct heir: Princes Fushimi, Kanin and Higashi Fushimi. These families are all direct descendants of emperors, and their heads have the title of *shinnō* (prince of the blood), whereas the other imperial princes, of whom there are ten, have only the second syllable of *shinnō* (pronounced *wō* when separated from *shin*). Second and younger sons of a *shinnō* are all *wō*, and eldest sons lose the title *shin* and become *wō* from the fifth generation. The Imperial prerogatives are specified in the Law of the constitution (1889). The Emperor's person is "sacred and inviolable," he combines "in himself the rights of sovereignty and exercises them according to the provisions of the Constitution," he "exercises the legislative power with the consent of the Diet," he "gives sanctions to laws and orders them to be promulgated and executed," he "has the supreme command of the Army and the Navy," he "declares war, makes peace and concludes treaties," he "convokes the Imperial Diet, opens, closes and prorogues it, and dissolves the House of Representatives" and his ministers are appointed by him and are individually responsible to him. In times of emergency the Emperor also issues Imperial ordinances in the place of law, but they must receive the approval of the Diet in the following session.

The Peerage.—In former times there were no Japanese titles of nobility, as the term is understood in the Occident. Nobles they were, however, namely, *kuge*, or court nobles, descendants of younger sons of emperors, and *daimyō* (great name), some of whom could trace their lineage to former Emperors, but owed their exalted position as feudal chiefs to military prowess. The Meiji restoration of 1867 led to the abolition of the *daimyō* as feudal chiefs, and they, together with the *kuge*, were merged into one class called *kwazoku* (flower families), a term corresponding to aristocracy, all inferior persons being *heimin* (ordinary folk). In 1884, however, the five Chinese titles of *ki* (prince), *kō* (marquis), *haku* (count), *shi* (viscount) and *dan* (baron) were introduced, and patents were not only granted to the ancient nobility but also conferred on men who had rendered conspicuous public service. The titles are all hereditary, but they descend to the firstborn only, younger children having no distinguishing appellation. The first list in 1884 showed 11 Princes, 24 Marquises, 76 Counts, 324 Viscounts and 74 Barons. After the war with China (1894–95) the total grew to 716, and the war with Russia (1904–5) increased the number to 912, namely, 15 Princes, 39 Marquises, 100 Counts, 376 Viscounts and 382 Barons. The number is now 953, 19 Princes, 39 Marquises, 105 Counts, 381 Viscounts, and 409 Barons.

Household Department.—The Imperial household department is completely differentiated from the administration of state affairs. It includes bureaux of treasury, forests, peerage, poetry, Imperial tombs, archives, Imperial mews, architecture and medical and culinary affairs, as well as boards of ceremonies and chamberlains, officials of the Empress's household and officials of the Crown Prince's household. The annual allowance made to the throne is £450,000, and the Imperial estate comprised in 1920 about 3,800,000 ac. of building land, forests and ordinary land, with buildings, furniture, live stock and other effects, the whole valued at about £73,000,000. Some of this has, however, since been disposed of. The Court in addition holds shares in various banks and industrial companies. Out of the income accruing from these various sources the households of the Crown Prince and all the Imperial princes are supported; allowances are granted at the time of conferring titles of nobility; a long list of charities receive liberal contributions, and considerable sums are paid to encourage art and education.

Departments of State.—There are 11 departments of state presided over by ministers—Foreign Affairs, the Interior, Finance, War, Navy, Justice, Education, Agriculture and Forestry, Communications, Commerce and Industry and Railways. These ministers form the Cabinet, which is presided over by the minister president of state, so that its members number 12 in all. Ministers of state are appointed by the Emperor and are responsible to him alone. There stood until recently between the Cabinet and the Crown a small body of men, "elder statesmen" (*genrō*)

who, though possessing no official status were by reason of their former distinguished services invariably consulted in a crisis and who had much to say in the making and unmaking of ministries. But of these men only one now survives. There is also a Privy Council, which consists of a variable number of distinguished men —in 1927 there were 24—whose duty it is to debate and advise upon all matters referred to them by the Emperor. There is no mention anywhere of the "Cabinet" in the Law of the Constitution and although that body meets under the presidency of the Prime Minister to discuss and decide matters of state, its members have no joint responsibility.

The total number of civil officials in 1925 was 338,498. The annual salaries of the principal officials are as follows:—Prime Minister £1,200; Ministers of State £800; Governor-General of Korea £800; Governor-General of Formosa £750; President of the Privy Council £750; Judges and Procurators £750 (mat.); Ambassadors £750 (with allowances varying from £2,600 to £4,500 yearly); Ministers Plenipotentiary £520 to £650 (with allowances varying from £1,500 to £2,200); Governors of Prefectures from £520 to £600 (with small allowances in certain cases). Pensions are small, ranging from ⅓ to ½ of the annual salary according to the period of service.

Legislature.—The first Japanese Diet was convoked the 29th of November, 1890. There are two chambers, a House of Peers (*kizoku-in*) and a House of Representatives (*shugi-in*). Each is invested with the same legislative power.

The upper chamber consists of four classes of members. They are, first, hereditary members, namely Princes of the Blood, Princes and Marquises, who are entitled to sit when they reach the age of 30; secondly, Counts, Viscounts and Barons, elected—after they have attained their 30th year—by their respective orders in the ratio of 18 Counts, 66 Viscounts and 66 Barons; thirdly, men of education or distinguished service who are nominated by the Emperor, and whose number must not exceed 125; fourthly, representatives of the taxpayers, elected, two for each prefecture, by their own class, and, fifthly, 4 members of the Imperial Academy elected by that body and nominated by the Emperor. The minimum age limit for non-titled members is 30. The House was composed in 1926 of 20 Princes of the Blood, 15 Princes, 31 Marquises, 18 Counts, 66 Viscounts, 65 Barons, 120 Imperial nominees and 66 representatives of the highest taxpayers—that is to say, 405 altogether.

The Lower House consists of elected members only. Originally the property qualification was fixed at a minimum annual payment of 30s. in direct taxes (*i.e.*, taxes imposed by the central government), but this has been altered from time to time, and by the Manhood Suffrage Law of 1925 the property qualification for electors was abolished entirely. There is no property qualification for candidates; but they must deposit £200 in cash or public bonds as security. Members are of two kinds, namely, those returned by incorporated cities and those returned by prefectures. In each case the ratio is one member for every 120,000 electors (3 to 5 for each electoral district) and the number of electoral districts is fixed at 122. Under the new law paid canvassers are not recognized; only election commissioners and election committees (not exceeding 50 persons) may take part in the election campaign. They however may receive payment for their services. The expenditure incurred by a candidate, which is now estimated at a maximum of £1,500, is in the charge of the election commissioners, and if the maximum is exceeded the candidate's election, should he secure a seat, is void.

Voting is by secret ballot, one man one vote, and a general election must take place once in 4 years for the House of Representatives, and once in 7 years for the House of Peers. The House of Representatives, however, is liable to be dissolved by order of the sovereign as a disciplinary measure, in which event a general election must be held within 30 days from the date of dissolution, whereas the House of Peers is not liable to any such treatment. Otherwise the two Houses enjoy equal rights and privileges, except that the budget must first be submitted to the representatives. Each member receives a salary of £300, with travelling allowances; the president receives £750, and the vice-president £450. The presidents are nominated by the sovereign from three names submitted by each house, but the appointment of a vice-president is within the independent right of each chamber. The lower house consists of 466 members, of whom 112 are returned by the urban population and 354 by the rural. Under the original property qualification the number of franchise-holders was only 453,474, or 11·5 to every 1,000 of the nation, but now that the Manhood Suffrage Law is in force the number must be a little over nine millions. By the constitution which created the Diet freedom of conscience, of speech and of public meeting, inviolability of domicile and correspondence, security from arrest or punishment, except by due process of law, permanence of judicial appointments and all the other essential elements of civil liberty were granted. In the Diet full legislative authority is vested: without its consent no tax can be imposed, increased or remitted; nor can any public money be paid out except the salaries of officials, which the sovereign reserves the right to fix at will. The Diet must be convoked every year, and a session is supposed to last three months. The regular time of sitting is from the end of December to the end of March. While a session lasts members are, save in certain specified cases, free from arrest, and they are not responsible outside the Diet for opinions entered in it. It will thus be seen that the powers of the Diet are limited, for, while it has control over legislation and finance, it has none over the "Cabinet," the members of which are not responsible to it but to the Emperor. Moreover, by appealing to the Throne the Government is in a position to procure the prorogation or even the dissolution of the House of Representatives when relations become too strained, and this is a weapon which it has not failed to use. In the circumstances it could scarcely be expected that an assembly which had many grievances to ventilate, abuses to redress, and wrongs, real or fancied, to avenge should always behave with perfect decorum and never lose its temper. As a matter of fact the early history of the Diet is one of perpetual and noisy strife between an almost powerless House and an experienced, determined and strongly entrenched bureaucracy, in the course of which prorogations and dissolutions were of by no means infrequent occurrence. But gradually the various "Cabinets" found means, not always very reputable, of effecting understandings with the leaders or with individual members of the various political factions in the House, so that the position became a little less acute and intervals of comparative quiet intervened. Eventually that astute statesman, the late Prince Ito, who, as Prime Minister in three Cabinets had had ample experience of parliamentary opposition, decided to form a party of his own, mainly, it has been asserted, with the object of fighting the growing power of the militarists. As a result the Seiyūkwai (Friends of the Government) came into existence in 1900, and with its support he formed his fourth ministry. He did not remain in power for more than a few months; but his successor, Prince Katsura, a soldier, followed the example he had set and organized another party, the Dōshikwai, subsequently changed to Kenseikwai, and again recently to Minseitō (Democrats). From Prince Ito the succession to the leadership of the Seiyūkwai passed, through Prince Saionji, to the late Mr. Hara, and when the latter formed a Cabinet in 1918 it was generally considered that the era of party government had at last begun. But the original and the fundamental obstacle to party government in the full sense of the word still remains,—the Cabinet is not responsible to the Diet. For this reason and for others there is still an atmosphere of unreality and irresponsibility about the proceedings in the Lower House, and noisy and violent scenes still disfigure its sittings.

Procedure of the Diet.—The official opening of the Diet takes place towards the end of December; but the Houses immediately go into recess for the New Year holidays, and the real business of the session does not commence till the latter part of January, when the Houses reassemble and the Prime Minister, the Minister for Foreign Affairs, and the Minister for Finance, respectively, address them in set speeches. The Budget, which by the Law of the Constitution must be laid before the Lower House first, is presented at the same time and referred at once to committee. This system of referring to committee applies to all

measures of importance, and is a useful device because no debate can take place on a measure till the committee concerned has reported on it, and, as in the vast majority of cases the report in question determines the attitude of the House, much time, which would otherwise be spent in debate, is thus saved. In the Chambers themselves the seats of members are designated by numbers, and permission to speak is obtained not by catching the President's eye but by members calling out their numbers,—a method not always conducive to order. Speeches are made from a regular rostrum, and, while members rarely, if ever display self-consciousness or awkwardness, eloquence is equally rare. Orators there have been, Mr. Yukio Ozaki and the late Mr. Saburo Shimada, for example, but the structure of the Japanese language is not conducive to clear and concise expression, and the great majority of the speeches made are verbose and confused. From the outset the proceedings of the Diet have been recorded verbatim, and Japan has thus, almost alone among the countries of the world, an exact record of all that has been said in the two Chambers from the day they first sat. The proceedings, both in committees and in the Chambers themselves, are printed and circulated among the members; but the general public is not allowed access to those relating to committees. The result is that garbled statements of what has happened at these meetings get into the press and are frequently telegraphed abroad. When committees are meeting the House does not sit.

Political Parties.—There is little to distinguish one party from another in Japan. It is true that during the last three or four years the Seiyūkwai, of which General Baron Tanaka is head, has been associated with a "forward" policy in China and the Minseitō with one of *laissez faire;* but, speaking in general terms, there is practically no difference between the platforms of the various groups, big or small, in the Diet. In a word parties follow men rather than principles. Apart therefore from the struggle for the establishment of real party government there is little of real interest in their history; but it is generally agreed that they are very corrupt.

The distribution of the various parties and factions in the Lower House in the autumn of 1928 was as follows:—

Seiyukwai	218
Minseito	192
Shinto Club	24
Proletarians	8
Meiseikwai	5
Business Men's Club	3
Kakushinto	1
Independents	11
Total	462

Divisions of the Empire.—The earliest traditional divisions of Japan into provinces was made by the emperor Seimu (131–190), in whose time the sway of the throne did not extend farther north than a line curving from Sendai Bay, on the north-east coast of the main island, to the vicinity of Niigata on the north-west coast. The region northward of this line was then occupied by barbarous tribes, of whom the Ainu (still to be found in Yezo) are probably the remaining descendants. The whole country was then divided into thirty-two provinces. In the 3rd century the empress Jingō, on her return from her victorious expedition against Korea, portioned out the empire into five home provinces and seven circuits, in imitation of the Korean system. By the emperor Mommu (696–707) some of the provinces were subdivided so as to increase the whole number to sixty-six, and the boundaries then fixed by him were re-surveyed in the reign of the emperor Shōmu (723–756). The old division of Japan is as follows:—

I. The *Go-kinai* or "five home provinces," *i.e.*, those lying immediately around Kyōto, the capital, viz.:—Yamashiro, Yamato, Kawachi, Idzumi and Settsu.

II. The seven circuits, as follow:—

1. The *Tōkaidō,* or "eastern-sea circuit," which comprised 15 provinces, viz.:—Iga, Isé, Shima, Owari, Mikawa, Tōtōmi, Suruga, Idzu, Kai, Sagami, Musashi, Awa, Kadzusa, Shimōsa and Hitachi.
2. The *Tōzandō,* or "eastern-mountain circuit," which comprised 8 provinces, viz.:—Omi, Mino, Hida, Shinano, Kōdzuke, Shimotsuke, Mutsu and Dewa.
3. The *Hokurikudō,* or "northern-land circuit," which comprised 7 provinces, viz.:—Wakasa, Echizen, Kaga, Noto, Etchū, Echigo and Sado (island).
4. The *Sanindō,* or "mountain-back circuit," which comprised 8 provinces, viz.:—Tamba, Tango, Tajima, Inaba, Hōki, Idzumo, Iwami and Ōki (a group of islands).
5. The *Sanyōdō,* or "mountain-front circuit," which comprised eight provinces, viz.:—Harima, Mimasaka, Bizen, Bitchū, Bingo, Aki, Suwō and Nagato.
6. The *Nankaidō,* or "southern-sea circuit," which comprised 6 provinces, viz.:—Kii, Awaji (island), Awa, Sanuki, Iyo and Tosa.
7. The *Saikaidō,* or "western-sea circuit," which comprised 9 provinces, viz.:—Chikuzen, Chikugo, Buzen, Bungo, Hizen, Higo, Hyuga, Ōsumi and Satsuma.

III. The two islands, Tsushima and Iki.

In 1868, when the rebellious nobles of Ōshū and Dewa, in the Tōzandō, had submitted to the emperor, those two provinces were subdivided, Dewa into Uzen and Ugo, and Ōshū into Iwaki, Iwashiro, Rikuzen, Rikuchū and Michinoku (usually called Mutsu). This increased the old number of provinces from sixty-six to seventy-one. At the same time there was created a new circuit, called the *Hokkaidō,* or "northern-sea circuit," which comprised the eleven provinces into which the large island of Yezo was then divided (viz., Oshima, Shiribeshi, Ishikari, Teshibo, Kitami, Iburi, Hiaka, Tokachi, Kushiro and Nemuro) and the Kurile Islands (Chishima).

The term Kwantō (east of the barrier) is applied to the eight provinces of Musashi, Sagami, Kōdzuke, Shimotsuke, Kazusa, Shimōsa, Awa and Hitachi,—all lying immediately to the east of the old barrier of Hakone, in Sagami.

The following is a list of the prefectures with their respective areas:—

	Area in sq.m.		Area in sq.m.
Central Japan			
Tōkyō	749·76	Shidzuoka	3,002·76
Kanagawa	927·79	Aichi	1,864·17
Saitama	1,585·30	Miye	2,196·56
Chiba	1,943·85	Gifu	4,001·84
Ibaraki	2,235·67	Shiga	1,540·30
Tochigi	2,854·14	Fukui	1,621·50
Gumma	2,427·21	Ishikawa	1,611·59
Nagano	5,088·41	Toyama	1,587·80
Yamanashi	1,727·50		
Northern Japan			
Niigata	4,914·55	Akita	4,493·84
Fukushima	5,042·57	Iwate	5,359·17
Miyagi	3,223·11	Aomori	3,617·89
Yamagata	3,576·89		
Southern Japan			
Kyōto	1,767·43	Okayama	2,509·04
Osaka	689·69	Hiroshima	3,103·84
Nara	1,200·46	Yamaguchi	1,324·34
Wakayama	1,851·29	Shimane	2,597·48
Hyōgo	3,318·31	Tottori	1,335·99
Shikoku			
Tokushima	1,616·82	Ehime	2,033·57
Kagawa	976·46	Kochi	2,720·13
Kyūshū			
Nagasaki	1,401·49	Oita	2,400·27
Saga	984·07	Miyazaki	2,904·54
Fukuoka	1,894·14	Kagoshima	3,589·76
Kumamoto	2,774·20	Okinawa	935·18
Hokkaidō			
Hokkaidō	36,328·34		

Local Administrative Divisions.—For purposes of local administration Japan is divided into 3 urban prefectures (*fu*), 43 rural prefectures (*ken*), and 3 special dominions (*chō*), namely Formosa, Hokkaidō and South Sakhalin. Korea, which was annexed to Japan in 1910, is dealt with in a separate article (*q.v.*). Formosa, which is under a governor-general is divided into 5 prefectures; and the Hokkaidō and Sakhalin are under civil governors. The former, however, has its own assembly and is thus not unlike a prefectural government. The prefectures are divided again into 636 sub-prefectures (*gun* or *kōri*); 101 towns (*shi*), 1,536 towns (*chō*) and 10,368 rural districts (*son*). The three urban prefectures are Tōkyō, Osaka and Kyōto. Each prefecture is named after its chief town, with the exception of Okinawa, which is the appellation of a group of islands called also Ryūkyū (Luchu). The chief administrator of a prefecture, whether urban or rural, is called a chiji (prefect).

Local Administrative System.—In feudal times the domains of the Shōgun were administered by Governors (*daikwan*) and those of the various clans by the clan rulers themselves; but a general supervision of affairs on behalf of the Shogunate was exercised by a class of officials called *Métsuké*. Although there was no such thing as popular representation an effective chain of responsibility was forged by dividing the people,—apart from the *samurai*,—into groups of five households or families,—each under the direction of a headman,—which were held jointly accountable for offences committed by any of their members. But after the Restoration, when the administrative system was remodelled on Western lines, steps were gradually taken in the direction of the introduction of the principle of representation in local administration. Beginning with the establishment of prefectural assemblies in 1880, the principle was later extended to the lesser administrative units, so that eventually every prefecture, rural district or county, city, town or village had its own local assembly. Owing, however, to the imposition of substantial restrictions in the way of property qualifications both on the voters and on the candidates for election representation was very limited; but, gradually, as the country advanced these restrictions were modified, always in the direction of the extension of the franchise, until in 1926 property qualifications were entirely abolished and every native-born Japanese of the age of 25 or over who had resided in any particular district for more than two years was accorded the right to vote or, if he chose, to stand for election to the prefectural, city, town, or village assembly of the locality in which he lived. The number of members of these various assemblies is fixed more or less in proportion to the population. In the case of a prefectural assembly there is no maximum limit; but the minimum is 30; for a city the maximum is 60 and the minimum 30, and for a village the minimum is 8. District assemblies no longer exist, the district system having been abolished in 1926 and its place taken by 25 branch prefectural offices. The duties of the head of the district or county were at the same time delegated either to the prefectural office itself or to the headmen of towns and villages. Members of assembly are not paid. For prefectural assemblies the term is four years; for town and district assemblies, six years, with the provision that one-half of the members must be elected every third year. The prefectural assemblies hold one session of 30 days yearly; but those of towns and districts have no fixed session; they are summoned by the mayor or the head-man when their deliberations appear necessary, and they continue in session till their business is concluded.

The assemblies are mainly advisory and their chief function is to deal with all questions of local finance. They discuss and vote the yearly budgets; they pass the settled accounts; they fix the local taxes within a maximum limit which bears a certain ratio to the national taxes; they make representations to the Minister for the Interior; they deal with the fixed property of the locality; they raise loans, and so on. It is necessary, however, that they should obtain the consent of the Minister for the Interior, and sometimes of the Minister of Finance also, before disturbing any objects of scientific, artistic or historical importance; before contracting loans; before imposing special taxes or passing the normal limits of taxation; before enacting new local regulations or changing the old; before dealing with grants in aid made by the central treasury, etc. The governor of a prefecture, who is appointed by the central administration, is invested with considerable power. He oversees the carrying out of all works undertaken at the public expense; he causes bills to be drafted for discussion by an assembly; he is responsible for the administration of the funds and property of the prefecture; he orders payments and receipts; he directs the machinery for collecting taxes and fees; he summons a prefectural assembly, opens it and closes it, and has competence to suspend its session should such a course seem necessary. The mayor of a city is nominated by the Minister for the Interior from three men chosen by the city assembly. Cities enjoy a greater measure of self-government than other local administrative bodies, for, in addition to being able to impose taxation, within certain limits they are empowered to own or control municipal undertakings,—such as water, gas, electric light and power, sewerage, sanitation, elementary education, etc. Their activities, however, are subject to strict supervision by the prefectural or central Authorities. Over the governors stands the Minister for the Interior, who discharges general duties of superintendence and sanction, has competence to delete any item of a local budget, and may, with the emperor's consent, order the dissolution of a local assembly, provided that steps are taken to elect and convene another within three months. The first elections for prefectural assemblies after the franchise revision of 1926 took place, in the case of 39 prefectures, in the following year. The candidates for election exceeded 2,000, the number elected was 1,489 and the total votes cast were over 6 million. A significant feature of the introduction of universal suffrage is the great increase in the activities of labour bodies and farmers' associations. Under the old system the candidates invariably belonged to the comparatively well-to-do classes; but in the elections of 1927 over 200 were members of labour organizations of some kind or other. Twenty-four of these candidates succeeded in obtaining seats. Political parties in the prefectural assemblies correspond with those in the Diet, the two most powerful in 1927 being the Seiyūkai, with 716 seats, and the Minseitō, with 577.

DEFENCE

The Japanese—as distinguished from the aboriginal inhabitants of Japan—having fought their way into the country, are naturally described in their annals as a nation of soldiers. The sovereign is said to have been the commander-in-chief and his captains were known as *o-omi* and *o-muraji*, while the duty of serving in the ranks devolved on all subjects alike. This information is indeed derived from tradition only, since the first written record goes back no further than 712.

Historical.—We are justified, however, in believing that at the close of the 7th century of the Christian era, when the empress Jito sat upon the throne, the social system of the Tang dynasty of China commended itself for adoption; the distinction of civil and military is said to have been then established for the first time, though it probably concerned officials only. Certain officers received definitely military commissions, and each important district throughout the empire had its military division (*gundan*). One-third—some say one-fourth—of the nation's able-bodied males constituted the army. Tactically there was a complete organization, from the squad of 5 men to the division of 600 horse and 400 foot. Service was for a defined period, during which taxes were remitted, so that military duties always found men ready to discharge them. Thus the hereditary soldier—afterwards known as the *samurai* or *bushi*—did not yet exist, nor was there any such thing as an exclusive right to carry arms. Weapons of war, the property of the state, were served out when required for fighting or for training purposes.

At the close of the 8th century stubborn insurrections on the part of the aborigines gave new importance to the soldier. The conscription list had to be greatly increased, and it came to be a recognized principle that every stalwart man should bear arms, every weakling become a bread-winner. Thus, for the first time, the distinction between "soldier" and "working man" received official recognition, and in consequence of the circumstances

attending the distinction a measure of contempt attached to the latter. The next stage of development had its origin in the assumption of high offices of state by great families, who appropriated as hereditary perquisites posts which should have remained in the gift of the sovereign. The Fujiwara clan, taking all the civil offices, resided in the capital, whereas the military posts fell to the lot of the Taira and the Minamoto, who, settling in the provinces and being thus required to guard and police the outlying districts, found it expedient to surround themselves with men who made soldiering a profession. These transmitted their functions to their sons, so that from the middle of the 10th century the terms *samurai* and *bushi* acquired a special significance, being applied to themselves and their hereditary followers by the local magnates, whose power tended more and more to eclipse even that of the throne. Finally, in the 12th century, when the Minamoto brought the whole country under the sway of military organization, the privilege of bearing arms was restricted to the samurai, who entered upon a period of administrative and social superiority which lasted, without serious interruption, until the middle of the 19th century. But it is to be observed that the distinction between soldier and civilian, samurai and commoner, was not of ancient existence, nor did it arise from any question of race or caste, victor or vanquished, as is often supposed and stated. It was an outcôme wholly of ambitious usurpations, which, relying for success on force of arms, gave practical importance to the soldier, and invested his profession with factitious honour.

Weapons.—The bow was always the chief weapon of the fighting-man in Japan. "War" and "bow-and-arrow" were synonymous terms. Tradition tells how Tametomo shot an arrow through the crest of his brother's helmet, in order to recall the youth's allegiance without injuring him; how Nasuno Michitaka discharged a shaft that severed the stem of a fan swayed by the wind. Still better authenticated were the feats performed at the "thirty-three-span halls" in Kyōto and Yedo, where the archer had to shoot an arrow through the whole length of a corridor 128 yards long and only 16ft. high. Wada Daihachi, in the 17th century, succeeded in sending 8,133 arrows from end to end of the corridor in 24 consecutive hours, being an average of over 5 shafts per minute; and Masatoki, in 1852, made 5,383 successful shots in 20 hours, more than 4 a minute. The lengths of the bow and arrow were determined with reference to the capacity of the archer. In the case of the bow, the unit of measurement was the distance between the tips of the thumb and the little finger with the hand fully stretched. Fifteen of these units gave the length of the bow—the maximum being about 7½ft. The unit for the arrow was from 12 to 15 hand-breadths, or from 3ft. to 3¾ft. Originally the bow was of unvarnished boxwood or *zelkowa;* but subsequently bamboo alone came to be employed. Binding with cord or rattan served to strengthen the bow, and for precision of flight the arrow had three feathers, an eagle's wing being most esteemed for that purpose.

Next in importance to the bow came the sword, which is spoken of as the samurai's chief weapon, though often during long ages it ranked after the bow. It was a single-edged weapon remarkable for its three exactly similar curves—edge, face-line and back; its almost imperceptibly convexed blade; its admirable tempering; its cunning distribution of weight, giving a maximum efficiency of stroke. The 10th century saw this weapon carried to perfection, and in every age numbers of men devoted their whole lives to acquiring novel skill in swordsmanship. Many of them invented systems of their own, differing from one another in some subtle details unknown to any save the master himself and his favourite pupils. Not merely the method of handling the weapon had to be studied. Associated with sword-play was an art variously known as *shinobi, yawara* and *jujutsu,* names which imply the exertion of muscular force in such a manner as to produce a maximum of effect with a minimum of effort, by directing an adversary's strength so as to become auxiliary to one's own. It was an essential element of the expert's art not only that he should be competent to defend himself with any object that happened to be within reach, but also that without an orthodox weapon he should be capable of inflicting fatal or disabling injury on an assailant. Were he caught weaponless by a number of assailants, his art of yawara was supposed to supply him with expedients for emerging unscathed. Nothing counted save the issue. The methods of gaining victory or the circumstances attending defeat were scarcely taken into consideration. Out of this perpetual effort to discover and perfect novel developments of swordsmanship, there grew a habit which held its vogue down to modern times, namely, that when a man had mastered one style of sword-play in the school of a teacher, he set himself to study all others, and for that purpose undertook a tour throughout the provinces, challenging every expert, and, in the event of defeat, constituting himself the victor's pupil.

The sword exercised a very potent influence on the life of the Japanese nation. The distinction of wearing it, the rights that it conferred, the deeds wrought with it, the fame attaching to special skill in its use, the superstitions connected with it, the incredible value set upon a fine blade, the honours bestowed on an expert sword-smith, the profound study needed to be a competent judge of a sword's qualities—all these things conspired to give the katana an importance beyond the limits of ordinary comprehension. A samurai carried at least two swords, a long and a short. Their scabbards of lacquered wood were thrust into his girdle, not slung from it, being fastened in their place by cords of plaited silk. The short sword was not employed in the actual combat. Its use was to cut off an enemy's head after overthrowing him, and it also served a defeated soldier in his last resort—suicide. In general the long sword did not measure more than 3ft., including the hilt; but some were 5ft. long, and some 7. Considering that the scabbard, being fastened to the girdle, had no play, the feat of drawing one of these very long swords demanded extraordinary aptitude.

Spear and glaive were also ancient Japanese weapons. The glaive (*naginata,* long sword) was a scimitar-like blade, some 3ft. in length, fixed on a slightly longer haft. Originally the warlike monks alone employed this weapon, but from the 12th century it found much favour among military men. Ultimately, however, its use may be said to have been limited to women and priests. The spear, however, formed a useful adjunct of the sword, for whereas the latter could not be used except by troops in very loose formation, the former served for close-order fighting.

Armour.—Japanese armour (*gusoku*) may be broadly described as plate armour, but the essential difference between it and the European type was that, whereas the latter took its shape from the body, the former neither resembled nor was intended to resemble ordinary garments. Perhaps the easiest way of describing the difference is to say that whereas a European knight seemed to be clad in a suit of metal clothes, a Japanese samurai looked as if he wore protective curtains. The Japanese armour was, in fact, suspended from, rather than fitted to the person. Iron and leather were the chief materials, and as the laminae were strung together with a vast number of coloured cords—silk or leather—an appearance of considerable brilliancy was produced. Ornamentation did not stop there. Plating and inlaying with gold and silver, and finely wrought decoration were freely applied. On the whole, however, despite the highly artistic character of its ornamentation, the loose, pendulous nature of Japanese armour detracted greatly from its workmanlike aspect, especially when the *horo* was added—a curious appendage in the shape of a curtain of fine transparent silk, which was either stretched in front between the horns of the helmet and the tip of the bow, or worn on the shoulders and back, the purpose in either case being to turn the point of an arrow. A true samurai observed strict rules of etiquette with regard even to the garments worn under his armour, and it was part of his soldierly capacity to be able to bear the great weight of the whole without loss of activity, a feat impossible to any untrained man of modern days. Common soldiers were generally content with a comparatively light helmet and a corselet.

The Japanese never had a war-horse worthy to be so called. The misshapen ponies which carried them to battle showed qualities of hardiness and endurance, but were so deficient in stature and massiveness that when mounted by a man in voluminous

armour they looked painfully puny. Both stirrups and the wooden saddle-frame were often of beautiful workmanship, the former covered with rich gold lacquer, the latter inlaid with gold or silver. In the latter part of the military epoch chain-armour was adopted for the horse, and its head was protected by a monster-faced mask of iron.

Early Strategy and Tactics.—Flags were used in battle as well as on ceremonial occasions. Some were monochrome, as the red and white flags of the Taira and the Minamoto clans in their celebrated struggle during the 12th century; and some were streamers emblazoned with figures of the sun, the moon, a dragon, a tiger and so forth, or with religious legends. Fans with iron ribs were carried by commanding officers, and signals to advance or retreat were given by beating drums and metal gongs and blowing conches. During the military epoch a campaign was opened or a contest preluded by a human sacrifice to the god of war, the victim at this rite of blood (*chi-matsuri*) being generally a prisoner or a condemned criminal. Although ambuscades and surprises played a large part in all strategy, pitched battles were the general rule, and it was essential that notice of an intention to attack should be given by discharging a singing arrow. Thereafter the assaulting army, taking the word from its commander, raised a shout of "Ei! Ei!" to which the other side replied, and the formalities having been thus satisfied, the fight commenced. In early mediaeval days tactics were of the crudest description. An army consisted of a congeries of little bands, each under the order of a chief who considered himself independent, and instead of subordinating his movements to a general plan, struck a blow wherever he pleased. From time immemorial a romantic value has attached in Japan to the first of anything: the first snow of winter; the first water drawn from the well on New Year's Day; the first blossom of the spring; the first note of the nightingale. So in war the first to ride up to the foe or the wielder of the first spear was held in high honour, and a samurai strove for that distinction as his principal duty. It necessarily resulted, too, not only from the nature of the weapons employed, but also from the immense labour devoted by the true samurai to perfecting himself in their use, that displays of individual prowess were deemed the chief object in a battle. Prior to the 15th and 16th centuries a battle resembled a gigantic fencing match. It was the samurai's habit to proclaim his name and titles in the presence of the enemy, sometimes adding from his own record or his father's any details that might tend to dispirit his hearers. Then some one advancing to cross weapons with him would perform the same ceremony of self-introduction, and if either found anything to upbraid in the other's antecedents or family history, he did not fail to make loud reference to it, such a device being counted efficacious as a means of disturbing an adversary's *sang-froid,* though the principle underlying the mutual introduction was courtesy. The duellists could reckon on finishing their fight undisturbed, but the victor frequently had to endure the combined assault of a number of the comrades or retainers of the vanquished. When the fighting had ceased, each samurai proceeded to the tent of the commanding officer and submitted for inspection the heads of those whom he had killed. A tent was simply a space enclosed with strips of cloth or silk, on which was emblazoned the crest of the commander. It had no covering.

Change of Tactics.—The disadvantage of such a mode of fighting was demonstrated for the first time when the Mongols invaded Japan in 1274. The invaders moved in phalanx, guarding themselves with pavises, and covering their advance with a host of archers shooting clouds of poisoned arrows. The Japanese never at any time of their history used poisoned arrows; they despised them as depraved and inhuman weapons. When a Japanese samurai advanced singly and challenged one of the Mongols to combat, they opened their ranks, enclosed the challenger and cut him to pieces. Many Japanese were thus slain, and it was not until they made a concerted movement of attack that they produced any effect upon the enemy. But although the advantage of massing strength seems to have been recognized, the Japanese themselves did not adopt the formation which the Mongols had shown to be so formidable. The great captains Takeda Shingen and Uyesugi Kenshin are supposed to have been Japan's pioneer tacticians. They certainly appreciated the value of a formation in which the action of the individual should be subordinated to the unity of the whole. But when it is remembered that firearms had already been in the hands of the Japanese for several years, and that they had means of acquainting themselves with the tactics of Europe through their intercourse with the Dutch, it is remarkable that the changes attributed to Takeda and Uyesugi were not more drastic. Speaking broadly, what they did was to organize a column with the musqueteers and archers in front; the spearmen and swordsmen in the second line; the cavalry in the third line; the commanding officer in the rear, and the drums and standards in the centre. In the days of Hideyoshi (1536–1598) combined flank and front attacks by bands of spearmen became a favourite device. But not until the close of the 17th century did the doctrine of strictly disciplined action obtain practical vogue. Yamaga Soko is said to have been the successful inculcator of this principle, and from his time the most approved tactical formation was known as the *Yamagaryū* (Yamaga style), though it showed no other innovation than strict subordination of each unit to the general plan.

Military Principles.—Although, tactically speaking, the samurai was everything and the system nothing before the second half of the 17th century, and although strategy was chiefly a matter of deception, surprises and ambushes, it must not be supposed that there were no classical principles. The student of European military history searches in vain for the rules and maxims of war so often invoked by glib critics, but the student of Japanese history is more successful. Here, as in virtually every field of things Japanese, retrospect discovers the ubiquitous Chinaman. The treatises of Sung and 'Ng (called in Japan Son and Go), Chinese generals of the third century after Christ, were the classics of Far-Eastern captains through all generations. (See *The Book of War,* tr. E. F. Calthrop, 1908.) These treatises came into the hands of the Japanese in the 8th century, when the celebrated Kibi no Mabi went to study civilization in China, just as his successors of the 19th century went to study a new civilization in Europe and America. Thenceforth Son and Go became household words among Japanese soldiers. Their volumes were to the samurai what the *Mahayana* was to the Buddhist. They were believed to have collected whatever of good had preceded them, and to have forecast whatever of good the future might produce. The character of their strategic methods, somewhat analogous to those of 18th-century Europe, may be gathered from the following:—"An army undertaking an offensive campaign must be twice as numerous as the enemy. A force investing a fortress should be numerically ten times the garrison. When the adversary holds high ground, turn his flank; do not deliver a frontal attack. When he has a mountain or a river behind him, cut his lines of communication. If he deliberately assumes a position from which victory is his only escape, hold him there, but do not molest him. If you can surround him, leave one route open for his escape, since desperate men fight fiercely. When you have to cross a river, put your advance-guard and your rear-guard at a distance from the banks. When the enemy has to cross a river, let him get well engaged in the operation before you strike at him. In a march, make celerity your first object. Pass no copse, enter no ravine, nor approach any thicket until your scouts have explored it fully."

The basis of their tactics is *The Book of Changes.* This treats of the positive and the negative principles; the sympathetic and the antipathetic elements; cosmos growing out of chaos; chaos re-absorbing cosmos—on such conceptions they founded their tactical system. The result was a phalanx of complicated organization, difficult to manoeuvre and liable to be easily thrown into confusion. Yet when Yamaga in the 17th century interpreted these ancient Chinese treatises, he detected in them suggestions for a very shrewd use of the principle of échelon, and applied it to devise formations which combined much of the frontal expansion of the line with the solidity of the column. More than that cannot be said for Japanese tactical genius. The samurai was the best fighting unit in the Orient—probably one of the best

fighting units the world ever produced. It was perhaps because of that excellence that his captains remained indifferent tacticians.

Ethics of the Samurai.—In estimating the military capacity of the Japanese, it is essential to know something of the ethical code of the samurai, the *bushido* (way of the warrior) as it was called. A typical example of the rules of conduct prescribed by feudal chieftains is furnished in the code of Kato Kiyomasa, a celebrated general of the 16th century:—

Regulations for Samurai of every Rank; the Highest and Lowest alike.

1. The routine of service must be strictly observed. From 6 a.m. military exercises shall be practised. Archery, gunnery and horsemanship must not be neglected. If any man shows exceptional proficiency he shall receive extra pay.

2. Those that desire recreation may engage in hawking, deer-hunting or wrestling.

3. With regard to dress, garments of cotton or pongee shall be worn. Any man incurring debts owing to extravagance of costume or living shall be considered a law-breaker. If, however, being zealous in the practice of military arts suitable to his rank, he desires to hire instructors, an allowance may be granted to him for that purpose.

4. The staple of diet shall be unhulled rice. At social entertainments one guest for one host is the proper limit. Only when men are assembled for military exercises shall many dine together.

5. It is the duty of every samurai to make himself acquainted with the principles of his craft. Extravagant displays of adornment are forbidden in battle.

6. Dancing or organizing dances is unlawful; it is likely to betray sword-carrying men into acts of violence. Whatever a man does should be done with his heart. Therefore for the soldier military amusements alone are suitable. The penalty for violating this provision is death by suicide.

7. Learning shall be encouraged. Military books must be read. The spirit of loyalty and filial piety must be educated before all things. Poem-composing pastimes are not to be engaged in by samurai. To be addicted to such amusements is to resemble a woman. A man born a samurai should live and die sword in hand. Unless he is thus trained in time of peace, he will be useless in the hour of stress. To be brave and warlike must be his invariable condition.

8. Whosoever finds these rules too severe shall be relieved from service. Should investigation show that any one is so unfortunate as to lack manly qualities, he shall be singled out and dismissed forthwith. The imperative character of these instructions must not be doubted.

Frugality, fealty and filial piety—these may be called the fundamental virtues of the samurai. Owing to the circumstances out of which his caste had grown, he regarded all bread-winning pursuits with contempt, and despised money. To be swayed in the smallest degree by mercenary motives was despicable in his eyes. Essentially a stoic, he made self-control the ideal of his existence, and practised the courageous endurance of suffering so thoroughly that he could without hesitation inflict on his own body pain of the most horrible description. Nor can the courage of the samurai justly be ascribed to bluntness of moral sensibility resulting from semi-savage conditions of life. From the 8th century onwards the current of existence in Japan set with general steadiness in the direction of artistic refinement and voluptuous luxury, amidst which men could scarcely fail to acquire habits and tastes inconsistent with acts of high courage and great endurance. The samurai's mood was not a product of semi-barbarism, but rather a protest against emasculating civilization. He schooled himself to regard death by his own hand as a normal eventuality. The story of other nations shows epochs when death was welcomed as a relief and deliberately invited as a refuge from the mere weariness of living.

Harakiri.—But wherever there has been liberty to choose, and leisure to employ, a painless mode of exit from the world, men have invariably selected it. The samurai, however, adopted in *harakiri* (disembowelment) a mode of suicide so painful and so shocking that to school the mind to regard it with indifference and perform it without flinching was a feat not easy to conceive. Assistance was often rendered by a friend who stood ready to decapitate the victim immediately after the stomach had been gashed; but there were innumerable examples of men who consummated the tragedy without aid, especially when the sacrifice of life was by way of protest against the excesses of a feudal chief or the crimes of a ruler, or when some motive for secrecy existed. It must be observed that the suicide of the samurai was never inspired by any doctrine like that of Hegesias. Death did not present itself to him as a legitimate means of escaping from the cares and disappointments of life. Self-destruction had only one consolatory aspect, that it was the soldier's privilege to expiate a crime with his own sword, not under the hand of the executioner. It rested with his feudal chief to determine his guilt, and his peremptory duty was never to question the justice of an order to commit suicide, but to obey without murmur or protest. For the rest, the general motives for suicide were to escape falling into the hands of a victorious enemy, to remonstrate against some official abuse which no ordinary complaint could reach, or, by means of a dying protest, to turn a liege lord from pursuing courses injurious to his reputation and his fortune. This last was the noblest and by no means the most infrequent reason for suicide. Thus the samurai rose to a remarkable height of moral nobility. He had no assurance that his death might not be wholly fruitless, as indeed it often proved. If the sacrifice achieved its purpose, if it turned a liege lord from evil courses, the samurai could hope that his memory would be honoured. But if the lord resented such a violent and conspicuous mode of reproving his excesses, then the faithful vassal's retribution would be an execrated memory and, perhaps, suffering for his family and relatives. Yet the deed was performed again and again. It remains to be noted that the samurai entertained a high respect for the obligations of truth; "A bushi has no second word," was one of his favourite mottoes. However, a reservation is necessary here. The samurai's doctrine was not truth for truth's sake, but truth for the sake of the spirit of uncompromising manliness on which he based all his code of morality. A pledge or a promise must never be broken, but the duty of veracity did not override the interests or the welfare of others. Generosity to a defeated foe was also one of the tenets of the samurai's ethics.

Something more, however, than a profound conception of duty was needed to nerve the samurai for sacrifices such as he seems to have been always ready to make. It is true that Japanese parents of the military class took pains to familiarize their children of both sexes from very tender years with the idea of self-destruction at any time. But superadded to the force of education and the incentive of tradition there was a transcendental influence. Buddhism supplied it. The tenets of that creed divided themselves, broadly speaking, into two doctrines, salvation by faith and salvation by works, and the chief exponent of the latter principle is the sect which prescribes meditation as the vehicle of enlightenment. Whatever be the mental processes induced by this rite, those who have practised it insist that it leads finally to a state of absorption, in which the mind is flooded by an illumination revealing the universe in a new aspect, absolutely free from all traces of passion, interest or affection, and showing, written across everything in flaming letters, the truth that for him who has found Buddha there is neither birth nor death, growth nor decay. Lifted high above his surroundings, he is prepared to meet every fate with indifference. The attainment of that state seems to have been a fact in the case both of the samurai of the military epoch and of the Japanese soldier to-day.

Abolition of the Samurai.—The policy of seclusion adopted by the Tokugawa administration after the Shimabara insurrection included an order that no samurai should acquire foreign learning. Nevertheless some knowledge could not fail to filter in through the Dutch factory at Deshima, and thus, a few years before the advent of the American ships, Takashima Shūhan, governor of Nagasaki, becoming persuaded of the fate his country must invite if she remained oblivious of the world's progress, obtained small arms and field-guns of modern type from Holland, and, repairing to Yedo with a company of men trained according to the new tactics, he offered an object lesson for the consideration of the conservative officials. They answered by throwing him into prison. But Egawa, one of his retainers, proved a still more zealous reformer, and his foresight being vindicated by the appearance of the American war-vessels in 1853, he won the government's confidence. At Egawa's instance rifles and cannon were imported largely from Europe, and their manufacture was commenced in Japan. Finally, in 1862, the shōgun's

government adopted the military system of the West, and organized three divisions of all arms, with a total strength of 13,600 officers and men. Disbanded at the fall of the shōgunate in 1867, this force nevertheless served as a model for a similar organization under the imperial government, and in the meanwhile the principal fiefs had not been idle, some—as Satsuma—adopting English tactics, others following France or Germany, and a few choosing Dutch. Then Omura Masujiro, a samurai of the Chōshū clan attempted to substitute for the hereditary soldier conscripts taken from all classes of the people, but was assassinated. In 1870 Yamagata Aritomo (afterwards Field-Marshal Prince Yamagata) and Saigo Tsugumichi (afterwards Field-Marshal Marquis Saigo) returned from a tour of military inspection in Europe, and organized a corps of Imperial guards, taken from the three clans which had been conspicuous in the work of restoring the administrative power to the sovereign, namely, the clans of Satsuma, Chōshū and Tosa. In 1873, an imperial decree substituted universal conscription for the system of hereditary militarism. Many persons viewed this experiment with deep misgiving, but it was dispelled a few years later. One of the serious difficulties encountered at the outset was that samurai conscripts were too proud to stand in the ranks with common rustics or artisans, and above all to obey the commands of plebeian officers.

But patriotism overcame this obstacle. To find competent officers was a problem, but the new military school turned out graduates at high pressure, and private soldiers who showed any special aptitude were rapidly promoted to positions of command. French military instructors were engaged. In 1877, this new army of conscripts had to endure a crucial test: it had to take the field against the Satsuma samurai, the very flower of their class, who in that year openly rebelled against the Tōkyō government. The campaign lasted eight months; as the Imperial forces were reduced by casualties in the field and by disease, it became necessary to have recourse to volunteers, but as these were for the most part samurai, the expectation was that their hereditary instinct of fighting would compensate for lack of training. That expectation was not fulfilled. Serving side by side in the field, the samurai volunteer and the heimin[1] regular were found to differ by precisely the degree of their respective training. The fact was thus finally established that the fighting qualities of the farmer and artisan reached as high a standard as those of the bushi.

Thenceforth the story of the Japanese army is one of steady progress and development.

In 1883, the total period of colour and reserve service was extended to 12 years, and substitution was no longer allowed. In 1888 the seven divisions of the army first found themselves prepared to take the field, and, in 1893, a revised system of mobilization was sanctioned, to be put into operation the following year, for the Chino-Japanese War (*q.v.*). The infantry were armed with the Murata single-loader rifle, but the field artillery was inferior, and the only two divisions equipped with magazine rifles and smokeless powder never came into action. The experiences gained in this war bore large fruit. The total term of service was slightly increased; new divisions were added, bringing the whole number of divisions to 13 (including the guards); with the aid of a German military mission strenuous efforts were made to improve the education of officers and men; and Japan became gradually independent of foreign aid so far as arms are concerned. In 1900, she sent a force to North China to assist in the campaign for the relief of the foreign legations in Peking, and on that occasion her troops were able to observe at first hand the qualities and methods of European soldiers. In 1904 took place the great war with Russia (*see* Russo-Japanese War). After the war important changes were made in the direction of augmenting and improving the armed forces. The number of divisions was increased to 19 (including the guards), of which one was for service in Korea and one for service in Manchuria. The term of service with the colours was shortened to 2 years for the infantry, 3 years remaining the rule for other arms, while the period of service with the reserves was extended to 14½ years, which greatly augmented the potential war strength. (X.)

[1]The general term for commoners as distinguished from samurai.

MODERN

All males between 17 and 40 are liable for military service, though normally those conscripted are not called up till the age of 20. About 600,000 attain military age each year. After undergoing a medical examination they are divided into five main categories according to their degree of physical fitness. As the annual colour quota is only about 100,000, those in the highest category are generally more than sufficient for the active army and selection is therefore made by ballot. The remainder, other than those who are definitely rejected as physically unfit, or whose service has been postponed for family, educational, or other such reasons, are similarly divided by ballot among the conscript reserve and 2nd levy of the national army.

Formerly those selected for the active army served three years with the colours, 4⅓ years with the 1st reserve (*Yobi*), and ten years with the 2nd reserve (*Kobi*); but, since 1905, successive changes have brought it down to 22⅓ months with the colours, 5⅓ years with the 1st reserve, and 10 years with the 2nd reserve, after which they are drafted into the 1st levy of the national army and do no more training. Those in the 1st reserve serve to fill up gaps in the active army on mobilisation, while the 2nd reserve is used to form reserve units on the outbreak of war. In point of fact, most infantrymen have, since 1927, had their colour service reduced to 18 months as a result of a scheme inaugurated two years previously. Under this system (*Seinen Kunren*) a man who, prior to conscription, passes a satisfactory course of military instruction, either at school or in a Young Men's Training Centre, is entitled to this reduction in service, provided he is selected for the infantry. In the schools and colleges, this preliminary training is supervised by regular officers on the active list, about 1,200 having been specially appointed for this purpose.

Conscript Reserve.—Men allotted to the conscript reserve (*Hoju*, equivalent to *Ersatz*) nominally undergo 150 days' training during their service in it, but in practice only a few thousand of the yearly contingent receive any training. They may, however, be drawn upon to replace casualties in the active army contingent in peace time, and in time of war they are called up to form depôt units, which supply drafts to replace casualties in the field armies. At the end of 12½ years they are drafted to the 1st levy of the national army, where they merge with those who have passed through the active army. The 2nd levy of the national army absorbs considerably more than half of those passed medically fit, and entails no training, though its members are liable to be called up for service in wartime as a last resort.

Though the ordinary conscript may rise to the rank of "superior soldier" (equivalent to Lance-Corporal) during his service with the colours, all other N.C.Os. and W.Os. in the active army are recruited from conscripts who extend their service voluntarily. The commissioned ranks are recruited from men who, taking up the army as a profession, have passed through the officers' school (*see* section, "Education"). Men with certain educational qualifications are permitted to serve with the colours as volunteer cadets (*Kambu Kōhosei*), formerly known as "one year volunteers" (*Ichinen Shiganhei*). Those from universities and other educational establishments of high standing serve only ten months, others for one year. At the end of that period (during which they receive special training), they undergo an examination. If successful, they are appointed to the 1st reserve as 2nd lieutenants. If they fail, they receive the rank of corporal or sergeant in the same reserve. Graduates of normal schools, in which teachers for Government schools are trained, receive only five months' training with the colours and then pass direct to the National Army. There are, in addition, certain men of inferior physique who are sent to commissariat units for two months' training in the care of horses under military discipline. In wartime these men would be called up to assist the fully-trained men of the commissariat.

Peace and War Strength.—On completion of demobilisation after her war with Russia, Japan was left with a peace-time army of 17 infantry divisions, two cavalry brigades and two artillery brigades, together with the independent garrisons of Formosa, North China, and of various fortresses, as well as certain guards

in Korea. The total personnel numbered about 210,000. As a result of subsequent additions, the strength was gradually increased to 21 divisions, four cavalry brigades, three field artillery brigades and two heavy artillery brigades, together with a number of smaller independent units, the total personnel amounting to 272,000 according to a statement made by the War Minister in the 1919–1920 session of the Diet.

The formation of another four divisions was contemplated, but the plans never materialised. Instead, in accordance with public wishes, steps were taken soon after to reduce the size of the army. By means of a re-organisation scheme drawn up in 1922, a number of smaller units were disbanded and other economies in man-power effected. A second and more drastic cut took place in 1925, when four whole divisions were disbanded, though this loss was partly offset by the decision to create a tank unit and an anti-aircraft regiment, and to carry out various improvements in the matter of arms and military equipment generally. At the same time, the Army Air Force, which had been made an independent arm in April 1923 (up to which time it had been merely a branch of the engineers), was expanded from six battalions (*daitai*) to eight regiments (*rentai*).

As a result of the reorganization and reduction[1], the peace strength, according to figures supplied by the Japanese War Department, in May 1928 stood at 220,000, the main units of the Japanese Army being as follows,—17 divisions, four cavalry brigades, four heavy field artillery brigades, three regiments and eight battalions of heavy artillery, eight air regiments and one anti-aircraft regiment. There are also certain smaller independent units.

Approximate Statistics.—Full details of both peace and war strength and organisation are kept strictly secret. The figures given below, therefore, can only be taken as approximate. Speaking generally, however, a division is normally composed of two infantry brigades (each of two regiments, each of three battalions), one regiment of cavalry (two squadrons), one regiment of field artillery (three battalions, each of two 4-gun batteries), one battalion of engineers (three companies) and one battalion of commissariat (two companies). Two of the existing 17 divisions (9th and 11th) have each a mountain artillery regiment instead of field artillery, and the two divisions in Korea (19th and 20th) are without commissariat units. In peace-time an infantry battalion is about 600 strong, a cavalry regiment about 300–400, an artillery regiment 500, an engineer battalion about 450 and a commissariat battalion about 300 men. An infantry battalion on peace footing has only three companies, but a fourth is added on mobilisation. An extra battery is likewise added to each artillery battalion. As each infantry company has six light machine-guns, it follows that a battalion at peace strength has 18 light machine-guns and at war strength 24. In addition, each infantry battalion and each cavalry regiment on mobilisation has four heavy machine-guns on pack transport, and a 37 mm. infantry gun and a mortar are added to each infantry regiment. A peace-time division may therefore be said to be from 5,000–5,500 strong with 24 field guns and 216 light machine-guns. On mobilisation it is expanded to about 20,000 with 36 field guns, 288 light machine-guns, 52 heavy machine-guns, four infantry (37 mm.) guns and four mortars.

Of units other than those included in the divisional organisation, the four heavy field artillery brigades each consist of two regiments, armed with both guns and howitzers. Each of the four cavalry brigades has two regiments, each of four ordinary and one machine-gun squadrons, the peace strength of a brigade being about 1,200. Mountain artillery regiments, the horse artillery battalion and the heavy artillery units, have the same organisation as field artillery. The anti-aircraft regiment, which is still in process of organisation, will probably be on a similar basis. The tank unit is understood to be the nucleus of a battalion with 25 tanks and may later be expanded still further. The strength of the air regiments is as uncertain as the organisation. At present there appear to be from 1–3 companies each of from 8–12 machines, the number varying according to type, per regiment, or 18 companies in all, while another eight are in process of formation. By 1931 there should be a total of 26 companies with from 2–4 companies per regiment.

The present peace strength of the Japanese Army may therefore be classified as follows—infantry 70 regiments and four battalions; cavalry 25 regiments; field artillery 15 regiments; mountain artillery four regiments and one battalion; horse artillery one battalion; heavy field artillery eight regiments; heavy artillery three regiments and eight battalions; engineers 17 battalions; railway corps two regiments; telegraph corps two regiments; air corps eight regiments; balloon corps two companies; commissariat 15 battalions; motor transport one battalion; anti-aircraft one regiment; tank corps one battalion.

War Strength.—Japan's war strength is kept even more jealously guarded than her peace strength. In her war with Russia Japan sprang a surprise upon her opponents by putting a *kobi* (2nd Reserve) brigade in the field simultaneously with each infantry division. There are reasons to believe that, in the event of another first-class war, Japan is capable of placing one, and later on possibly a second, reserve division in the field for every division of her peace-time standing army, thus giving a total of 34 or, if trebled, 51 divisions as her war-time strength. The large proportion of officers and W.Os. on her peace establishment, and her large reserves of man-power, appear to make this quite feasible, even without drawing upon the "indispensables" required for work in munition factories and other necessary industries.

The exact number of reserves available is unknown, but rough estimates indicate that she has well over a million and a half trained reserves, more than half a million partially trained, and seven or eight million untrained men fit for service. Under the newly instituted system of preliminary training for youths (*see* section below, "Education"), the number of part-trained reserves will be greatly increased. Fully trained reserves will likewise increase to some extent as a result of the recent reduction in colour service for infantry.

Command and Distribution.—According to the Japanese Constitution, the Emperor is in supreme command of both army and navy. As advisory bodies on naval and military affairs he has the Board of Marshals (*Gensuifu*) and the Military Council (*Gunji Sangiin*). The former is composed solely of marshals and fleet admirals. The latter includes all the members of the former, together with the Ministers of War and Marine, the Chiefs of the General and Naval Staffs (all these being ex-officio members) and certain high officers specially nominated by the Emperor. The Military Council can initiate and decide on policies to be adopted. The Board of Marshals cannot initiate policies, but can give final decisions, subject to the Emperor's consent, to policies submitted to them for approval. The Army is controlled by the War Minister, Chief of General Staff, and Inspector-General of Military Education ("I.G.M.E."). Each is co-equal with the others and is responsible to the Emperor alone. The War Minister, though he is a member of the Cabinet, has direct access to the Throne like the other two and is therefore virtually independent of the Premier so far as purely military administrative matters are concerned. Although the question of making civilians eligible for the post of War Minister has frequently been mooted in recent years, the present regulations lay down that the appointment must be held by a general officer on the active list. He is responsible for administration and execution of policy, and presides over the War Office. Under him are a Vice-Minister (also a general officer) and the directors of 7 main bureaux.

The Chief of the General Staff ("C.G.S.") initiates plans, etc., and has a Vice-Chief and 6 bureaux directors immediately under him. The Commandant of the Staff College is likewise under his direct control. Like the C.G.S., the I.G.M.E. is also independent of the War Minister. A Vice-Inspector-General and Inspectors-General of the various arms are his immediate sub-

[1]According to semi-official announcements made at the time the two cuts took place, the first involved a reduction of about 56,000 and the second effected a further net cut of about 27,000. These figures, however, are not compatible with the present total strength of 220,000, as now given out by the War Department, and with the 272,000 quoted by the War Minister in 1920.

ordinates. Next in importance to the C.G.S., War Minister, and I.G.M.E. are the commanders of the Korean, Formosan (including Pescadores), and South Manchurian garrisons, the Commander of the Tokyo Garrison (all Generals or Lt. generals) and the 17 divisional commanders (Lt. generals). All these officers are appointed by, and are responsible to the Emperor, though they are under the orders of the War Minister for administration, C.G.S. for operations and I.G.M.E. for training. Other important posts are those of Chief of Military Police and Commander of North China garrison (directly under the War Minister), commandants of the various military schools (under I.G.M.E.), and commanders of fortresses and of independent brigades and other independent units generally (responsible to the commanders of the divisions in whose areas they are located). Brigades are commanded by major-generals, regiments by colonels and battalions by majors.

The main force of the Japanese Army, as is only natural, is concentrated in the four main islands of Japan. Of the 17 infantry divisions, 2 are stationed permanently in Korea and normally 14 are kept in Japan—2 in Kyushu, 1 in Shikoku, 1 in Hokkaido and 10 (including the Guards) in the main island of Honshu. Actually there are 11 divisional districts in Honshu, but 1 division is always absent in S. Manchuria, this division being relieved every 2 years by a fresh one from the Homeland. In the oversea garrisons the distribution is as under—*Korea* 2 divisions, 1 air regiment, 1 heavy artillery battalion. *S. Manchuria* 1 division, 4 independent infantry battalions for guarding the railway, 1 heavy artillery battalion. *N. China* (Peking and Tientsin) 2 battalions (supplied from Home units) *Formosa and Pescadores* 2 independent infantry regiments, 2 heavy artillery battalions, 1 mountain artillery battalion and 1 air regiment. *Tsushima* 1 heavy artillery battalion. The 4 cavalry brigades, the 4 artillery brigades, and all other units not specifically mentioned above are kept permanently in Japan in peace-time.

Education.—Education in Japan is compulsory up to the age of 13. After this, those who desire to become army officers either enter a middle school for 4 years or else, after a year at a middle or higher primary school, pass into the military preparatory school (*Yōnen Gakkō*). They then enter the Officers' School (*Shikwan Gakkō*), the number of vacancies for such applicants being fixed each year. There are also a few allotted (a) to conscripts between the ages of 17 and 21 who, after service with the colours, elect to try for commissions, and (b) to selected N.C.Os. of under 26, who have been recommended by their commanding officers. Formerly, successful candidates from the military preparatory and middle schools did 6 months and 12 months regimental training respectively in the ranks before entering the Officers' School, where they remained 1½ years and then became probationary officers for 6 months.

Under the new system, however, all candidates for commissioned rank carry out a 2-year preparatory course at the Officers' School and each one is then attached to a military unit for 6 months. The branch of the service to which a cadet is sent depends partly on individual choice and partly on the arm for which this preliminary course has shown him to be best fitted. On completion of his regimental attachment, the cadet returns to the school for a further course of a year and 10 months, during which he specialises in the particular arm to which he has been allotted. Then follows two months as a probationary officer in the unit to which he was formerly attached, after which he is gazetted 2nd lieutenant, provided the C.O. and other officers signify their approval.

For those who have obtained commissions, a large number of military educational establishments are available for specialising or increasing their knowledge generally. Of these the most important is the Staff College, aspirants for which must be under the rank of captain at the time of entry. A 3-years' course, both practical and theoretical, is provided. Successful graduates generally receive accelerated promotion, though no extra pay accrues to staff appointments. Other existing educational establishments for officers are the infantry school and schools of cavalry, heavy artillery, field artillery, artillery and engineering, military engineering, aviation (3), physical training, mechanical transport, signalling and communications, and gendarmerie. Some of these schools include courses for N.C.Os, and there are, in addition, 3 N.C.O's Schools. There are also schools of instruction for the medical and veterinary services and for intendance and bandsmen. Apart from those who pass through the Staff College, rise in commissioned rank in the earlier stages takes place automatically without recourse to promotion examinations, though an officer who has shown himself inefficient may be passed over.

Morale and Tactics.—Taken generally, the outstanding points in Japanese military education are the immense importance attached to training in *morale* (*Seishin Kyōiku*) and in tactics. The former includes instruction in the "seven duties of the soldier"—loyalty, valour, patriotism, obedience, humility, morality and honour—and insistence on frugality, simplicity and spartan existence generally. Tactics, both practical and theoretical, are given far more attention than any other subject in most of the military schools and in barracks too. The encouragement of foreign language study is another noteworthy feature. Military history, on the other hand, finds little space as a separate subject in the curriculum of an officer's training, though examples are frequently quoted in tactical instruction.

Fortifications.—Rather than spend large sums on powerful fortresses, Japan prefers to maintain a number of fortified zones which permit of manoeuvre and mobility, and co-operation with naval units. Being an island country with no land frontiers, other than the mountainous northern border line of Korea, such permanent fortifications as exist within these zones are coastal. Just how much these zones are fortified is unknown, as extreme secrecy is observed and every precaution taken to prevent unauthorised persons obtaining any clue. The probability is that permanent fortifications are few in number and that very little in the way of fixed defence works exist, though it is safe to assume that all necessary steps have been taken in regard to the siting and construction of gun emplacements and field works for use in time of war. All that is known for certain is that the localities marked off as fortified areas are centred round strategic points, such as the entrances to the Inland Sea, the Sea of Japan and Tōkyō Bay, and the districts adjacent to naval bases. Formerly such forts as existed were manned by fortress artillery units, whose strength and organisation differed according to local requirements. Fixed fortifications and fixed armaments were the rule. Little or nothing in the way of mobile armaments existed. As a result of lessons learned in and since the Russo-Japanese War, however, the whole system has been altered. The organisation has been unified, lighter guns have been added, and the heavy artillery (which has now replaced the old-style fortress artillery) has been given a mobility which permits far greater freedom of action, both for offence and defence, than ever it had before.

Forts and fortified areas appear to be divided into three kinds in peace-time, according to their degree of importance. The 3 most important—Yokosuka, Miyama (eastern entrance of Inland Sea), and Shimonoseki—each have a regiment of heavy artillery stationed nearby. To each of the next 8, in order of importance, a battalion of heavy artillery is allotted. These are Hakodate, Maizuru, Sasebo, Keichi (island of Tsushima), Masan (southern Korea), Port Arthur, Keelung (northern Formosa), and Maho (Pescadores). After these come Nagasaki, Hoyo (the strait between Kyushu and Shikoku), the coastline facing Hakodate, Eiko (eastern Korea), and the Bonin islands, which, in peace time, have nothing but small maintenance parties for their upkeep.

In so far as the Korean frontier is concerned, nothing in the way of strong permanent fortifications exist, so far as is known, as the natural features of the local terrain help to provide all the protection needed throughout the greater part of the border line. There are believed, however, to be a number of light defence works at certain points. (M. D. K.)

AIR

The air services in Japan are definite branches of the army and navy, though co-ordination is effected by two service councils, the board of Marshals and the Supreme Military Council. In estimat-

ing the present position of aviation in Japan it must be remembered that during the World War other nations were compelled by military necessity to develop their air arms with great rapidity. At the conclusion of peace Japan found herself, one of the great powers, considerably inferior to her allies in both branches of aviation. With characteristic energy she proceeded to build up the nucleus of powerful and efficient air services which, had not the disastrous earthquake of 1923 intervened, would by now be even stronger than they are.

The Military Air Service.—The Japanese military air service is part of the army and has been since 1925 a separate arm equal in status to the infantry, cavalry and artillery. The air service is controlled by a military aviation directorate which is divided into four departments (a) General Affairs. (b) Research and Investigation. (c) Aircraft Inspection. (d) Supply.

The air service largely based on the French model consists of 8 wings, 3 schools and 1 balloon company. A wing somewhat similar to a French air regiment is made up of two or more squadrons, an operational and training section, an equipment section, an *intendance* section and a medical section. It is considered that elasticity and easy expansion can be attained by this organization. Pilots are appointed from both commissioned and non-commissioned ranks, the proportion being roughly $\frac{2}{3}$ officer and $\frac{1}{3}$ N.C.O. pilots. The Military Air Service having modelled itself on its French counterpart and having been trained largely by French personnel has naturally turned to France for its equipment, and has bought machines and engines in that country or alternatively their manufacturing rights. The following are approximate strengths: officers (including some 300 pilots) 700, other ranks (including some 150 pilots) 4,000, aircraft, 200.

Naval Air Service.—The naval air service is an integral part of the navy and is concentrated at the five stations and in the three aircraft carriers. After the World War the services of a British air mission were employed to lay the foundations of an efficient naval air arm and as a result a considerable amount of British material was bought. Aircraft are now being efficiently manufactured in Japan for the naval air service and generally speaking it is the policy to purchase manufacturing rights and to build up an efficient national industry. There are believed to be four operational stations and one training station, but the organization of each station is not definitely known. There are three aircraft carriers in commission, or about to be commissioned, capable of carrying approximately 100 aircraft, namely, "Hosho" (9,500 tons displacement), "Akagi" 30,000 tons displacement, "Kaga" 27,000 tons displacement. The semi-rigid type of airship is favoured, but one which was recently purchased from Italy was destroyed in 1927. Pilots are appointed from both commissioned and non-commissioned ranks and are stated to be most efficient and energetic. The following are approximate strengths: officers (including some 150 pilots) 300; other ranks (including some 90 pilots) 3,000; aircraft 200; airships, 1 small in commission, 1 under construction. (A. R. B.)

NAVY

Japan's geographical position, analogous as it is to Great Britian as an island outpost of a great continent, inevitably caused her to evolve into a sea power of very considerable importance; but, unlike Britain, the people of Japan were slow to appreciate the importance, in fact the vital necessity, for a fleet. In consequence, she suffered severely at the hands of a more enterprising neighbour when, in the 13th century, a Mongol fleet came to Kiūshiū and found her with no warcraft capable of opposing the invaders. Again, at the close of the 16th century, military operations in Korea were brought to an untimely end through the defeat of Japan's weak forces afloat by Korean war-junks. It was not as if, at this time, the Japanese were without models for sizeable ships, for the waters of the Far East, in the second half of the 16th century, were visited by the great galleons of Spain, Portugal, Holland and England.

In the early part of the 17th century, however, Japan first called in foreign aid to assist her in shipbuilding in the shape of a castaway English pilot, one Will Adams, under whose supervision two ships were built to the order of Iyeyasu; but a severe check to her maritime ambitions was received when, in 1636, an edict was issued vetoing the construction of seagoing vessels as part of the Tokugawa policy of isolation.

Modern Beginnings.—It was not until over 200 years later that a naval policy was initiated, and it was to the Dutch that Japan then went for assistance. In 1855 a seaman's training station was opened at Nagasaki with Dutch instructors. At the same place a building slip was constructed and an iron factory established. A naval school was organised at Tsukiji in Yedo, and the Dutch presented a small warship, the "Kwanko Maru," for training cadets. Two other vessels were purchased from the Dutch in 1857 and 1858, and these, with a third given by Queen Victoria, formed the nucleus of Japan's Navy.

The dockyard at Yokosuka was planned and its construction supervised by Monsieur Betin, a Frenchman, but it was not long before the shōguns (government) sought British naval assistance, and Captain Tracey R.N., with a small mission of naval officers, was engaged to run the school at Tsukiji. Unfortunately they arrived just as the Tokugawa shogunate fell and the new administration did not desire their services. Eventually, however, such fleet as Japan possessed was taken over by the Imperial government and in 1873 the British government, by request, sent out a second and much larger naval mission under Commander (afterwards Admiral Sir) Archibald Douglas. The Japanese navy in embryo had already had some experience when in 1868 a naval force was sent to Yezo to attack a revolutionary squadron. In 1874 a fleet of transports was convoyed to Formosa and in 1877 the navy took part in crushing a serious rebellion at Satsuma. With the aid of Commander Douglas and his assistants the Japanese navy steadily improved and increased.

The first steam warship constructed in Japan was a gunboat of 388 tons, launched in 1866 from a building yard at Ishikawajima on the island at the mouth of the Sumida river on which Tokyo stands. Two larger vessels of 897 tons and 1,450 tons respectively followed in 1875 and 1876. Japan acquired her first ironclad from England in 1878. This was the "Fusō," a ship of 3,717 tons. Then came the "Kongo" and "Hiei," steel-framed cruisers of 2,248 tons. In 1878 the Japanese flag was seen for the first time in European waters, when the cruiser "Seiki" (1,897 tons), built in Japan and navigated solely by Japanese, appeared there. In 1882 a programme of construction of 30 cruisers and 12 torpedo boats was approved, and in 1886 this was extended, funds being obtained by issuing naval loan-bonds. It was not until 1892, however, that political opposition was overcome and money was voted for the construction of two battleships. These latter, however, were not available at the outbreak of war with China in 1894. On paper Japan's naval position gave cause for considerable anxiety. She could only muster 28 fighting craft with an aggregate of 57,800 tons and 24 torpedo boats, the most powerful of the former being a belted cruiser of 4,300 tons, whereas China had two ironclads of nearly 8,000 tons each. Nevertheless the superior training and leadership of the Japanese navy stood them in good stead and the Chinese were severely defeated off the Yalu and at Wei Hai Wei (*see* CHINO-JAPANESE WAR).

Superiority in Orient Attained.—From now onwards the fleet was rapidly augmented with battleships and cruisers, mostly built in England, so that when the Russo-Japanese War (*q.v.*) came, Japan was able to assert her sea superiority in no unmistakable fashion. The Japanese fleet and army together made Port Arthur practically untenable as a Russian naval base and combined to bring about its downfall, while the war at sea ended in the crushing defeat of the Russian naval forces at Tsushima. As the outcome of this war the Japanese naval authorities set out to acquire a fleet consisting of eight battleships, eight battle-cruisers and the necessary complement of auxiliary vessels, but the World War intervened before this standard was reached.

Meanwhile naval conditions in the Pacific had undergone considerable change. Great Britain had withdrawn practically the whole of her battleships from eastern waters, and an Anglo-Japanese alliance had been formed and was relied on to preserve the status quo in that ocean. The United States on the other hand

had gradually attained a more prominent position in the Far East. In her desire to preserve the balance of power, it was rather to her trans-Pacific neighbour than to her ally on the opposite side of the world that Japan turned a critical eye in reviewing the naval position. In 1917 the Imperial Diet formally approved, in principle, the "eight eight" policy in capital ships.

The World War and After.—Japan entered the World War in August 1914, when the strength of her fleet was as follows:—

Battleships	16 (+6 building)
Cruisers, Armoured: 12in. gun ships	4
Cruisers, Armoured: Older ships	9
Cruisers, Light	14
Destroyers	54 (+2 building)
Torpedo boats	55
Submarines	15 (+2 building)

The Japanese fleet co-operated with the Allied naval forces in the considerable combined operations against Tsingtau, which surrendered on Nov. 7, 1914. Japanese ships throughout the war also assisted the Allies in escort work in the Pacific and Mediterranean. Her losses consisted of one battleship, the "Kawachi" and one battle-cruiser, the "Tsukuba," both destroyed by internal explosion; two light cruisers and one destroyer wrecked; one old coast defence ship torpedoed, and one torpedo boat mined.

After the war, Japan, in company with other of the great Powers, found herself faced with the expense of considerable naval construction if she was to hold her own in the arena of naval affairs, whilst financial stringency made itself more and more felt. Relief came in the shape of the Washington Treaty (*q.v.*). As the result of this Japan accepted a ratio of three as against five for Great Britain and the United States in capital ship tonnage, with the result that four old battleships, two old battle-cruisers and four capital ships building were broken up. Two more battleships were sunk, one converted to a target ship and two others to aircraft carriers. The Japanese fleet of 1928 consisted of:—6 Battleships, 4 Battle-cruisers, 35 Cruisers, plus 6 building, 3 Cruiser minelayers, 4 Aircraft carriers, plus one building, 114 Destroyers, plus 12 building, 65 submarines, plus 12 building, 5 Gunboats and despatch vessels, 8 River gunboats, 4 Mine-sweepers, plus 2 building.

Administration.—The Japanese Navy is administered by a Minister, who is an Admiral, and one parliamentary and one permanent Vice-Minister (a Vice-Admiral). The bureaux of the Japanese Admiralty are divided into personnel, supplies, construction, education, engineering, medical, finance, law, technical board, and geographical. There is an Admiral's council consisting of five members. The naval staff board consists of two Admirals.

Naval Commands.—The coast of Japan is divided into three naval districts, each having its naval port, *i.e.*, Yokosuka, Sasebo and Kure. At each of these ports there is an arsenal, marine corps and the general equipment of a naval base. There are the "strategic ports" Maizuru, Ominato and Chinhai (Korea). There are also private shipyards approved for naval use. These latter include the Mitsubishi shipyard at Nagasaki, Kawasaki shipyard at Kobe and six others. The first two are capable of building the largest type of warships.

Personnel.—The executive officers, engineers and paymasters are trained respectively at a naval academy, engineering academy and paymasters' school. Other non-combatant officers, such as surgeons, pharmacists, hydrographers and construction officers are appointed from candidates who would otherwise be graduates of universities or other schools of similar standing. Warrant officers promoted from the lower deck are eligible for commissions and may rise to the rank of lieutenant commander or even higher. The ships' companies are composed of volunteers supplemented by conscription, in the proportion of approximately half and half.

Naval Air Service.—The navy has its own air service with shore bases at Yokosuka, Kosumigaura and Sasebo, to which is to be added one at Omura. When the approved programme is completed the navy will have seventeen fleets (flights) with 136 aeroplanes. A small semi-rigid airship is being built to replace the "N3" which was lost in a gale in 1927. (E. A.)

EDUCATION

There is no room to doubt that the literature and learning of China and Korea were transported to Japan in very ancient times, but tradition is the sole authority for current statements that in the 3rd century a Korean immigrant was appointed historiographer to the Imperial court of Japan and another learned man from the same country introduced the Japanese to the treasures of Chinese literature. About the end of the 6th century the Japanese court began to send civilians and religionists direct to China, there to study Confucianism and Buddhism, and among these travellers there were some who passed as much as 25 or 30 years beyond the sea. The knowledge acquired by these students was crystallized into a body of laws and ordinances based on the administrative and legal systems of the Sui dynasty in China, and in the middle of the 7th century the first Japanese school seems to have been established by the emperor Tenchi, followed some 50 years later by the first university. Nara was the site of the latter, and the subjects of study were ethics, law, history and mathematics.

Not until 794, the date of the transfer of the capital to Kyōto, however, is there any evidence of educational organization on a considerable scale. A university was then opened in the capital, with affiliated colleges; and local schools were built and endowed by noble families, to whose scions admittance was restricted; but for general education one institution only appears to have been provided. In this Kyōto university the curriculum included the Chinese classics, calligraphy, history, law, etiquette, arithmetic and composition; while in the affiliated colleges special subjects were taught, as medicine, herbalism, acupuncture, shampooing, divination, the almanac and languages. Admission was limited to youths of high social grade; the students aggregated some 400, from 13 to 16 years of age; the faculty included professors and teachers, who were known by the same titles (*hakase* and *shi*) as those applied to their successors to-day; and the government supplied food and clothing as well as books. The family schools numbered five, and their patrons were the Wage, the Fujiwara, the Tachibana (one school each) and the Minamoto (two). At the one institution—opened in 828—where youths in general might receive instruction, the course embraced only calligraphy and the precepts of Buddhism and Confucianism. Great academic importance attached to proficiency in literary composition, which demanded close study of the ideographic script, endlessly perplexing in form and infinitely delicate in sense. To be able to compose and indite graceful couplets constituted a passport to high office as well as to the favour of great ladies, for women vied with men in this accomplishment. But it is to be observed that all this refinement was limited virtually to the noble families residing in Kyōto, and that the first object of education in that era was to fit men for office and for society.

Education in the Middle Ages.—Meanwhile, beyond the precincts of the capital there were fast growing to maturity numerous powerful military magnates who despised every form of learning that did not contribute to martial excellence. An illiterate era ensued which reached its climax with the establishment of feudalism at the close of the 12th century. It is recorded that, about that time, only one man out of a force of five thousand could decipher an Imperial mandate addressed to them. Kamakura, then the seat of feudal government, was at first distinguished for absence of all intellectual training; but subsequently the course of political events brought thither from Kyōto a number of court nobles whose erudition and refinement acted as a potent leaven. Buddhism, too, had been from the outset a strong educating influence. Under its auspices the first great public library was established (1270) at the temple Shōmyo-ji in Kanazawa. It is said to have contained practically all the Chinese and Japanese books then existing, and they were open for perusal by every class of reader. To Buddhist priests, also, Japan owed during many years all the machinery she possessed for popular education. They organized schools at the temples scattered about in almost every part of the empire, and at these *tera-koya*, as they were called, lessons in ethics, calligraphy, reading and etiquette were given to the sons of samurai and even to youths of the mer-

cantile and manufacturing classes.

Education in the Pre-Meiji Era.—When, at the beginning of the 17th century, administrative supremacy fell into the hands of the Tokugawa, the illustrious founder of that dynasty of shōguns, Iyeyasu, showed himself an earnest promoter of erudition. He employed a number of priests to make copies of Chinese and Japanese books; he patronized men of learning and he endowed schools. It does not appear to have occurred to him, however, that the spread of knowledge was hampered by a restriction which, emanating originally from the Imperial court in Kyōto, forbade any one outside the ranks of the Buddhist priesthood to become a public teacher. To his fifth successor Tsunayoshi (1680–1709) was reserved the honour of abolishing this veto. Tsunayoshi, whatever his faults, was profoundly attached to literature. By his command a pocket edition of the Chinese classics was prepared, and the example he himself set in reading and expounding rare books to audiences of feudatories and their vassals produced something like a mania for erudition, so that feudal chiefs competed in engaging teachers and founding schools. The eighth shōgun, Yoshimuné (1716–1749), was an even more enlightened ruler. He caused a geography to be compiled and an astronomical observatory to be constructed; he revoked the veto on the study of foreign books; he conceived and carried out the idea of imparting moral education through the medium of calligraphy by preparing ethical primers whose precepts were embodied in the head-lines of copy-books, and he encouraged private schools. Iyenari (1787–1838), the eleventh shōgun, and his immediate successor, Iyeyoshi (1838–1853), patronized learning no less ardently, and it was under the auspices of the latter that Japan acquired her five classics, the primers of *True Words,* of *Great Learning,* of *Lesser Learning,* of *Female Ethics* and of *Women's Filial Piety.*

Thus it may be said that the system of education progressed steadily throughout the Tokugawa era. From the days of Tsunayoshi the number of fief schools steadily increased, and as students were admitted free of all charges, a duty of grateful fealty as well as the impulse of interfief competition drew thither the sons of all samurai. Ultimately the number of such schools rose to over 240, and being supported entirely at the expense of the feudal chiefs, they did no little honour to the spirit of the era. From 7 to 15 years of age lads attended as day scholars, being thereafter admitted as boarders, and twice a year examinations were held in the presence of high officials of the fief. There were also several private schools where the curriculum consisted chiefly of moral philosophy, and there were many temple schools, where ethics, calligraphy, arithmetic, etiquette and, sometimes, commercial matters were taught. A prominent feature of the system was the bond of reverential affection uniting teacher and student. Before entering school a boy was conducted by his father or elder brother to the home of his future teacher, and there the visitors, kneeling before the teacher, pledged themselves to obey him in all things and to submit unquestioningly to any discipline he might impose. Thus the teacher came to be regarded as a parent, and the veneration paid to him was embodied in a precept: "Let not the pupil tread within three feet of his teacher's shadow." It may be remarked here that this wholesome spirit of respect can hardly be said to exist to-day.

Unfortunately, however, the policy of national seclusion prevented for a long time all access to the stores of European knowledge. Not until the beginning of the 18th century did any authorized account of the great world of the West pass into the hands of the people. A celebrated scholar (Arai Hakuseki) then compiled two works—*Saiyō kibun* (*Record of Occidental Hearsay*), and *Sairan igen* (*Renderings of Foreign Languages*)—which embodied much information, obtained from Dutch sources, about Europe, its conditions and its customs. But of course the light thus furnished had very restricted influence. It was not extinguished, however. Thenceforth men's interest centred more and more on the astronomical, geographical and medical sciences of the West, though such subjects were not included in academical studies until the renewal of foreign intercourse in modern times. Then (1857), almost immediately, the nation turned to Western learning, as it had turned to Chinese thirteen centuries earlier. The Tokugawa government established in Yedo an institution called *Bansho-shirabe-dokoro* (place for studying foreign books), where Occidental languages were learned and Occidental works translated. Simultaneously a school for acquiring foreign medical art (*Seiyo igaku-sho*) was opened, and, a little later (1862), the *Kaisei-jo* (place of liberal culture), a college for studying European sciences, was added to the list of new institutions. Thus the eve of the Restoration saw the Japanese people already appreciative of the stores of learning rendered accessible to them by contact with the Occident. Commercial education was comparatively neglected in the schools. Sons of merchants occasionally attended the *tera-koya,* but the instruction they received there had seldom any bearing upon the conduct of trade, and mercantile knowledge had to be acquired by a system of apprenticeship.

Education in Modern Japan.—Shortly after the government of the Restoration came into power, the Emperor solemnly announced that "henceforward education shall be so diffused that there may not be a village with an ignorant family nor a family with an ignorant member." But so long as the feudal system survived, even in part, no general scheme of education could be thoroughly enforced, and thus it was not until the conversion of the fiefs into prefectures in 1871 that the government saw itself in a position to take drastic steps. A commission of investigation was sent to Europe and America, and on its return a very elaborate and extensive plan was drawn up in accordance with French models, which the commissioners had found conspicuously complete and symmetrical. This plan subsequently underwent great modifications. It will be sufficient to say that in consideration of the free education hitherto provided by the feudatories in their various fiefs, the government of the restoration resolved not only that the state should henceforth shoulder the main part of this burden, but also that the benefits of the system should be extended equally to all classes of the population, and that the attendance at primary schools should be compulsory. At the outset the sum to be paid by the treasury was fixed at 2,000,000 yen, that having been approximately the expenditure incurred by the feudatories. But the financial arrangements suffered many changes from time to time, and finally, in 1877, the cost of maintaining the schools became a charge on the local taxes, the central treasury granting only sums in aid. These grants now amount to four million pounds sterling annually; but the sums spent on account of education by the various provincial and communal treasuries in 1923 were close to thirty-five millions.

Every child, on attaining the age of six, must attend a common elementary school, where, during a six years' course, instruction is given in morals, reading, arithmetic, the rudiments of technical work, gymnastics and poetry. Year by year the attendance at these schools has increased. Thus, whereas in the year 1900, only 81·67% of the school-age children of both sexes received the prescribed elementary instruction, the figure in 1905 was 94·93%. Now there is practically no illiteracy. The desire for instruction used to be keener among boys than among girls, as was natural in view of the difference of inducement; but ultimately this discrepancy disappeared almost completely. Thus, whereas the percentage of girls attending school was 75·90 in 1900, it rose to 91·46 in 1905, and the corresponding figures for boys were 90·55 and 97·10 respectively. In 1924 the number of boys attending elementary schools was a little over 4,800,000 and of girls 4,300,000; so that now the proportion is almost the same in both sexes. The tuition fee paid at a common elementary school in the rural districts must not exceed 5s. yearly, and in the urban districts, 10s.; but in practice it is much smaller, for these elementary schools form part of the communal system, and such portion of their expenses as is not covered by tuition fees, income from school property and miscellaneous sources, must be defrayed out of the proceeds of local taxation. Including public and private institutions there were in 1924 altogether 8,708 ordinary elementary schools with 183 higher elementary schools, and 16,571 combined ordinary and higher, that is to say schools classed as elementary but having sections where, subsequently to the completion of the regular curriculum, a special supplementary course of study might be

pursued in agriculture, commerce or industry (needle-work in the case of girls). The time devoted to these special courses is two or three years, according to the degree of proficiency contemplated, and the maximum fees are 15d. per month in urban districts and one-half of that amount in rural districts.

There were also in 1924 801 kindergartens, with an attendance of 66,687 infants of ages varying from 3 to 7. In general the kindergartens are connected with elementary schools or with normal schools.

If a child, after graduation at a common elementary school, desires to extend its education, it passes into a common middle school, where training is given for practical pursuits or for admission to higher educational institutions. The ordinary curriculum at a common middle school includes moral philosophy, English language, history, geography, mathematics, natural history, natural philosophy, chemistry, drawing and the Japanese language. Five years are required to graduate, and from the fourth year the student may take up a special technical course as well as the main course; or, in accordance with local requirements, technical subjects may be taught conjointly with the regular curriculum throughout the whole time. The law provides that there must be at least one common middle school in each prefecture. The actual number in 1924 was 491.

Great inducements attract attendance at a common middle school. Not only does the graduation certificate carry considerable weight as a general qualification, but it also entitles a young man to volunteer for one year's service with the colours, thus escaping one of the two years he would have to serve as an ordinary conscript. Demand is, however, far short of supply, and so great is the number of applicants for admission that candidates are obliged to undergo a competitive examination for entry. It is said that only about 10% of the qualified applicants succeed in getting in. The maximum number of boys in a middle school is at present 800; but this is to be increased to 1,200.

The graduate of a common middle school can claim admittance, without examination, to a high school, where he spends three years preparing to pass to a university, or four years studying a special subject, as law, engineering or medicine. By following the course in a high school, a youth obtains exemption from conscription until the age of 28, when one year as a volunteer will free him from all service with the colours. A high-school certificate of graduation entitles its holder to enter a university without examination, and qualifies him for all public posts; 28 of these schools were in existence in 1924 with an attendance of 15,343 pupils. The complete course covers seven years—four for the ordinary course and three for the higher.

For girls also high schools are provided, the object being to give a general education of higher standard. Candidates for admission must be over 12 years of age, and must have completed the second-year course of a higher elementary school. The regular course of study requires four years, and supplementary courses as well as special art courses may be taken. There were 746 of these schools (including private) in 1924, with 271,375 pupils.

In addition to the schools already enumerated, which may be said to constitute the machinery of general education, there are special schools, generally private, and a considerable number of commercial and technical schools (including a few private), where instruction is given in medicine and surgery, agriculture, commerce, mechanics, applied chemistry, navigation, electrical engineering, art (pictorial and applied), veterinary science, sericulture and various other branches of industry. There are also apprentices' schools, classed under the heading of elementary, where a course of not less than six months, and not more than four years, may be taken in dyeing and weaving, embroidery, the making of artificial flowers, tobacco manufacture, sericulture, reeling silk, pottery, lacquer, woodwork, metal-work or brewing. There are also schools—nearly all supported by private enterprise—for the blind and the dumb.

Normal and higher normal schools are maintained for the purpose of training teachers, a class of persons not plentiful in Japan, doubtless because of an exceptionally low scale of emoluments. The number of these institutions in 1924 was 98.

There are six Imperial Universities,—in Tōkyō, Kyōto, Sendai, Fukuoka, Sappiro, and Seoul (Korea). The most important is that in Tōkyō, with a faculty of 598 professors and lecturers and with over 7,000 students. Its colleges number seven: law, medicine, engineering, literature, science, agriculture and economics. It has a university hall where post-graduate courses are studied, and it publishes a quarterly journal giving accounts of scientific researches, which indicate not only large erudition, but also original talent. The University of Kyōto is a comparatively new institution. It has the same number of colleges as the Tōkyō University; but its teaching staff numbers only 374 and the students number only a little over 4,000. The remaining Imperial Universities are much smaller. There are in addition four government and four prefectural universities at which medical degrees only are given; there is a University of Commerce in Tōkyō; and there are 16 private universities which enjoy the same status as similar government institutions. Of these the most famous are the Keio University, founded by the late W. Fukugawa, and the Waseda University, the patron of which was Marquis Okuma.

By a reform effected in 1916 public and private schools are given practically the same status; but notwithstanding this the latter are still in a somewhat disadvantageous position because unless a private school brings its curriculum into exact accord with that prescribed for public institutions of corresponding grade, its students are denied the valuable privilege of partial exemption from conscription, as well as other advantages attaching to state recognition.

Public education in Japan is strictly secular: no religious teaching of any kind is permitted in the schools. The total number of libraries publicly or privately owned in 1926 was 3,904. Of these the most important is that of the Imperial University of Tōkyō. This was unfortunately totally destroyed in the earthquake of 1923, but is now in course of rapid restoration.

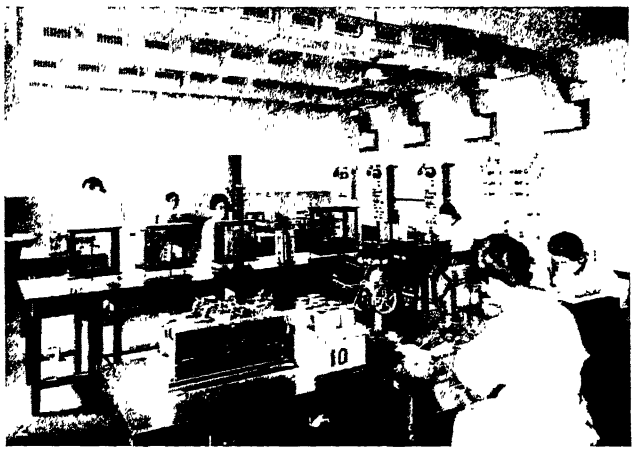
Owing to the disproportion between the number of persons anxious to enter educational institutions and the accommodation which those institutions are at present able to provide, entrance into practically all public schools or colleges, from the secondary schools upwards, is now a matter of competitive examination, in which the candidates are greatly in excess of the vacancies. The large majority of competitors therefore cannot possibly hope to be successful, although theoretically the certificates they may possess entitle them to admission into the school or college in question without examination. They are in consequence obliged to shift for themselves as best they can. For instance, the proportion of successful candidates in 1926 for admission into the Technical and Mining schools was 46%, into the Agricultural, Forestry and Sericultural schools 37%, and into the Higher Commercial schools 48%. In the case of the High schools, out of 25,012 candidates in 1925 only 2,538 were successful in obtaining admission.

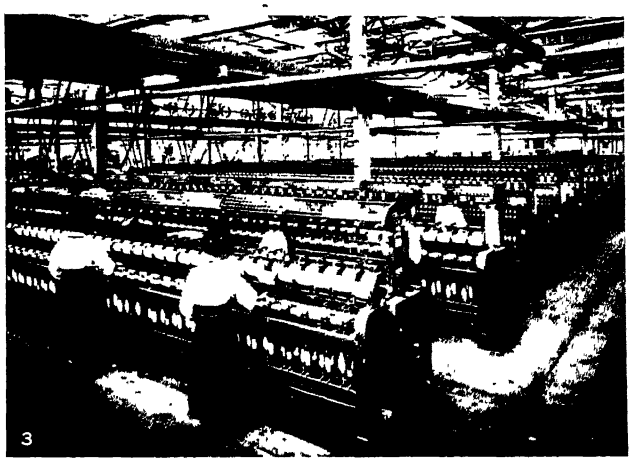
RELIGION

Shintō.—The primitive religion of Japan is known by the name of Shintō, which signifies "the way of the Gods," but this term is of comparatively modern application. The term Shintō being obviously of Chinese origin and acquaintance with the Chinese language in Japan having preceded the arrival of Buddhism by only a century, it is reasonable to conclude that the primitive religion of Japan had no name, and that it did not begin to be called Shintō until Buddhism had entered the field. Shintō was ultimately practically absorbed into Buddhism, a fate which would probably have been inevitable in any circumstances, for a religion without a theory as to a future state and without any code of moral duties could scarcely hope to survive contact with a faith so well equipped as Buddhism in these respects. But though absorbed it was not obliterated. Its beliefs survived; its shrines survived; its festivals survived, and something of its rites survived also.

Shintō, indeed, may be said to be entwined about the roots of Japan's national existence. Its scripture—as the *Kojiki* must be considered—resembles the Bible in that both begin with the cosmogony. But it represents the gods as peopling the newly created earth with their own offspring instead of with human beings











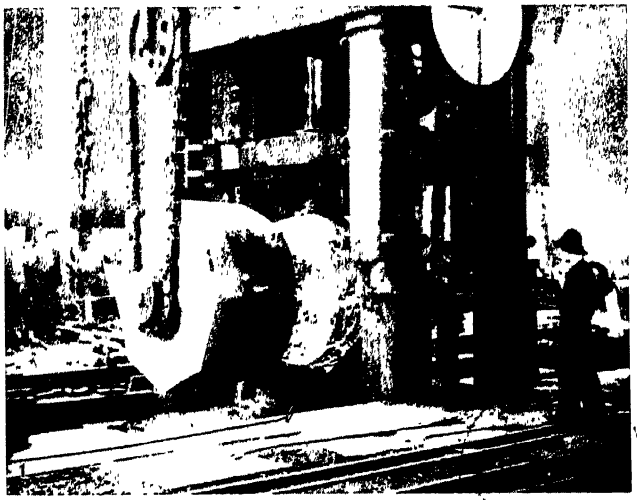


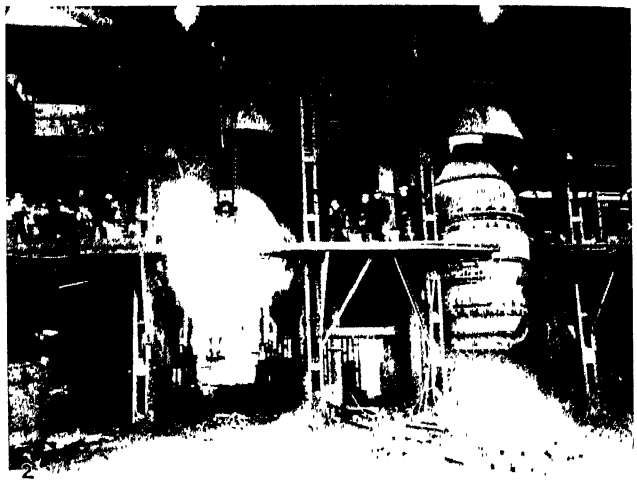
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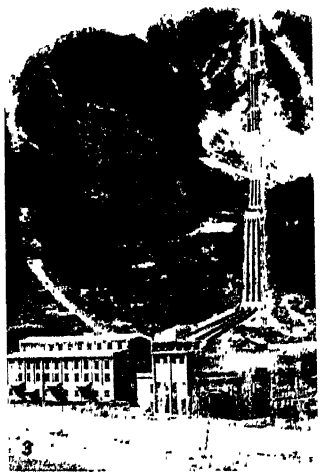
PROCESSES IN MANUFACTURING SILK AND COTTON IN JAPAN

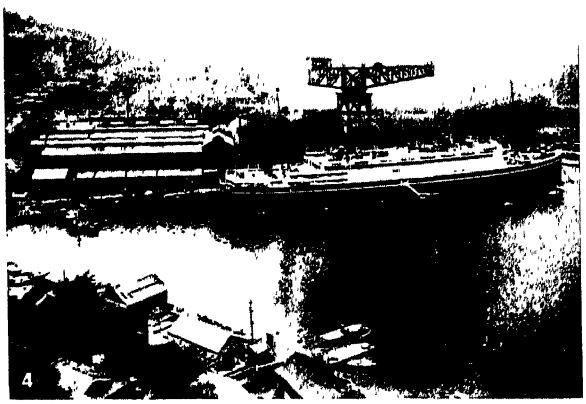
1. Silk conditioning house in Yokohama. Japanese girls, operating the automatic stop winding machines, making skeins for testing silk
2. Testing room, Yokohama silk mill, where standard size of skein is determined. Skeins are twisted at table in foreground, and weighed on delicate scales (background) for comparison with accepted standard
3. Cotton spinning mill of Kanega Fuchi textile works, near Tokyo
4. Winding department of raw silk factory, where, to ensure quality, skeins are tested by counting the number of breaks in a given skein
5. Weaving room, showing modern machinery for weaving silk cloth. Beaming machines, shown here, weave cloth from thread on spindles
6. Assembling large Diesel engines and turbines in a Japanese shop

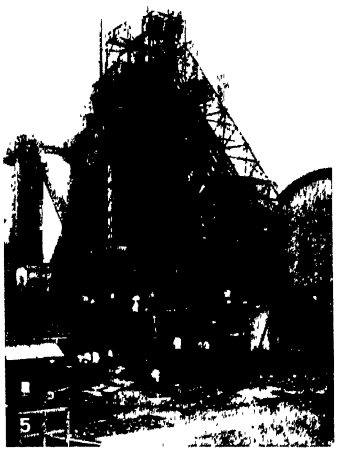
JAPAN

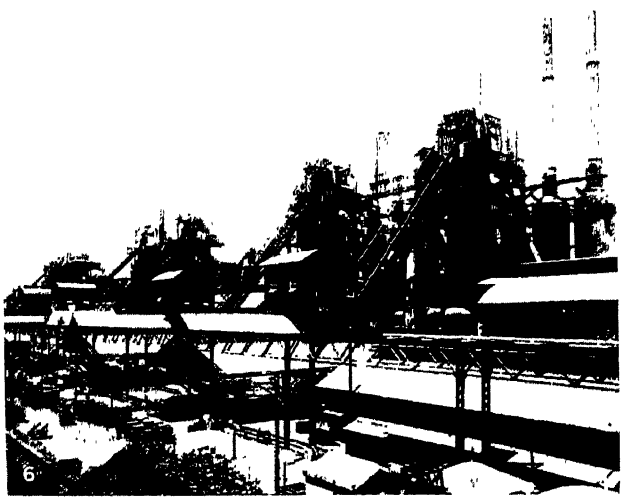














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IRON AND STEEL WORKS, HYDRO-ELECTRIC AND SHIPBUILDING PLANTS IN JAPAN

1. Hydraulic press forging a large steel ingot, Muroran works
2. View of two converters in Yawata steel works; converter at left is being emptied at the end of the "blow" or steel-making process
3. Large hydro-electric plant at Shinetsu, showing generating plant (below) and flumes or conduits leading up the mountainside to reservoirs from which the water supply is obtained for the plant
4. An ocean liner almost completed in Mitsubishi dockyard, Nagasaki
5. A modern blast furnace in the government iron foundry at Yawata; inclined skip hoist carries coke and ore to furnace
6. Battery of four blast furnaces at Yawata works (*see* fig. 5)
7. Large castings (right) and some small steel forgings (foreground) in the foundry of the great iron and steel works at Osaka

expressly made for the purpose. The actual work of creation was done by a male deity, Izanagi, and a female deity, Izanami. From the right eye of the former was born Amaterasu, who became goddess of the sun; from his left eye, the god of the moon; and from his nose, a species of Lucifer. The grandson of the sun goddess was the first sovereign of Japan, and his descendants have ruled the land in unbroken succession ever since, the 123rd ascending the throne in 1928. Thus it is to Amaterasu (the heaven-illuminating goddess) that the Japanese pay reverence above all other deities, and it is to her shrine at Ise that pilgrims chiefly flock.

"Shintō," to quote Sir Charles Eliot, "makes no appeal to reason or emotion . . . it has no moral code; its prayers and sacrifices aim at obtaining temporal prosperity and indicate no desire for moral or spiritual blessings. Yet these strange lacunae are somehow filled by its intensely patriotic spirit. For it Japan is the land of the Gods; the greater preside over the Empire, the lesser over towns and hamlets; the noble or humble dead have their due place in the cult of the state, city, or family." It regards human nature as naturally virtuous, and while believing in an existence after death, holds no theory as to its pleasures or pains. The dead become disembodied spirits and possess power to bring sorrow or joy into the lives of their survivors, which is why they were first worshipped or propitiated. Purity and simplicity being essential characteristics of the cult, its shrines are built of white wood, entirely without ornament and fashioned on the model of the dwellings of the first Japanese settlers. There are no images—a fact attributed by some critics to ignorance of the glyptic art on the part of the original worshippers—but there is an emblem of the deity, which generally takes the form of a sword, a mirror, or a so-called jewel (magatama), these being the insignia handed by the sun-goddess to her grandson, the first ruler of Japan. The emblem is not exposed to public view. The mirror sometimes seen in temples is a Buddhist innovation and has nothing to do with the true emblem of the creed. Worship takes the form of offerings and the recital of rituals (*norito*). Twenty-seven of the latter were reduced to writing and embodied many centuries ago in the *Engishiki*. Couched in antique language, these liturgies are designed for the dedication of shrines, the averting of evil, for entreating blessings on the harvest, for purification, for obtaining household security, for bespeaking protection on a journey, and so forth. But they contain no reference to a future state of reward or punishment or to assistance in the path of virtue. One ceremonial only is designed to avert the consequences of sin or crime; this is the rite of purification, which, by washing with water and by the sacrifice of valuables, removes the pollution resulting from wrong-doing. Originally performed on behalf of individuals, this *ōbarai* (great driving away) ultimately came to be a semi-annual ceremony for sweeping away the sins of all the people. The adherents of Shintō numbered 16,038,437 in 1927.

Buddhism.—Buddhism reached Japan from China by way of Korea in A.D. 552, when the King of Pakché sent the Emperor of Japan an image of the Buddha with several sûtras and a letter in which he extolled Buddhism as the most excellent of doctrines. Hostility to the new creed was manifested by some of the Shintō court officials, and its arrival was unluckily followed by an outbreak of pestilence, the result being that the reception accorded to it at first was not encouraging. Nevertheless after some vicissitudes it succeeded in obtaining a foothold of a kind; but it was not till the Prince-Regent Shōtoku Taishi (572–621) appeared upon the scene that its position became really secure. This brilliant statesman, warrior and scholar was throughout his life its ardent supporter, and laboured to such effect on its behalf that when he died it was more than strong enough to stand alone. The struggle between it and Shintō persisted for a number of years, but was ultimately composed towards the end of the century by means of a compromise by which the Shintō deities were recognized as Bodhisattvas and their shrines handed over to the custody of the Buddhist priesthood. In this manner Buddhism became practically the established church of the land. Thenceforward its history was one of steadily growing influence and power. There can be no doubt that in the earlier stages of its history in Japan it exercised a powerful civilizing influence over a nation then admittedly in a state of barbarism. Much of the best in the literature and art of the Nara and later periods is due to the inspiration of Buddhism or was the work of Buddhist priests themselves, and even in the darkest days of the Ashikaga regency art and literature still found a home within the monastery walls. But as the influence and the power of the Buddhist church increased its aims became more and more temporal. It began to interfere in political affairs; its abbots built in and around the capital or in the provinces great monasteries such as Hieizan, Kōyasan, Miidera and others and filled them with armed monks; its prelates were involved in intrigues about the throne (it is possible that the removal of the capital from Nara to Kyōto may have been due to imperial fear of priestly statecraft); it even made attempts to establish direct ecclesiastical control over the state. The various sects too began to quarrel among themselves and were as ready to appeal to the arbitrament of arms as the warring factions outside. It was at this stage of Japanese history that the sovereign began to lose his hold of the reins of state and to become the shadowy figure he was fated to remain till the Restoration of 1868. As a result the control of affairs passed into the hands of a succession of powerful families of regents or of soldiers of fortune, and, save for a brief interval of peace in the Ashikaga regency, the country was for nearly two hundred years in a state of continual civil war. Rival houses strove for the reins of government in the capital; in the provinces the territorial nobility were a law to themselves; the common people suffered untold miseries. Into this welter of strife the Buddhist priesthood plunged readily. Monastery fought monastery; sect fought sect; while the monks of Hieizan and other priestly strongholds trooped down so often in their thousands to overawe the capital that the Emperor Shirakawa once exclaimed: "Three things there are which I cannot control,—the river Kamo in flood, the fall of the dice, and the monks of Hieizan." On the other hand it was in this black period that the Jōdo and other reforming sects made their appearance. Buddhism reached the zenith of its power and influence in the years following the Mongol invasions (1275 and 1281), in the defeat of which the prayers of its priesthood were believed to have been mainly instrumental; its political eclipse dates from the rise to power of Nobunaga and Hideyoshi, which synchronized with the introduction of Christianity by the Portuguese missionaries. Nobunaga hated and feared the Buddhist church, and was resolved to humble it. For this reason and because he hoped to use Christianity as a counterpoise, he encouraged the new religion; simultaneously he had recourse to arms to enforce his will. In the prolonged struggle which ensued he was ultimately successful. Hieizan and its three thousand monasteries were utterly destroyed, the greater part of the inmates massacred, and the rest driven into exile. A similar fate befell other priestly strongholds. From these blows the monasteries never recovered, while the church itself never regained its political influence. But for the folly of the missionaries themselves in indulging in political intrigue and for the intemperance of their attacks on the adherents of the native religion it is possible that Buddhism might have been completely annihilated; their actions however drew on them the suspicions of the regents, and eventually the missionaries themselves were banished or put to death and the Christian faith proscribed under the severest penalties. The political power of Buddhism being effectively destroyed, the next line of regents, the Tokugawa, could afford to regard it with friendly eyes. Iyeyasu, the first of his line, was a member of the Jōdo sect, Iyemitsu, the second regent, was a staunch supporter of Buddhism, and Tsunayoshi, the fifth, was almost a fanatic. Its position too was assured by a decree in 1614 which obliged everyone to become a parishioner of the temple of the district in which he lived, to be entered on its registers, and to be buried according to its rites. It could reckon also on the solid and generous piety of the merchant and farming classes, a constant mainstay through all vicissitudes. Therefore although the church was shorn of political power the outlook was by no means hopeless. But from the 17th century

onwards it had new foes to meet,—the hostile influences of Confucianism and of the Shintō revival, the one pseudo-religious, the other political; and in the long struggle which ensued Shintoism ultimately triumphed. In 1868, when the Restoration took place, the Buddhist church was disestablished and partly disendowed and Shintō declared the state religion. Buddhist emblems were removed from the Ryōbu-Shintō temples and from the palace, the temples themselves were handed over to Shintō priests, and Buddhist monks were forbidden to beg for alms. Thenceforward till 1875 the Government was openly hostile to Buddhism. Nevertheless it still remained a living force. But from 1875 onwards this hostility gradually relaxed, and, finally, in 1884, when freedom of religious belief was granted to all, the restrictions placed upon it were entirely removed. Since then popular interest in Buddhism has revived, and at the present moment its temples and shrines number over 71,000, its priesthood about 54,000, and its adherents nearly 46 millions.

Japanese Buddhism is sometimes defined as a form of Mahayana; but this definition is, in the opinion of Sir Charles Eliot, inadequate. "Whatever its pedigree may be," he says, "whatever the doctrines it accepts in theory, its various phases, not only to-day but in some thousand odd years of history, smack of the soil." "Its most salient feature," he adds, "is its intimate connection in all periods with the general condition of the nation, both political and social."

Buddhist Sects.—There are at present 12 recognized Buddhist sects in Japan,—the Hossō, Kegon, Tendai, Shingon, Yūzū-Nembutsu, Jodo, Rinzai, Sodo, Obaku, Shin, Nichiren, and the Ji. The first eight are old and imported from China; the last four came into existence at the end of the 12th century and were all remodelled, if not actually created, in Japan. The Tendai, which was introduced by Dengyō-Daishi, and the Shingon, which was introduced by that most celebrated of Japanese saints and hero of countless legends, Kōbō-Daishi, are closely connected and came to Japan almost simultaneously. They had their centres in the two great monasteries of Hieizan and Kōyasan, which have already been referred to above. Their theology is somewhat abstruse. The former preaches that all known forms of Buddhism are phases of true doctrine but that the Lotus Sûtra is its crown and quintessence; the latter is the Mantrayâna, a late form of Indian Buddhism which was carried to China, Japan and Thibet. But their rich mythology appeals to the popular taste. Their combined priesthoods number at present about ten thousand and their adherents five million. Of the last four sects mentioned above the oldest is the Jōdo; but this was overshadowed by the later Jōdo-Shinshū, or Shin, which claims to present the Jōdo teaching in a simpler form. The main doctrine of both is that by faith in Amida (Amitabha) the believer, when he dies, enters the Paradise of the West, or as it is known in the Far East, Jōdo (the pure land). It is in fact the doctrine of faith not works. The founder of the Jōdo sect was Genku (Hōnen-Shōnin) and of the Jōdo Shinshū his disciple, Shinran Shōnin. This sect is marked by a distinctly popular and progressive spirit and by the fact that its priests are allowed to marry, a privilege which in the middle ages resulted in its hierarchy becoming hereditary and practically feudal barons. The Nichiren sect was founded in the 13th century by the priest of that name. There are two salient features in the doctrines preached by Nichiren. The first is his identification of religion with the national life, the second is his protest against the worship of Amitabha. Nichiren divided the history of Buddhism into three millenniums, the last of which he called Mappō (the period of the destruction of the law), a dark age full of trouble in both the political and the religious world. Salvation from this was to be found in the teaching of the Lotus sûtra, concentrated in the invocation "Nammyō-hō rengé-kyō" (Reverence to the sûtra of the Lotus of the Good Law), and the essence of the teaching itself is that Sakyamuni, not as the man but as the eternal omnipresent Buddha mind, is one with all reason and all nature. It is therefore not Amitabha but Sakyamuni whom men should worship. The sect, like its founder, has always been noted for its aggressiveness and intolerance. The Rinzai, Sōdō, and Obaku sects are subdivisions of the Zen sect, which was introduced into Japan in the twelfth century. The Zen rejects scripture as a medium for communicating truth and prescribes meditation as a substitute for revelation. It met with little success when first introduced into Japan, but ultimately became the creed of the military caste, probably because of its insistence on simplicity of life, discipline of mind and body, and concentration of thought. It is still very influential, and its influence on art has been deep and enduring. (The above section is based on information contained in a manuscript lent by Sir Charles Eliot.)

Christianity in Modern Japan.—The story of the first Christian missionaries to Japan is told elsewhere. Their work suffered an interruption for more than 200 years until, in 1858, almost simultaneously with the conclusion of the treaties, a small band of Catholic fathers entered Japan from the Luchu islands, where they had carried on their ministrations since 1846. They found that, in the neighbourhood of Nagasaki, there were some small communities where Christian worship was still carried on. It would seem that these communities had not been subjected to any severe official scrutiny. But the arrival of the fathers revived the old question, and the native Christians, or such of them as refused to apostatize, were removed from their homes and sent into banishment. This was the last example of religious intolerance in Japan. At the instance of the foreign representatives in Tōkyō the exiles were set at liberty in 1873, and from that time complete freedom of conscience existed in fact, though it was not declared by law until the promulgation of the constitution in 1889. The following figures taken from the *Résumé Statistique de l'Empire du Japon*, show the numbers of the clergy, teachers, congregations, and adherents of the various Christian denominations in Japan:—

	Priests, preachers, etc.			Churches, chapels, etc.	Adherents (in 1,000s)
	Japanese	Foreign	Total		
Roman Catholic	61	157	218	193	77
Greek Church	151	1	152	102	74
Presbyterian	303	75	378	271	..
Congregationalist	124	28	152	132	21
Episcopal Church	246	114	360	209	20
Baptist	94	28	122	76	5
Methodist	294	146	440	231	23
Lutheran	16	8	24	19	..
Salvation Army	103	4	107	78	9
Church of Christ	71	30	101	31	31
Other	204	98	302	163	..
Total	1,667	689	2,356	1,505	..

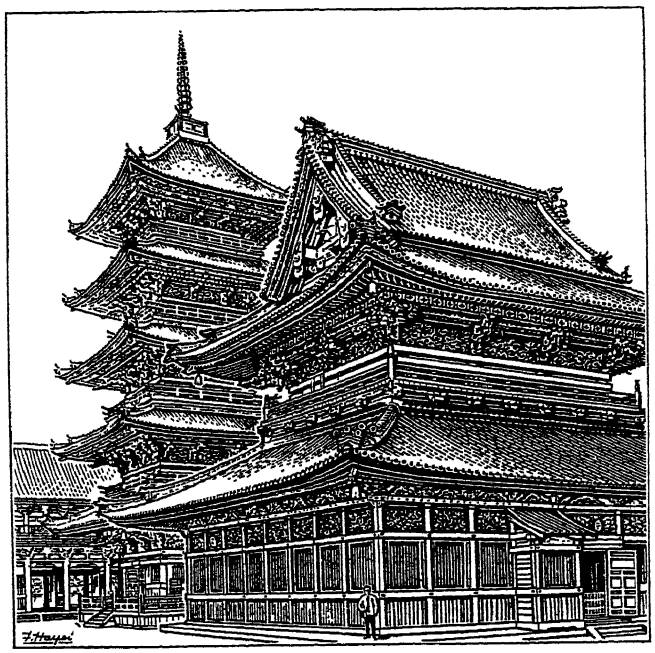
The total number of converts of all denominations is about 220,000. The Roman Catholic Church, which is presided over by an archbishop with five bishops, of whom one is Japanese, resumed its labours in Japan in 1859. In addition to its regular missionaries it is assisted by about a thousand male and female workers belonging to various orders. There are, further, seven male and female orders engaged in charitable and educational work, three entirely Japanese sisterhoods, two leper hospitals, a number of dispensaries, day nurseries, orphanages, schools for children of both sexes, and a university. An Apostolic Delegate is now stationed in Tōkyō. The Greek Church is served entirely by Japanese clergy. Its fine cathedral, once a famous landmark in Tōkyō, was destroyed in the earthquake of 1923. The Episcopal Church was established in 1859 by two American clergymen in Nagasaki and now, in conjunction with the Episcopal Churches of the United States and Canada, it has missions collectively designed as the Nihon Seikōkwai. All the more important Protestant denominations maintain schools, seminaries, and hospitals, and the Congregationalists, Methodists, and Episcopalians have in addition educational establishments which are practically universities,—as, for instance, the Dōshisha, the Aoyama Gakuin, and St. Paul's University at Ikebukuro near Tōkyō. The work carried on by the Salvation Army is much the same in form in Japan as in England,—shelters, rescue homes, social settlements, slum posts, etc. In

addition it publishes a fortnightly paper,—the Toki no Koe (War Cry). Other religious associations engaged in Christian propaganda work are the Society of Friends, the American and London Religious Tract Societies, the Young Men's Christian Association, the Young Women's Christian Association, the Japan Women's Christian Temperance Union, etc. The translation of the Old Testament into Japanese was completed in 1879, that of the New Testament in 1876. Japanese Christians concern themselves little with the subtleties of dogma which divide European Christianity, and for this reason there is practically no sectarian strife. Their tendency is to consider only the practical aspects of the faith as a moral and ethical guide, and to adapt the creed to their own requirements. This genius for adaptation has been from the earliest times a marked national characteristic and is not confined to religion only. There is, however, a strong movement among the Protestant bodies in the direction of home-rule in matters of finance and general administration, and it is believed to have been accelerated by the recent anti-Japanese immigration legislation in the United States. Outwardly Christianity makes little progress in Japan; but its doctrines have undoubtedly secured a deep hold on the modern culture of the country. For the Anthropology of Japan *see* ASIA, *Anthropology and Ethnology* (*North and East Asia*). (X.)

HISTORY

The early history of Japan is indistinguishable from mythology and consists of legends collected in the two chronicles called Kojiki and Nihongi or Nihonshoki. Both were composed in the 8th century: the first ends about 500, but the second closes with the year A.D. 697, and the latter portion of it is more or less historical, though the chronology is not trustworthy. The legends contained in these works are so nebulous and disconnected that they cannot be summarized in a coherent narrative but they tell how the land and people of Japan were produced by the Gods among whom the Sun goddess Amaterasu and her brother Susanoo play a principal part. It is noticeable that in the earliest stories there are two centres. Susanoo descends to Silla in Korea and sails thence to Izumo in Japan where his posterity rule, but the child sent by the Sun goddess to rule Japan descends, after negotiations with the rulers of Izumo, to the province of Hyūga in Kyushu. This confirms the theory, which is probable for other reasons, that the Japanese are a mixed race. The oldest known stratum of population is represented by the Ainus, whose bones are said to show some of the characteristics found in European prehistoric skeletons. There is no record, even legendary, of their arrival in Japan, but the evidence of place names shows that they once occupied the entire country, including Kyushu. They were gradually driven to the north by invaders who came partly from Korea, and perhaps ultimately from Central Asia, and partly from the south. Recent discussions tend to emphasize the importance of a Malay-Polynesian element in the Japanese language and customs and the legend also dwells on the activity of the descendants of the Sun goddess who reigned in Kyushu rather than on the doings of the rulers of Izumo.

According to the chronicles the first human sovereign of Japan was Jimmu Tennō who, starting from Kyushu, proceeded to conquer the east. He halted on the northern shores of the Inland sea and then, after much fighting, established his rule in the province of Yamato, which now becomes the centre of Japan. It is doubtless true that at some period before the Christian era there was a movement of population from the west to Yamato, but the details seem entirely legendary. Jimmu was not really the ancient name of the leader (Kami Yamato Ihare-biko) but a posthumous title invented by scholars in the 8th century, and the date of his accession, February 11, 660 B.C., is a similar invention. But in 1889 the leaders of Japan wished the nation to believe in the continuity of Japanese history and the antiquity of the imperial lineage, and with this object promulgated the new constitution on the supposed date of Jimmu's accession and made it a public holiday. In the same spirit they erected in 1890 a mausoleum on the plains of Yamato near a tumulus where he is said to have been buried. The chronicles give the names of Jimmu's successors, but ascribe to them impossibly long reigns, and there also appears to be an error in chronology by which the dates are 120 years too remote. Although the record is mainly genealogical it contains points of interest: (1) Women hold an important position and are the heroines of many tales. (2) Irrigation works are mentioned and the Emperor Suinin is said to have constructed more than 800 ponds and channels. (3) The imperial harem was large. Thus the Nihongi



TENNOJI PAGODA, AT OSAKA, A TYPICAL EXAMPLE OF THE FIVE-STOREYED TEMPLE BUILT OF WOOD TO BE RESILIENT TO EARTHQUAKE SHOCKS

tells us that the Emperor Keikō gave "fiefs of provinces and districts" to 77 of his children and each child proceeded to his own province. In this way, no doubt, arose the territorial nobility which plays such a conspicuous part in subsequent history. (4) In an edict ascribed to 81 B.C. ships are stated to be of cardinal importance, because of the difficulty of land transport, and every province is ordered to build them. (5) About the time of our era the practice of burying men alive with princes was discontinued and clay figures were substituted. (6) Several expeditions against savages, that is, probably, Ainus, are mentioned, the principal being ascribed to Yamato-takeru, son of the Emperor Keikō and first of the picturesque young heroes of Japan. He subdued first the land of Kumaso in Kyushu (so called from the Kuma and So, two tribes which inhabited it) and then successfully attacked the north and east, penetrating as far as Shimosa and Shinano. But he fell ill and died at the age of 30 on "the moor of Nobo," regretting in his last words that he could not report his victories to the emperor. "Alone I lay me down on the waste moor with none to say a word to me. But why should I regret the loss of this body? My only grief is that I cannot meet thee." His son or descendant, Chūai, became emperor and sent another expedition against the Kumaso, but it was not victorious.

Invasion of Korea.—We now come to an important legend, the conquest of Korea by the Empress Jingō, for which the traditional date is A.D. 200. Apparently it did not belong to the Yamato cycle, for the Kojiki transfers the scene abruptly to Kyūshū. The Nihongi makes a more coherent though still very strange story by telling how the court removed to Kyushu and how the empress, after invading Korea, regained possession of Yamato which had revolted during her absence. But it is fairly clear that there were two cycles of legends, one having Kyushu the other Yamato as its centre. After this period Yamato definitely becomes the seat of the emperor and of government. The Empress Jingō appears to have been a real person, for the Chinese annals, though they do not mention her name, say that Japan was ruled by a woman at this period. The Nihongi recounts how she invaded

Silla, how the neighbouring kings of Koryo (or Koguryo) and Pakche spontaneously tendered submission, and how during many years tributary missions were sent at intervals to Japan and occasionally punitive expeditions despatched to Korea. Whether at this period the Japanese subdued any considerable part of Korea may be doubted, but the Korean annals mention many incursions of Japanese pirates and also the exchange of missions. There must have been considerable intercourse, both peaceful and hostile, between the two countries. In A.D. 284 the Emperor Ōjin summoned from Pakche a learned man called Wang-in, who became tutor of the heir apparent and the ancestor of "the chiefs of writing." Ōjin was succeeded by Nintoku who is one of the romantic figures in Japanese history. The throne remained vacant for three years because he wished his brother to occupy it. The latter refused and at last solved the question by committing suicide. Nintoku made Naniwa, the modern Osaka, his capital. A celebrated story relates how he ascended a tower and looking over his country observed that no smoke was rising from the houses. Inferring that his people were poor and had no rice to cook, he abolished forced labour for three years. His palace fell into disrepair, but "the people had plenty, the praise of his virtues filled the land and the smoke of cooking was also thick." The Nihongi states that in this reign an official named "Kino Tsuno was the first to distinguish the boundaries of provinces and districts and to commit to writing in detail the products of the soil in each locality." We also hear that it became the custom to store ice in ice-houses for use during the summer.

Beginning of History.—The first date given by the Nihongi which is confirmed by external evidence is equivalent to A.D. 461 and the reign of the Emperor Richu, which is reckoned as beginning in A.D. 400, is generally considered to mark the commencement of the historical period. The appearances of deities become less frequent, but the chronology is still confused, but, as few important events are recorded, this defect is not of much moment. The Government is represented as a monarchy inherent in one family of divine descent but with somewhat irregular succession and subject to frequent usurpation. The emperors are generally represented as beneficent and beloved of their subjects, with two exceptions Yuriaku (456–471) and Buretsu (498–506) who are described as monsters of cruelty and injustice. The nobles are called Omi and Muraji, the former apparently claiming divine, that is remote imperial lineage, and the latter content with a merely human pedigree and probably descended from the old nobles of Kyushu and Izumo. At the beginning of each reign a great Omi and a great Muraji were appointed who seem to have corresponded to a chancellor and a commander-in-chief. Besides these there were personages, Kuni-no-Miyakko or chiefs of provinces, who were heads of clans owning the territory in which they resided. There were also numerous corporations called *Be*, such as the *Bes* of the mountain warders, seamen and carpenters. It is not clear how these corporations fitted into the clan system, but they included many immigrants from Korea. The most important feature of the period from A.D. 400–550 is the growth of relations with this country. The chronicles contain many admissions that the Japanese learned from it various arts of life and, on the other hand, if the language used about conquest and tribute is unduly patriotic, it is clear that they had some sort of special sphere in the peninsula. Between the two little kingdoms of Silla (or Shiragi) on the coast facing Japan and Pakche (Kudara) to the west, lay a territory called Imna or Mimana, to the west of the modern Fusan. Here the Japanese had a settlement and we hear from time to time of a Japanese garrison and Japanese governors or perhaps residents, for a king of Imna is also mentioned. The relations of Imna and Pakche were generally friendly but the rulers of Silla were from the Japanese point of view unsatisfactory and insubordinate. With the aid of the northern kingdom of Koryo they invaded Pakche and in 562 they "destroyed the Miyake of Imna."

Introduction of Buddhism.—But meanwhile an event of the utmost importance occurred. A mission from the king of Pakche asking for armed assistance recommended Buddhism to the attention of the emperor of Japan as the religion of the civilized world, and presented an image of the Buddha and sacred books. This incident is justly selected by historians as marking the introduction of Buddhism and Chinese civilization, for the Japanese Government were confronted with the immediate problem of what to do with the presents, but naturally the ground had been prepared by immigration and intercourse. In 540 we read that the men of Ts'in (China) and Han, etc., were "assembled and enrolled in the registers of population": that the men of Ts'in alone numbered 7,053 houses and that one of them was made director of the Treasury. The emperor and his court were probably not wholly ignorant of Buddhism, and Soga, perhaps the greatest personage in the aristocracy, is represented as asking whether Japan was to be alone among the nations in not worshipping the Buddha. Other councillors objected, but at last it was agreed that the Soga family should worship the image as an experiment. A pestilence which broke out at this time was regarded as a sign of the anger of the native gods and Buddhism was forbidden but, as the pestilence then grew worse, this was with equally good reason interpreted as the anger of the Buddha. As a compromise Buddhism was tolerated as the family cult of the Sogas, but since that family was very much to the fore and rising in importance it became the established church in a few decades. On the death of the Emperor Yomei there was a dispute as to the succession which led to war between the Sogas and their rivals, the Mononobe, opponents of Buddhism who championed the institutions of old Japan. The Sogas were completely victorious and after further dynastic troubles in which the Emperor Sujun was assassinated Soga no Numako's niece, known as the Empress Suiko (593–628), was summoned to the throne in her own right, although there was no lack of male heirs. At the same time Shōtoku Taishi, a son of the Emperor Yōmei who had fought with Soga against the Mononobe, was declared heir apparent and though he did not live to reign himself became one of the best known figures in all Japanese history. He was also called Umayado, or Prince Stable-door, because he was born unexpectedly while his mother was inspecting the imperial stables. He was entrusted with the government from 593 to 621 and when he died, says the Nihongi, the old wept as if they had lost a child, the young as if they had lost a parent. His name is associated with the establishment of Buddhism in Japan and he built the temple of Hōryūji which still exists. He was a lover of art and the greatest scholar of his time, the author of commentaries on several Buddhist scriptures and of a history of his country. But more than this; he seems to have introduced good administration and humane customs into a land which sadly needed them. The Nihongi, speaking of the year 562, observes "at this time between father and child, husband and wife, there was no mutual commiseration." Shōtoku Taishi "prepared for the first time laws." They consist of 17 clauses which are moral maxims rather than legal enactments and are inspired by Confucianism, though Buddhism is held up for admiration as the universal religion. The power of the throne is emphasized, the duties of ministers defined, the provincial authorities are forbidden to levy exactions and forced labour is to be required only at seasonable times. Japan had now official relations with China as well as Korea. In 607 an envoy was sent to the Emperor Yang-Ti of the Sui dynasty and next year a return mission arrived. The two potentates were not quite agreed as to their respective rank, for while the Chinese despatch began "The Emperor greets the sovereign of Wa" (the old name of Japan), the reply said "the emperor of the east respectfully greets the emperor of the west." But there was no doubt that Japan wished to learn from China all that was useful.

The Sogas.—Shōtoku Taishi, as practical ruler of Japan, had maintained good relations with the great Soga family, but after his death their power and arrogance became excessive and provoked the suspicion that they intended to usurp the throne. The story of their downfall is one of the best known episodes in early Japanese history. They had placed on the throne the Empress Kōgyoku, widow of the Emperor Jomei, but Soga no Iruka governed the country and kept almost imperial state. There was at that time a certain young man called Kamatari, who afterwards received the name of Fujiwara and became the founder of that illustrious house. He belonged to the family of Nakatomi, heredi-

tary guardians of the great Shinto shrines and rivals of the Soga. "He was indignant with Soga no Iruka," says the Nihongi, "for breaking down the order of prince and vassal, senior and junior and for cherishing veiled designs on the State." He was offered the post of head of the Shinto religion but refused it and, keeping away from court, entered into a conspiracy with the empress's brother, Prince Karu, and also secured the friendship and assistance of Prince Naka, her son, by his politeness in a game of football. As Soga was always guarded when out of doors it was decided to kill him at court in the presence of the empress. When the critical moment arrived the swordsmen appointed to strike the blow were afraid and Prince Naka himself cut Soga down. He fell at the feet of the empress, who was greatly shocked, but Naka said to her—"He wished to destroy utterly the Heavenly House and subvert the Solar Dignity. Is he to take the place of the Heavenly House?" This ended the pre-eminence of the Soga family. The empress thought it prudent to abdicate. Naka was content to be prince imperial and Karu succeeded her in 645 under the name of Kōtoku.

The Reforms of Taikwa.—He decided that the beginning of his reign should be known as Taikwa, great civilization or development, and the changes he introduced are spoken of as the Reforms of Taikwa. This is the first instance of the use of a *nengō* or year name, which became the regular method for fixing dates in Japan. Instead of using an era which covers many centuries, a special name is given to a few years. In quite modern times this period coincides with an emperor's reign; thus 1904 was the 37th year of Meiji and 1927 the second year of Showa. But formerly any remarkable event was considered a sufficient reason for a new *nengō*. In later Japanese history events are commonly referred to in terms of nengō, as for instance the Wars of Ōnin (1467–9), the Code of Kemmu (1334–6), where Ōnin and Kemmu are names not of people or places but of periods. From Taikwa down to the present Showa there have been 247 nengō. Kōtoku was not a personality like Shōtoku Taishi, but he was assisted by Kamatari, who proved one of the ablest statesmen that Japan has produced. Under his guidance the Government was reorganized and Chinese institutions were adopted on a scale which can only be paralleled by the deliberate imitation of European methods under the Emperor Meiji. The Nihongi says that "he honoured the religion of Buddha and despised the way of the Gods," that is, Shintoism or the ancient worship of Japan. The development of Japanese religion does not come within the province of this article, but it may be mentioned that though there was naturally a struggle between the imported faith and old institutions, the contest was comparatively gentle and had little of the violence which attended the Reformation in Europe. It is only occasionally and mostly quite late in history that we hear of troubles arising between the two creeds. At the time of which we are treating the triumphal progress of Buddhism was remarkable; we hear continually how images were cast and temples built in a magnificent style unknown to Shintō, which favoured simplicity; how teachers and priests arrived from Korea and China; how Japanese eagerly received ordination as monks and nuns and how an important precedent was set by a prince who retired to a monastery to avoid political complications. But all this did not mean merely an influx of foreign piety or superstition. Kōtoku and his advisers saw that the existing system of government and society was radically wrong and set themselves to reform it, taking China as their model. The central power was weak and had no machinery by which it could exert its authority far from the capital; the great mass of the people were ignorant peasants, victims of the tyranny of numerous local magnates, who were not appointed by the crown but owed their position either to birth or, very often, to their unscrupulous use of their opportunities. The system of forced labour was abused; the administration of justice and the collection of taxes were both purely local and corrupt; the families of serfs were distributed as their masters chose and provincial chiefs appropriated both lands belonging to private persons and the estates of the crown. To remedy such abuses the regulations of Taikwa appointed three great officials styled ministers of the left, right and interior; provincial governors were ordered to prepare registers showing the number of free men and serfs and the area of cultivated land in their jurisdiction. It was further ordained that the common people should have equal share in the advantages of irrigation: that the acceptance of bribes should be punished: that a box for receiving petitions should be placed in the imperial court and a bell be hung for the use of those who had complaints to make: that the absorption of land into great estates should cease: that officials should receive by way of emolument "sustenance fiefs," that is to say, the taxes of a certain number of homesteads: that in cities and townships (defined as 50 houses) aldermen should be appointed for "the superintendence of the population and the examination of criminal matters": that officials should have as assistants "men of solid capacity, skilled in writing and arithmetic." Also the whole soil of the empire was supposed to be surrendered to the central Government and was theoretically at least distributed among peasants in equal holdings of a few acres, subject to a six-yearly redistribution. The old taxes and forced labour were abolished and a system of commuted taxes instituted. Many matters of detail which cannot be here enumerated, are dealt with at length. For instance, the practice of constructing enormous tombs diverted labour from more profitable work. It was now enacted that the tomb of a prince must not require the labour of more than 1,000 men for a week, and that the grave of an ordinary official must be completed by 50 men in one day. In 649 the emperor ordered the establishment of eight departments of State, though perhaps this central organization was not really completed until somewhat later. Of these eight ministries which were modelled on the six boards of the Tang dynasty, four were concerned with the court, but their province included questions which we should now call education and public worship. The other four were the Home Office (Minbushō), the War Office (Hyōbushō), the Treasury (Ōkurashō) and the Ministry of Justice. The intention of Kōtoku's reforms was evidently to arrest feudalism, but in this they were not successful, though they did much for the improvement and civilization of his country. In China there were few great families and public opinion found selection by merit and even by public examinations natural. But the subsequent history of Japan shows that the tendency to consider office and influence as hereditary was not easily eradicated.

On the death of the Emperor Kōtoku, Prince Naka, though recognized as the heir apparent, again stood aside and allowed his mother to have a second reign under the style of Saimei. It was not till her decease in 661 that he at last came to the throne as Tenchi. At this period an important change occurred in Korea: with the assistance of the Chinese, Silla conquered the other States of the peninsula. The Japanese sent a force to help their old ally Pakche but it was annihilated by the Chinese fleet in 663, and until the time of Hideyoshi at the end of the 16th century Japan had to keep her hands off Korea. But after the fall of Pakche and Koguryu large numbers of Koreans emigrated to Japan and were hospitably received by Tenchi. He was an able and enlightened monarch but on his premature death in 671 the country was thrown into confusion by civil war between his son Ohotomo, who had been set aside, and his younger brother who had been named prince imperial. The latter won and ruled till 686 as the Emperor Temmu. The Kojiki and Nihongi which were compiled by his orders, though not completed until after his death, give a long and sometimes imaginative account of the struggle.

When he died there was again a difficulty about the succession: his son Ohotsu was put to death and his widow came to the throne as the Empress Jitō. She abdicated in 697 and for the first time in Japanese history a minor was made emperor, a practice which afterwards became very frequent. He was known as the Emperor Mommu and was both grandson and nephew of the late empress. Coming to the throne when only fourteen he died at the age of twenty and was succeeded by his own mother the Empress Gemmei. In 697 the Nihongi comes to an end, but the chronicles of old Japan are continued in the Shokunihongi, Nihon-Kōki and other official histories. The Civil Code of Taiho also throws much light on the condition of Japan at this period. It is the oldest extant body of Japanese law, but what has come down to us is not the original text which was published in the year of 702

but the edition of 833, in which a commentary is incorporated.

THE NARA PERIOD

Up to this time there had never been a fixed metropolis. The court had moved about from one town to another in the five home provinces (Gokinai), the provinces of Yamato, Yamashiro, Settsu, Kawachi and Izumi) or to Otsu on Lake Biwa, the capital being always changed on the death of the sovereign and often at other times. This habit had many inconveniences and caused great hardship to the labouring classes who were called upon to construct new palaces at frequent intervals. So in 710, in the reign of the Empress Gemmei, Nara was selected as a fixed capital and with brief intervals continued to be the imperial residence for three-quarters of a century. Except for a campaign in the north conducted by a Fujiwara general against the Ainu, the Naran period was eminently peaceful and marks an epoch in the history of art, literature and religion. The city was laid out on the plan of the Chinese capital and was visited by learned men and artists not only from China and Korea but from India, Cambodia and Central Asia. Many Japanese also went to China to study. It was the fashion to imitate everything Chinese, in art and letters, in costume and amusements; but in many religious carvings and ornaments, Indian influence is also apparent. But though this cultivated society had not much originality, it was not wanting in force and power of expression, for the Naran sculpture is remarkable for its vigour and beauty. It was at this time that the first anthology of poems (the Manyōshū) was compiled and the poets Hitomaru and Akahito wrote. Nara was pre-eminently a Buddhist centre. There were seven monasteries in or near the city and, as ecclesiastical property paid no taxes, it tended to increase, for the peasants were quite ready to surrender their land to the church and then hold it as tenants in return for a rent smaller than the imposts levied by the Government. At this period the private ownership of land began to be recognized, for it was found that the uncertain tenure and frequent redistributions prescribed by the regulations of Taikwa deterred improvements. In 708 copper was discovered and a mint established, but its operations were seriously impeded because so much of the new metal was required for the casting of bells and images. The greatest of these was the Daibutsu in the Tōdai-ji of Nara, a gigantic image weighing more than 550 tons. It was dedicated in 749 by the Emperor Shōmu who appeared before it with all his Court and declared himself the servant of the Three Treasures—the Buddha, the Law and the Church. In fervour of devotion he may rank with the Indian emperor Asoka, and like him he constructed hospitals and almshouses, roads and bridges. In all these enterprises, whether appertaining to religion or public works, he was assisted by the eminent Korean priest, Gyōgi Bosatsu, who was made head of the hierarchy. Shōmu took the tonsure and abdicated in favour of his daughter Kōken, who was also a zealous Buddhist and followed her father's example by becoming a nun in 752, a young prince succeeding her as the Emperor Junnin. But she continued to control the more important affairs of the empire and there was thus a dual monarchy consisting of a retired and a reigning sovereign, a position which often reappears in Japanese history.

The emperor's chief adviser was Emi no Oshikatsu, of the Fujiwara family, which was growing powerful, and the empress was under the influence of a handsome and ambitious monk called Dōkyō. Oshikatsu attempted to make away with him, but the empress took vigorous action in her favorite's defence and civil war broke out. Oshikatsu had many enemies on account of his sudden rise to eminence at court and was overpowered and executed. The empress then banished the young emperor to the island of Awaji where he was strangled and, emerging from her retirement, again ascended the throne in 756, changing her name to Shōtoku. Dōkyō became chancellor and practically ruler of the empire, but his ambition knew no bounds and he spread a report that the God of War wished him to be made emperor. Even his devoted mistress raised objection to this and insisted that the oracle must be consulted officially. When this was done, his enemies arranged that the divine reply should be a decided negative. Dōkyō, however, did not fall at once and even had time to take personal vengeance on his opponents. But, when the empress died in 769, he was banished. Nothing remarkable happened for the moment, but it is significant that no empress was allowed to reign again until 1630. An elderly prince came to the throne and ruled for twelve years as Kōnin Tennō, under the guidance of Fujiwara Momokawa and was then succeeded by a really able emperor, Kwammu (782–805).

THE FUJIWARA PERIOD AND WARS OF GEMPEI

Kwammu removed the court to Nagaoka, Yamashiro; then in 794 to the new city of Kyōto, which continued to be the imperial residence until 1869. The chief reason for the change was no doubt the fear that at Nara the Government might be made subservient to the Buddhist church, and the incident of Dōkyō shows that there were ambitious prelates who dreamt of a state analogous to the Papacy or the Lamaist hierarchy of Tibet. At Kyōto the Government was for the time being at any rate not exposed to undue ecclesiastical influence. Not that Kwammu in any way quarrelled with the Buddhist church: he built many temples himself, but he made an enactment that imperial sanction was necessary for the construction of new ones. Kwammu also tried to abolish, though without permanent success, the hereditary tenure of office enjoyed by provincial governors. These officials owned large tax-free estates called shōen which, like those of the monasteries, continually increased by absorbing the neighbouring land owned by peasants. This system had two most important consequences: first it created a class of quasi-independent territorial magnates and secondly it impoverished the exchequer by increasing the extent of areas which paid no taxes. Kwammu's reign was also remarkable for a long campaign against the Ainu. At this time the extreme outpost of the Japanese empire was the fortress of Taga about 50 miles to the north of Sendai. The Ainu seized it in 780 and it was not till 802 that the fighting was over. The hero of these wars was Sakanoe Tamuramaro, whom Japanese romances represent as the ideal soldier, most terrible to his enemies but gentle and unassuming among his friends. He was the first to receive the title of Sei-i-tai-Shōgun, or Barbarian-subduing-Generalissimo, which was the name by which the later rulers of Japan were known.

The sovereigns who immediately succeeded Kwammu were not without ability and have been called the learned emperors. But from this point onward a most remarkable and persistent feature makes its appearance in Japanese history. This is the constant tendency to separate titular and real authority, to preserve a venerable hereditary office but to set up beside it a recognized and efficient power which was also generally hereditary. Not only was the Government during many centuries administered by a Shōgun but the effective power of the Shōgun sometimes passed to a deputy and at other times an emperor who had nominally abdicated in favour of a minor retained the real control of the State. The history of Japan from Kwammu to Meiji is not a history of emperors but of certain great families of whom the Fujiwaras were the first. Yet the really remarkable fact is the continued existence of the imperial house and the veneration in which it was held through all these vicissitudes. The period from the beginning of the 9th century to the middle of the 11th is commonly known as the period of the Fujiwaras. They were not like the later Shōguns, a military power which brought pressure to bear on the court: they ruled by identifying themselves with the imperial family. For instance, Fujiwara Michinaga (966–1027) who governed the country for thirty years, was the father-in-law of three emperors and the grandfather of four more. The emperors married Fujiwara ladies and their children were educated in Fujiwara palaces. Very often the emperor was a minor and in that case his maternal grandfather acted as regent. If he was of full age, a Fujiwara filled the office of Kwambaku, a sort of chancellor. If the emperor showed any inclination to assert himself, he generally had to retire to a monastery. During 200 years of Fujiwara rule there were fifteen emperors, of whom seven were minors and eight abdicated.

The Fujiwara or Heian period as it is sometimes called (Heian-kyō, or capital of peace, being another name of Kyōto) was a

peaceful time. There were, indeed, some disturbances, such as piracy and the short-lived attempt of Masakado (939) to make himself emperor in the Kwantō and there was in the north some fighting with the Ainus and with the Japanese family of Abe which had established itself there. But such distant troubles did not much affect the court at Kyōto. Literature, art and gallantry flourished. Buddhism also flourished and the great monasteries on Mount Hieizan began to acquire a dangerous importance in politics, as those of Nara had done before. Scholars like Kōbō Daishi and Dengyō Daishi visited China and brought back with them novelties in art and religion. As at Nara, everything Chinese was fashionable. The fault of this pleasant and cultured society was that being engrossed with its own refined amusements, it neglected the provinces where great estates continued to grow and attract the military spirit of the country.

Tenjin.—A picturesque figure of this period is Sugawara no Michizane, known to every Japanese as Tenjin. Though not of the Fujiwara stock, his talents and learning gained him high office early in life and the confidence of the Emperor Uda, who however retired to a monastery in 897 and abdicated in favour of his son Daigo, aged fifteen. He entrusted the youth's education to Michizane and intended to retain control of the Government with his assistance. This was more than the Fujiwaras could stand: the young Emperor had to sign an edict appointing Michizane viceroy of Kyushu, then regarded as a remote province, and the ex-Emperor protested in vain. But after Michizane's death at his distant post some years afterwards the country was visited with droughts, fires, floods and other calamities, in which popular imagination saw the vengeance of his indignant spirit. He was canonized as Tenjin Sama, the god of calligraphy, and his temples, marked by plum trees, of which he was specially fond, are to be found in most Japanese towns.

The first check to the power of the Fujiwara family was the reign of the Emperor Go-sanjō (1068–1072) who came to the throne because the Fujiwara bride selected as Empress for his predecessor was childless and who ruled with considerable independence. He seriously attacked the evils of provincial administration, ordered that no governor should hold office for more than one term and confiscated many *shōen* which could produce no title deeds. Unfortunately he reigned only four years. The next period, 1073–1156, is sometimes called the rule of the Cloistered Emperors, because the two sovereigns Shirakawa and Toba, though they became monks and nominally retired from the world, managed to keep the real power with a court and a council of their own, whereas the Fujiwara could only control the titular emperor, who was a minor. But the system did not work well. There was a natural conflict of authority between the two courts and the Cloistered Emperors, having become nominal monks, allowed the church to acquire great temporal power. Enormous sums were spent on building and adorning temples, and the monasteries of Hieizan, which had established the practice of keeping mercenaries, became veritable fortresses whence, if any ecclesiastical interest was at stake, armed forces used to descend into Kyōto to over-awe the Government. Even Shirakawa complained that, though he was emperor, there were three things he could not control: the inundations of the river Kamo, the hazards of the dice and the monks of Hieizan. The evils of provincial administration increased, for the court stultified its own edicts. It prohibited the extension of *shōen* but at the same time, being in need of money, it sold appointments and prolongation of office.

Taira and Minamoto.—Two great clans came specially to the front, the Taira and Minamoto: both were of imperial descent but both rose to power through the military services which they rendered, the first in western Japan, the second in the extreme north against the Ainu. Also the Cloistered Emperors established for their own protection a new body of guards in which both clans were employed, though special confidence was placed in the Taira. The contest between the two clans is often called the wars of Gempei.

Troubles about the succession in 1156 and a conspiracy in 1160, for taking part in which many Minamoto lost their lives, made the Taira supreme and Kiyomori, the head of the house, was practically a dictator until his death in 1181. The brief rule of the Taira does not seem to have been inspired by any original policy or to have had any special consequences for the history of Japan and it was unpopular. Kiyomori was haughty and exacting: he distributed all the great offices of state among his kinsmen: he made enemies of the Buddhist clergy, although when he was ill he took the tonsure according to the custom of the time and, strange to say, recovered: at great expense and inconvenience to both nobles and commoners he made the court remove for a time to Fukuwara near the modern Kobe where he had his private residence. Besides this, evils for which he was not responsible, pestilence, fire and famine ravaged Kyōto and though he died in peace himself, the rule of the Taira came to an end four years after his death and gave way to the Minamoto, led by Yoritomo.

Yoritomo.—Though the issue at stake was the supremacy of one or other family, Yoritomo began by having the support of many of the Taira, for Kiyomori had favoured only his own section of the clan and had made enemies of others. His first attempts during the life of Kiyomori were unsuccessful. He was captured and narrowly escaped being killed but was banished to Izu. Subsequently in the battle of Ichi-no-tani near Suma (1184) and the great sea-fight of Dan-no-ura (1185), the power of the Taira was completely crushed. These victories were mainly due to the genius of Yoshitsune, Yoritomo's younger half brother, and it is melancholy to relate that when Yoritomo's power was established he was not merely ungrateful but determined to remove his brother as a dangerous rival. Yoshitsune fled to northern Japan and when pursued by Yoritomo's assassins committed hara-kiri. But he lives in military history as one of the greatest Japanese strategists, and in art and romance he and his faithful henchman Benkei are still among the most popular heroes of the Japanese public.

THE KAMAKURA PERIOD

Instead of trying to rule the court at Kyōto as the Fujiwara and Taira had done, Yoritomo with the help of his celebrated counsellor, Oye Hiromoto, set up at Kamakura a new military government called the Bakufu with a council, home office, treasury and supreme law court of its own. The owners of *Shōen* were no longer allowed to appoint their own stewards. In each province was placed a High Constable (*Shugo*) whose duty was to raise troops and keep order, and a Land Steward (*Jito*) who collected taxes and superintended the administration of justice. Both officers were responsible to the Bakufu and not to the emperor or the owners of estates. Unlike Kiyomori, Yoritomo was careful to conciliate the Buddhist clergy and to show due deference to the emperor and court. The titles and property of the Kyōto nobles —called *kuge* or courtly houses as distinguished from *buke* or military houses—were duly respected and he himself obtained from the emperor the title of Sei-i-tai-Shōgun, which was equivalent to giving him a permanent commission to see to the defence and tranquillity of the empire. The title had been granted before to Tamuramaro (as mentioned above) and to others, but hitherto it had been limited in time and place whereas Yoritomo's mandate was permanent and for the whole empire. It is difficult to exaggerate the importance of the changes introduced by Yoritomo. Before his time, Japan means Kyōto and the neighbouring provinces. We hear of the west and the north-east as regions in which rebellions occasionally occurred and to which troublesome persons were banished. But now the size of the country seems more than doubled and the Kwanto emerges as an integral part of the empire, a civilized land with a great capital. Secondly, the Japanese character has at least two sides—one artistic and one military. The civilization of Nara and Kyōto and the open imitation of Chinese culture developed the former, not without danger of encouraging effeminacy. There was plenty of turbulence, it is true, even among the clergy but in reading the earlier chronicles one does not receive the impression that the Japanese were a nation of soldiers. But under the institutions of Yoritomo they became so. Except at the Court of Kyōto, the administration and social life were controlled by the military class. Yoritomo died in 1199. Though he founded a system of government, he did not found a

dynasty. It is true that the Minamotos remained prominent in Japanese history, for both the Ashikagas and Tokugawas were branches of that family, but his own descendants did not rule.

Rule of the Hojō.—The real power passed into the hands of the house of Hōjō, to which his wife belonged. They assumed the title of *Shikken,* constable or regent, and for about a century governed in the name of puppet Shōguns, much as the Fujiwaras had governed in the name of the emperor.

Yoritomo's two sons and nephew were allowed to succeed but after that the Shōguns were generally minors and chosen from among imperial princes. For some time the court at Kyōto had a certain independence. The chief power was in the hands of the ex-emperor Go-Toba, a man of ambition and some talent, who realizing that it was very hard for a titular sovereign to have much influence in Japan, had abdicated and was allowed to manipulate the succession among his sons as he pleased. In 1221 he made an attempt, in which he relied to a considerable extent on the military strength of the great monasteries, to break the power of the Kamakura Government. The attempt seems to have been premature and the exceedingly prompt action of the Hōjōs had no difficulty in crushing it immediately but it had important consequences. Go-Toba was banished, the Hōjōs took charge of the court and the imperial succession as the Fujiwaras had done and two of them were installed in Kyōto as military governors. More than this, 3,000 estates belonging to Go-Toba's adherents were confiscated and distributed among the supporters of the Bakufu, which materially strengthened the feudal system.

Mongol Invasion.—The most remarkable and creditable event in the Hōjō administration was the repulse of the Mongol invasion. In the 13th century the Yüan or Mongol dynasty seized the throne of China and also subdued Korea. This conquest brought them almost into contact with Japan and Khublai Khan came to the conclusion that it ought to accept his authority. So in 1268 he sent a patronizing letter addressed to the "King" of Japan, pointing out what had happened in Korea and asking that a mission might be sent to China. No answer was sent and in 1274 an attempt of the Mongols to land at Hakozaki in Kyushu was repulsed. Further envoys sent by Khublai were executed, so in 1281 he decided to despatch a really great expedition and chastise the Japanese. This aroused an outburst of patriotism in which the Buddhist Church took part. The forces of nature aided the Japanese: a great typhoon destroyed Khublai's armada and no more was heard of the Mongol peril.

But, in spite of this success, the Government of Kamakura became unpopular and inefficient. Takatoki, the ninth Hōjō Regent, was conspicuously debauched and extravagant. The central administration lost its hold on the provinces, and the old evil of independent fiefs, large and small, against which Yoritomo had legislated, reappeared. The military class were sinking deeper and deeper into penury and debt and their only hope was a successful war.

Go-Daigo.—Bad harvests and pestilence had brought the peasantry close to starvation. It had been the custom of the earlier Hōjōs to store grain and distribute it in times of need at low prices, but their successors, instead of following this wise custom, endeavoured to make money by selling it to the highest bidder. At Kyōto the practice of putting on the throne minors who abdicated early became increasingly frequent and at one time (1298–1304) there were no less than five ex-emperors alive. Go-Daigo, however, who succeeded in 1318, was of mature age and in a few years' time quarrelled with the Government of Kamakura because they refused to recognize his son as Prince Imperial on the ground that he was ineligible by the terms of a will made by the Emperor Go-Saga (1272). In the dispute which ensued the emperor was banished to the island of Oki but it was soon clear that the Hōjōs could not rely on the support of the country or even of their own nominal adherents.

Go-Daigo managed to escape from Oki in 1333: Ashikaga Takauchi who was sent against him went over to his side and in the east Nitta Yoshisada, another eminent general of the Bakufu, turned against them and burnt Kamakura. With the suicide of Hōjō Takatoki and 300 followers the rule of the Hōjō came to an end. The interesting events of the stormy half century which followed form the theme of many historical romances but are so complicated that they can only be summarized here very briefly. The period 1334–35 is often called the Restoration of Kemmu and it may seem that Go-Daigo, being left master of the situation, could have permanently restored the ancient imperial régime, especially as his own son was named titular Shōgun. But he evidently lacked the ability to do this, and he refused to follow the wise and cautious advice of his devoted follower Kutsunoki Masashige, celebrated as a model of self-sacrificing loyalty. The man who emerged as victor was Ashikaga Takauji. He proclaimed himself Shōgun in 1335. Go-Daigo refused to recognize him and fled with the regalia. On this Takauji deposed Go-Daigo and appointed to the throne an imperial prince who reigned as the Emperor Kōmyō and in return recognized him as Shōgun.

THE ASHIKAGA PERIOD

Thus began the Ashikaga line of Shōguns (1338–1565) and also a period of divided sovereignty which lasted 56 years, the Emperor Go-Daigo and his descendants reigning at Yoshino as the southern court and the Emperor Kōmyō and his descendants at Kyōto as the northern court. Though the former court is generally considered as legitimate, it ultimately had to yield and handed over the regalia to the court of Kyōto in 1392, when the double sovereignty ceased.

This arrangement was effected by Yoshimitsu, the third and ablest Shōgun (1367–1395) of the Ashikaga house, for he saw that the struggle between the rival courts was demoralizing authority, ruining the peasantry and giving over the whole country to lawlessness and brigandage. During most of the Ashikaga period the imperial dignity descended regularly from father to son: few sovereigns abdicated and the country was not distracted by ex-emperors ruling *de facto* without any constitutional warrant. The Shōguns resided in Kyōto but did not attempt to govern by making matrimonial alliances with the imperial family. The court simply subsided into the second place, chiefly because hardly any revenue reached it. Yoshimitsu also checked piracy and restored some sort of order in Kyushu. He re-established commercial and diplomatic relations with China and the results were lucrative, though he had incurred much censure from patriotic Japanese because in his official correspondence with the Ming emperor he tolerated and even used phrases which implied that Japan was a vassal state. Towards the end of his life he retired and became a monk, but continued to govern the country from his palace Kinkakuji (the golden temple) in Kyōto. After Yoshimitsu's death and especially from the rule of Yoshimasa the eighth Shōgun (1443–1474) onward, things went from bad to worse, but in reading the melancholy annals of the Ashikaga—one long catalogue of individual debauchery and tragedies and of ruinous wars between the great feudal houses—we must not forget that this was also the golden age of Japanese painting, when some of the best literature was produced and the Nō drama was invented. Art, it is true, flourished chiefly in monasteries and its inspiration, largely Chinese, was due to the intercourse with China promoted by Yoshimitsu's policy. Still, this art was by no means devoid of vigour and originality and the monasteries could not have produced such talent had the general intelligence of the age been stagnant. Disastrous as was the strife of noble houses, it at least stimulated the spirit of adventure and offered a career to men of ability, regardless of birth. The system of serfdom which had prevailed for more than a thousand years was broken up, and no chieftain could hope to hold his own unless he could attract men to his service and maintain a moderately just and efficient administration within his own domains.

Nevertheless, it is impossible to give a favourable account of either the capital or the provinces during the Ashikaga rule of 15 Shōguns. Eleven were minors at their accession, nine abdicated, five died in exile, and at least two came to violent ends. Just as the Hōjō regents had ruled instead of the Minamoto Shōguns, so officials called wardens (Kwanryō) took the power from the Ashikaga Shōguns and fought for it among themselves. This arrangement became so much a matter of course that the

three houses (Shiba, Hosokawa and Hatakeyama) who claimed the right to hold the office were called Sankwan, or the three warden families. By the middle of the 15th century Kyōto was in ruins and reduced to a population of 22,000.

Nor were things any better in the provinces. Taxation is said to have amounted to 70% and the unfortunate cultivators had to pay not only regular imposts but also extraordinary taxes called Dansen levied for special purposes sometimes more than once in a year. This resulted in frequent popular tumults demanding a Tokusei or benevolent act of the Government, that is, cancellation of debts. In the time of Yoshimasa alone there were 13 such Tokusei. The Kwantō was governed by regents taken from another branch of the Ashikaga family, but after about 1440 their authority became precarious. The whole region was practically independent of Kyōto and the chief power was in the hands of the Uyesugi family. Disastrous dissensions in the great houses of Shiba and Hatakeyama known as the wars of Ōnin (from the name of the period when they began in 1467) wasted the country for ten years. Soon afterwards another war broke out, occasioned by internal jealousies of the Hosokawa family. But, long as the struggle lasted, it ended in nothing: the antagonists wore themselves out and in the 16th century both Ashikagas and Hosokawas disappeared. In this century, one of the most eventful in the history of Japan, two features are specially remarkable. The first is the almost simultaneous rise of three great men, Nobunaga (1534–1582), Hideyoshi (1536–1598) and Iyeyasu (1542–1616) whose successive efforts, though they consisted of little but war, ended by giving their country unity and peace. The second feature is the discovery of Japan by the Portuguese in 1542 and the arrival of European merchants and missionaries.

NOBUNAGA, HIDEYOSHI AND IYEYASU

It now becomes comparatively easy to follow one main thread in the history of Japan. An account of Nobunaga's conquests is an account of the successive withdrawal of various territories from chaotic feudalism to form the basis of a new Japanese empire. At the time that he was born, there was no central government. Though the emperors remained the fount of honour, they did not make a single public appearance between 1521 and 1587: the Shōguns were puppets in the hands of contending chieftains: the provinces ceased to be administrative areas and the only effective government was that exercised by the heads of the principal feudal houses in the lands—often comprising several provinces—which they had acquired by force of arms. The free city of Sakai near Osaka was an interesting but unique phenomenon. It had expelled its feudal lord, and the Jesuit Vilela says it was "governed by its own laws and customs in the fashion of Venice." An important factor in the situation was the temporal power of the Buddhist Church. Even more than before the larger monasteries became fortresses with lands, troops and secular ambitions. In spite of this worldly tendency Buddhism had shown itself in the preceding centuries by no means deficient in religious vigour. The preaching of Nichiren stimulated patriotism in the time of the Mongol invasions and out of the monasteries of Kyōto, wealthy foundations devoted to art and political intrigue, there arose in the 12th century sects analogous to Protestantism which preached with signal success simple doctrines intelligible to the masses. One of these sects called Shinshū allowed the clergy to marry, with the result that abbots became hereditary and even more like feudal lords than celibate prelates had been. In Echizen, Echigo, Kwantō and Kaga, the vast tracts ruled by religious establishments of this sect were hardly distinguishable from ordinary baronies, and Kennyō, the eleventh abbot, was accused of wishing to supplant the emperor.

Nobunaga.—Oda Nobunaga belonged to the Taira family and inherited a small fief in the province of Owari. He was a brilliant military genius and at that time the natural career for a man of his calibre was to extend his lands by conquest and, if possible, penetrate to Kyōto and get the Shōgun into his power. In executing this programme he had the assistance of Hideyoshi, a simple peasant said to have been remarkably ugly, who entered his service as a groom, and after his death surpassed his achievements and ended by administering the whole empire. Nobunaga also acted in concert with Iyeyasu, a rising young warrior of the Tokugawa family which was a branch of the Minamoto. By 1568 Nobunaga had taken possession of all Owari with the neighbouring provinces of Mino, Ise and Omi, had entered Kyōto and installed Yoshiaki, the last of the Ashikaga Shōguns.

Arrival of Portuguese and Jesuits.—It was in 1572 that Nobunaga first made the acquaintance of the Jesuits, to whose doings we must now turn. Thirty years earlier the hazard of a storm had driven a Portuguese ship which was bound for Macao to the coast of Tanegashima, an island lying off the extreme south of Kyushu. They were well received, and when the news of the discovery spread among the Portuguese establishments in the East seven expeditions were equipped in the next few years to exploit the new market. They traded in the ports of Kyushu and even visited Kyōto. In 1549 the first missionary, Xavier (*see* article XAVIER), landed at Kagoshima, accompanied by two Portuguese priests, and by a Japanese called Anjiro or Yajiro who had somehow found his way to Malacca. He was most favourably received by the Daimyō of Satsuma, who saw in his arrival a prospect of opening a lucrative trade with foreign markets. But the ships which were expected at Kagoshima, went to Hirado instead. In 1550 the disappointed Daimyō issued an edict in which he forbade Christianity, and the missionaries thereupon moved to Hirado. Here they were well received by the Portuguese merchants, who recommended them to the Japanese, and their preaching had some success. Xavier paid a fruitless visit to Kyōto, but his stay at Yamaguchi in western Japan and in the province of Bungo in Kyushu had more result. When he left, after spending about two years in Japan, it is said that he had baptized 760 persons. In the year following Xavier's departure more Jesuits arrived in Bungo, which was for some time the principal Christian centre. It was from there that they began to send to the General of their order in Rome the series of reports called *Annual Letters* which give a most valuable picture of contemporary Japan. The head of the Otomo family, the ruling house in the province, assisted them not only by encouragement in his own territories but by his influence among his neighbours. In Hirado the fortunes of Christianity varied: sometimes the desire to encourage trade at any price prevailed, but sometimes indignation at aggressive propaganda, and such outrages as burning temples, provoked restrictive legislation. Sumitada, chieftain of Omura, a fief near Hirado, became a most zealous Christian. He gave land and residences to the Jesuits, forced Christianity on his vassals by drastic means, and in 1567 built a church at Nagasaki, then an obscure fishing village. His object was to provide a centre for Portuguese trade and religion and he succeeded so well that in five years Nagasaki grew into a town of 30,000 inhabitants, while he himself became one of the most important feudal lords of Kyushu. His neighbour, the chieftain of Arima, thought it well to follow this example and became known to the Portuguese as Prince Andrew. In Arima and other places there were many vicissitudes, but on the whole the progress of Christianity was astonishing. The *Annual Letter* of 1582, only thirty-two years after the landing of Xavier, reports that there were 150,000 converts. In this year, too, at the suggestion of the Jesuit Valegnani, an embassy of four Japanese youths was despatched from Kyushu to the Pope and also visited Lisbon and Madrid. The vast majority of the conversions mentioned took place in Kyushu, but the propaganda of a Jesuit called Vilela had considerable results in Kyōto, and its success is interesting because his converts cannot have been actuated by commercial motives. In 1564 a chieftain called Takayama Yushō challenged Vilela to a public disputation and, admitting that he was vanquished, embraced Christianity with all his household and vassals. But in Kyōto too, the aggressiveness of the missionaries irritated the Buddhist clergy, who as early as 1565 and 1568 induced the emperor to issue two anti-Christian edicts, and it would probably have fared ill with the new religion but for the constant support of Nobunaga, who was now the most powerful man in Japan and who ruled 30 out of the 66 provinces. He

assisted and protected the Jesuits in every way he could and even built a house and church for them in the new city of Azuchi which he constructed on the shores of Lake Biwa. Nobunaga never showed the slightest sign of becoming a Christian himself but, like many Japanese, he was anxious to learn all he could from Europeans, and he was also actuated by violent hatred of the Buddhist priesthood. In his early struggles they had taken sides against him and in 1570 they were a menace to his rule in Kyōto. In that year the Miyoshi family threatened the city in conjunction with the Shinshū priests of Osaka, whose temple there was one of the strongest fortresses in Japan, and while he was occupied with them his enemies, the nobles of Echizen and Omi, planned another attack with the help of the monasteries of Hieizan. As soon as he had disposed of his lay enemies Nobunaga made a sudden attack on this holy mountain and, after perpetrating an appalling massacre, burnt the monasteries of which there are said to have been 3,000. He was not quite so successful in dealing with the temple fortress of Osaka which, under the command of the abbot Kennyō, a most capable soldier, withstood a long siege until both parties agreed to accept the mediation of the emperor, who evidently regarded this open war with a religious body as a public scandal. Nobunaga's stormy career now came to an unexpected close. He had sent Hideyoshi to the west in order to subdue the powerful Daimyō of Chōshū near the straits of Shimonoseki. In June 1582 a body of troops under Akechi Mitsuhide which was meant to reinforce this expedition suddenly turned on Kyōto. The motives of Mitsuhide, who was killed in the struggle, have never been satisfactorily explained. Possibly he was avenging some ancient insult. At any rate he attacked Nobunaga's house and the latter, being unable to escape, committed suicide.

Hideyoshi.—Nobunaga was a considerable military genius but not of any administrative ability. He had, however, made his age familiar with the idea that supreme authority under the emperor was vested in one man, and Hideyoshi, the peasant who had been his groom, who had become his trusted lieutenant, and who now took his place, made the most of this idea and in eight years' time became both military and civil master of the whole country. At first the question of succession presented some difficulty. Hideyoshi supported the claims of the child of Nobunaga's deceased eldest son and constituted himself the infant's guardian. Nobunaga's other sons objected and one of them, Nobuo, ultimately took the field and had the support of Iyeyasu. But when Iyeyasu and Hideyoshi, who had formerly worked together, found themselves pitted against one another, they thought that the question at issue was not worth a conflict and made a compact which they confirmed by a matrimonial alliance. None of Nobunaga's descendants ultimately played any political rôle of importance and Nobuo subsequently fought for Hideyoshi. In the first years of his rule Hideyoshi conducted a vigorous and successful campaign against Echizen and, as a result, four provinces on the Sea of Japan submitted to him. He also subdued the island of Shikoku which had become a practically independent principality under Chōsokabe of Tosa. But, more than this, he began to organize an efficient system of central government supervised by five ministers called Bugyō, and to reform the administration of justice and the coinage. In 1585 he received from the court the title of Kwampaku and was master of all Japan except Kyushu and the Kwantō with the provinces to the north of it. He now turned his attention to these two regions, beginning with Kyushu. The warlike Shimazus of Satsuma had been advancing towards the north and threatened Bungo among other provinces. The chieftain of Bungo asked Hideyoshi to intervene. He gladly did so and when he received a defiant answer to his representations from Satsuma, he invaded the island and reduced it to submission, but was careful to show a wise clemency to the powerful house of Shimazu.

Christianity.—This expedition brought Hideyoshi into contact with Christianity as a political power and led to the restrictive edicts which caused the Jesuits to execrate his name. Up to this time he had shown no animus against them and he certainly was not prejudiced in favour of Buddhism, for he had an old quarrel with the monastery of Negoro, which he burnt in 1584. In the main island the Jesuits had confined their activity to religious matters, but what Hideyoshi saw and heard in Kyushu evidently convinced him that they were not merely a new sect but that they aimed at establishing an *imperium in imperio* and were a danger to the State. He was careful to complete his campaign before making new enemies, but when on his return journey he reached Hakata in the north of the island he unexpectedly caused five questions to be put to the vice-provincial of an order which sufficiently indicate the nature of his suspicions. On what authority, he asked, do the Jesuits constrain Japanese subjects to become Christians? Why do they incite their disciples to destroy temples? Why do they persecute Buddhist priests? Why do they eat animals useful to men, such as cattle? Why do they allow Portuguese to carry off Japanese and make slaves of them in the Indies? The answers to these questions were not considered satisfactory and an edict was immediately published (1587) ordering foreign priests to leave the country within 20 days on pain of death. Portuguese merchants, however, were allowed to remain. But this ordinance was not put into force. A certain number of churches were destroyed, but Hideyoshi was clement by nature and desirous to reap the advantages of foreign trade. He winked at the infractions of his edict and in the years following it, though the Christians were obliged to behave with more moderation, their numbers seem to have increased, for in 1595 we are told there were 137 Jesuits in Japan and 300,000 converts. But in 1597 he became uncompromisingly severe, the reason for this change of attitude being apparently the arrival of Spaniards.



BY COURTESY OF THE Y.W.C.A.

JAPANESE GIRLS IN NATIVE GARB

Spaniards.—In virtue of a papal bull, accepted by both Spain and Portugal, the latter enjoyed a monopoly of religious propaganda and trade in Japan. But in 1593 a party of Franciscans, describing themselves as envoys, arrived from Manila and were well received. They quarrelled with the Jesuits, against whom they made accusations to the Japanese authorities. About the same time a Spanish ship was stranded on the coast of Tosa and, according to the story, the pilot being anxious to impress the Japanese, dilated on the Spanish conquests and when asked how they had been made replied that "the Catholic king first sent ministers of the Gospel to convert the natives, who afterwards uniting with the captains of his majesty made their work of conquest easier." This remark, whether historical or not, is no doubt a correct epitome of Hideyoshi's suspicions. He was seized with a fury against missionaries: 26 Christians, native and foreign, were executed, many churches were destroyed: feudal chiefs were forbidden to become Christians, and all Jesuits were commanded to leave the country. But they managed to evade the order for some time and before it could be rigorously enforced Hideyoshi died. We must now return to his other doings.

After his successful expedition to Kyushu, only the east and north remained to be subdued. The northern districts were not in a position to offer much resistance but the provinces called Kwantō were practically a powerful independent kingdom ruled by Hōjō Ujimasa. This family of Hōjōs had nothing to do with the great but now extinct house of Kamakura. They had come from Ise about a century before and established themselves at Odawara in a strong position. As they refused to come to Kyōto and do homage to the emperor, who was still recognized as the nominal sovereign, Hideyoshi, Iyeyasu and Nobuo marched against them in 1590 with an army of 250,000 men and received their submission before the end of the year. The castle of Odawara

had to surrender in 1590. The Daimyōs of the north also tendered their submission. This time Hideyoshi treated his vanquished enemies with unusual severity. The Hōjōs were ordered to commit suicide and their provinces were given to Iyeyasu who was recognized as ruler of the Kwantō. Hideyoshi's return to Kyōto was a veritable triumph. Custom would not allow him to become Shōgun, for the office was restricted by tradition to those of Minamoto lineage, but in 1591 he received at his own request the title of Taikō by which he is generally known. This title, which had fallen out of use, had formerly been used by the Fujiwara, when they retired from the office of Kwampaku. Hideyoshi was now master of the whole country and has been called the Napoleon of Japan. There is some truth in this name, for he began to show signs of overweening ambition.

Korean War.—Hitherto his objects had been eminently reasonable—for who can doubt that Japan needed unification?—but he now aimed at the conquest not merely of Korea, but of China. His motives are unknown. The Jesuits assert that his prime object was to acquire land outside Japan where he could settle all the Christian nobles and Samurai, and keep them out of mischief. But though he sent 20,000 Christian troops to Korea, and may have thought it a good plan to leave them there, this is not likely to have been his chief reason for embarking on so great and dangerous an enterprise. Remarks attributed to him earlier in his career suggest that he had long cherished the scheme: he was undoubtedly impressed with the value of foreign commerce, and acquaintance with the Spaniards and Portuguese may have opened his eyes to the advantage of foreign conquests. Also he probably found it easier to subdue Japan than to rule it in peace. Though he had broken the power of the ancient great houses so completely that only five of them were left, the country was full of new military leaders who were ready enough to follow him in any profitable adventure but who, he may have felt, were likely to grow restless in peace and quiet. At any rate as early as 1587 he complained to the Korean court of their failure to send embassies to Kyōto. The diplomatic correspondence which ensued was not altogether amicable and it is noticeable that in writing to the king of Korea (as also to the Spanish governors of the Indies and Philippines) Hideyoshi expressed himself as if he were sovereign of Japan and made no allusion to the emperor. Finally he informed the king of his intention to invade China and called for his co-operation. The king of Korea refused and is said to have remarked that the idea of conquering China was like "a bee trying to sting a tortoise through its armour." However, an army of some 300,000 men was prepared and despatched against Korea in May, 1592, from Nagoya in Hizen where Hideyoshi spent more than a year superintending the preparations. He did not go to Korea himself and Ukida Hideiye was named commander-in-chief. Transport was, of course, the great difficulty but every feudatory was ordered to furnish ships in proportion to his revenue. The plan of campaign was to divide the invading force into three parts. The van, consisting of three army corps, was to land at Fusan and advance at once on Seoul by three routes, eastern, central and western. Then four more corps together with the troops under the direct orders of the commander-in-chief were to cross and effectually subdue the regions through which the van had passed. Finally two more corps were to be sent by sea up the western coast to Phyong-Yang (Heijo) and there join the van, which by that time would be preparing to march into China across the Yalu river. The first part of this programme was duly executed. Before autumn the first and second parts of the expedition occupied Seoul and Phyong-Yang, but disasters at sea prevented the third portion from reinforcing the troops which were to advance into China. At this period the Japanese had nothing which could be called men-of-war, but merely open transports propelled by rowing. The Koreans, however, who had been taught by experience in fighting pirates, had "turtle-shell" ships, which, being covered and protected, gave them a great advantage. The Japanese flotilla was practically destroyed and thus the troops already in Korea were isolated from their base. In October the Chinese awoke to the fact that their territory was threatened with invasion, but with their usual self-confidence thought it sufficient to send 5,000 men across the Yalu. The Japanese had no difficulty in routing this small force, but then the tide turned. The Government of Peking at last realized the danger and despatched a considerable army. The Japanese troops had to evacuate Phyong-Yang and fall back on Seoul and to evacuate that city in turn in May 1593. Though after this the Chinese gained no more victories, and though the war continued until 1598 not wholly unsuccessfully for the Japanese, yet from this point onwards it ceased to be an attempt at conquest. The Japanese held a line of forts along the southern coasts of Korea and took the fortress of Chinju with a terrific slaughter of Koreans but Hideyoshi devoted his attention chiefly to obtaining honourable terms of peace. The negotiations were slow, for though the Chinese seem to have been willing to make terms, the Koreans were not. At last, in 1596, a Chinese embassy was received by Hideyoshi at Osaka, but when the envoys handed him a patronizing missive from the Ming emperor recognizing him as king of Japan he flew into a passion and sent them back. Large reinforcements were despatched to Korea next year and this time the Japanese were successful in a naval engagement, which secured their communications. The Chinese also sent reinforcements and the struggle recommenced. In October 1598 the Satsuma detachment of Japanese troops gained a victory of which a gruesome memorial still survives in the Mimizuka or Ear mound at Kyōto. It is said that 38,000 of the enemy fell. Their ears were cut off, packed in barrels and sent to the capital where they were buried under this tumulus. This was followed by a brilliant Japanese victory at Junten, but meanwhile, though it was not known in Korea at the time, Hideyoshi had died on September 16th. It is said that before his death he requested Iyeyasu to arrange for the immediate termination of hostilities. At any rate, a general withdrawal of troops from the peninsula was at once begun, though not without difficulty, since, in spite of the armistice, the Chinese and Koreans attacked the transports. The exact date when diplomatic relations were resumed is uncertain but it was soon after 1600.

Iyeyasu and Hideyori.—The question of Hideyoshi's successor now became all important. His son had died and in 1598 he handed over the office of Kwampaku to his nephew Hidetsugu, a man of some ability but of an extremely cruel disposition, whom he intended to make his heir. But in the same year one of his wives bore him another son who received the name of Hideyori. Hideyoshi then quarrelled with his nephew, who was finally ordered to commit suicide, and the infant Hideyori was recognized as heir apparent. At the time of Hideyoshi's death Iyeyasu was the most important Daimyō in Japan. He ruled the Kwantō and his new fortress town of Yedo was rapidly growing. The dying Taikō asked him to become the guardian of his son. Iyeyasu was unwilling to do this, but by the Taikō's last instructions he was installed as chief of a board of five regents and Hideyori with his mother resided in the great castle which his father had built at Osaka. The board of five ministers appointed in 1585 was retained to administer the country under the direction of the five regents who collectively acted as Taikō, yet another board, called middle counsellors, being appointed to arrange all difficulties which might arise between the two bodies. But this complicated arrangement did not work well, and the divergences of opinion between the two boards gradually took the form of a more personal quarrel between Iyeyasu and Ishida Mitsunari, a man of great ability who had been easily first among the ministers and now found himself overshadowed by the regents. He formed a powerful combination against Iyeyasu, charged him with disobeying the Taikō's last instructions and practically declared war. Iyeyasu, however, showed even greater ability in forming a counter-combination and in inducing Ishida's confederates not to give him effective support. The issue was decided at the great battle of Sekigahara in the province of Mino on Oct. 21, 1600, one of the most important dates in Japanese history as it practically inaugurated the Tokugawa régime. Iyeyasu, however, for the moment took no steps against Hideyori but absolved him and his mother of all complicity and proceeded to consolidate his own power. As the Tokugawa family were a branch of the Minamoto,

he was eligible as Shōgun and he obtained this title from the emperor. Strictly speaking, it had been in abeyance for only six years, as the last of the Ashikagas lived on in obscurity until 1597, and Iyeyasu himself held it for only two years for, following the inveterate Japanese habit of abdicating while retaining the real power, he ceded the title to his son Hidetada in 1605. He fixed his residence at Shizuoka and for some time kept on friendly terms with the young Hideyori, who was encouraged (perhaps in order to get rid of some of his great wealth), to re-erect the temple of Hokoji in Kyōto and a colossal image which had been set up by his father but destroyed in the earthquake of 1596. When the building was ready, Iyeyasu objected to the inscription placed on a bell and forbade the dedication ceremony. Subsequent explanations did not remove the misunderstanding—if indeed there really was one—and a breach became inevitable. Hideyori and his advisers invited to Osaka all who had suffered by the general redistribution of fiefs which took place after the battle of Sekigahara and finally Iyeyasu besieged the castle at the end of 1614. The resistance was stubborn and in Jan. 1615 a peace was arranged, one of the terms being that the moats should be filled in and the outer ramparts demolished. This considerably reduced the strength of the defences and Iyeyasu found a pretext to renew the siege in May. The fortress was stormed at last. Hideyori committed suicide: his cause collapsed and Iyeyasu's rule was undisputed.

THE TOKUGAWA PERIOD

The Dutch.—It was at this time that the Dutch first landed in Japan. In 1600 the "Liefde" was towed into the harbour of Funai in Bungo after a terrible voyage. On board was the "pilot major" of the expedition, an Englishman, Will Adams of Kent, whom Iyeyasu summoned to Osaka and honoured with his confidence. Adams was made master ship-builder to the Yedo Government, was employed as adviser and diplomatic agent in dealing with foreigners and received a substantial estate. He died in Japan in 1620. In 1605 the Shōgun gave the Dutch a licence to trade and four years later the Dutch East India Company established a factory in Hirado.

Adams, Saris and Cocks.—In 1613 an English factory was established there by Capt. John Saris of the "Clove." Saris received from Iyeyasu a most liberal charter which stated that "ground in Yedo in the place which they may desire shall be given to the English and they may erect houses and reside and trade there." Adams, who entered the service of the company, strongly advised that Uraga in the neighbourhood of Yedo was a better site than Hirado, but Saris would not listen. The enterprise was not successful, possibly because Iyeyasu's wish that Yedo should be its headquarters was disregarded. Saris departed in 1613 leaving Richard Cocks behind him as chief merchant. Cocks kept a diary which contains interesting information, but he was apparently not a good man of business: the "English House" came to an end after a troubled existence of ten years and was dissolved with a loss.

Christianity.—Iyeyasu seems, like Hideyoshi, to have started with no prejudice against Christianity but, like him, to have come to the conclusion that the Church as administered by Spanish and Portuguese priests was a dangerous political machine. Will Adams explained to him the difference between Roman Catholics and Protestants and how in Europe Catholic priests had been expelled from Protestant countries. The Portuguese Jesuits did all they could to calumniate the Spanish Franciscans and urged the Government to expel them. More than once the Spaniards advised the expulsion of the Dutch, and in 1611 an envoy sent by the viceroy of New Spain actually proposed to send Spanish men-of-war to burn all Dutch ships found in Japanese ports. Some incidents in Japan also roused Iyeyasu's suspicions. The Christian Prince of Arima endeavoured to obtain some disputed territory by means of forged documents and was most severely punished. All Christians holding offices at court were at the same time dismissed. The Spaniards had obtained permission to survey the Japanese coast, the Government seeing no harm in what was then a novel request, but when a Franciscan friar called Sotelo hastened to take an active part in the survey, suspicions were aroused. Although Hideyoshi's edict of 1593 was in force, Sotelo opened an oratory in Yedo and held services. He himself was merely imprisoned for a short time but his converts were executed. Some Christians were also executed in Nagasaki, and Iyeyasu was much annoyed because their remains were worshipped as relics. On Jan. 27, 1614, a proclamation was issued suppressing Christianity. It directed that all foreign priests should be collected at Nagasaki and then removed: that all churches should be destroyed and that Japanese converts should be compelled to renounce their faith. As on previous occasions the priests refused to comply and either hid in Japan or returned after a short absence. The siege of Osaka distracted Iyeyasu's attention but did not mollify his severity, for there were many Christians on Hideyori's side.

A somewhat perplexing incident of this period is the despatch of an embassy to the pope and the king of Spain by Date Masamune, Daimyō of Sendai. He was a patron of art and literature as well as a most successful warrior and may well have been in favour of foreign trade and interested in Christianity. But it is not clear why he should have thus taken the initiative in approaching European powers. Perhaps at this moment Iyeyasu, who was cognizant of the whole business, may have been glad to have more information about Europe and have thought it a good thing to send a mission which could not be represented as coming from the Japanese Government if its credentials were seriously examined. Date obtained the release of the Father Sotelo mentioned above and despatched him in 1613 with one of his retainers called Hasekura and 60 persons to Mexico and thence to Spain and Rome. Hasekura was solemnly baptized in the presence of Philip III. and received with great pomp by the pope. When the mission returned in 1620, Date's views on religion and foreign policy had apparently changed. Its members were ordered to renounce Christianity, but Hasekura refused to do so and was not persecuted. Sotelo was less fortunate. On his way back he was detained two years in Manila and when he at last reached Japan he was imprisoned and ultimately burned.

Iyeyasu.—Iyeyasu died in 1616 and next year his remains were transferred with great pomp to Nikko. A well-known caricature represents Nobunaga as grinding flour, Hideyoshi as baking, and Iyeyasu as eating the cake. It may, perhaps, be said that he snatched it from Hideyoshi's heir and certainly statesman-like—a non-moral adjective—is the gentlest term that can be used to describe the proceedings by which he removed Hideyori. But it is hardly doubtful that the removal was for the good of Japan, for had Hideyori remained, Japan seemed likely to relapse into its previous woeful condition of internecine war. Iyeyasu had not perhaps the genius of Hideyoshi. On the other hand he avoided such perilous ventures as the Korean war and with admirable sagacity so consolidated and organized the system of Government that it remained almost unchanged in the hands of his descendants for two centuries and a half. Although he inaugurated the Tokugawa era, yet he was not responsible for the best known feature of it, namely, the seclusion of Japan and the almost complete expulsion of foreigners. Had he lived longer he might, like his grandson, have found this policy necessary, but up to the end of his life he drew a distinction between foreign trade and missionary enterprise. The former he wished to encourage: the latter he considered a political danger as preparing the way for foreign aggression and tending to draw Japanese away from their natural allegiance. But under his rule there were no executions of foreign missionaries. Before describing the conditions of Japan in the Tokugawa period it will be well to recount how in the next few decades the comparatively liberal principles of Iyeyasu gave way to the exclusion policy of Iyemitsu.

Exclusion Policy.—In 1616 Iyeyasu was succeeded by his son Hidetada who had already been nominal Shōgun for 11 years. A few months after his father's death he issued an edict against Christianity severer than any which had preceded it, although its enforcement was postponed until the next year on account of the obsequies of Iyeyasu. It again ordered the expulsion of all foreign Christian priests, and for the first time it was now declared a capital offence for any Japanese to become a Christian or have any connection with Christian missionaries, the punish-

ment being death by burning and confiscation of property. Moreover, Daimyōs were forbidden to keep Christians in their service or on their estates.

The Government probably thought that Christianity could be stamped out without much bloodshed, for in many districts Japanese had been forcibly converted wholesale by order of their feudal lords. But, as on previous occasions, the missionaries refused to leave. Japanese Christians, too, who, apart from religious convictions, had learnt from feudal warfare that loyalty to a cause is the first of human duties, showed extraordinary fortitude. There seem to be no accurate statistics of the number of native victims but it must have been very large. Japanese records speak of 200,000 persons being "punished," but this does not mean executed. The Jesuit Father Cardim gives a list of between 1,400 and 1,500 martyrs. Several foreigners perished. Two priests, de l'Assumpcion and Machado, who had been deported returned in 1617 and were decapitated. Instead of inspiring terror their execution gave new courage: thousands flocked to their tomb, which was believed to work miracles, and the two vice-provincials of Augustinians and Dominicans came out of hiding and started open propaganda. They were beheaded secretly. After some isolated executions of foreigners, there occurred in 1622 what was known as "the great martyrdom of Nagasaki," when 25 persons (including nine foreign priests) were burnt alive and 30 others were beheaded.

Iyemitsu.—Hidetada nominally abdicated in 1623 in favour of his son Iyemitsu and died in 1632. On becoming Shōgun Iyemitsu reissued the existing anti-Christian decrees, and 300 persons were executed in the immediate domains of the Tokugawa family, where hitherto there had not been much persecution. But it now continued uninterruptedly throughout Japan, being most violent in Kyushu because there were more Christians in that island than elsewhere, and the governors of Nagasaki were exceptionally rigorous.

Shimabara.—The last act of this tragedy is known as the Shimabara revolt. This district is a peninsula to the east of Nagasaki and opposite to it is the large island of Amakusa. In both Christianity had taken root earlier and more thoroughly than anywhere else in Japan and both had been the scene of severe persecutions. At the end of 1637 they rose in open rebellion. The old Dutch and Portuguese historians are disposed to regard this rising as mainly an agrarian revolt due to economic causes, especially over-taxation, whereas Japanese authorities treat it as a religious and political insurrection. Both causes were probably operative but it seems certain that for a long time the most stubborn and militant Christians had been collecting in this district, prepared to make a last stand. At the beginning of 1638 the insurgents withdrew from the island and fortified the ruined castle of Hara, where they defended themselves—some 37,000 men, women and children—for about three months against the forces sent to subdue them. Dutch ships assisted the Shōgun's troops in the siege and fired on the castle. When it was at last stormed an appalling massacre took place. Only 105 prisoners were taken and Christianity in Japan was practically suppressed. After this we hear of comparatively few martyrs. In Nagasaki and the neighbourhood the practice of Efumi, that is, trampling on pictures of Christ or the Virgin and Child, was enforced in the first month of each year. All the inhabitants, even children, were required to perform this ceremony to show that they did not belong to what was called the "wicked sect." The assertion that the Dutch complied with this regulation in order to ingratiate themselves with the authorities, though often made, seems not to be proved. The ceremony was not officially abolished until 1856. Yet it is said that Christianity was not entirely exterminated and that when the country was thrown open to foreigners in 1858, Roman Catholic priests found some of their co-religionists in Kyushu and Sado who had maintained their worship in secret.

Anti-foreign Legislation.—But the political consequences of the insurrection were most important. It is clear that the Tokugawa court were obsessed with the idea that foreigners were planning some sort of aggressive action. Hidetada had already got rid of the Spaniards, being moved chiefly by the reports of an investigator, Ibi Masayoshi, whom he had sent to make confidential enquiries in Europe. Whereas his father had sent envoys to Manila, he refused to receive a Philippine embassy in 1624, and an edict was published ordering all Spaniards to be deported. Thus intercourse between the Japanese and Spaniards came to an end after lasting 32 years (1592–1624) but the Portuguese were allowed to trade at Nagasaki for 15 years longer. In this period the Tokugawa government clearly became more and more anti-foreign. In 1636 it was enacted that no Japanese vessel and no Japanese subject should go abroad under pain of death; that all descendants of Spaniards should be expelled; and that no ships large enough to cross the ocean should be constructed. At the same time many restrictions were placed on the Portuguese and in Nagasaki the artificial island of Deshima was constructed for their reception in front of the former Portuguese factory. In 1638 an edict was issued saying that since the Portuguese had continued to bring missionaries into Japan in spite of previous edicts, and since they had instigated the Shimabara rebellion, from that time onwards every Portuguese ship coming to Japan should be burnt with all her cargo and that all on board her should be executed. The Portuguese were most unwilling to abandon their profitable commerce. Four elderly and respected citizens of Macao were sent to Nagasaki on a special vessel carrying presents but no cargo, with instructions to explain that the Portuguese had no connection with the late rebellion and that the cessation of trade would injure Japan as much as Portugal. Their reception showed that the Japanese were in earnest. By order of the Shōgun to whom their arrival was reported the envoys and 57 of their companions were beheaded, 13 being sent back to Macao to tell the tale with a message which bade the Portuguese "think no more of us just as if we were no longer in the world." In spite of this very decided answer the Portuguese made one more attempt. For some years they had been subject to Spain. When they recovered their independence, Don Gonzalo di Siqueira was sent in 1647 with two vessels to explain that Portugal was now actually at war with Spain, and to urge that commercial relations with Japan should be reopened. But the reception was not much better than before. There was, indeed, no bloodshed but the Portuguese were surrounded by armed men and were glad to escape with their lives.

Now came the turn of the Dutch. Though they lost no opportunity of explaining to the Japanese that they did not belong to the same religion as the Spaniards and Portuguese and though they showed their animosity to Catholicism on many occasions, notably at the siege of Hara mentioned above, they did not escape suspicion and evidently there was a strong party against them at the Shōgun's court. Their factory was at Hirado and, apart from foreign politics, the authorities of Yedo were not disposed to see the Daimyōs of Kyushu, always ready to become semi-independent, strengthened by overseas trade. The governor of Ft. Zelandia in Formosa was badly received when he visited Yedo in 1627 and he subsequently quarrelled with a Japanese vessel in his own territory. As a result the Dutch factory at Hirado was suspended for four years and when it re-opened irksome restrictions on the sale of goods were imposed and there was much vexatious interference. The governor of Batavia sent an envoy to remonstrate and appeal to Iyeyasu's charter. But he was merely informed that the Japanese Government attached no importance to foreign trade and that the Dutch might remain only on condition of leaving Hirado and living in Nagasaki.

Dutch at Deshima.—Here their residence was restricted to Deshima, the artificial island which had been constructed for the reception of the Portuguese. It was not more than 300 paces in any direction and lay close to the shore with which it was connected by a bridge. Within these narrow limits and under almost intolerable conditions, the Dutch factory existed for more than two centuries. Communication with the shore and even domestic life on the island were subject to rigorous police surveillance and, though as time went on this severity was somewhat relaxed, the existence of the Dutch merchants was always humiliating. Their only outing was an annual mission to Yedo to offer

presents to the Shōgun and his court. We have a picture of one of these missions and of the life at Deshima from the pen of Kaempfer, a Westphalian who entered the service of the Dutch East India Company and arriving in Japan in 1690 spent two years there. According to his account the mission was on the whole well treated though subjected to disagreeable espionage, and he gives a strange description of how they appeared before the Shōgun and were obliged to dance, jump, pretend to be drunk, and perform other antics supposed to be illustrative of European life.

The question of allowing the British to trade in Japan never arose, because the British factory in Hirado, not being a financial success, was voluntarily closed in 1623 before serious friction between the Japanese Government and foreigners had begun. In 1673 the English East India Company attempted to reopen its trade and sent to Nagasaki a ship called the "Return" with a copy of the privileges granted to the former factory at Hirado, asking for their renewal. The vessel was not roughly treated but the crew were not allowed to land and the only reply vouchsafed was "that since our King (Charles II.) was married with the daughter of Portugal, their enemy, they could not admit us to have any trade and for no other reason." The seclusion of Japan was thus complete.

No Japanese might go abroad and no foreigner might come to Japan except a limited number of Dutch under special conditions as described. This state of things continued until American ships under Commodore Perry arrived in 1853.

Tokugawa Social System.—Iyemitsu, the third Shōgun, who ruled without abdicating until his death in 1631, is justly regarded as the chief author of the singular social system which prevailed in the Tokugawa period. But though he was of a haughty and imperious disposition, it is clear that his counsellors and the general opinion of the country saw no objection to his institutions. Japan of this time is well described in a document called the Legacy of Iyeyasu, which may contain some principles of its reputed author but was certainly not completed in its present form until the reign of Iyemitsu. But, though it may be called a forgery, it is a purely Japanese production and good evidence of custom and sentiment in the middle of the 17th century. In a hundred short sections it describes the constitution of society and the proper working of government. The Japanese were familiar with the division of society into three classes, the court nobles (*Kuge*), the military class (*Buke* or *Samurai*) and the common people (*Heimin*). This division was maintained theoretically by the Tokugawas but they also sanctioned the change which had gradually grown up in the period of internal war, namely the practical pre-eminence of the great feudal houses. The *Kuge* of Kyōto, of whom 138 houses survive, all claimed descent from ancient emperors or from deities. They ranked high above the military class and had a hereditary right to many great offices of state. Practically, having lost their estates and being reduced to poverty, they merely filled court sinecures in Kyōto and spent most of their time in artistic pursuits. The emperor, strictly guarded by the Shōgun's troops, was invisible and unapproachable for all except his court and high officials, his duty being not to govern but to mediate between his heavenly ancestors and his subjects. An exceedingly curious passage of the Legacy (sections XXIX. and XXX.) describes how an imperial prince is to be installed as chief abbot of the Toyeizan temple at Tokyo, and that in the event of the emperor at Kyōto being "assailed by inimical barbarians" this princely abbot is to be elevated to the throne and receive the armed support of the Shōgun. In other words, if the emperor is so unwise as to make friends with the enemies of the Shōgun, the latter may depose him and has ready at hand a substitute whom he can immediately appoint in his place. There was actually an attempt to put this procedure in force in 1868 when the opponents of the emperor Meiji carried off the princely abbot to the north and proclaimed him as emperor there. Under the Hōjō and Ashikaga Shōguns great estates frequently changed hands according to the fortunes of war, but under the Tokugawas, though redistributions of fiefs occurred, a nobility grew up, each Daimyō enjoying considerable independence, provided that he conformed strictly to the general principles of government as laid down at Yedo. The extraordinary ability of Iyeyasu is shown by the way in which he consolidated and arranged his conquests. The estates of those whom he vanquished formed an immense territory which passed into his hands and was so redistributed that all important strategic positions were held by nobles of undoubted loyalty, while every feudatory who was open to suspicion had for his near neighbours partisans of the Tokugawa family. Moreover, great Daimyōs were not allowed to remain too long on their estates, lest they might become too important as local potentates and independent of the central administration. They were obliged to have mansions in Yedo where their wives and children under age resided permanently, while they themselves had to visit the capital in alternate years.

No Daimyō might intermarry with the court nobility without the consent of the Shōgun or make any application to the emperor or build a new castle on his own estate. The Daimyōs were divided into two classes: *Fudai* or hereditary vassals of the Tokugawa, defined in the Legacy as those who followed Iyeyasu and proffered their fealty before the siege of Osaka, and *Tozama*, or outside lords, those who submitted after its downfall. The *Fudai* were more directly dependent on the good-will of the Shōgun than the others, for he could alter their revenues or transfer them from one fief to another, but they only (with rare and late exceptions) were eligible as members of the *Gorōjū*, or Shōgun's council of State, and as governors of the great castles of Osaka, Fushimi and the Nijō in Kyōto. The last was practically charged with the custody of the emperor. Owing to their position the *Tozama* Daimyōs of the north and west enjoyed considerable independence. The Shōguns, for instance, were exceedingly cautious in interfering in the affairs of Satsuma.

The wealth of a Daimyō was estimated in terms of *Koku* of rice, the value of one *Koku* being about £1. About half the amount went to the Daimyō himself, the other half to the tillers of the soil. The richest was Mayeda of Kaga, who had more than a million *Koku*. The Tokugawa family itself was divided into the three houses of Mito, Kii and Owari (the fiefs bestowed by Iyeyasu on three of his sons), and in event of the Shōgun having no direct issue it was from these that the heir was chosen. The general body of Samurai or retainers lived frugally on stipends calculated in terms of *Koku*. In theory they paid no taxes, but in practice the presents which they were obliged to present to their superiors at stated intervals were a heavy impost. Comparatively few owned land, which was usually bestowed as a reward of conspicuous merit. An important class of small landowners was formed by the Hatamoto (under the flag) who were supposed to be immediate retainers of the Shōgun and ranked immediately after the Daimyōs. The Rōnin (wavemen), who play some part in history and a greater one in Japanese romance, were homeless and lordless Samurai, who had left their master's service for some reason, it may be for misconduct or it may be because they proposed to do something—*e.g.*, to take revenge—which, though regarded as a moral duty, might bring their master's house into trouble if performed by his retainers. In Yedo there were two distinct classes of population between whom little love was lost, the townsmen subject to the civil magistrates, and the Samurai under the direction of their feudal chiefs, who were guided by the *Buke Shohatto*, or regulations for the military class, supposed to be issued at the beginning of each Shōgun's reign. The feudal chiefs resided in mansions called Yashikis near the palace, often with grounds of considerable extent and surrounded by a labyrinth of tortuous streets and small dwellings assigned to their retainers.

The Heimin, or commoners, were divided into three classes, husbandmen, artisans and traders. Of these the first were the most respected, and a farmer on his own land might wear one sword, but never two, that being the privilege of the Samurai. Artisans were also esteemed, particularly as they were often artists in our sense of the word and were in the permanent service of feudal lords from whom they received fixed salaries. But throughout the Tokugawa period traders were regarded with disdain and stood lowest in the social scale, though still more contemptible were the outcasts, *Eta* and *Hinin* who were regarded as being outside the community and performed such disagreeable duties as

slaughtering animals and executing criminals. The Eta lived in separate villages and could not eat or intermarry with others. In spite of many hypotheses, no certain account can be given of their origin. They were officially enfranchised in 1871, but the popular prejudice against them is still strong and gives rise to occasional riots.

The Government of Yedo, like the Chinese, had a great dislike of litigation: every attempt was made to discourage it and to settle disputes by arbitration or conciliation. The various classes of magistrates had also other functions such as municipal duties and the collection of revenue. It was some time before a Supreme Court was evolved and even then it was not quite independent of the administration, for members of the council of State could be present unseen and supervise its proceedings behind a curtain.

Iyetsuna.—Iyemitsu died rather suddenly in 1651 and was succeeded by his young son Iyetsuna, whose guardianship he entrusted to Hoshina of Aizu. The situation was not without danger but was saved by the heads of the houses of Kii and Mito, who were younger sons of Iyeyasu and supported the new Shōgun. In the same year there was a formidable conspiracy of Rōnin, led by Yui and Marubashi. The former was the son of a dyer who had formed the dangerous ambition of emulating Hideyoshi: the latter was the son of the dispossessed Daimyō of Tosa who had fought against Iyeyasu at Osaka. The plot was discovered. Yui had time to commit suicide, but his partner and accomplice with many of their wives and children were either crucified or beheaded. It was part of the conspirators' design to set fire to Yedo, and the events of 1657 showed what awful proportions such a conflagration might assume and how easy it would have been for a band of desperadoes with their plans prepared to take possession of the city. In that year a fire broke out during a hurricane: Yedo was almost literally reduced to a heap of ashes and the loss of life was appalling. Waegener, who was there at the head of the annual Dutch mission, estimated it at 100,000. Fortunately the Government granaries were defended by thick mud walls which withstood the flames and, as in 1923, the administration dealt ably and energetically with the work of relief and reconstruction.

In 1669–70 occurred what is called the Great Ainu Revolt, a last attempt of the aborigines to assert their independence. It had important consequences, for Mutsu and Dewa, the distant provinces of the north, were now utilized as granaries of the empire. The legislation of 1635 had made it illegal to build sea-going vessels, but this drastic legislation was now modified and a regular service of rice-transports was organized to provision Yedo and Osaka. Under the rule of Iyetsuna an attempt was also made to render the laws of Japan more humane. Cruel punishments were somewhat mitigated and the relatives of criminals were less severely treated, *Junshi*, the suicide of retainers in order to follow their master in death, was forbidden and accessories were punished. Iyemitsu had actually ordered some of his counsellors and attendants to "follow him on the dark path," and how deeply rooted this idea is in Japan may be seen by the fact that Gen. Nogi and his wife killed themselves on the occasion of the emperor Meiji's funeral in 1912, and for having done so are held up as an example to the youth of Japan and almost deified.

Iyetsuna, who had never taken an active part in the business of government, became an invalid in 1675 and left everything in the hands of Sakai Tadakiyo, who filled the office of Tairo. Five years later he died without issue. Sakai proposed to revert to the practice of the old Kamakura administration and to appoint an imperial prince as Shōgun, remaining regent himself. But the council refused to accept this proposal. Sakai had to retire and Iyemitsu's fourth son Tsunayoshi (1680–1709) succeeded.

Tsunayoshi.—He became known to the populace by the nickname of the Shōgun of dogs. Though he was an ardent student of Confucian literature, he was also a devout Buddhist and carried to an extreme length the beautiful Buddhist precepts forbidding cruelty to animals. He made it a crime not only to kill but even to maim animals, and by his orders a page was beheaded for having accidentally killed a bird. The first of these decrees was published in 1687 and from that time to Tsunayoshi's death hardly a year passed without the issue of edicts re-affirming or supplementing this unusual legislation. It is interesting to see that the Shōgun's position was so strong that he was able to make his subjects submit to what most of them must have regarded as a craze, for though the eating of meat was not common at this period, the Samurais' code attached little value to the life of men, let alone animals. The chief reason for this obedience was no doubt the extreme efficiency of the Tokugawa despotic system. Even if a Daimyō was not in Yedo himself his family were obliged to be in his mansion there and could be made answerable for any act of disobedience on his part.

Tsunayoshi had also a passion for the *Nō* drama and appeared on the stage himself, for it was a peculiarity of these plays that the aristocratic amateurs could take part in them without losing caste, whereas other kinds of acting were considered disgraceful. Theatres of all kinds flourished in Yedo, and life was not only gay but artistic. The products of the Genroku epoch (1688–1704) are of remarkable excellence, especially the lacquer. The provinces were impoverished because the Daimyōs were continually imposing new taxes on the cultivators to pay for their own town amusements, but there was plenty of money in the capital. The coinage was depreciated but as the Samurai received their stipends mostly in kind and had more rice than they required for their household needs, they sold the surplus and cash was abundant. Ultimately the money squandered on actors and geishas passed into the pockets of the mercantile class, for none of it went abroad. Though they were still theoretically the lowest grade of the social scale, merchants amassed such large fortunes that it was impossible to ignore them. Many of the commercial magnates of modern Japan, such as the Mitsui and Sumitomo, were already flourishing at this time. Another side of life is illustrated by the story of the Forty-Seven Rōnin, the most celebrated of Japanese romances. A certain nobleman was insulted in the Shōgun's palace in the year 1701 and drew his sword within the sacred precincts. For this unpardonable outrage he was obliged to commit *harakiri* at once, his family was declared extinct and his retainers were disbanded. They accepted their position without hesitation: the code of military honour obliged them to slay the man who had insulted their master, although the Civil Code threatened them with capital punishment for doing so. They spent two years in every kind of adventure, and having at last surprised and killed their adversary, they deposited his head on their lord's grave amidst the applause of admiring crowds, and all disembowelled themselves. The temple in Tokyo where they are buried is still a resort for popular pilgrimages and incense is kept continually burning before their tombs. In 1703 and 1708 the life of Yedo was disturbed by disastrous earthquakes and there was also an eruption of Mount Fuji. As he grew older, the Shōgun devoted himself more and more to art and literature and let his favourite Yanagisawa manage all public business. After the death of his mother in 1705 he secluded himself entirely under plea of mourning. Four years later he died somewhat mysteriously but apparently the story that he was murdered by his wife does not merit credence. He was succeeded by his nephew Iyenobu, who promised to be a competent ruler but unfortunately died in 1712 three years after his accession. The people went into voluntary mourning for him, a compliment which had been paid to no previous Tokugawa. He was succeeded by his infant son, Iyetsugu, who also held the nominal office for only three years. No events of much importance occurred in this interval, but an interesting description of the life of the period has been preserved in the works of Arai, the tutor and afterwards the adviser of Iyenobu. He relates among other things how he examined the Italian priest Sidotti, who came to Japan on a missionary enterprise and died in prison. With the death of the infant Iyetsugu the line of Hidetada, the second Tokugawa Shōgun, became extinct, and an heir had to be found in one of the three Tokugawa houses descended from Iyeyasu. Iyenobu, foreseeing that his own son was not likely to live long, had designated as heir Yoshimune of the house of Kii.

Yoshimune.—Yoshimune was perhaps the best of the Tokugawa Shōguns and illustrated the excellence of paternal

government when exercised by a capable and unselfish sovereign. His long rule (1716–1744) offers few exciting incidents but is a continuous record of reform and beneficial legislation, much of it obviously directed against the dangers threatening a capital and military class entirely given over to luxury. He did his best to make the court ceremonial simpler and more rational. Whereas previous Shōguns had received the Dutch envoys unseen and sitting behind a curtain, he met them face to face and conversed with them. Similarly, he made a practice of receiving ordinary Samurai in audience, if they had in any way distinguished themselves. In order to know more of the opinions and grievances of simple citizens he revived the ancient institution of a "Complaint (or suggestion) Box," which was set up outside the Supreme Court. He kept the key himself and any properly signed communication received due attention. Yoshimune spent his leisure in hunting and hawking whence, in contrast to his predecessor Tsunayoshi, he was called the Hawk Shōgun or Bird-catching Shōgun. Believing outdoor sports to be a good corrective of the luxurious life of Yedo, he encouraged the Samurai to accompany him and devised for them such strenuous forms of exercise as the unexpected swimming of a river. In 1726 he organized a great hunting expedition in which 60,000 men took part and were put through evolutions like an army in the field. There was, it appears, no code of law at this time, but Yoshimune made a beginning by himself supervising the preparation of the Hundred Articles of Kwampō, which became the basis of the criminal law. These articles were issued in 1742, but it is interesting to note that it was not thought necessary to bring them to the notice of the public, but merely to distribute copies among the judges and other officers concerned. Ōoka Tadasuke, a sort of Japanese Solomon, was city magistrate of Yedo in this period and his sagacious and often amusing decisions are among the best known stories even now.

Yoshimune was strongly in favour of primogeniture as a principle for settling disputed succession and thus avoiding the dissensions from which almost every great family suffered. Unfortunately his own family showed that the principle has disadvantages, for his eldest son Iyeshige was a debauchee and of no ability, whereas his second son seemed a most desirable successor and his advisers suggested that he might be named heir apparent. But Yoshimune was unwilling. He retired nominally in 1744, his eldest son being declared Shōgun and his grandson Iyeharu heir apparent. His intention was to supervise Iyeshige and, if he proved incorrigible, to make him retire when Iyeharu attained his majority, but he died himself before that happened. He also established his two younger sons as heads of new Tokugawa houses and later his grandson, the second son of Iyeshige, received the same honour. The three houses thus formed were those of Tayasu, Hitotsubashi and Shimizu and, in the event of direct heirs to the Shōgunate failing, had a right to the succession. Iyeshige (1744–1760) proved a deplorably bad ruler, especially after his father's death in 1751. He is not charged with specially heinous acts of tyranny but at this time the personal power of the Shōgun was so great that if he was dissolute himself he was bound to injure the whole administration. For instance, if he required money for his pleasures, the Daimyōs were informed that (contrary to the practice in Yoshimune's time) the gifts which it was the custom for them to present on ceremonial occasions ought to be of real value. Great officials imitated the Shōgun and naturally givers of presents recouped themselves at the expense of their dependents. Favouritism, extortion and corruption became rampant and risings of the peasantry occurred. The management of affairs passed into the hands of chamberlains and secretaries. Nevertheless, no great disaster occurred under Iyeshige's rule. He died in 1761 having abdicated the year before in favour of his son Iyeharu, then aged 23. Iyeharu was a youth of good parts and began his rule with some legal reforms. But though he was not a profligate like his father and inherited his grandfather's love of open air sport, he had also a dangerous love of display and magnificence and let himself be ruled by favourites, the chief of whom was Tanuma, who is said to have amassed a colossal fortune. The dissipation and extravagance of Yedo increased and spread to the surrounding districts, for it was the custom to hire servants for the Daimyōs' mansions by the year, after which many of them returned to the country with their morals not improved. But still, contemporary testimony states that in south-western Japan and in the great fief of the Uyesugi family, whose capital was at Yonezawa, the local administration was good. A little later an interesting light is thrown on the condition of the rural districts by the career of Ninomiya (1787–1856) who founded in the Kwantō and neighbouring provinces a system of credit associations to which farmers subscribed and from which they obtained loans in case of need. The later years of Iyeharu were darkened by a series of terrible natural calamities. Earthquakes and eruptions were followed by a drought known as the famine of Temmei (the period 1781–1789), and after this came equally destructive floods. More than a million persons are said to have perished in these various disasters and the measures proposed by the Government to relieve the distress proved totally inadequate.

Iyenari.—Iyeharu died in 1786. His two sons had predeceased him and he had adopted as his heir Iyenari of the house of Hitotsubashi, according to the arrangement mentioned above. The young prince did not attain his majority until 1793, and during this period the Government was administered by Matsudaira Sadanobu, who really belonged to the Tasuya house and was a grandson of Yoshimune, although he had been adopted into the Matsudaira family. Tanuma, the late Shōgun's favourite, had to retire, his son having been assassinated two years before. According to Titsingh, the head of the Dutch factory at Deshima to whom we owe an interesting account of this period, this son was "of a truly enlightened and imposing character" and would have opened Japan to foreigners, but Japanese accounts state that the family were hated for their rapacity and corruption. The populace stoned the funeral cortège of the victim, and the assassin, though he had to commit suicide, became an object of public veneration.

Matsudaira Sadanobu's administration (1786–93) was one of the periods of reform and retrenchment which occurred periodically in the history of the Tokugawa Shōgunate. There was, indeed, something self-contradictory in the principles of that Government. Soldiers were recognized as the highest class and yet there was no place for the soldier's occupation—fighting. Japan had no dealings with foreign nations and consequently no foreign wars: even defence against foreign aggression was not a practical necessity. Internal wars between the great feudal houses were obviously harmful to the country. The result was that most Samurai, especially in Yedo, tended to drift, not towards insurrection (for the extraordinarily efficient discipline averted this danger), but towards dissipation and effeminacy. The regent set himself to correct public morals and with considerable success. The system of requiring presents was abolished; favouritism and corruption were greatly diminished and the administration of justice, which had grown very bad, became prompt and efficient. But he found the military class so hopelessly in debt that they could not pay if they lived by honest means, and therefore he had recourse to the old device of a cancellation of debts. All debts of more than six years' standing incurred by Hatamotos were nullified and more recent ones were payable at reduced interest. These ordinances were accompanied by unusually severe sumptuary legislation. The use of gold and silver for ornament was practically interdicted and there were rigorous regulations about dolls and sweetmeats. Sadanobu's reforms seem to have done real good for a time but in some other ways he was less judicious and under his rule we see faint signs of the movements which were destined to overthrow the Shōgunate and restore the authority of the emperor. Hitherto the Shōguns had been on good terms with the court of Kyōto and had kept it in obscurity while treating it with great respect. But in the interests of economy Sadanobu requested them to despatch less frequent missions to Yedo, which was taken amiss and he had a misunderstanding with the Emperor Kokaku about the imperial right to confer titles. For the moment nothing of

great importance happened, but several enthusiasts, notably Gamō, Hayashi and Takayama travelled about the country preaching the duty of paying more respect to the emperor. Takayama committed *harakiri* as a public protest against the neglect of loyalty and Hayashi was imprisoned for seeming to exalt the emperor to the prejudice of the Shōgun, but in the Meiji era he received posthumous rank as a reward for his services to the imperial house. Sadanobu retired from the regency in 1793 and the young Shōgun assumed control of the Government which he continued to exercise for 48 years, for though he abdicated in favour of his son in 1837 he continued to rule until his death in 1841. Though not devoid of talent, Iyenari cannot be ranked among the ablest men of his house, and he was somewhat under the influence of his friends and especially of his numerous seraglio. For the first 13 years of his rule he was also strongly influenced by his father, who considered he had been slighted by Sadamaru and disliked the latter's reforms. Accordingly the old tendency to magnificence and luxury set in again. Iyenari married a daughter of Shimazu of Satsuma who had been adopted into the Konoye family, one of the branches of the Fujiwara house. He was thus brought into intimate relations with the court nobility and the great but very distant house of Kyushu, and this tended to give the Fudai—or vassals of the Tokugawa house—less power than they had previously enjoyed.

The influence of the Rōjū or council of State also declined. Iyenari paid most respectful attention to the emperor who showed his appreciation by conferring on him several titles which added nothing to his real power, but so great is the importance attached to ceremony that the Shōgunate seemed to have reached the acme of its magnificence. After the death of Iyenari's father Mizuno Tadashige became chief adviser and favourite, and when he died in 1835 he was succeeded by another Mizuno, Tadakuni, who became well known as the author of another set of sumptuary laws which were not very successful. He also seems to have been in favour of foreign intercourse.

About this time there was a famine, and popular indignation was aroused against the guilds of merchants, who were accused of buying up necessaries and selling them only at outrageous prices. A serious outbreak occurred at Osaka where one Oshio designed to kill the magistrates, seize the castle and force the merchants to distribute their stores. Though the plot was betrayed and frustrated, there was serious fighting and a great part of the city was burnt. Mizuno dealt drastically with the guilds and practically suppressed them for some years, but it was found necessary to revive them and his ordinances against luxury were not more permanent. Apparently they were so worded as to bear heavily on the ordinary townsfolk, whereas earlier legislation of the same kind had chiefly affected the upper classes. Mizuno was suddenly dismissed in 1843, restored to his office next year but dismissed again and banished for good in 1845. Meanwhile, Iyenari had died in 1841 and his son Iyeyoshi, who was already titular Shōgun, had to govern without his assistance. Though Iyeyoshi was 45 years of age he had no will of his own and counted for nothing during his rule which lasted till 1853, the year of Commodore Perry's arrival.

Shinto Movement.—Under the long rule of Iyenari various movements which conspired to bring about the surprising transformation of Japan in the latter part of the 19th century began to make themselves felt. One of these was a movement in favour of pure Shinto, as distinct from Chinese Confucianism and Buddhism, the two systems most favoured by the Tokugawa régime. Yet the origin of the movement may be traced to the literary activity of Mitsukuri (1628–1700), head of the Mito branch of the Tokugawa family, who, with the help of a band of scholars composed the Dai Nihonshi, a general history of Japan down to 1413, which is still a standard book. The practical bearings of his studies are shown by the fact that he destroyed 1,000 Buddhist temples on his estates. In the next century followed such distinguished exponents of Shinto as Mabuchi (1697–1769), Motoori (1730–1801) and Hirata, his even more influential pupil (1778–1843). Though this movement seems to be literary and philosophic, it had a most important political bearing. It was intensely Japanese and anti-Chinese. But in exalting everything that was purely Japanese it had to fall back on the Kojiki and Nihongi and other ancient lore which dealt with the imperial house of divine descent. Here it naturally found itself in conflict with the doctrines which were acceptable at Yedo, for all its teachings tended to glorify the emperor and had no place for the Shōgun. A work of Hirata's which had won the admiration of the court at Kyoto was suppressed and he was banished to his native town in 1840.



COURTESY OF THE PRESBYTERIAN BOARD OF FOREIGN MISSIONS
SHINTO PRIEST IN PAPER CEREMONIAL ROBES

Dutch Learning.—Another intellectual movement, small in numbers but of great importance, was the furtive pursuit of Dutch learning. The Japanese are the most inquisitive people in the world and the terror of European aggression did not prevent the few who had any opportunity from learning all they could about Europe, especially its science and inventions. It has been truly observed that the adventures of these pioneer students were often as interesting as the most thrilling romances published in Yedo. A physician called Sugita Fusai (*c.* 1780) has left an autobiography in which he describes his difficulties and troubles in learning Dutch and practical anatomy, which latter he studied on the execution ground. He wrote a book on the human body and was allowed to present a copy to the Shōgun. In this he was more fortunate than his predecessors, for a little while before, a work published by a naturalist called Gotō had been suppressed, simply because it contained the Dutch alphabet. Though the Government discouraged the study of Dutch, the Shōgun Yoshimune himself had Dutch books translated for his own benefit, and Titsingh tells us that several "persons of quality" diligently studied the language and that the Prince of Satsuma (the father-in-law of the Shōgun Iyenari) used the Roman alphabet in his letters when he wished to write secrets. When Siebold was in Japan (1823–29) his house was frequented by pupils from every part of the empire, but they got into trouble and he himself had difficulties. A little later clubs for the study of Dutch were established. There was strenuous opposition, but on the other hand medical opinion insisted on the importance of the study and made itself heard. The Government decided that only physicians might learn Dutch and a medical school was established in Osaka in 1838. The result was that everyone who wished to learn Dutch professed to be a medical student and 3,000 pupils are said to have passed through the school in 24 years. In 1795 an edict required all candidates for official posts to subscribe to the doctrines called Teishu, that is, the particular interpretation of Confucian philosophy which was taught in Government schools, though many learned men favoured other interpretations. Though these persistent efforts to suppress foreign learning and freedom of thought affected comparatively few, they contributed to the unpopularity of the Shōgunate. It had not many disinterested friends when the great upheaval came after 1854.

Intercourse with Europe and America.—Though the opening of Japan came quite suddenly and though the Shōgun's Government enforced the prohibition of intercourse with all foreigners except the Dutch with extraordinary rigour and efficiency until the last, yet naturally, from stress of weather or other causes, foreign vessels occasionally touched at Japanese ports. They were generally driven away, sometimes by gunfire even when their object was benevolent, such as the repatriation of Japanese who had strayed abroad. In 1808 when Great Britain and Holland were at war a sensation was created by the brief apparition at Nagasaki of H.M.S. "Phaëton" in pursuit of Dutch ships. The Japanese saw in this a sign of European aggression and the Dutch, wishing to preserve a monopoly of foreign trade, worked on these fears. The first attempts at establishing relations with Japan were made by the Russians in

nection with the fur trade. A Russian envoy appeared at gasaki in 1804, but only to receive a flat refusal. Collisions owed between Japanese and Russians in Sakhalin and the rile islands; but renewed Russian attempts to find some basis amicable intercourse failed. The whaling industry began to w at this period and ships often sent boats to the Japanese st to obtain supplies. In 1824 the crew of an English vessel o landed in this way near Kagoshima slaughtered cattle and d other violence. This aroused strong ill-feeling and next ir the Government published an expulsion decree, ordering the al authorities to drive away all foreign vessels attempting to t into port and to arrest or execute any foreigners who might d. Somewhat later the Japanese became impressed with the owing power of England in the Far East, as shown by the ssion of Hongkong and the opening of various Chinese ports d Mizuno Tadakuni, who was then at the head of affairs, issued 1843 modified instructions to local authorities saying that ough foreigners were on no account to be allowed to land, yet reign ships were not to be driven away but were allowed to reive provisions and fuel. At the same time he requested the utch at Deshima to supply him with models of European maines and copies of illustrated books and newspapers. Even the utch now began to recommend the opening up of Japan, and e king of Holland sent an envoy with a despatch advising the ōgun to abandon the policy of isolation. The envoy was not lowed to proceed beyond Nagasaki and when a reply was at st sent in 1845 (after the fall of Mizuno) it simply stated the w of Japan as it stood, adding, "Henceforth pray cease corspondence."

Owing to the increase of whaling enterprise of trade with China, merican ships were beginning to frequent the Far East but eir occasional visits to Japanese ports had left a disagreeable npression, the "Morrison" having been fired on in 1837. In 345 a resolution was introduced in Congress recommending that commercial arrangements" should be made with Japan and for is purpose Commodore Biddle was sent with two ships next ear. He stayed nine days at Uraga but his attempts to negotite a treaty met with a flat refusal and he was roughly handled imself but, as his instructions ordered him to do nothing that ould excite hostility, he accepted the apologies offered and reurned to the United States.

Commodore Perry.—The Government of Washington, however, determined not to drop the matter and on July 8, 1853, Commodore Perry entered Uraga harbour with four ships and 60 men. He bore a letter from the President requesting the conclusion of a commercial treaty but abstained from any attempt o coerce or threaten. He presented his letter, distributed many presents consisting chiefly of mechanical toys and instruments, nd after staying ten days sailed away to China, saying that he would return in the spring. The Japanese, who, since the days of he Mongol invasion, had not seen more than a couple of foreign ships together, were panic-stricken at the appearance of the American squadron. The emperor at Kyōto was solemnly informed of the awful event, and his majesty ordered that prayers for the destruction of the barbarians should be offered at the seven principal shrines. At first the Government of Yedo seems to have thought of resistance. The prohibition against building sea-going ships was removed and feudal chiefs were ordered to build and arm large vessels; the Dutch at Deshima were asked to furnish a man-of-war and modern military appliances and the army was prepared for action. But the conviction soon prevailed that effective resistance was impossible, and on Dec. 2 instructions were issued that if the Americans returned, they were to be given a pacific reception. Perry did return in the February of the next year (1854) with a still more formidable force of ten ships and 2,000 men and after six weeks of negotiation obtained a treaty of peace and friendship which stipulated that the ports of Shimoda in Izu and Hakodate should be opened to American ships and that Americans be allowed to frequent them within definite limits: that American consuls or agents might reside in Shimoda: that shipwrecked sailors should be relieved and that ships might obtain fuel and provisions in Japanese territory. Perry remained in Japan till June and then went to Canton. His visit had been short and successful, but the last entry in the *Journal* of Wells Williams, his interpreter, is "Thus ends my expedition to Japan, for which praise God."

Meanwhile Japan was in a ferment. The Shōgun died in 1853 and was succeeded by two nonentities, Iyesada (1853–1858) and Iyemoshi (1858–1866). It may be mentioned that the name Tycoon commonly used by foreigners at this time is the Japanese Taikun or great prince. The title had been used in negotiations with Korea in the 16th century and was now resumed in dealing with western powers, with the object of enhancing the dignity of the Shōgun since that word means simply generalissimo. This was explained in a despatch addressed to Townsend Harris in November 1857.

The emperor was Kōmei (1847–1867) the father of Meiji, a man of more character than his immediate predecessors and of strongly conservative, that is anti-foreign, principles. From 1853 to 1860 the chief power was in the hands of Ii Naosuke, who was Tairō or First Minister, during the last two years of his life. He was a man of great intelligence and courage who, seeing that Japan had no chance of successfully withstanding foreign insistence, assumed the responsibility of signing the treaties. His policy had many prominent opponents, especially Tokugawa Nariaki of Mito, and the quarrel was complicated by this latter's desire to make his own son Shōgun. This son (who eventually became the last Shōgun under the name of Keiki or Yoshinobu, had been adopted as heir of the house of Hitotsubashi and hence was eligible for succession, but Ii successfully supported the claims of Iyemochi of the house of Kii. Ii was assassinated by Rōnin of Mito in 1860—a victim to anti-foreign sentiment and clan intrigues. However, it was not possible to refuse to other powers the concession already granted to America. Russia, Holland and England soon secured for themselves similar treaties. But these instruments were in reality mere grants of privileges and not commercial treaties such as are usual among friendly nations. America again led the way. Townsend Harris, the first consul general of the United States, arrived at Shimoda in 1856 and in the next year signed a convention which gave American citizens the rights of permanent residence at Shimoda and Hakodate and opened Nagasaki to American ships. But Harris was not satisfied with this and pressed for permission to proceed to Yedo and negotiate directly with the Shōgun. After ten months he succeeded and was received in audience. In 1859 a treaty was signed providing that the port of Yokohama should be opened from July 4, and that commerce between Japan and the United States should be freely carried on there. The Shōgun's ministers signed this document without receiving the imperial sanction and were well aware of the danger they were incurring in acting contrary to public opinion, but they were also greatly impressed by the news communicated to them by Harris, of the suppression of the Indian Mutiny, the capture of the Taku forts, the Treaty of Tientsin and the impending arrival of British and French plenipotentiaries with squadrons to enforce their demands. They therefore thought it better to sign at once a moderate treaty with America which they could offer to other powers and perhaps prevent them from asking for more. A few weeks after the signature of this treaty Lord Elgin, British commissioner to China and Japan, arrived at Shimoda, and on Aug. 20 concluded a treaty with Japan on the basis of the American treaty and in the following October Baron Gros did the same thing for the French. In Feb. 1860, the Japanese despatched their first foreign envoys to Washington. Their time of absence was strictly limited and they remained only six weeks in America. A second mission was despatched in 1862, this time to all the European courts in succession, and it returned after spending a year in making this round of visits.

The Emperor and the Shōgun.—Meanwhile the position of the Shōgun himself was becoming very difficult. Quite apart from the question of foreign intercourse, there had arisen a party whose watchword was the sanctity of the imperial house. When foreigners insisted on landing, the sentiment of the people was at first hostile. The Government of the Shōgun, having to face

ıe practical work of negotiation and the possibility of a bombardment, was comparatively liberal in its attitude, whereas the mperor, disturbed by no disagreeable contact with the outside ′orld, remained severely aloof and naturally came to be regarded as the guardian of Japan's sacred soil which his servant he Shōgun could not or would not protect from barbarian inasion. The cry Son-o jo-i, "revere the Sovereign": "expel barbarians," which was heard everywhere, began to be interpreted s meaning revere the emperor not the Shōgun, and the incidents f the protracted crisis naturally made intelligent citizens feel he evils of a dual and not always harmonious Government. The 'okugawa statesmen did their best to bring about some form of nion. A marriage was arranged between the young Shōgun and he emperor's sister and took place at Yedo in 1862. The year fter, the Shōgun was summoned to Kyōto which no Shōgun had isited since 1634. He remained there three months, showing he utmost deference to the emperor and finally agreed to the ıssue of orders directing Daimyōs to muster troops and prepare ɔ assist the court in the task of "sweeping out barbarians." Vhen such a temper prevailed, it is not surprising if murderous ttacks were made on foreigners. In 1862 two sentries had been illed in an attack on the British legation and an Englishman alled Richardson had been cut down on the road between Yedo nd Yokohama, because he got in the way of the retinue of the rince of Satsuma. The British Government demanded an inemnity and punishment of the murderers, but Prince Shimazu efused to comply and as he was the most independent of all he feudal chiefs, the Government of the Shōgun could not have ompelled him to give satisfaction even had they desired it.

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These proceedings may seem to be a victory for the Government of Yedo, but they were not, and the Shōgunate was now tottering. To begin with, the idea of abolishing the emperor was unthinkable to any Japanese. If the administration was to be simplified, it was clear to everyone that it was the Shōgun who had to go. And for practical purposes it was no doubt better that the impending work of reconstruction should be undertaken by a power which, though ancient and sacrosanct, emerged from its retirement like something new, than by a worn out feudal administration hampered by numerous quarrels with its vassals. In consenting to the treaties in 1865 the emperor was far from indicating that he yielded to the views of the Yedo Government. On the contrary he dismissed and punished the negotiators—a step without precedent and tantamount to withdrawing the administrative commission given to the Tokugawa family in the time of Iyeyasu. On this the Shōgun presented his resignation, but at the same time handed in a memorial showing that the opening of the country was inevitable. For the moment the resignation was not accepted.

Parkes showed good judgment in getting into touch with the distant but powerful clans who were about to play a great part in the making of new Japan. In 1865 he went to Shimonoseki, where the authorities expressed satisfaction with the new treaty and next year he visited Kagoshima, where Prince Shimazu entertained him with the utmost cordiality, and Shikoku. Satsuma purchased steamers and manufactured breach-loaders, and a batch of Satsuma youths were smuggled on board ship and sent for a course of instruction to England. Chōshū continued to be in rebellion and the Government of Yedo at last persuaded the unwilling emperor to begin an active campaign against it in the summer of 1866, but a few months afterwards the Shōgun died at the age of 20, leaving no issue. Hereupon the emperor ordered the suspensions of the operations against Chōshū which had not been proceeding very satisfactorily. After some months Hitotsubashi, who had been put forward as a candidate for the Shōgunate in 1858, most reluctantly consented to accept it now and took the name of Keiki. He made it a condition that the emperor should listen to his advice and that the Daimyōs should promise him their support. He was invested with his dignity at Kyōto and never visited Yedo as Shōgun, a significant sign of the change which had taken place. Part of his programme was the punishment of the rebellious Chōshū clan, but three weeks after his investiture the emperor Kōmei suddenly died of smallpox on Feb. 3, 1867, and in view of the court mourning and the accession of a new emperor the Shōgun agreed to order the disbandment of the troops on both sides.

MEIJI PERIOD

Kōmei was succeeded by his son Mutsuhito, aged 15, who under the title of Meiji (meaning Enlightened Government) became the best known name in modern Japan. The new Shōgun Keiki was a man of ability and mature intellect who had been convinced by events that it was impossible for Japan to continue in seclusion. He gave proof of his convictions by attempting to remodel the army and navy on European lines and by sending his brother to see the Paris exhibition. But there was a strong party against him in which the Daimyōs of Satsuma, Tosa and Chōshū were prominent. In Oct. 1867 Yōdō, the chief of Tosa, presented to him a memorial setting forth the difficulties of the present position and suggesting that the administration should be restored to the emperor. Keiki at once summoned a conference of heads of clans in Kyōto and informed them that he approved of the suggestion and intended to surrender his authority to the throne. The proposal was accepted without discussion, and the resignation was formally tendered and accepted. Thus ended the system

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of government which had been established by Iyeyasu in 1603.

Keiki left Kyōto secretly and retired to his castle at Osaka, but the clan of Tokugawa were not so ready as their lord to give up their privileges. Their enemies also, the clans of Satsuma and Chōshū, were not satisfied and, suspecting Keiki of an intention to come back, induced the court to take measures against his followers which were, perhaps, needlessly irritating. All officials connected with the Tokugawa were deprived of the offices they held in Kyōto and the Shōgun's troops were removed from the palace gates which it was their ancient privilege to guard. Keiki could not restrain the indignation of his followers, and at last reluctantly allowed them to march against Kyōto. The attempt was a failure and they were beaten back. Keiki fled to Yedo and made unconditional submission, but in the north the struggle was not over till August 1869. The Matsudairas of Aizu resisted with especial stubbornness until their stronghold of Wakamatsu was taken and, as mentioned above in speaking of Iyeyasu's institutions, an attempt was actually made to proclaim the princely Abbot of Ueno as emperor. This prince's life is an instance of the extraordinary careers which Japanese can have. Ordained in his youth, he was head of the temples of Nikko and Ueno. At the age of 19 he was carried off to the north and proclaimed emperor. When his partisans were defeated, he was unfrocked and sent to study in Europe, where he spent seven years. On his return he commanded in Formosa, under the name of Prince Kitashirakawa, and a Shinto temple dedicated to him is one of the principal sights of the capital of that island. Yenomoto, an officer in the Shōgun's navy, who had recently returned from a stay of six years in Europe, fled with several ships to the island of Yezo (Hokkaido), which was then an almost unknown country, and established himself in Hakodate with the intention of founding an independent state. Hopeless as was their cause, he and his followers showed the greatest courage and skill and for six months kept at bay all the forces sent against them. When their fortress was at last captured their lives were spared and Yenomoto and others eventually held important posts under Meiji.

In 1868 two unfortunate attacks on European officials were made near Hyogo. But adequate reparation was offered and the Japanese officers held responsible were ordered to commit suicide in the presence of foreign witnesses. In his *Tales of Old Japan*, Lord Redesdale (Mitford) has given a most impressive account of the terrible rite of *harakiri* at which he was officially present.

In considering the extraordinary changes effected in the Meiji era, it must be remembered that only the nobles and the military class, about one-sixteenth of the population, were concerned in them. The mass of the people were amenable to discipline, but had few anti-foreign prejudices. They were, of course, alarmed when they were told that Japan was going to be overrun by barbarians and there were misunderstandings with individual foreigners. But from early times they had always been ready to assimilate when opportunity offered. In the 7th century they eagerly adopted Chinese usages: in the 16th, considering the small number of missionaries, the number of converts to Christianity was surprising. Kaempfer observed that the Japanese "have so much sense and innate curiosity that if they were not absolutely denied free and open conversation and correspondence with foreigners they would receive them with the utmost kindness and pleasure," and in the 19th century Europeans often noted the contrast between the cordial hospitality which they received from the ordinary folk and the fierce antipathy shown by officials and Samurai. But even in the upper classes it is clear that there was a strong movement of curiosity and acquisitiveness. As far back as the time of Hideyoshi there was a craze for wearing Portuguese clothes, and Iyeyasu was anxious to import such inventions as he considered useful. But his successors formed the deliberate conviction that intercourse with Catholic Europe was a national danger, and had their knowledge been wider, had they known the history of Goa and Ceylon, of Mexico and Peru, can we suppose that they would have changed their conviction? The fear that Japan might become a European dependency was by no means absurd. The closing of the country to foreigners was the work of a few individuals and so was its re-opening. But it is clear that both in the 17th and 19th centuries what was done by the few was not disapproved by the many.

The collapse of the Yedo Government was not unnatural: it had lasted longer than the rule of the Ashikagas and Hōjōs, and in its later phases it showed the same feature of a want of really able men. The grouping of the clans about 1865 indicates that the great south-western fiefs, which had always been quasi-independent, wished to contest the supremacy of the Tokugawas. It was a chieftain of Tosa who suggested the abolition of the Shōgunate, and probably many in Satsuma desired to secure some sort of pre-eminence for their own house. Besides this, the movement in favour of Shintō had created a wide feeling that the emperor was not allowed to exercise the power which was his by right. But what is truly surprising is the manner in which not only individuals like the last Shōgun but, later on, whole classes like the Daimyō and Samurai surrendered their privileges in what they believed to be the interests of their country. Considering everything, the opposition offered to the astonishing changes which took place between 1867 and 1878 was very slight.

Another remarkable feature is that, whereas in previous critical epochs the ultimate settlement and reconstruction were the work of some man of genius such as Yoritomo, or Iyeyasu, no such figure appeared now and no individual or noble house reaped the harvest of the change. The prime movers were Samurai like Kido, Ito, Inouye, Matsukata, Okuma and Yamagata who won great distinction, but merely aspired to posts attained by any successful public man in Europe. The emperor, indeed, found himself in a new and much higher position, but obviously the change was not due to the ability or ambition of Kōmei or his young son Meiji. The latter, however, at once began to act (on the initiative of his council of course) as the sovereign of Japan in a way unknown to his predecessors. In Feb. 1868, he informed the foreign representatives that he had assumed the supreme executive authority and that his title should be substituted for that of the Shōgun in existing treaties. An imperial rescript was also published notifying his subjects that "intercourse with foreign countries shall in future be carried on in accordance with the public laws of the whole world." His Majesty also appeared out of doors, received diplomatists and summoned the nobles to the palace, where he took in their presence what was called the charter oath. Like many Far Eastern documents, this charter seems to consist of moral maxims rather than of definite legal statements, but it promises that a deliberative assembly shall be summoned, that all classes shall have a share in the government and that justice, not ancient custom shall in future be the guiding principle of the administration. As a further sign of the change which was being made the emperor and his court removed to Yedo, which henceforth bore the name of Tokyo, or the eastern capital, as distinguished from Kyōto. The abolition of the Shōgunate and the accession of Meiji are generally called by Japanese the Restoration (Isshin), the idea being that the rightful powers of the emperor were now restored to him.

The Abolition of Feudalism.—In the early days of the Restoration it had probably not been realized that the unification of the nation, which was one of the watchwords, implied the abolition of feudalism. Yet it became clear that this was necessary. As things stood every feudal chief collected and spent the revenues of his fief, and was an autocrat within his own territory. There was no homogeneous system of law operative throughout the empire. It is not easy to see how unification and uniformity could have been achieved by imperial edicts or any form of compulsion, but such was the spirit of the times that the change was made spontaneously and without any difficulty. In 1869 the chiefs of the four great western clans of Satsuma, Tosa, Chōshū and Hizen publicly surrendered their fiefs to the emperor begging him to re-organize them and bring them under the same system of law. The idea is said to have originated with Okubo Toshimichi of Satsuma and the example of the four clans was quickly imitated. In making this remarkable surrender the Daimyōs followed the advice of their leading clansmen, who doubtless thought that they might find better opportunities for a brilliant career under the new régime, but still men like the chiefs of Satsuma

and Tosa must have been inspired by a rare patriotism, for they gave up an almost regal position without any return. The emperor acknowledged the sacrifice in a laconic rescript, but it was decided to proceed with caution. The feudal chiefs were appointed as governors of the districts in which they had ruled and the Samurai retained their salaries and positions. At the same time the distinction between the court nobles and the Daimyōs or feudal chiefs, who had previously ranked below them, was abolished. But the system of local autonomy thus introduced was clearly transitional, and in 1871 a second edict was issued by which territorial nobles ceased to be governors and a system of local autonomy was abolished; taxes were to be paid into the Treasury and all officials were to be appointed by the central Government. At the same time the chiefs of Satsuma, Tosa and Chōshū accepted ministerial office in Tokyo and sent contingents of troops to form the nucleus of a national army. But the Samurai still remained a great difficulty. They were the essence of the feudal system, but now that it was abolished their existence had no meaning and their stipends practically became pensions. There were about four hundred thousand men in receipt of incomes mostly hereditary which had been granted them in consideration of their devoting themselves to military service. In 1873 a decree announced that the Government was ready to commute these pensions at the rate of six years purchase for hereditary and four years for life pensions, one half of the commutation to be in cash and one half in bonds bearing interest at the rate of 8 per cent. The Samurai were allowed to give up their swords and to engage in other occupations. Contempt for money was part of their code and they showed their loyalty to it by the fortitude and resignation with which they accepted these disadvantageous conditions. Only in Saga was there a small rebellion. At first the commutation was voluntary but further legislation followed. A conscription law made every adult male liable to military service without regard to his social standing, and in 1876 commutation was made compulsory and the wearing of two swords, the ancient badge of the warrior, was forbidden. This overtaxed the already sorely tried temper of the Samurai. It was not the financial loss which wounded them but the ruthless destruction of their old ideals and customs. Before a generation accustomed to another outlook and new occupations had time to arise, the incomes, traditions, rights and status of the gentry were all swept away: military service became a necessary part of everyone's life instead of a special career, and all this was done by a Government which when it first started could not have lasted a day without the support of the Samurai. Feelings like this played a great part in bringing about the Satsuma rebellion.

The Satsuma Rebellion.—This was the only serious reactionary movement with which the Restoration had to contend and the wonder is that there were not more. The immediate cause was a dissension in the cabinet respecting the question of declaring war on the Koreans. They had treated Japan with discourtesy and when the change of administration was notified, had sent a contemptuous reply which the Japanese Government thought it prudent to conceal for the time. In 1875 they fired on a Japanese gunboat which was surveying the coast. The gunboat replied and got very much the best of the fighting which followed. The majority of the cabinet thought that war was most undesirable at this juncture, but some members who were in favour of it resigned. The principal of these was Saigō Takamori, who retired to his native district of Satsuma. He had played a brilliant part in the Restoration and was a man of commanding character and presence; his ambitious character also doubtless influenced his conduct at this time. Satsuma was in many ways an exceptional province and the natives had a strong individuality. It had rendered little more than nominal obedience to the Shōguns: its chief had contributed more than anyone else to the establishment of the new Government by setting the example of surrendering his fief, and the people were disposed to welcome European inventions. But they remained a clan of fighting men and disliked the recent social changes. Saigō settled down in a country seething with discontent and established there schools of arms in which young Samurai were trained in the old traditions, and also in gunnery and other branches of modern military science. He soon had an efficient and devoted army of 40,000 men and in 1877, shortly after the publication of the edicts finally abolishing the status of the Samurai, he declared war, not of course against the emperor but against his majesty's evil counsellors. The struggle lasted eight months and Saigō's defeat was apparently due to his having made the mistake of turning aside to invest the castle of Kumamoto and wasting men and time in a long siege. If he had advanced to the main island, he would certainly have found the Government unprepared to oppose him, and it is impossible to say what the issue might have been. As it was, Saigō and a band of devoted followers were all killed or committed suicide in a last battle fought outside Kagoshima. The result of this rebellion was most important, for it demonstrated to the people that the new army created by the Government was not to be despised. They had put 65,000 men into the field and had proved that military virtue was common to all Japanese and not the exclusive property of the Samurai class. It is remarkable, too, that not one of the Satsuma men in the service of the Government, military or civil, forsook it during the rebellion, not even Saigō's younger brother, who was himself a distinguished soldier. Yet Saigō did not suffer in the public esteem: he had been stripped of his honours as a rebel during his lifetime, but the court restored them posthumously in 1890, his son was made a marquis and a statue was erected in his honour at the entrance of Ueno park.

Reforms.—In the years following 1868 all manner of reforms were introduced. All the restrictions on Japanese going abroad were removed: Christianity was permitted, vaccination, posts and telegraphs, and steamships were introduced. The press became a power. The first railway (between Tokyo and Yokohama) was built with the assistance of English engineers and opened in 1872. Torture was abolished and European dress was prescribed for officials. European and American advisers were freely employed and the indiscriminate imitation of everything European was in danger of leading to vandalism and stupid blindness to the many beauties and merits of Japanese culture.

Though the general tendency was to adopt European institutions indiscriminately and too rapidly, the administration showed some circumspection in introducing parliamentary government. In the charter oath the emperor was made to say that all things must be determined by public discussion. But the first deliberative assembly was composed of nobles and Samurai only. It had no legislative powers and was dissolved after two sessions. In 1874 arrangements were made for annual meetings of provincial governors and the first was convened in Tokyo. These officials also had no legislative powers and being appointed by the cabinet could not be said to be in any way representative of the people. Their function was simply to keep the central administration informed of events and public feeling in their district. The foundations of a legislative assembly were indeed laid in the next year when a senate (Genrō-in) was appointed by imperial decree. Its duty was to discuss and revise all laws prior to their promulgation. Though this senate was abolished in 1889, yet Genrō or elder statesmen continued to play an important part in politics and were frequently consulted by the emperor. Even at the present day (1928) it is often announced that Prince Saionji, the only surviving Genrō, had been so consulted, for instance, about the formation of a new ministry.

The Government seemed disposed to let the question of representative institutions drop, but one of the leaders of the Restoration, Itagaki Taisuke, insisted on keeping it before their notice. He resigned his post in the cabinet, like Saigō, because he was in favour of war with Korea and retired to his home in Tosa, where he began a campaign in favour of representative government, and was joined by discontented Samurai and by many ambitious young men who had visited Europe or America, and found on their return that they could not obtain the posts that they desired. When the Satsuma rebellion broke out Itagaki took advantage of it to present a memorial in which he charged the administration with restraining public opinion by oppressive meth-

ods, and demanded the creation of a legislative assembly. But still the Tosa Liberals were not really demanding popular government in the European sense, and it is on record that Itagaki would have been satisfied with an assembly consisting half of officials and half of non-official Samurai. Having mastered the Satsuma rebellion, the Government felt emboldened to refuse even this, but they had a disagreeable surprise when next year, 1878, Ōkubo Toshimichi, who had been prominent as an opponent of Saigō, was assassinated by sympathisers of the latter who came not from Satsuma but from Kaga. They gave themselves up to justice and stated that one of their motives was to call attention to the Government's failure to grant representative institutions. Two months after the assassination an edict was issued ordering the establishment of elective assemblies in various prefectures and cities. A property qualification was prescribed for the electors and members. The duties of the assemblies were to levy and spend local taxes, subject to the approval of the Home Office, and they were authorized to address the central Government. On the whole they worked well, but, though they were a good school for future parliamentarians, they did not at all satisfy the ambition of Itagaki and his friends. He redoubled his agitation and was helped by the growing power of the Press. He founded the first political organization in Japan under the name of Jiyūtō or Liberal party. As its members indulged in great freedom of speech, their meetings were frequently broken up by the police, which attracted both attention and sympathy. In 1881 another political party was founded by Okuma Shigenobu who seceded from the ranks of the Administration. It was called the Shimpōto or party of progress. It might be supposed that this party would have united with the existing Liberal party, but they did not combine and indeed were rather hostile to one another. In studying recent Japanese politics, one must remember a feature which even now has hardly disappeared. A party is a body of men who follow a certain leader to whom they owe loyalty and from whom they expect reward. It is in fact the ancient clan reappearing in another sphere. The party may advocate certain principles, but its essence does not consist in any programme or platform, and identity of principles does not mean identity of party. Also the House of Peers has parties of its own which may from time to time support parties in the lower house but are not identical with them.

The Constitution.—The Administration felt the gravity of the popular demand but still would not allow itself to be hurried. An edict was issued in Oct. 1881, declaring that a National Parliament was to be established in 1890 in order that the imperial purpose of gradually creating a constitutional form of government might be accomplished. In the interval of nine years which remained, the Government made preparations for the coming change. At the Restoration in 1868, the mediaeval form of the executive had been revived, but in 1885 it was replaced by a cabinet on the European model, at the head of which was a minister-president. Itō was the first to fill the post. The senate was abolished and a privy council (Sumitsu-in) composed of persons who had won distinction in the public service was appointed.

The laws were reformed and codified. A criminal code, modelled on that of France, was brought into practice in 1882, but was subsequently modified in 1890 and 1908. Civil and commercial codes were not drawn up until 1899, and followed in the main the principles of German law. It was agreed that the future legislature should consist of two houses, peers and commons, but it was necessary to define the peers, and in 1884 an imperial rescript established five orders of nobility rendered in English as: princes, marquises, counts, viscounts and barons. In 1887 the court ceremonial and the imperial household were reorganized on the German model.

Financial questions were also taken in hand, for the national treasury was in a bad way. The Satsuma rebellion had greatly increased the already heavy liabilities of the Government and there had been a large issue of inconvertible paper currency, which had fallen 60% as compared with specie. In 1879 the Yokohama Specie bank was founded, and in 1882 the Bank of Japan to which was reserved the privilege of issuing notes, other banks being deprived of this right which they had previously enjoyed. This issue of convertible silver notes brought paper back to par and it remained so for ten years. The railway, postal and telegraphic services were steadily extended: harbour works were constructed and the foundations of a strong mercantile marine were laid: numerous students were sent at the public expense to complete their studies in Europe or America, and the system of competitive examinations was introduced. The Government, however, did not receive in all quarters the credit which it deserved. The Opposition, while waiting for the Constitution, became more violent in its methods, not even shrinking from assassination. A class of political bullies called Sōshi came into existence who, like the ancient Rōnin, but without their romance, often terrorized the capital. The ministers had not yet assimilated European usages sufficiently to think of arguing or defending themselves in public speeches, but they gave extraordinary powers to the police. Meetings, associations and newspapers were frequently suppressed and many Sōshi were summarily banished or imprisoned. The Constitution was at last solemnly promulgated in 1889. It had been drafted by Marquis Itō who had visited Europe and America in order to study on the spot various systems of parliamentary government. According to its provisions two chambers were created, the House of Peers and the House of Representatives, with the rights of legislating, imposing taxes and petitioning the emperor. The upper house consisted of not more than 300 members, including (*a*) all princes and marquises, (*b*) one-fifth of the remaining peers, elected by themselves, (*c*) citizen delegates elected by the fifteen richest men of each district, (*d*) men of learning and ability nominated by the emperor. The House of Representatives consisted of 300 members, the electorate consisting of persons who paid at least fifteen yen in direct taxes.

His majesty opened both chambers in Nov. 1890. Prince Yamagata was induced to act as prime minister but handed over the office to Matsukata, the minister of finance, in 1891, and the career of the new parliament was at first far from peaceful. One of the great objects of Itagaki and his followers had been to abolish the clan system, but they found to their regret that it flourished under parliamentary institutions even better than before. The Sat-chō, as the two great clans were compendiously termed, managed to get the running of the whole machine into their hands, Satsuma controlled the navy, finance and industries; Chōshū the army, civil service and education. Also the cabinet's tenure of office depended solely on the emperor, and his ministers took their mandates from him and not from parliament. Hence it was impossible to turn a ministry out by a mere vote: it could be made to fall only by obstruction which rendered legislation and finance impossible and, as many of the Opposition had suffered imprisonment or fines during the recent period of agitation, the virulence of their attacks knew no bounds. Had not the House of Peers been consistent in its support of the Government the necessary routine of administration might have become difficult. But a great change occurred in the attitude of the Opposition when war with China broke out in 1894. There has never been any doubt about the patriotism of any Japanese party, and when once the interests of the country were at stake all combined to assist the administration.

Treaty Revision.—Before passing on to the wars of modern Japan, it will be well to say a few words about a question which exercised the minds of both Japanese and foreigners during many years, namely the revision of the treaties made with foreign Powers. In 1882 when the first conference met in Tokyo to consider the possibility of settling this question, the situation was as follows. Since the signature of the first treaty by Commodore Perry, a number of others had been made with foreign Powers and as they all contained a most favoured nation clause all were practically identical. The principal provisions were (*a*) Kanagawa and five other ports were opened to foreign trade and foreigners were allowed to reside within a radius of about 24 miles round each, called treaty limits. (*b*) Foreigners enjoyed extra-territoriality; that is to say, they were exempt from the jurisdiction of

Japanese law courts and were justiciable only to their own consular courts. (*c*) A very low rate of import duties was fixed, mostly 5% *ad valorem*. In the days of their early ignorance the Japanese found these arrangements quite convenient, for extra-territoriality saved much trouble. But when they began to go abroad they soon perceived that the situation had another aspect which was most galling to their national pride. It meant that they were not really treated as the equals of other nations and were regarded as people who could not be trusted to administer justice or impose reasonable duties, although all the Western Powers trusted one another to this extent. As hostility towards foreigners soon died out, no objection was felt to giving them freedom of residence if Japan could obtain judicial and tariff autonomy. As early as 1876 a treaty which gave the Japanese most of what they desired was concluded with the United States, but it was of little use, except as an admission of principles, for it contained a clause saying that it would come into force only when the other Powers made similar agreements. Meanwhile the laws were revised with the assistance of French and German experts. The negotiations which began in 1883 lasted no less than eleven years and the delay was not entirely due to the hesitation of foreigners. Mexico, Russia and Germany signed agreements, when suddenly Japanese opinion seemed to change. It was proposed that for a few years four foreign judges should assist the Japanese courts in trying cases in which foreigners were concerned and this was bitterly denounced as derogatory to the national dignity. The patriots of the Opposition began to talk of the danger of Japan being swamped by a foreign invasion and a bomb was thrown at Count Okuma, the minister of foreign affairs, which blew off his leg. Naturally the Japanese Government thought it well to proceed with caution and public opinion began to change again. Negotiations recommenced and a new watchword, probably inspired by the Government, "Treaty revision and equal rights" became popular. Great Britain, which had hitherto shown little disposition to make concessions, now came to the front and in 1894 consented to a new treaty which abolished extra-territoriality and gave Japan the right to fix her own import duties and a monopoly of the coasting trade. Similar treaties with other Powers were soon concluded and the emperor issued an edict declaring in unequivocal terms that it was his desire to abolish all distinctions between natives and foreigners. 1899 was the date fixed for bringing the treaties into force and it was duly observed. Complete tariff autonomy, however, was not obtained till 1911.

In the period following the institution of parliamentary government, Japan undertook two considerable wars, one with China (1894–5) and one with Russia (1904–5). She also took part in the expedition to Peking (1900) and made an alliance with Great Britain. Looking back, one can see that this military activity was well timed. During the period of metamorphosis external entanglements had been avoided: coming when it did, military and naval success consolidated the nation. The severest critics of the new régime had to admit that it had made of Japan a State which was accepted by the world as one of the Great Powers, capable of competing with the others in peace or war. As early as 1874 an incident occurred which might have led to a breach with China, if not carefully handled. A ship from the Ryū-kyū islands was wrecked on the coast of Formosa, then nominally Chinese territory, and its crew were barbarously treated by the natives. Representations at Peking had no result, so the Japanese sent a punitive expedition to the island. The Chinese Government protested, and the matter was arranged by the intervention of the British minister at Peking, Japan agreeing to withdraw her troops and China to indemnify her for the expenses of the expedition. The political status of the Ryū-kyū islands was obscure and complicated. They had a king of their own: for about two centuries they had been rather fitfully administered by the Daimyō of Satsuma, and they paid occasional tribute to both China and Japan. In 1875 Japan boldly made them into a prefecture, probably knowing that no serious trouble would occur. China protested and discussions ensued, but Japan kept the islands. The king received a pension and subsequently was made a marquis.

In dealing with the question of Sakhalin at this period the Japanese showed themselves eminently pacific. Some Japanese had settled there as early as 1620, but Russians arrived in 1847 and under the Shōgunate there were negotiations for the partition of the island, which led to no result. Apparently both parties came to the conclusion that the territory was not worth much. At one time the Russians seemed not unwilling to sell the whole, but the Japanese withdrew from the bargain and in 1875 agreed to an arrangement by which they recognized Russia's title to the whole of Sakhalin, while Russia recognized Japan's title to the Kurile islands.

The Chinese War.—At first, Japan's attitude towards Korean questions was similarly pacific. As related above, the majority of the cabinet refused to declare war in 1875, though Korea had offered provocation, and some of the ministers resigned. Japan proceeded to treat Korea in the same way as she had herself been treated by Commodore Perry. A considerable fleet was sent to demand a treaty of amity and commerce. This was signed in 1876 and three Korean ports were opened to foreign trade. When one remembers the ambitions of Hideyoshi in the 16th century and likewise the ultimate fate of Korea, it is hard not to think that Japanese statesmen were already meditating the conquest of the peninsula, but their avowed policy was perfectly pacific and reasonable. They claimed the right of trade and residence, just as western countries had claimed it in Japan, and they wished to introduce reforms, fearing that the state of Korea might become so bad that other Powers might have an excuse for intervening to restore order and for establishing themselves in a position inconveniently near to Japan. But continual difficulties were created by the Government of Peking, which adhered to the ancient doctrine of tributary states. It was the immemorial policy of China to surround herself with petty states which might act as buffers to break the shock of foreign contact: if any other Power interfered with these states she protested, but if they misbehaved themselves, she admitted no responsibility. Such a relationship had worked well in the middle ages, but it was clearly not practicable in the new era of international intercourse which had already begun. On the one hand, China seemed to recognize the independence of Korea by permitting the conclusion of treaties with Japan and subsequently with other countries: on the other, a Chinese resident, who practically directed all important affairs, was stationed at Seoul. The members of the Min family to which the queen belonged were allowed to monopolize office and misgovern the country and, whenever there was a rising, Chinese troops were despatched to suppress it. On two occasions, in 1882 and 1884, the Japanese legation was burnt in the course of outbreaks, partly, it would seem, owing to the Korean hatred of Japanese immigrants, many of whom were low-class adventurers. After the attack in 1882, Japan was allowed to have troops in Seoul for the protection of the legation, and in 1885 a convention was concluded with China by which each Power undertook not to send troops without notifying the other.

In the following years some reforms were introduced in Korea: the customs service was reorganized and foreign settlements were opened, but the Japanese continually had reason to complain that they were prevented from enjoying the commercial rights guaranteed to them by treaty and that the Chinese resident prevented them from obtaining redress. In 1894 another rising against the Korean Government broke out. The Chinese sent a force of 2,500 men to suppress it and conformably to the convention notified the Japanese, describing Korea at the same time as a tributary state. The Japanese Government replied by sending 8,000 men and stated that they would not be withdrawn "without some understanding which would guarantee the peace and good order of Korea." As the rebellion, which had been the pretext for China's intervention, had meanwhile died a natural death, the Japanese further stated that the dispatch of any more Chinese troops would be regarded as an act of hostility. In spite of this the Chinese sent by sea 1,200 troops which encountered the Japanese cruiser "Naniwa." There is some discrepancy in the accounts of what occurred, but it is generally stated that the Chinese fired first. At any rate, their ships were sunk and the

troops perished. War was declared by both nations a few days later on Aug. 1. The campaign which followed was a succession of triumphs for Japan. The Chinese entrenched themselves at Phyong-Yang (the same town which had figured in Hideyoshi's campaigns) and made leisurely preparations for defence. The Japanese took some time to arrive, but when their columns converged on Phyong-Yang they carried all the positions in a day, with great loss to the Chinese and little to themselves. On the very next day, Sept. 17, they won a brilliant naval victory at the mouth of the Yalu river. They then took Port Arthur and Talienwan with little difficulty, but had a stubborn fight with the remainder of the Chinese fleet at Wei-hai-wei. But there, also, the Chinese were obliged to surrender and the war was at an end, having lasted seven months and a half. The Chinese sent Li Hung-Chang to negotiate terms and he signed a treaty of peace with Itō, the prime minister, on April 17, 1895, at Shimonoseki. It recognized the independence of Korea and ceded to Japan Formosa and the Pescadores islands, as well as the southern part of Manchuria: China was to pay an indemnity of 200,000,000 taels and to give new facilities to foreign trade. Japan had now a disagreeable experience of European diplomacy. Russia, Germany and France presented a joint note recommending that the territory ceded on the mainland should not be occupied permanently, and it was understood that they were ready to enforce this advice by an appeal to arms if necessary. The Japanese Government grasped the position and yielded at once, but the incident long rankled in the memories of both ministers and people.

In the years between the Chinese and Russian wars there were no fewer than six ministries, but these vicissitudes were signs of the rise and fall of various cliques rather than of any serious change in policy. The two important struggles which went on all the time and continued until quite recently were, first, the contest between the oligarchs of the great clans and the more radical elements and, second, the contest between civil and military authorities for the upper hand. A significant event in parliamentary history was the foundation of the Seiyukai party by Prince Itō in 1900. It corresponded to some extent to a liberal party in Europe, but the sentiments enunciated in its original manifesto are so vague and non-committal that one might suppose all Japanese would accept them. But Prince Itō's action implied that a cabinet ought to represent a party, a principle which had not been admitted by any one of his eminence before. The position of Prince Yamagata, then prime minister, became untenable and for the fourth time Prince Itō formed a ministry, but held office for less than a year.

The Japanese emerged from the Chinese war with the island of Formosa and a free hand in Korea. They took possession of the former without much trouble, although the Chinese population rose in what was known as the Black Flag rebellion. In 1896 a Japanese administration was introduced into the island and it was duly divided into departments and prefectures. But, considering the length of time it has been in Japanese hands, the process of introducing peace and order has not been so rapid as might have been expected, for even now the unruly tribes of the north-eastern portion are imperfectly subdued and still practice head hunting.

Korea.—In Korea, too, there were many difficulties. Chinese obstruction being now removed, the Japanese tried to introduce reforms which they hoped might lead to the establishment of order and the increase of trade. Count Inouye was sent to Seoul for this purpose, but seems to have erred by excess of zeal. His successor, Gen. Miura, was even less successful and came into collision with the queen, who was a woman of most masterful character. A conspiracy was formed in which Japanese were implicated and in Oct. 1896, the palace was surprised and the queen was killed with all her suite. As the Japanese legation was accused of being privy to this conspiracy, the minister and his staff were at once recalled and put on their trial at Tokyo, but were acquitted. The results of the whole incident in Korea were disastrous. The king took refuge in the Russian legation and remained there for two years, during which time he did his best to nullify all the reforms extorted under Japanese pressure and gave valuable concessions to the Russians, including the right to cut timber in the valley of the Yalu river. In 1898 the Germans occupied Kiao-Chiao in Shantung as an indemnity for the murder of two missionaries. Immediately afterwards Russia received from China a lease of the Liaotung peninsula, although three years before she objected to the cession of the same region to Japan, and permission to construct a branch of the Trans-Siberian railway through Manchuria from north to south. Soon after this, in 1900, came the Boxer rising and the siege of the legations at Peking. Japan acted throughout in concert with the Powers of Europe and, being the nearest country geographically, was the first to send a force to relieve not only her compatriots but the Europeans and Americans who were beleaguered in Peking and Tientsin. The conduct and results of this expedition were most gratifying to the Japanese: their troops co-operated with Europeans on an equal footing: practical comparison showed that they were inferior to none in efficiency and discipline and their behaviour was good, better in fact than the behaviour of some of the European troops. All this was eminently satisfactory to the authorities at Tokyo, but at the same time the action of Russia caused them the gravest anxiety. One result of the Boxer troubles was that Russia remained in military occupation of Manchuria and this, combined with strong pro-Russian feeling in the official circles and also among the populace of Seoul, created a position most dangerous for Japan's interests. Japan undoubtedly desired peace and while realizing that war might be inevitable did her best to avoid or postpone it. She acted in concert with Great Britain and the United States, and Russia was induced to sign a treaty pledging herself to withdraw her troops from Manchuria in three instalments.

Anglo-Japanese Treaty.—The position of Japan was further strengthened by the Anglo-Japanese Treaty (the precursor of the Anglo-Japanese alliance) which was signed on Jan. 30, 1902. It recognized "the independence of China and Korea, the special interests of Great Britain in China and of Japan both in China and in a peculiar degree, politically as well as commercially and industrially, in Korea, and the rights of both parties to take such measures as may be indispensable to safeguard those interests either against the aggressive action of any other Power or in the case of disturbances in either country." In the event of either party becoming involved in war with a third Power, the other party was to remain neutral unless "any other Power or Powers should join in hostilities against that ally, when the other high contracting party will come to its assistance and will conduct the war in common and make peace in mutual agreement with it."

The Russian War.—Russia did not withdraw her troops from Manchuria at the dates fixed, and the Japanese Government opened direct negotiations at St. Petersburg (Leningrad). They proposed that Russia and Japan should each recognize the other's status in Manchuria and Korea respectively: that both Powers should respect the territorial integrity of China and Korea and be parties to an engagement that all nations should have equal commercial and industrial opportunities in Korea and Manchuria. The negotiations lasted for five and a half months, but Russia proved unyielding and unconciliatory. The representations made in St. Petersburg were received with a silence that seemed discourteous. As the position became intolerable, the Japanese severed diplomatic relations on Feb. 6, 1904. The war which followed contained many striking incidents, especially the capture of Port Arthur and the annihilation of the Russian fleet by Admiral Tōgō. The details are given in a separate article (*see* RUSSO-JAPANESE WAR).

Brilliant as had been the victories of Japan, it was doubtful if she could continue the contest. In Russia the war had never been popular with the nation and the inglorious struggle had been most depressing. When, therefore, in June 1905 the President of the United States made an offer of mediation it was gladly accepted. The plenipotentiaries of both countries met at Portsmouth in New Hampshire, and on Aug. 29, 1905, the treaty of peace was signed. It recognized Japan's "paramount political military and economic interests" in Korea: provided for the

evacuation of Manchuria by both parties: transferred to Japan Russia's lease of the Liaotung peninsula, together with the southern section of the Manchurian railway from Port Arthur to Kwang-cheng-tse and all collateral privileges, mining or other: and ceded to Japan the southern half of Sakhalin. It was agreed that Japan should receive £4,000,000 on account of moneys spent in maintaining Russian prisoners. But, with this trifling exception, Russia refused to pay any indemnity and the Japanese plenipotentiaries did not dare to imperil the negotiations by insisting. But the Japanese public were indignant at the terms. The war had cost 170 millions sterling and 230,000 men killed or wounded, and the material gain in return for this expenditure seemed totally inadequate, however great might be the increase in prestige. Angry riots broke out at Tokyo, and the police buildings were burnt, but no better terms were obtainable. The prime minister, Prince Katsura, resigned, feeling that he could not face the diet. He made it, however, a condition that his successor, Prince Saionji, should carry through a measure which he had prepared for the nationalization of the railways of the empire and this was duly done in 1906. Katsura returned to power in 1908 and it was pretty plain that an arrangement had been made to enable him to retire until the nation's anger at not receiving an indemnity had subsided.

The Anglo-Japanese Alliance.—His services had indeed been considerable for just before the Treaty of Portsmouth was signed, he had concluded a new treaty of alliance with Great Britain. Unlike the agreement of 1902 it did not deal with the independence and integrity of Korea, but it bound the contracting parties to come to each other's assistance and conduct war in common, if "by reason of unprovoked attack or aggressive action wherever arising on the part of any other Power or Powers either party should be involved in war in defence of its territorial rights or special interests." These were defined as (*a*) the maintenance of peace in Eastern Asia and India, (*b*) the independence and integrity of China and the principle of equal opportunities for the commerce and industry of all nations there, (*c*) the maintenance of the territorial rights of both Powers and the defence of their special interests in Eastern Asia and India. In the same year a third treaty was signed with China confirming the transfer to Japan of Russia's rights in Manchuria. Two other agreements concluded with France and with Russia in 1907 further consolidated Japan's international position.

In view of the Treaty of Portsmouth the Powers withdrew their legations from Seoul and replaced them by consulates, and the Japanese sent Prince Itō as resident-general. A comprehensive scheme of reforms was introduced embracing law, police, education, taxation and currency. At first the Korean Government was asked to effect the necessary changes by employing Japanese advisers. But no attention was paid to the advice of these officials and a new arrangement was made in 1907 by which the resident-general practically became a governor with legislative and executive powers, including authority to appoint and remove officials and to employ Japanese in the administration. Prince Itō also found it necessary to disband the standing army, as being inefficient and a useless expense. The soldiers resisted vehemently, and many of them formed the nucleus of an insurrection which lasted two years. Though the proposed reforms seemed excellent in conception, they were perhaps enforced somewhat drastically and were most distasteful to the natives. While Prince Itō was on a visit to Harbin in 1909 he was assassinated by a young Korean, who claimed that he was avenging the wrongs of his country. Naturally the attitude of the Japanese Government became more severe: the insurrectionary movement of the disbanded soldiers was repressed with considerable loss of life, and it was shortly decided that the country must be annexed to the Japanese empire. This was done by an imperial rescript in 1910.

The Russian war had been costly but the Japanese were not afraid of spending money to secure military efficiency. Six divisions were added to the army and a new law of conscription was introduced, the general result of which was to provide within 10 years a fully trained army of 1,500,000 men and half a million recruits who could be used for reinforcement. New ships, arsenals and dockyards were built. Of course the financial burdens of the nation increased. The national debt rose from 56 millions sterling in 1904 to 227 in 1908, and taxation became very much heavier. It is indeed surprising that there was no serious financial embarrassment, but the development of trade and industry, improved economic conditions, and the good international status of Japan combined to prevent any crisis.

Japanese Immigration into America.—Although the relations of Japan and the United States had hitherto been excellent, a question now began to arise which is still troublesome and from time to time creates difficulties. This is Japanese immigration into American territory, especially California. To a less extent the same question affects British Columbia. Experience shows that the Japanese do not settle willingly in new countries where the climate and standard of comfort are not what they are accustomed to, such as their own territories of Formosa and even Hokkaido, but that they gladly migrate, at least temporarily, to regions like the Pacific Coast of North America where the pioneer work of colonization has already been done and conditions are to their liking. In 1908 it was stated that there were more than sixty thousand Japanese in California who did not intend to become American citizens but to make money and return to their homes. They were objectionable to other classes of the population, partly on account of the difference in their customs, but chiefly because they were ready to work for longer hours and less wages than labourers of European descent. The State legislature of California made certain enactments designed to restrict the entry and residence of Japanese, and this produced intense popular indignation in Japan. In order to understand the attitude of the Japanese Government and people in this matter, which is still far from settled, it must be remembered that the recurring cause for irritation is not so much the actual inconvenience which may be occasioned by restrictive enactments, as the implication which seems to be contained in them that the Japanese are not really the equals of Europeans and Americans, but belong to an inferior race. President Roosevelt attempted to calm the anti-Japanese agitation in California without much success, but in 1911 the Japanese Government made an agreement (originally concluded with Canada, but subsequently extended to the United States) by which without surrendering any of their treaty rights they voluntarily undertook to limit the immigration of their subjects. This was known as the "Gentleman's Agreement" and though it by no means closed the question, it was admitted that the Government of Tokyo were sincere in their efforts to execute it.

It also became apparent that there was a divergence between American and Japanese views as to Manchuria, for in 1910 Mr. Knox, the Secretary of State, made an unexpected proposal that all railways in that district should be neutralized. This suggestion was not to the taste of Russia, China or Japan and fell through, but it had the result of bringing Russia and Japan together. They signed an agreement by which they pledged themselves to maintain the *status quo* in Manchuria and to abstain from any unfriendly competition in developing that region. In the same year a modification was made in the Anglo-Japanese alliance. A general treaty of arbitration between Great Britain and the United States was then under discussion, whereas the treaty with Japan, without mentioning any names, provided for the possibility that Great Britain might be her ally in the event of a war with the United States. It was now stipulated that nothing in the treaty should entail on either contracting Power the obligation to go to war with any third Power with whom a treaty of general arbitration might be in force. This new treaty was for ten years and after that period was to continue automatically unless denounced by either party.

Death of the Emperor Meiji.—In 1911, Marquis Katsura, who had been premier for nearly five years and had accomplished various financial reforms as well as the annexation of Korea, resigned and was succeeded by Prince Saionji, the leader of the Seiyukai party. Next year the Emperor Mutsuhito, better known as Meiji, died and the period called by the same name came to an end. His decease caused profound regret and was an event of

unusual importance for the nation. It cannot be said that he initiated or was responsible for the amazing changes which occurred in the Meiji era and even under his "enlightened Government" the sovereign was hidden by a veil which makes it hard to tell how great was the part which he personally played. But all accounts agree that he was a man of strong and even obstinate character and that after he attained manhood no important steps were taken without his knowledge and consent. It is known that he interfered in national crises and apparently he was never on the wrong side. During the 45 years that he was emperor he witnessed and took part in a succession of extraordinary changes such as can hardly have occurred in any other one reign in any other country of the world and, unlike most revolutionary changes, they were not to the detriment of the monarchy. Though he delegated his authority, he did not impair it and he retained until his death the veneration and devotion of his people.

He was succeeded by his son Yoshihito, born in 1879, who adopted as the title of his reign *Taishō* or Great Righteousness. Soon after his accession the Saionji cabinet fell, because the military party insisted on having two army divisions in Korea, to which the other ministers were opposed on grounds of economy. Other short and confused ministries followed.

Prince Katsura returned to political life, but found the lower house intractable. He then resigned and started in 1913 a political party called Rikken Doshikai, the Constitutional Comrades association. It attracted a large membership but unfortunately its founder died almost immediately. The Yamamoto cabinet which followed (1913) was also short lived owing to a naval scandal and the trial of high officers on the charge of having accepted bribes from a foreign company in connection with the building of a Japanese warship.

JAPAN AND THE WORLD WAR

The Siege of Tsingtao.—In April 1914 Count Okuma, who of recent years had been devoting all his energies to the foundation and development of the Waseda university in Tokyo, undertook to form a cabinet. It lasted only two years but is memorable because under this administration Japan joined the Allies in the World War and, since the Germans were in occupation of Kiao-Chiao, was called upon to take action at once. On Aug. 14, an ultimatum was sent to Berlin demanding the immediate withdrawal of German warships from Chinese and Japanese waters and the surrender of Kiao-Chiao to China before Sept. 15. As no answer was returned to this communication, Japan declared war against Germany on Aug. 23 and Tsingtao, the principal town in the German leased territory was invested. It fell on Nov. 7, and Japan assumed the administration of the territory. (For an account of the operations and capture of the city by the Anglo-Japanese forces *see* the article TSINGTAO, SIEGE OF.)

Admiral von Spee's ships were now seriously menacing commerce in the South Seas. Japanese squadrons were sent to the China sea and Pacific ocean and two cruisers co-operated with British vessels in patrolling the western coast of America. Towards the end of 1914, as a result of these concerted operations, von Spee's squadron was chased in the direction of Cape Horn and was ultimately sunk off the Falkland islands. The Marshall, Pelew, Caroline and Marianne islands were captured. The Japanese did not send any troops to Europe, but Admiral Saito proceeded to the Mediterranean and assumed the duty of convoying Allied vessels from port to port and protecting them against the attacks of German submarines. It is said that in all they successfully escorted 788 ships.

In 1918, Japan joined Great Britain, France and the United States in sending an expedition to Siberia and landed a considerable force at Vladivostok and in October Czechoslovak troops from the interior made their way through to the coast. An anti-Bolshevik government under Admiral Kolchak was established at Omsk and an expedition into European Russia was contemplated, but was rendered unnecessary by the Armistice of Nov. 11. Japanese troops did not advance farther inland than Chita and Irkutsk.

Okuma retired from ill-health in 1916 and Terauchi, of the party called Seiyukai, was appointed to succeed him, although the majority in the diet belonged to the Kenseikai (Constitutionalists), a party which was an amalgamation of the Doshikai with some smaller associations and led by Kato. This appointment created considerable hostility and was considered to be due to the influence of the Genrō. The diet proved so unmanageable that Parliament was dissolved and a general election took place in 1917. It resulted in a striking victory for the Government party or Seiyukai, the Kenseikai losing heavily. This may seem a strange result considering the popular clamour which led to the election, but until quite recently the Government under whose auspices an election is held and which is in charge of the necessary police arrangements has never lost an election in Japan. In view of the war Terauchi was desirous of obtaining unanimity in foreign policy. For this purpose he created the temporary Diplomatic Investigation council, on which all political parties were represented. But in spite of its victory at the polls in 1917, his cabinet had continual trouble, complicated by rice riots and strikes, and he resigned in 1918. Hara, leader of the Seiyukai in succession to Saionji, was selected as the new premier. He was remarkable as being the first commoner to hold office and also his cabinet, as representing a party professing certain principles, approximated more nearly to European political institutions than any of its predecessors. In March 1918 the Government had been obliged by popular demand to bring forward an Electoral Reform Bill by which the property qualification for voters was reduced from a payment of ten yen in taxes to three yen. But a decided democratic movement began to show itself. This extension of the vote was not regarded as satisfactory: there was a clamour for universal suffrage and a bill providing for it was introduced by the Opposition in Feb. 1920. The Government, however, contended that as no election on the basis of the extended suffrage had yet taken place, it was premature to make a further suffrage reform without consulting the country. The diet was accordingly dissolved and at the election which took place immediately afterwards the Government party, that is the Seiyukai, as usual obtained a large majority. The position was somewhat curious for the Seiyukai, who were supposed to be the liberal party, were against universal suffrage and the Kenseikai were supporting it for political reasons, though it was distasteful to many of them.

Peace Conference.—At the Peace conference held in Paris in 1919, Japan brought forward a proposal, most dear to Japanese sentiment, that the principle of racial equality should be admitted. The Powers were invited to accord as soon as possible to all nationals of the States members of the League equal and just treatment in every respect, making no distinction either in law or in fact on account of their race or nationality. In making this proposal Count Makino explained that the clause did not demand the immediate realization of racial equality: it enunciated the principle only and left the methods of applying it in the hands of the Governments concerned. In the course of discussion the wording was somewhat modified in the hope of meeting objections, but even so the proposal obtained only 11 votes out of 17 and it was ruled that unanimity was essential. Japan accepted the decision, reserving the right to raise the question again at an opportune moment, but no doubt this refusal to recognize racial equality created a very unfortunate feeling. In other respects the main results of the peace for Japan were two in number. First, the former German islands in the Pacific lying north of the Equator which had been under Japanese occupation since 1914 were now allocated to Japanese administration under mandate. Secondly, in spite of the objections of China, it was finally decided to give Kiao-Chiao to Japan, but on the understanding that she would not retain it but would restore it to China as a mark of goodwill and friendship. Both these transfers of territory created a good deal of discussion, which was continued at the Washington Conference summoned at the end of 1921. One of the islands transferred under mandate was Yap in the Caroline group, which had a special importance as being a centre of the cable system in the Pacific. The United States took exception to Yap becoming an integral part of Japanese territory on the ground that it vitally affected the world's communications. The question was eventually

settled: an agreement was signed in which the United States admitted the authority of Japan as the mandatory power in Yap, while Japan accorded to the United States full rights and facilities in respect of cables.

The question of the rendition of Kiao-Chiao was complicated by the relations which had arisen between China and Japan during the war. In 1915 the Powers of Europe were engaged in a conflict the issue of which was by no means certain; should Germany prove victorious Japan's prospects in China were not at all favourable. The internal condition of China was equally uncertain and no one could say what form of government might eventually be established there. Japanese troops were in occupation of Tsingtao and a portion of Shantung. In these circumstances the statesmen of Tokyo thought it wise to make use of the opportunity and strengthen the position of their country.

The Twenty-one Demands.—Baron Kato, the minister of foreign affairs, presented to the Government of Peking what became known as "the Twenty-one Demands," ranged in five groups dealing with (*a*) Shantung, (*b*) Manchuria, and Eastern Mongolia, (*c*) the Hanyehping Company, (*d*) an engagement that China would not cede any harbour to a third Power. The fifth group was not at first made public but was presented confidentially as "wishes." It included the appointment of Japanese as advisers in political, financial and military matters: the priority of Japanese capital in railways, harbours and mines in the province of Fukien opposite to the Japanese island of Formosa: and other important points. The demands were presented in January and for some time no reply was received, but in May the Japanese Government pressed for a definite answer within a time limit and China accepted within the month. Two treaties were concluded, one dealing with Shantung and the other with Mongolia and Manchuria.

The Washington Conference.—By the latter the leases of Port Arthur and Dairen as well as of the South Manchurian railway and the Antung-Mukden railway were extended to 99 years and Japanese were accorded various privileges, residential, commercial, agricultural and industrial. The question of these treaties did not come up at the Washington Conference officially but, since it stood in the way of a good understanding, informal discussion between the Chinese and Japanese delegates was arranged. The restoration of the former German leased territory to China was agreed upon. The Japanese delegates also stated that in view of the changes which had taken place since 1915 they were ready to withdraw many of the demands then made and granted; *e.g.*, the preferential rights regarding Japanese advisers. The most important part of the treaty of 1915 still remaining in force is the agreement respecting the Kwangtung peninsula (another name for the Dairen territory), South Manchuria and Eastern Mongolia. In virtue of it the leases of that peninsula, of the South Manchurian railway and the Antung-Mukden railway remain extended for 99 years, that is till 1977, 2002 and 2007 respectively. The administration of the former German leased territory in Shantung was actually transferred to China in Dec. 1922.

The Japanese troops remained in Siberia longer than those of other Powers, but a promise was made at the Washington Conference to withdraw them as soon as the situation permitted. Japan, as a near neighbour, was affected by the fact that Siberia, since the death of Kolchak, was in Bolshevik hands and a most unfortunate incident had occurred in March 1920 when 700 Japanese were massacred at Nikolaievsk by a Bolshevik guerrilla gang. On this the Japanese occupied northern Sakhalin. The troops on the mainland were withdrawn in 1923 and in the same year negotiations were started for the recognition of the Soviet Government. These negotiations were at first informal but were subsequently conducted by the Japanese and Soviet representatives at Peking and resulted in a convention signed in Jan. 1925. By its terms Japan recognized the Soviet Government which tendered "an expression of sincere regret" for the massacre of Nikolaievsk. Japan undertook to withdraw her troops from northern Sakhalin immediately, special arrangements being made for the working of oilfields in this region by Japanese firms. There were further stipulations as to granting other concessions and fishing rights. It is significant that whereas in 1915 the Japanese Government seemed inclined to adopt a forward policy on the mainland, their subsequent attitude became most unassuming. They withdrew from Shantung and Siberia and did not even attempt to retain the northern portion of Sakhalin.

For the various agreements respecting the limitation of naval armaments and other matters at the Washington Conference, *see* that article. Of special importance was the agreement by which the Anglo-Japanese alliance was brought to an end and replaced by a Four-Power Treaty between France, Great Britain, Japan and the United States.

In 1921 the Crown Prince Hirohito made a tour in Europe and was received in Great Britain with the greatest cordiality by both the court and the public. This was the first time that a prince in the direct line of succession had left the sacred soil of Japan. In 1922 the Prince of Wales returned the visit and was received with equal cordiality.

The health of the emperor had never been robust. From the beginning of 1920 he ceased to appear in public and on Nov. 25, 1922, the Crown Prince was appointed regent. In 1924, H.I.H. married the daughter of Prince Kuni, head of one of the collateral princely houses.

THE GREAT EARTHQUAKE

The Hara cabinet continued in power until Nov. 1921. From a Japanese point of view, it was only moderately successful in foreign politics and many accusations of corruption in domestic matters were brought against it. Nevertheless the sudden assassination of Mr. Hara on Nov. 4 appeared to be the act of a crazy youth rather than a sign of popular resentment. Takahashi, minister of finance, succeeded Hara both as prime minister and head of the Seiyukai party but, finding the cabinet not amenable to his leadership, resigned after six months and Admiral Tomosaburo Kato, minister of marine and chief delegate to the Washington Conference, became prime minister in June 1922. Though he had no party affiliations he was promised the unconditional support of the Seiyukai. His first act was to abolish the temporary Diplomatic Investigation Council established in 1917. He endeavoured to cope with the growing social unrest and with the very serious commercial depression which was beginning to set in as a reaction after the abnormally favourable conditions which had prevailed at the end of the war. Unfortunately his health was bad and he died after little more than a year of office. Count Yamamoto, who had lived in retirement since the collapse of his cabinet in 1914, was commanded by the throne to form a ministry and while he was engaged on the task there occurred the terrible earthquake of Sept. 1, 1923 (*see* EARTHQUAKE). This stupendous disaster relegated ordinary political affairs to a secondary place for some time.

The Government took prompt action for the relief of the afflicted population, but the question of reconstruction created great divergences of opinion and the projects of Viscount Goto, minister of the interior, and the officials principally concerned created much discussion. On Dec. 27 another crazy youth made an attempt on the Prince Regent's life and the cabinet, regarding it as a disgrace to their administration, resigned. This action was entirely in accordance with Japanese political etiquette, but it was probably also a not unwelcome escape from a difficult position. Viscount Kiyoura was summoned to form a ministry. His cabinet was non-party and consisted almost entirely of bureaucrats and, as it showed no marked ability in dealing with the pressing problems created by the earthquake, discontent became general. The Seiyukai split into two sections, the seceding party being called the Seiyuhontō. A general election was held in May, 1924, at which the Kenseikai party obtained 162 seats, the Seiyukai 137, and the Seiyuhontō 94. Viscount Kato Takaaki, former minister of foreign affairs and ambassador at London, formed a coalition cabinet and in March, 1925, carried through the Universal Suffrage Bill, by which all males above 25 received the vote. But divisions began to appear in the coalition cabinet and some important members resigned. Gen. Giichi Tanaka became head of the Seiyukai and there was much talk of this party reuniting with the Seiyuhontō. In July the cabinet could not agree

upon a scheme proposed for the reduction of taxation and Kato resigned. He was ordered, however, to continue as prime minister and accordingly formed a new and homogeneous cabinet, consisting entirely of Kenseikai members but, unfortunately, he died suddenly in the following January. The minister of home affairs, Wakatsuki, succeeded him. Difficulties connected with immigration into America increased. In 1921 California and the other Western States made it illegal for a Japanese to own or lease land or even act as guardian for his own children born in America (who are by law American citizens) if they held land. On May 15, 1924, Congress passed an immigration law excluding Asiatics, which was regarded as equivalent to a declaration that Japanese, whatever their individual merits might be, were inadmissible as immigrants. This discrimination aroused profound resentment in Japan and the Government protested.

The Emperor Taisho died on Christmas Day 1926 and was succeeded by his son the prince regent, who adopted Showa as the title of his reign.

In November and December 1928 the new Emperor performed all the ceremonies prescribed by tradition in connection with his enthronement, and made several pronouncements declaring the policy of the Showa era. The new reign began auspiciously in spite of promises of disturbance.

BIBLIOGRAPHY.—Wenckstern's *Bibliography of the Japanese Empire* contains the names of all important books about Japan, both ancient and modern. Vol. ii., published in 1907, deals with literature which appeared from 1894–1906. The most important recent work on Japanese history is Murdoch, *A History of Japan*, 3 vols. Other recent works are Sir E. Satow, *A Diplomat in Japan* (1922); J. H. Gubbins, *The Making of New Japan;* J. L. Longford, "Japan" in the series, *Nations of To-day* (1923). (C. EL.)

JAPAN, BANK OF: *see* NIPPON GINKO.

JAPANESE ARCHITECTURE. The physical features of the country and the national characteristics of cleanliness and simplicity have determined and guided the general trend of Japanese architecture; wood is the principal building material, for Japan is abundantly supplied with such splendid timber as *hinoki* (*Chamaecyparis obtusa*), which is still in excellent condition in buildings 12 or 13 centuries old. A commission was created in 1897 for the preservation and care of such buildings, as well as sculpture and other works of art, and up to the beginning of 1928 more than 1,100 buildings, in spite of the recurrent conflagrations, had been placed under "special State protection."

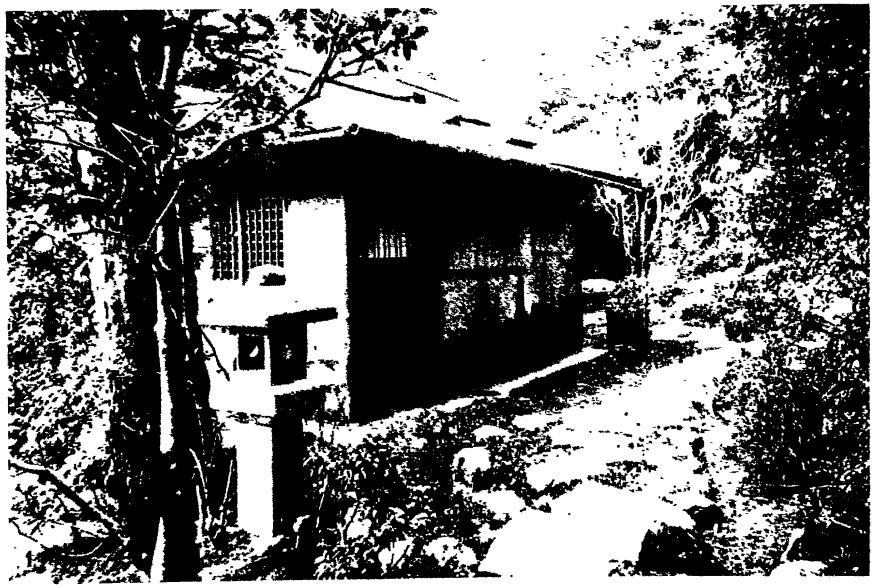
Pre-Buddhistic Period.—The primitive form of Japanese architecture is known as "primaeval palace construction." It consists in two posts set in the ground and supporting a ridge-pole, to each end of which are lashed slantwise two rafters reaching to the ground. To these rafters are tied horizontal beams to support a thatch which serves both as walls and roof; later a wooden floor was introduced, the whole structure raised, and the original shape of the roof retained while vertical walls were added. This simple form of architecture has been adhered to in some shrines sacred to Shintō. The oldest style is *Ō-yashiro,* the prototype of which is the shrine at Izumo; it developed into such forms as *Ō-tori* and *Sumiyoshi,* in none of which is there any evidence of the curves of a later date. These forms soon underwent slight variation, forming the style known as *Shinmei,* a perfect example of which is the Imperial Ise Shrine, which is rebuilt every 20 years, exactly the same to the minutest detail, with plain white wood and a thatch of chamaecyparis bark. It is recorded that the emperor Nintoku (A.D. 313–399) did away with palace decorations for the sake of economy, and "lofty architecture" is spoken of in connection with his reign as well as with those of two succeeding emperors, thus showing that the palaces at that time were no longer built in the simplest form. Their architectural development, however, was retarded, owing to the custom of changing the seat of the imperial court at the death of each emperor, and real growth, therefore, only came with the establishment of the court, first at Nara (708) and later at Kyoto, where it remained nearly 11 centuries before it was finally removed to Tokyo in 1868.

Early Chinese Influence.—The official introduction of Buddhism to Japan from Korea in A.D. 552 completely changed the architecture as well as other branches of Japanese art. Temples on a grand scale with elaborate detail were built. Some of the buildings of the Hōryuji monastery date from the beginning of the 7th century, and are considered to be the oldest wooden buildings in the world. With Buddhism, the influence of the six dynasties of China became evident, though those who built the Japanese temples were Koreans introduced at the same time. Soon afterwards, however, T'ang influence became irresistible, and monasteries assumed a still greater grandeur in scale, as may be seen from what remains of Tōdaiji at Nara (completed about 750), a representative work of the Tempyo period (708–781). The exterior of the temple was coated with red oxide of lead and the interior painted in vivid colours, especially in the shade known as *unigen;* the palace at that time was also probably gorgeous with red pillars and green tiles. With the rise of two powerful sects of esoteric Buddhism (Shingon and Tendai) in the early Heian period (782–888) temple architecture again underwent a change, as the tenets of those sects required the monasteries to be built on mountain tops; Shintō architecture changed also and a curve was given to gable and roof, such forms being evolved as *Kasuga, Nagare* and *Hiye.*

First Nationalist Movement.—In the second half of the 9th century intercourse between Japan and China was interrupted. Left alone, Japan enjoyed a period of self-realization which gave the native taste a chance to discriminate and reassert itself in architecture, as well as in other branches of art. Grace and finish were imparted to architectural detail without sacrificing the strength and harmony of the whole. To the roof was given a gentle sweep of exquisite grace; to the interior a richer, but more subdued tone. However, the later Fujiwara period (1069–1185) revealed signs of weakness and a tendency to over-refinement and delicacy, and a philosophical endeavour to amalgamate Shintoism and Buddhism resulted in the modification of Shintō architecture. Aristocrats began building their mansions much after the fashion of the imperial residences; a style of architecture—*Shindenzukuri*—consisting of a series of oblong houses systematically arranged and joined by corridors, with a garden laid out on the southern side in which was a big pond, became the fashion.

Second Chinese Influence.—Another great wave of Chinese influence began to be felt in the Kamakura period (1186–1335), when the Zen sect of Buddhists, which was destined to grip the mind of the people and to influence the art of the country fundamentally, was introduced from China. At the same time a peculiarity of the Sung dynasty under the name of "Tenjiku," or Indian, was introduced. Side by side with these imported styles the native architecture continued, and only later was influenced by the Zen principles; the "Tenjiku" style, apparently not congenial to native taste, was allowed to die out. In the Zen style the interiors were either plain, or coloured with utmost simplicity, a low relief generally constituting the only form of decoration. The period being strongly militaristic it was but natural that a style should arise, known as *Buke-zukuri,* for military aristocrats. It was a natural native growth, but its fuller development was seen in the Nanbokucho (1336–93) and the Ashikaga (1394–1573) periods. Generally speaking, the Ashikaga period emphasized detail, ignoring structural significance, and revealing weakness in place of refinement, though it produced some great works with far-reaching consequences.

Based upon the *Shinden* style of Fujiwara and the *Buke* style of Kamakura, already mentioned, and under the influence of Zen, there arose a form known as *Shoin-zukuri* (a study style) in connection with domestic and palace architecture. It admitted more light into the house and provided the room with *tokonoma* (a recess for paintings and flowers to serve as decoration) and shelves for ornaments, etc.—two characteristic and pleasing features in the Japanese house. However, a greater triumph of native architecture was the creation of the *Chaseki,* a place for *cha-no-yu,* commonly known as the tea ceremonies, which, with Zen at its foundation, has most vitally influenced all branches of Japanese art, especially painting, architecture and garden designing. In the *chaseki* variation was insisted on lest monotony should weary the mind, and harmony and balance lest freedom of soul should be disturbed. While *cha-no-yu* was in vogue—in the latter part of









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TEA PAVILION, A SHRINE AND OTHER JAPANESE BUILDINGS

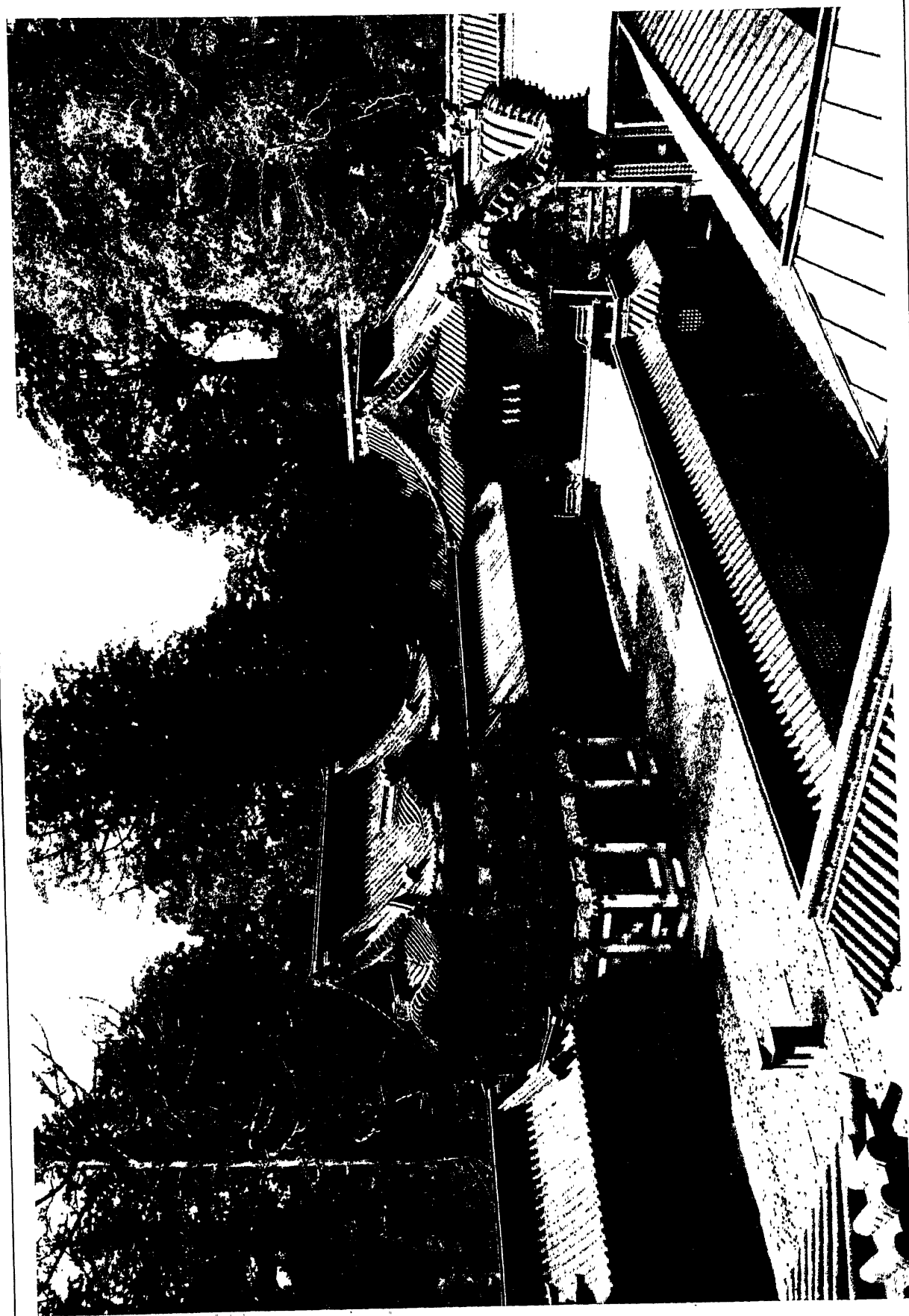
1. Korin's *chaseki* (tea pavilion) in the garden of the Ninnaji, Kyoto 2. Shinto shrine 3. Nijo palace, Kyoto 4. Thatch-roofed cottages, Viscount Saga's villa at Atami

JAPANESE ARCHITECTURE

JAPANESE TEMPLES, AND OTHER BUILDINGS

1. Veranda of the Sanboin, Daigo, looking out on a 17th century garden
2. *Chaseki* (tea pavilion) in the garden of the Katsura palace
3. Veranda of the Chion-in temple, Kyoto
4. Hiunkaku, in Kongwanji, Kyoto; originally at Momoyama, 16th century

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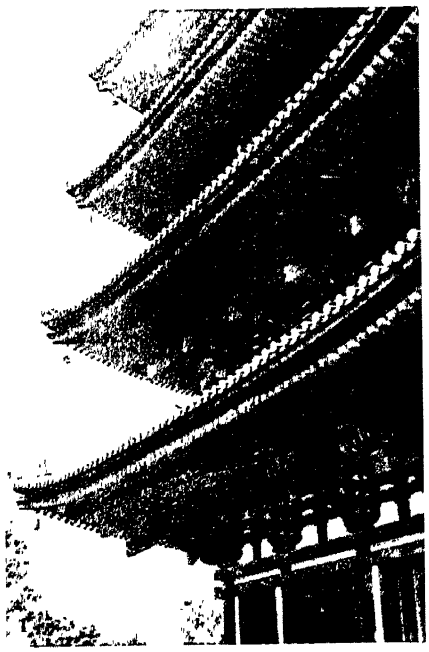


NIKKO SHRINE

Nikko shrine, showing Yomeimon, its principal gateway; built in the 17th century

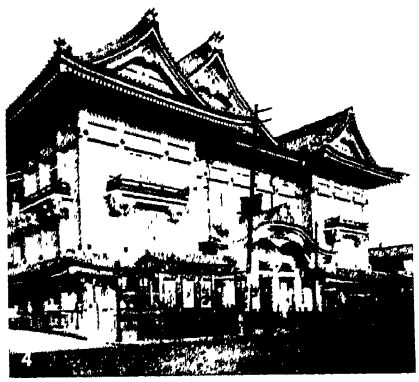
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JAPANESE ARCHITECTURE

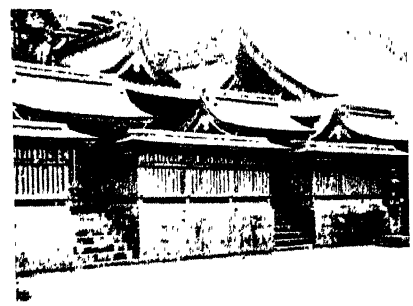
















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VARIOUS FORMS OF JAPANESE ARCHITECTURE

1. Detail, five-storied pagoda of the Kofukuji, Nara. Kamakura period (1186–1335)
2. Pagoda of the Yakushiji; Tempyo period (708–781)
3. Castle at Hikone
4 and 5. Two views of the Kabukiza theatre in Tokyo; re-enforced concrete building; designed by Dr. Shin-ichiro Okada, executed by Obayashi-gumi
6. Shinto shrine at Nachi
7. Hōwōdō of Uji, built in the 11th century
8. Kondo of the Horyuji Monastery, built at the beginning of the 7th century; said to be the oldest wooden building in the world

the Ashikaga period culminating in the Momoyama period (1574–1602)—there developed the art of building fortified castles, strong and massive, and resistant to earthquakes. In the Momoyama period, though the forms were too well established to suffer any material change, architecture sustained a great innovation. For the first time in its long history, there were built lay buildings which far surpassed the temples in splendour; among noteworthy examples now remaining may be mentioned the Hiunkaku and the Stork chamber, both in Nishi Hongwanji, Kyoto, but originally at Momoyama, and the sanctuary of Ninnaji at Omuro which was part of an imperial palace.

Second Japanese Nationalist Movement.—Another nationalist period began with the Tokugawa régime (1603–1867), a period of peace and wealth. Many new buildings were erected and ruined temples restored; but it was in the construction of mausoleums and great edifices built over the bones of Tokugawa Shoguns that the spirit of the age found its fullest expression. The best examples may be seen at Nikko. They are in a style known as *Gongen* or *Yatsumune*, suggesting a complicated system of roofs; the buildings were lacquered within and without, and profusely decorated with carvings. Many feudal lords of the period, following the example of the Shogun, erected such extravagant buildings that it became necessary to impose restrictions. The magnitude of the scale on which the Shogun kept his court may be conceived from the Nijō palace in Kyoto, still well preserved.

Dwelling-houses.—The evolution of the common dwelling-houses of to-day was completed in the Tokugawa period. It was based on the *Chaseki* and *Shoin* styles, which were adopted by the people in general, and it brought with it a great development in landscape gardens which became indispensable as an integral part of the dwelling. The ordinary dwelling-house is one or two storied, roofed either with grey tiles, or in the country, with thatch. The floor is covered with closely-fitted mats 2 inches thick, measuring 3×6 ft., the size of rooms being computed by the number of mats in them. The house is divided into rooms by sliding screens; light is admitted by a paper-covered lattice mounted as a sliding window, these screens are removable so as to throw the series of rooms into one. At night the house is closely shuttered by wooden panels running in grooves on the outside. It is now usual to have one reception room furnished in Western style. The kitchen, long neglected, has been much improved by the introduction of Western conveniences and labour-saving devices. The whole interior, however, remains essentially simple and refined.

Post-Restoration.—With the restoration of power to the imperial throne in 1868, which was followed by the suppression of the feudal system, an attempt was made "to abolish every institution in Japan which had no counterpart in the civilized west." Naturally, the Western style of architecture was welcomed with a zeal that led to the invitation of European and American architects to the country to demonstrate the art of building with bricks, stone, iron and concrete. Some attempts were made to harmonize the Western and native styles of architecture, but with little success. A certain reaction set in just before the great earthquake and fire of 1923 destroyed much of Tokyo and its vicinity, exposing the weaknesses of both styles. A tendency, however, is to be noted towards the adoption, on one hand, of Western architecture for public buildings, and on the other towards maintenance of the pure native style for private dwelling-houses, since the old customs are still kept up in private life and the taste for simplicity remains essentially unchanged. (*See* ARCHITECTURE; SCULPTURE; NO DRAMA; WOOD CARVING.) (J. HAR.)

JAPANESE ART: *see* JAPANESE PAINTING AND PRINTS; JAPANESE ARCHITECTURE; JAPANESE SCULPTURE; NO DRAMA, JAPAN; DANCE, JAPAN; IVORY CARVING, JAPANESE; JEWELLERY, CHINESE AND JAPANESE; ENAMELS, CHINESE AND JAPANESE; IRON IN ART, CHINESE AND JAPANESE; POTTERIES AND PORCELAINS, NEAR EASTERN AND FAR EASTERN; TEXTILES AND EMBROIDERIES, FAR EASTERN; INTERIOR DECORATION, CHINESE AND JAPANESE; JAPANESE GARDENS.

JAPANESE BEETLE, a cetoniid beetle (*Popillia japonica*) which was accidentally introduced into the United States in the larval form in earth around the roots of some plant imported from Japan. It was first discovered in the United States in 1916 near Riverton, N.J. At the end of 1923 it had infested an area of about 2,500 sq.m. in New Jersey and Pennsylvania. Since that time it has entered adjoining States. The adult beetle feeds upon about 200 species of plants, including practically all the economic crops, seeming to prefer, however, apple, quince, peach, sweet cherry, plum, grape, blackberry, clover and corn. It also attacks the foliage of many shade trees and ornamental shrubs; also many weeds, especially smartweed (*Polygonum sp.*). In many cases it completely defoliates trees and feeds upon the earlier-ripening varieties of fruits. The larva, living below the surface of the ground and feeding upon the roots of plants, damages lawns, pastures and golf courses, and also the roots of strawberries, cabbage and other plants that have been set in heavily infested fields. The eggs are deposited in the soil, and hatch in about 14 days. The larva is one of the so-called white grubs, and passes its entire existence underground. The winter is passed in this stage, and during May it transforms to prepupa, and then to pupa, the adult beetle emerging about the middle of June.

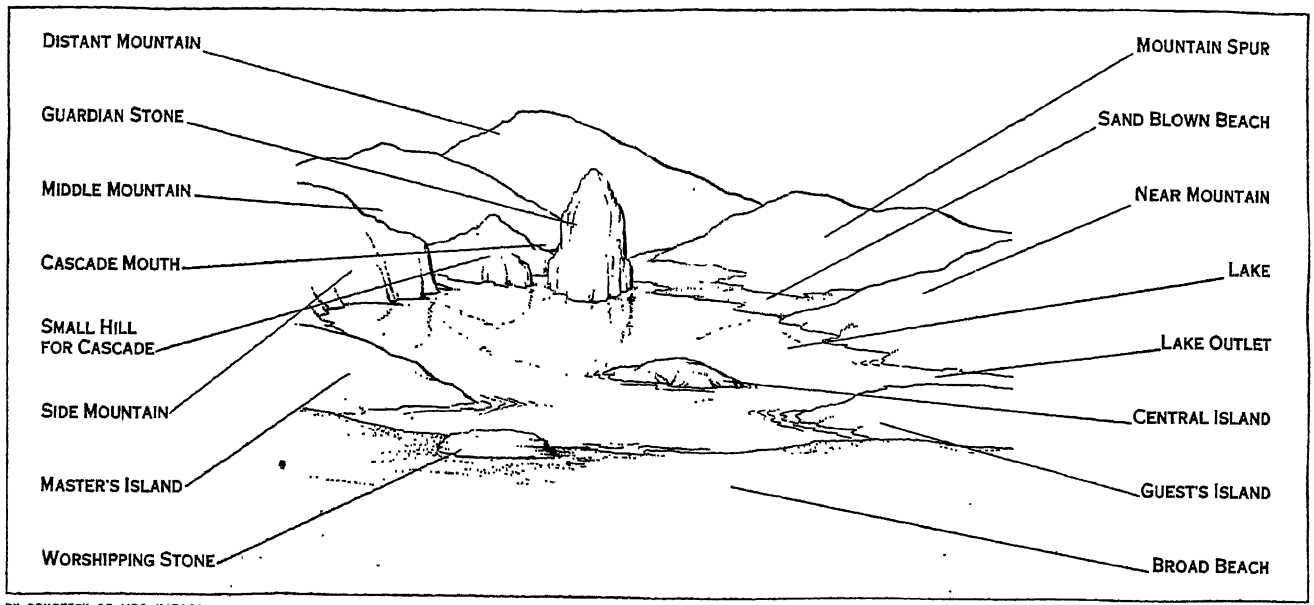
The adult beetle is about $\frac{3}{8}$ in. in length, and about the same in width. It is bright metallic-green in colour, with copperybrown wing covers. The beetles fly readily, feed avidly and lay eggs in late summer. There is only one generation each year, five-sixths of the time being spent in the soil as egg, larva or pupa.

The insect has spread from the original centre of infection at the rate of from 10 to 15 m. per year, practically entirely by the flight of the adults, which may occasionally be carried by storms to very considerable distances. The movement of infested farm products and of soil in which the larvae occur is another method of distribution. During 1923 more than 32,000 beetles were removed from sweet corn consigned to New York from one New Jersey district. Vigorous attempts have been made by the States concerned and by the Federal Government, by quarantine and inspection, to prevent the rapid spread of the insect. Intensive investigations for direct remedies have been carried on for a number of years. Methods of treating the soil on lawns and golf courses have been developed; and effective sprays have been found. The beetles seem to avoid trees sprayed with arsenical compounds, but it has been found that a substance known as geraniol attracts them to unsprayed trees, and when they have concentrated upon such trees are killed by a contact insecticide.

Under the auspices of the U.S. Government, intensive studies of the Japanese beetle have been made in its original home. Several species of parasitic wasps and flies have been found to destroy it there, and these have been imported into the United States, where several of them have become established. (L. O. H.)

JAPANESE GARDENS. The art of garden-making was probably imported into Japan from China or Korea. Records show that the imperial palaces had gardens by the 5th century, their chief characteristic being a pond with an islet connected to the shore by bridges—as is shown later by mentions of the emperor Shōmu's (724–748) three gardens in Nara. During the Heian period (782–1185), when the symmetrical *shinden* style of architecture prevailed, the main garden (as often, even to-day) was laid out on the southern side of the house, always with hills and a pond with an island. However, with the change in domestic architecture of the Kamakura period (1186–1335), came modifications of the garden. Learned Zen priests, who assiduously studied the art of garden-making, gave Buddhistic names to different rocks in the design, and linked religio-philosophic principles with the rules governing it. Other cults and superstitions crept in also, further complicating the design.

With the supremacy of the Ashikaga dynasty (1394–1573) came popularization of gardens, which were designed to be enjoyed from within as from without, opening a new era in the development of garden-making. The subjective mood became dominant, and the gardens reflected individuality. People demanded *shibumi* in their gardens—an unassuming quality in which refinement underlies a commonplace appearance, appreciable only by a cultivated taste. Aesthetic priests, "tea-men," and connoisseurs devised new forms of gardens for *cha-seki*, the little pa-



BY COURTESY OF JIRO HARADA

GENERAL KEY TO GARDEN DESIGN OF LANDSCAPE TYPE

vilions or rooms built for *cha-no-yu* (tea-ceremonies), and a special style developed which revolutionized Japanese garden art.

Styles in Gardens.—The vogue of designing in the three degrees of elaboration—*shin, gyo* and *so* (elaborate, intermediate and abbreviated)—was adopted also for gardens. Many splendid gardens were produced in the Momoyama (1574–1602) and Edo (1603–1868) periods. However, the centre of garden activity gradually shifted from Kyoto to Edo, the seat of the Tokugawa Shōgun. One development was a utilitarian phase; *e.g.*, the duck pond in the Hama detached palace in Tokyo, and the cultivation in the Kairaku-yen at Mito of reeds for arrow-shafts, and plums for military supplies. Feudal lords generally had fine gardens in their provincial homes as well. Quite a number of gardens have survived the abolition of the feudal system after the Restoration of 1868, when so many celebrated gardens perished through neglect or were sacrificed. The establishment of public parks, which were not unknown even in feudal times, has been specially encouraged throughout the country since 1873. Gardens of Western style came with other Western modes but made little headway. The great earthquake and fire of 1923 demonstrated the utilitarian value of the Tokyo gardens. Tens of thousands found safety in the parks and in the large private gardens scattered throughout the city.

Classes of Gardens.—Japanese gardens are generally classified, according to the nature of the ground, under two heads: *tsuki-yama* (artificial-hills) and *hira-niwa* (level-gardens), each having special features. *Tsuki-yama* consists of hills and ponds, and *hira-niwa* of a flat piece of ground so designed as to represent a valley, a moor, and so on, and *tsuki-yama* may embrace a portion laid out as *hira-niwa*, both types being treated in the three degrees of elaborations already mentioned. Hill-gardens as a rule include a stream and pond of real water, but in the *kare-sansui* (dried-up landscape) style, while rocks are composed into the form of a waterfall and its basin, and of a winding stream and pond, gravel or sand is used to symbolize water, or to suggest the temporary phase of a naturally dried-up landscape. In extreme examples, where prime importance is given to rocks, and trees are absent, a real "rock garden" may be said to result. There are also styles known as *sen-tei* (water-garden) or *rin-sen* (forest-water), and, in level gardens, *bunjin-zukuri* (literary men's style), a very simple and small type, originated by dilettanti in Chinese literature. The tea-garden or *roji* (dew-ground or passage) as it is called, is another distinct style evolved to meet the requirements of the tea ceremonies, as already mentioned. *Genkwan-saki* (front of entrance) or house-approaches have always claimed special treatment—a simple curve, wherever possible, partially to conceal the entrance to the house and give character to its front view.

Characteristic Features.—The characteristic features of a Japanese garden are the waterfall, of which there are ten or more different modes of arrangement, the spring and the stream to which it gives rise, the lake, the hills built up from the earth excavated when its basin is dug, the islands with many varieties of bridges, and the natural stones which constitute the skeleton of the garden. The selection and effective distribution of these stones are the prime consideration and have been endlessly experimented with and deeply pondered, the cream of such experiments in composition being handed down by means of drawings. The studied irregularity of the arrangement of the stepping-stones in the *cha-no-yu* garden, wherein beauty and use are combined, is a noteworthy element of garden-design. In modern Japanese gardens flowers are few and evergreens popular. The significance here is that simplicity, restraint and consistency are sought rather than gaiety, showiness or the obvious variations of the seasons, and subtle gradation in the tones of the foliage is preferred to the changing aspect of deciduous trees, though with some exceptions such as maple trees. As in the case of stones, trees must be distributed in the garden in harmony with their natural origin and habit of growth. Of garden furniture and accessories, the well, decorative and useful alike, the stone water-basin, endless in variety, stone lanterns, figures and pagodas, arbours and summer-houses, are the most characteristic, together with gateways and fences, particularly the widely varying *sode-gaki* (sleeve-fence) attached to the side of the house to screen certain portions, and used to blend harmoniously the natural beauty of the garden with the human art displayed in the architectural features of the house.

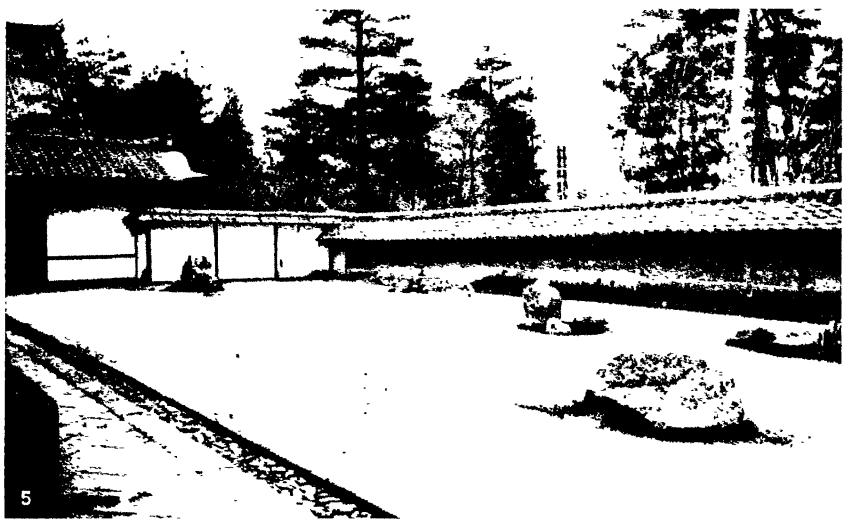
Ideals and Aims in Garden Design.—The ideals of garden-designing have often been modified during its long history, being influenced by the prevailing thought of each period. At one time eminent Zen priests designed gardens in accordance with the principles which lay at the base of their philosophical teaching, at another, painters became deeply interested and designed gardens as though they were painting landscapes on silk. In the course of history the objective standpoint in garden-making gave place to a subjective impulse. Various philosophic principles and religious doctrines were embodied in the making of gardens, not so much to interpret those particular principles and doctrines as to explain the aesthetics of garden design, and more particularly of the distribution of natural rocks, by illustrations drawn from familiar philosophic principles. Long after such principles have ceased to sway the mind of the people, the terminology survived, preserving a repertory of symbols. The laws of direction, of harmony, of the five elements, the principles of cause and effect, of the active and passive, of light and shadow, or of the nine spirits of the Buddhist pantheon, as well as superstitions of all sorts, still continue to











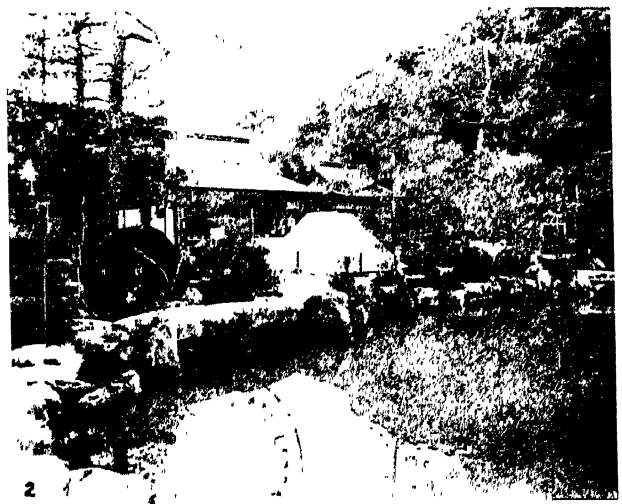
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CHARACTERISTIC JAPANESE GARDENS

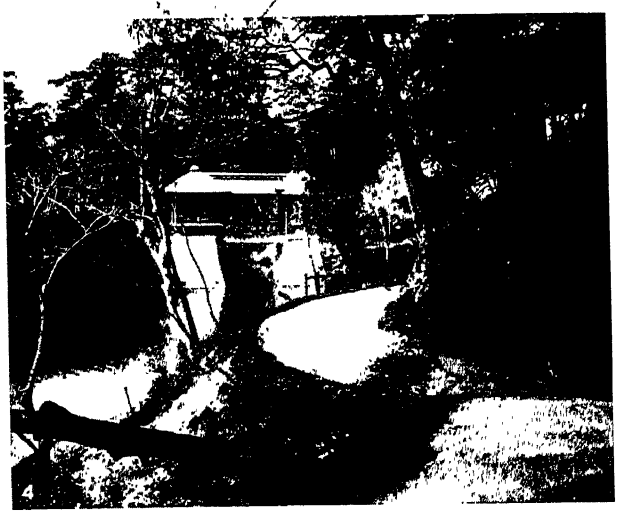
1. Garden of the Tenryuji, Buddhist Temple, Kyoto; designed by Musokokushi (14th century)
2. Koraku-yen, Okayama (17th century)
3. Garden of the Dempo-In, Tokyo
4. Crane and Tortoise Islands, In the garden of the Kinkaku-ji, Kyoto
5. Garden of the Ryoanji, Kyoto, attributed to Soami

JAPANESE GARDENS


1


2


3


4


5


6

BY COURTESY OF JIRO HARADA

IMPERIAL AND OTHER JAPANESE GARDENS

1. Kenroku-yen, Kanazawa
2. Garden of the Ginkakuji, Kyoto, attributed to Soami
3. Garden of Shisenkaku, designed by Ishikawa Jodan, Kyoto
4. Imperial Garden of Shukaguin, Kyoto
5. Imperial Garden of the Katsura palace, Kyoto
6. Imperial Garden at Shinjuku, Tokyo

influence to some extent the general design of gardens.

The aim is to bring man closer to Nature, and all manner of means have been resorted to in the effort to realize it. Some of the master-designers reproduced in miniature famous scenes of China and Japan. They planned the garden and planted trees to give the illusion of a view extending over and beyond its own immediate confines, but at the same time they so designed it as to be a secluded and sylvan retreat from the world, great ingenuity being displayed in both directions. In some instances, with only a few stones in a narrow strip of ground, a great expanse of landscape has been included as a background. In another instance, Rikyu, in his garden at Sakai, obstructed the open view of the sea in such a way that only when the guest stooped at the stone water basin to wash his hands and rinse his mouth preparatory to entering the *cha-seki*, did he catch an unexpected glimpse through the trees of the shimmering sea, thus being suddenly made to realize the relation of the dipperful of water lifted from the basin to the vast expanse of sea, and of himself to the universe. The Japanese have tried to emphasize in their gardens the charm of restraint, and of beauty so concealed that it may be discovered individually, thus providing that thrill of joy to the soul which comes from doing a good deed in stealth. Thus, at least in its ideals, the Japanese garden, which has always been part and parcel of the home, by no means stops at merely creating and arranging beautiful spots, but aims at being natural that it may satisfy the human craving for nature, and, by supplying peace and repose, may be a retreat in which man's spirit can wander and find spiritual recreation and sustenance. (*See also* BONKEI; BONSAI; BON-SEKI; HAKO-NIWA; JAPANESE ARCHITECTURE.)

See J. Conder, *Landscape Gardening in Japan* (1893); J. Harada, *The Gardens of Japan* (1928). (J. HAR.)

JAPANESE INDUSTRIAL BANK, THE. This bank, the *Nippon Kogyo Ginko*, was established by the Japanese Government in 1902 as a joint stock company with an authorized capital of 50,000,000 yen fully paid up.

The business of the Industrial Bank is (1) to make loans on pledges of national and local bonds and Companies' debentures and shares; (2) to subscribe for or take up national and local bonds and companies' debentures; (3) to receive deposits of money and accept articles of value for custody; (4) to engage in trust business for mortgage debentures; (5) to discount bills; (6) to promote bills of exchange; (7) to make loans on security of foundations created as prescribed by law; (8) to make loans on mortgage of ships or ships under construction, such loans to be redeemable by annual instalments within a period not exceeding 15 years (or less as fixed); (9) to make loans on security of shipbuilding materials or equipments; (10) to subscribe for or take up shares which have been approved by the competent Minister of State; (11) to subscribe for national or local bonds and companies' debentures, or to act as agent for receiving these instalments payable by general subscribers; (12) to make call-loans or loans for a fixed term on security of sites and buildings belonging to factories or of residential land buildings lying in localities where the City Organization Law is in force, and (13) to purchase national or local bonds or companies' debentures and shares or gold and silver bullion with available money which the bank may employ for the purpose. (S. YA.)

JAPANESE LANGUAGE. Japanese is an agglutinative language. Its origin is still a matter of conjecture. Korea was probably the first foreign country with which Japan had relations; but whether and to what extent she borrowed from its language is uncertain, and it is not till she came into contact with China that we are on sure ground. From that country she borrowed the ideographs now in general use, attempting at the same time to follow the Chinese pronunciation of the period. In the process of time, however, the true Chinese sounds and their Japanese imitations drifted so far apart that save in a comparatively few instances they are to-day quite different. Originally introduced into Japan at the end of the 3rd century A.D., the ideographs were then pronounced according to what is called the *Gō-on* (*Wu* sound); but in the 7th and 9th centuries this was superseded by the *Kan-on* (*Han* sound), which is that now in general use. The following are examples:—

Gō-on.	Kan-on.	Japanese equivalent.	Meaning.
Nin.	*Jin.*	*Hito.*	*Person.*
Mon.	*Bun.*	*Fumi.*	*Letter.*

The ideographs run into many thousands; but the number which the ordinary educated Japanese is able to read and write correctly probably does not exceed seven or eight thousand. When first introduced they were used for phonetic purposes as well as for their regular one; but, as they proved too cumbersome for the former, two syllabaries, called respectively the *Katakana* and the *Hiragana*, were eventually derived from them and are in use to-day. Each contains 50 characters; but the *Hiragana*, which is used in writing, has many variants. The movement to dispense with ideographs entirely and to substitute for them Roman letters (*Romaji*) has not so far achieved much success. The original native vocabulary was very limited; but the introduction of the ideographs and Chinese literature and philosophy enriched it materially, and since the invasion of Western ideas and scientific terms expansion has been most marked. Chinese ideographs being singularly well fitted to express these ideas and terms, it is by combinations of them in groups of two or more that the modern Japanese vocabulary has been built up. Very many of these words have found their way into the ordinary spoken language; but the process of colloquialization is not complete and perhaps never will be. Many words, too, have been adopted from European languages, some before the Meiji restoration, most since. Examples are *biidoro* (vitrio), glass; *kasŭtera* (castilla), sponge cake; *kōhi* (koffij), coffee; *bōto*, boat; *naifu*, knife; etc. The most generous borrowings have been from English, and it is no unusual thing to see in a newspaper an expression printed in Chinese ideographs with the English equivalent in *kana* at the side. There are two distinct languages in Japanese, the colloquial and the written; but the newspaper and the complicated needs of modern life are gradually breaking down the barriers between them.

Grammar.—With regard to pronunciation it may be said in general terms that both vowels and consonants are softer than in most European languages, the vowel sounds resembling the Italian. The long vowels are pronounced approximately as follows:—

ā,	as	a	in father.
ē,	,,	e	in grey.
i,	,,	ii	in siege.
ō,	,,	o	in cone.
u,	,,	oo	in brood.

There is hardly any tonic accent in pronouncing words. The older Japanese grammarians recognized only three parts of speech, the substantive, the predicative, and the postposition (*teniwoha*); European categories are not particularly suitable. The following are some salient points of Japanese grammar and syntax expressed in the broadest and most general terms. There is no article, and the noun, which is indeclinable, has neither number nor gender. It is in fact a "universal" and not a "particular." Gender is expressed by the use of the prefixes *o* (male) and *me* (female), modified occasionally for purposes of euphony, or by the words *otoko, osu* (male) and *onna, mesu* (female); *e.g.*, "a boy," *otoko no ko*; "a girl," *onna no ko*. Abstract nouns are generally expressed by Sino-Japanese words or by the combination of an adjective or a verb with the word *koto* (thing). Inanimate objects are rarely personified, and compound nouns are common. Case is shown by the postpositions *ga* or *wa* (nom.), *no* (poss.), and *wo* (acc.). *Wa* emphasises the word it follows. Adjectives have three endings—in *i* (attributive or predicative), in *o*, and in *ku* (adverbial). There are no inflections to indicate degrees of comparison; but so-called secondary inflections, produced by combinations of the verb *aru* (is) with the adverbial form of the adjective, exist to indicate tense and mood. The personal pronoun is avoided whenever possible and person shown by the context. The stock form of "I" is *watakushi*, of "you" *anata* or *kimi* (polite) and *omae* (depreciatory). There is no relative pronoun, its place being taken by a verb used adjectivally; *e.g.* "the dog which barks," *hoeru inu* (barks dog). Verbs may be conveniently divided into two conjugations (Lange; Chamberlain

gives three). In those of the first conjugation the stem ends in *e* or *i* and remains unchanged, in those of the second it ends in *i* but changes in conjugation. There are a few auxiliary and irregular verbs and many compound. There is also a desiderative form ending in *-tai*, really an adjective and subject to inflection. The passive voice is rarely used in Japanese, and there is no special conjugation for it. But passive and potential forms are derived by adding *rareru* to the stem of verbs of the first conjugation, and *reru* to that of verbs of the second. Similarly, causative verbs are formed by adding *saseru* and *seru* to the stem respectively. In all three the vowel *a* is also added to the stem in the case of verbs of the second conjugation.

There are two series of numerals, one Japanese, the other derived from Chinese. They are as follows:—

Japanese	*Chinese*	*English*
hitotsu	ichi	one.
fūtatsu	ni	two.
mitsu	san	three.
yotsu	shi	four.
itsutsu	go	five.
mutsu	roku	six.
nanatsu	shichi	seven.
yatsu	hachi	eight.
kokonotsu	ku	nine.
tō	jū	ten.

100 is *hyaku*, 1,000 is *sen*, and 1,000,000 is *hyaku man*. There are also a number of auxiliary or classifying numerals. For instance, "two books" is *hon ni satsu* (books two volumes), and "two horses," *ūma ni tō* (horses two heads), *satsu* and *tō* being respectively the classifying numerals of the objects specified. Ordinals are formed by prefixing *dai* (order) to the Chinese cardinal number, by adding *me* or *bamme* to it, or by using *dai* and *me* or *bamme* together; as, "the second," *dai ni, ni bamme*, or *dai ni bamme*. The place of the preposition in English is taken by the postposition. There are two kinds; postpositions proper and quasi-postpositions, the latter really substantives to which the postposition *no* is prefixed; *e.g.*, "outside," *no soto* (exterior of). Adverbs proper and conjunctions scarcely exist. Honorifics, whether in the shape of special prefixes, nouns, or verbs play a very important part in the language, and particular care must be exercised in their use.

The fundamental rules of syntax are briefly: (a) qualifying words precede the word qualified, (b) the object precedes the verb, (c) the verb is at the end of the sentence. There are no expressions in Japanese corresponding exactly to "Yes" or "No," and in replying, for instance, in the affirmative to questions such as "Is that so?", "Did you go?", etc., a Japanese would say "It is so" or "I went." Similarly, if the answer were in the negative he would say "It is not so," or "I did not go." The following points deserve the attention of the student: (1) long and short vowels should not be confounded, (2) the use of personal pronouns should be avoided, (3) honorifics should not be applied to himself by the person speaking, but care should be taken to apply them to superiors.

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JAPANESE LITERATURE. From the neighbouring continent the Japanese derived the art of writing, probably about the middle of the 3rd century, but the earliest book now extant dates from 712. This is the *Kojiki* (Record of Ancient Matters), translated into English by Chamberlain, as vol. x. of the *Transactions of the Asiatic Society of Japan*. The *Kojiki* is written in the archaic form; that is to say, the language is that of old Japan, the script, although ideographic, being used phonetically only. It is a species of saga, setting forth not only the heavenly beginnings of the Japanese race but also the story of creation, the succession of the various sovereigns and the salient events of their reigns, the whole interspersed with songs, most of which may be attributed to the 6th century. The next authentic work, *Nihongi* (Chronicles of Japan), composed only eight years later, was completely Chinese in style and embodied Chinese traditions and Chinese philosophical doctrines. The poetry of Japan is distinctive. Its form has remained unchanged till modern times. The *tanka* is a five line verse of 5, 7, 5, 7, 7 syllables, and the *hokku* of three lines (5, 7, 5). The *content* of Japanese poetry began to change with the importation of Chinese metaphors and actual Chinese words. The two masters of pure Japanese verse were Hitomaro and Akahito (8th century), followed by Tsurayuki (early 10th century). In 756 was published the *Manyōshū* (Collection of a Myriad Leaves), a work containing the best verses of Hitomaro, Akahito and a host of minor poets. In 905 Tsurayuki and three other poets compiled the *Kokinshū* (collection of Odes, Ancient and Modern), and this was the first of the *Ni-jū-Ichi Dai Shū* (Anthologies of the Twenty-One Reigns), a series finally completed in the 15th century. With the mention of the *Hyaku-Nin-Isshu* (Hundred Verses by a Hundred Poets), assembled by Teika Kyō in the 13th century, the tale of Japanese poetry is told. From the end of the 9th century the making of poetry declined and although, in their passion for everything Chinese, the leaders of the literary world imitated the Chinese style of verse, none of their efforts ever attracted the attention of Chinese poets. Since Chinese poetry, like that of the West, has rhymes and a great variety of metres, as well as a complicated system of "parallelism" between the characters of the different lines, and the Japanese disregarded all these points, their non-success is not surprising.

THE DARK AGE

The so-called dark age of Japanese literature (*c.* A.D. 1425–1625) was not entirely unproductive; besides the *Tsurezure gusa* (Idle Thoughts), by Kenkō-bōshi, it gave the drama (*Nō*) to Japan. Tradition ascribes the origin of the drama to a religious dance of a pantomimic character, called *Kagura* and associated with Shintō ceremonials. The Nō, however, owed its development mainly to Buddhist influence. Very soon the Nō came to occupy in the estimation of the military class a position similar to that held by the *tanka* as a literary pursuit, and the *gagaku* as a musical, in the imperial court. For a moment, when the tide of Western civilization swept over Japan, the Nō seemed likely to be permanently submerged. But, in recent years, the popular mind has definitely been drawn from its favourite, rather coarse, variety stage to an appreciation of the classical drama. There are five schools of Nō presentation and a healthy competition stimulates public interest.

There was an attempt, in the period immediately following the dark age, to popularize the purely Japanese art of versification and the Tokugawa era (1603–1867) opened even more splendidly than it closed. Bashō and a collection of his "disciples" made the earlier years of this period lustrous with the myriad *hokku* or *haikai* (verses of three lines, 5, 7 and 5 syllables), produced on all subjects from the minutest natural object to personal reproaches, and thumb-nail sketches of new ideas, as when "the writing of Dutchmen" was said to "straggle like geese across the sky!"

Soon after the end of the Tokugawa period some imaginative Japanese saw an opportunity to pull their ancient poetry out of its rut. Foreign models of odes, sonnets, ballads, quatrains and long poems were slavishly copied; even *vers libre* was forced into a Japanese dress. The genius of the language, however, was all against such an innovation and the party led by Prof. Tozama watched its efforts fade into nothingness without even stirring the surface calm of the national taste.

Influence of Women.—A close view of the history of Japan will demonstrate the tremendous activity of men in the numerous battles and feudal squabbles which began soon after A.D. 1000. In these circumstances it is far from surprising that women dominate the literary history of Japan. Not only did women begin it (the empress Gemmyō ordered the transcription of the *Kojiki*, and again to an empress we owe the *Nihongi*), but they perpetuated it, and there are few, if any, works of outstanding merit in the pure Japanese tongue written by men. The latter, for the most

part, slavishly copied the Chinese style until it became recognized as the one vehicle for men, and women were left to guard the pure tongue. This distinction still prevails not only in writing but in speech, so that a Japanese woman's conversation is not only softer but more diffuse (Japanese being an inexact language), while the men interlard their speech with the direct, vigorous Chinese vocables. Early in the 11th century two notable works appeared from the pens (or rather, brushes), of two court ladies. The *Genji Monogatari* (Story of Genji) by Murasaki no Shikibu is a lengthy novel, tedious in itself, but valuable as a mirror of the real life of that time. The *Makura no Sōshi* (Pillow-sketches) by Sei Shōnagon is an amazingly unaffected record of the writer's impressions of life and its problems in daily practice ("Things I dislike heartily," "Things I am fond of" are two perfectly delightful sections of these fugitive papers). Through the naïveté of the writer's confessions appears a marvellously clear picture of life in aristocratic and Court circles in the 11th century.

THE TOKUGAWA PERIOD

The Tokugawa era (1603–1867), which popularized the drama, had memorable effects upon Japanese literature. Yedo, the shōgun's capital, displaced Kioto as the centre of literary activity. An unparalleled development of mental activity necessitated wholesale drafts upon the Chinese vocabulary. To this may be attributed the appearance of a group of men known as *kangakusha* (Chinese scholars). The most celebrated among them were: Fujiwara Seikwa (1560–1619), who introduced his countrymen to the philosophy of Chu-Hi; Hayashi Rasan (1583–1657), who wrote 170 treatises on scholastic and moral subjects; Kaibara Ekken (1630–1714), teacher of a fine system of ethics; Arai Hakuseki (1657–1725), historian, philosopher, statesman and financier; and Muro Kiusō, the second great exponent of Chu-Hi's philosophy. Iyeyasu's grandson, the feudal chief of Mito (1662–1700), organized the compilation of *Dai-Nihon-Shi,* in 240 volumes. This became now the standard historical work and was followed by the imperially named *Reigi Ruiten* (Rules of Ceremonial), in more than 500 volumes. In the year 1827 was published the *Nihon Gwaishi* (General History of Japan), by Rai Sanyo. These works are, for the most part, mere dull recitals of plain fact with no style or alleviation of any kind. At a later period popular ballads, dramatically detailing the struggles of great rival clans, replaced these histories in the popular fancy. In the last years of the 19th century the Japanese recognized this sad defect and instituted a section for historiographers in the Imperial university of Tokyo.

Although the incursions made into Chinese philosophy and the revival of Japanese traditions during the Tokugawa epoch contributed materially to the overthrow of feudalism and the restoration of the Throne's administrative power, the immediate tendency of the last two events was to divert the nation's attention wholly from the study of either Confucianism or the *Record of Ancient Matters.* A universal thirst set in for Occidental science and literature, so that students occupied themselves everywhere with readers and grammars modelled on European lines rather than with the Analects or the *Kojiki.* English at once became the language of learning. Thus the three colleges which formed the nucleus of the Imperial university of Tokyo were presided over by a graduate of Michigan college (Prof. Toyama), a member of the English bar (Prof. Hōzumi) and a graduate of Cambridge (Baron Kikuchi). If Japan was eminently fortunate in the men who directed her political career at that time, she was equally favoured in those who presided over her literary culture. Fukuzawa Yukichi, founder of the Keiō Gijuku, now one of Japan's four universities, did more than any of his contemporaries, by writing and speaking, to spread a knowledge of the West, its ways and its thoughts; and Nakamura Keiu laboured in the same cause by translating Smiles's *Self-help* and Mill's *Representative Government.* A universal geography (by Uchida Masao); a history of nations (by Mitsukuri Rinshō); a translation of *Chambers's Encyclopaedia* by the department of education; Japanese renderings of Herbert Spencer and of Guizot and Buckle—all these made their appearance during the first 14 years of the Meiji era. The business of translating went on apace. Great numbers of European and American authors were rendered into Japanese—Calderon, Lytton, Disraeli, Byron, Shakespeare, Milton, Turgeniev, Carlyle, Daudet, Emerson, Hugo, Heine, De Quincey, Dickens, Körner, Goethe—their name is legion and their influence upon Japanese literature is conspicuous. This energetic pursuit of another alien literature had its inevitable reaction in a further nationalist movement. When English was made a compulsory subject in all Japanese schools this movement was made even stronger as a direct result of the schoolboys' revolt against forced tuition in a difficult study. The full effects of this, however, were not to be felt until the dawn of the next era (Taishō).

The glory of Meiji was, alas, not to be sustained. Whether the mistake lay with the old giants of the Meiji era or in the insufficiency of their sons it is impossible at this close range to decide. In the later years of the Meiji period it became obvious that the spirit animating the intellectual and literary leaders was dying; some of the old magic still clung to the name of the dynasty, but nothing more. The new writers lacked the capability for sustained effort, their works were spasmodically produced, and were often completely without style. There was an unrestrained crudeness about the new literature which horrified those who still remembered the early Meiji period.

The change was almost complete when the young men began banding themselves together into various associations, such as the "New Romanization Society" (Shin Romaji Kai), the "Foreign Language Research Society" (Gaikokugo Kenkyu Kai), the "Japanese Script Society" (Nipponji Kai), etc. These unofficial organizations achieved very little, except of positive harm. Americanisms, cant and slang terms, undistinguished from "standard English," were imported freely and incorporated into novels, belles-lettres and even scientific treatises. The free-verse writers of England and America must be held responsible for a peculiarly unpleasing form of composition which, while entirely foreign to the genius of the Japanese language, was adopted by the writers of this period in place of the *tanka* and *hokku* as the only possible style of poetic composition. The actual result of these liberal importations from foreign fields was the flood of ineffective and often vulgar books offered to foreign students as Japanese contemporary literature. While book-production was never so ample, it was never so uniformly devoid of merit.

The Meiji era translations of European classics and contemporary works, though marred by many faults of inexperience, are still to be preferred to later versions. Bacon, Shakespeare, Macaulay, Milton, Byron, Shelley, Keats, Victor Hugo, de Maupassant, Dante, Heine were all retranslated under this dynasty. The new translations are, however, far from being reliable. In many cases whole sections of the original are left untranslated, at the whim of the editor. Despite this, the character "zen" (complete) is found on the back of the book and on the title-page. In other cases, scenes which are purely national in the original work are recast, details being altered to suit Japanese surroundings. Thomas Hardy's novels suffer particularly in this unnatural transmutation: in one or two popular translations now in vogue Hardy becomes merely a mediocre Bakin leading some dull puppets over dreary Japanese marshes.

THE MODERN MOVEMENT

The outstanding literary feature of the Taishō era is the inundation of Japan by Russian works. Tolstoi ceased to be fashionable; Andreyev, Balmont, Sologub, Pushkin, Zinaida Hippius, Lermontov, Gogol, Tchekhov and Turgeniev held the imagination of youthful Japan during these years. Although no further impulse was needed, it was supplied by the signing of the Russo-Japanese Treaty early in 1925, when numerous societies for the encouragement of research into Russian literary and philosophic fields sprang into existence. Russian plays were hastily and imperfectly translated into Japanese (*The Cherry Orchard* was a noteworthy exception), and produced by Japanese actors at the Little theatre in Tsukiji, Tokyo. Gogol, in his more dreary moods, was freely translated into novels of social life, and the sentimentality so characteristic of the true Japanese novelist becomes tinctured

with a despair imported from the Siberian steppes. Arishima Takeo, an idol of the young reader in modern Japan, demonstrated this phase not only in his novels but in his life and death.

The Occidental treatment of women engaged the attention of writers of all classes, and political writers condemned the drastic changes proposed by the novelists. Foremost, perhaps, not only of modern woman-novelists but of all since the days of Murasaki no Shikibu, is Mrs. Yayoi Nogami, wife of Nogami Toyoichiro, the greatest living Japanese authority on the classical drama (Nō), and translator of Bernard Shaw. A later novel of hers, *Kaishin Maru* (The Seagod Ship), is justly esteemed above all contemporary works.

No account of modern Japanese literature would be complete without reference to certain writers who, in spite of their lack of real merit, have captured and held the popular imagination. Natsume Sōseki is chiefly remembered for his *Wagahai wa Neko de Aru* (I am a Cat) and *Botchan* (The Boy). He died before the full force of change induced by indiscriminate importation had been felt, and his work was modelled rather on the later Meiji style. "The Two Kikuchi," as they were familiarly called (Kikuchi Kan and Kikuchi Yuhō), devoted themselves to the writing of novels in which women's problems are discussed and advanced views of social life are set forth. Kume Masao, Satomi Ton and Akutagawa Ryunosuke also, in some measure, gratified the current passion for original styles and exotic scenes. Kurata Hyakuzo is regarded as the leading spirit of modern Japanese drama; one of his plays, *The Priest and his Disciples,* has been translated into English and published with the original text by Glenn Shaw (Tokyo, 1923). The sex-novel of Europe has its imitations in works by Tanizaki Junichirō and Morita Sōhei. Tanizaki writes very colloquially on the subject of hysterical women, psychoanalytic studies in the West providing him with unlimited material. Morita Sōhei was once considered a very brilliant writer, his *Baien* (Sooty Smoke) being an exceptional success. He afterwards turned his attention to translations of Ibsen's plays.

Matsuura Hajime is the only literary man of this period to remain true to the best traditions of his country's literary history. Unaffected by the many new movements for the development of art, letters and the drama, he is the foremost poet and essayist of modern Japan. In 1925 he resigned his professorship at the Imperial university in Tokyo, "as a protest against the insincerity and shallowness of modern academicians, artists and writers, who would profane the shrine of pure art by setting up base images of foreign clay." In his *Bungaku no Byakkō* (The Pure White Light of Literature) Matsuura displays a sensitiveness and purity of ideal which had been lost to Japan since the close of the Nara period.

The constitutional ban on revolutionary and socialist doctrines resulted in the issue of a complete Marxian library and a series of handbooks purporting to be short cuts to Bolshevism. The Showa period, which began in December 1926, has so far not made any original literary gesture and there is no sign of a return to the early simplicity of literary models.

See W. G. Aston, *Japanese Literature* (1908); Chamberlain, *The Classical Poetry of the Japanese* (1880); *Japanese Classics,* i. (Tokyo, 1925); *Genjimonogatari,* trans. by A. Waley (1925–).

(A. N. J. W.)

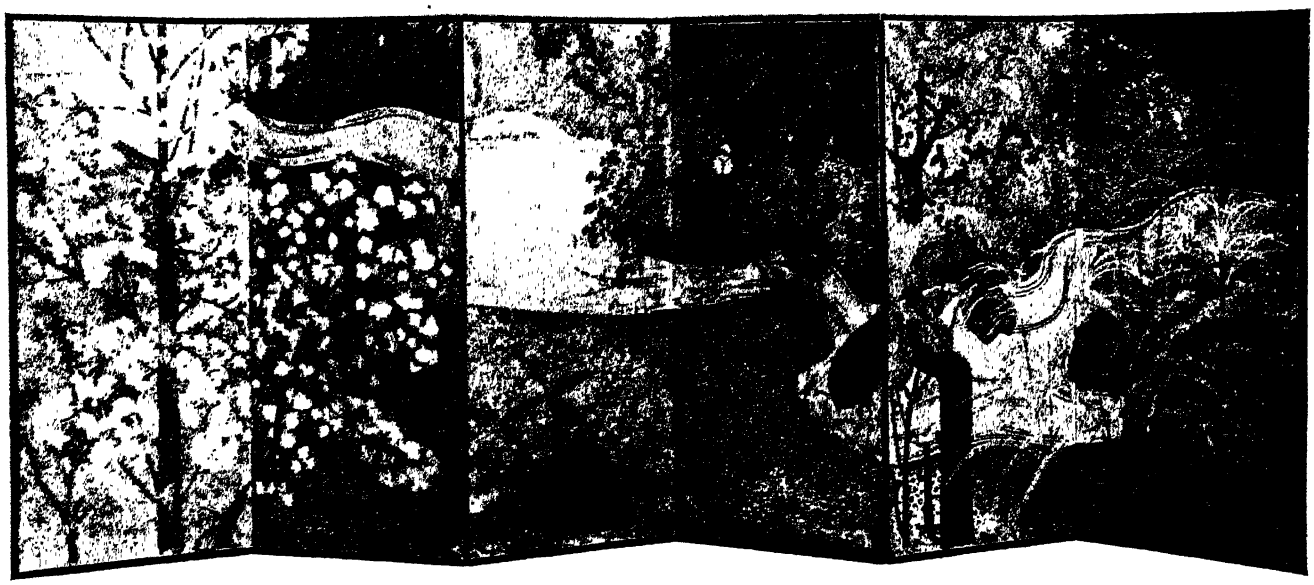
JAPANESE MUSIC. The traditional origin of Japanese music is generally traced back to Izanagi and Izanami, the creator and creatress of the country in Japanese mythology, whom the 8th century *Kojiki* records as having sung together in chorus. Dancing is likewise linked with the performance of the celestial deities before the cave of the Sun Goddess, when songs were sung and Amano Kanatomi-no-mikoto played on a harp formed of 6 stretched bows. Historically, too, vocal music came first and when instruments were introduced, they were generally the accompaniments of the dance as well as song. When foreign musical instruments were imported their influence was felt in Japanese vocal music, but ethnical characteristics have helped to develop it in the direction of *uta-mono* (singing) and *katari-mono* (recitative) so that at the present time there is the *gagaku* (classical court music) with a history of more than 10 centuries behind it, the *naga-uta* (long songs), with a tradition several centuries old, and the music for the popular *samisen* (three-stringed guitar) going back some 300 years, all developing side by side with the lately-imported European music.

Primitive Period.—The musical history of Japan may be divided into 4 periods: The first is the primitive period ending with the death of the emperor Inkyō (412–453) when native music existed in which the stress was laid on the beauty of the human voice, though later more value was attached to its literary contents. This consisted of *rōyei* (chanting poems), *kume-uta* (songs of war), *imayō* (the singing of genre sonnets), and such instrumental music as *kagura* (sacred dance), *saibara* and *utagaki* in which men and women joined in the revels on the outskirts of their villages. Records speak of the emperor Inkyō playing on a *wagon* (Japanese native *koto*) and the empress dancing at the imperial banquet given in 419 on the completion of their new palace building. Hand-drums and pipes made of bamboo appear to have been in existence at that time.

Period of Foreign Music (453–1186).—The second period is marked by the importation of foreign music, beginning with 453 and lasting about 700 years. Its main events may be summarized as follows, each numeral covering about a century: (1) The king of Shiragi (in Korea) sent 80 musicians to attend the funeral of the emperor Inkyō in 453, thus marking the first importation of foreign music into Japan, although the custom of using music at the funeral ceremonies of important persons was already in existence locally, while in 554 a number of musicians were sent from Shiragi to the court of the emperor Suiko. (2) The king of Kudara (in Korea) in the middle of the 7th century dispatched a number of musicians to remain at the Japanese court, some of them being replaced later by a new batch; about the same time music came also from Koma (in Korea). At this time *kure-gaku* (*gagaku*) was also introduced which played an important part in Buddhist ceremonial, and some of the masks worn in connection with this music are still preserved in the Horyuji monastery. (3) Indian, as well as Chinese, music had already found its way to Japan through Korea. But the influence of T'ang music, coming direct from China, became irresistible and played an important part in the grand inauguration ceremony of the Great Buddha of Todaiji, Nara, in 752. (Some of the masks and dresses used on that occasion are still preserved in the imperial treasure-house, Shōsō-in.) The music of European Turkey and of Arabia also found its way to Japan before the establishment in 702 of the imperial bureau for music (*Uta-ryo*) which consisted of more than 500 singers, musicians, etc. (4) The *biwa* and the *koto* (the Chinese *kin*) were brought in from China. (In the Shōsō-in collection dating from the 8th century there are examples of *wagon,* Chinese *kin,* 5-stringed *biwa,* 4-stringed *genkan, shō* and *wu,* a kind of mouth-organ with long pipes of slender bamboo, harps and flutes.) There was a revival of T'ang and Korean music and this foreign music so dominated the Uta-ryo, that O-uta-dokoro was created for the development of native music to be used on certain ceremonial occasions. (5) The contact between and harmonization of foreign and native music gave rise to new instruments such as the *hichiriki* pipe. (6) There was a further development of *gagaku* for the court use. (7) There came into existence *shirabyoshi* (white measure-markers) whose semi-poetical chants were accompanied by drum and fife. It was during this time that a separation of popular from the aristocratic music took place.

Period of National Music (1186–1896).—The third period covers about 700 years, beginning with the reign of the emperor Gotoba (1186), and is characterized by the birth of genuine national music. The principal features of the period, each covering about a century, are: (1) the vogue of *hei-gaku,* the recital to *biwa* accompaniment of epics of the Taira clan, and of *yei-nen* (life-lengthening dance) by the monks; (2) the rise of *Den-gaku* (originally an agricultural mime) which found favour with the military class; (3) the rise of *Saru-gaku* (monkey mime) patronized by the court; (4) a new movement was in evidence in native music and there appeared the signs of the birth of popular or people's music; (5) a real popular music was born with the appearance in the Hoei era (1704–11) of the *samisen* (3-stringed





BY COURTESY OF (1) THE MUSEUM OF FINE ARTS, BOSTON, (2) THE METROPOLITAN MUSEUM OF ART

KORIN AND KOYETSU SCREENS

Korin and Koyetsu were two of the most famous painters of Japan and the two screens shown herewith represent their styles. The top screen, with its almost incandescent coloration of the jagged rocks around which raging waves lash, shows the strength and verve of Korin's art; while the lower screen, in its grasp of the colour and mood of autumn, gives an idea of Koyetsu's understanding of nature. Another piece by Korin is shown in "Screens," Plate I

banjo), being a Japanese modification of 2-stringed lute with snake skin brought from Luchu; (6) the *samisen* music of the common people made great stride and alongside it *uta-mono* (songs) and *katari-mono*, such as the tragic recitation of the *joruri* also flourished; (7) there was a commingling of various kinds of music in the closing century of this period.

Period of European Music (1896–).—The fourth period begins with the end of the China-Japan war in 1896, and is characterized by the importation and spread of European music in Japan. It was in 1896 that Western gramophones found their way to Japan. Such a welcome did the Japanese give to them that ten years later a gramophone company sent their agents there and had a good deal of Japanese music recorded. European music gained great favour in Japan, especially with the young people, and it so dominated the Tokyo Academy of Music, the highest institution of its kind in Japan, that in 1911 a special commission was set up in the academy with the purpose of preserving the traditional music of Japan. Naturally pianos and Western violins have entered much into Japanese homes. But the *koto, samisen* and *shakuhachi* (bamboo pipe) are still retained, and the tragic recitative of the *joruri* or *gidayu*, with or without the accompaniment of puppet or other plays, together with other forms of recitative such as the popular *naniwa-bushi*—epic of 47 Ronins, etc.—and the remnant of the minstrelsy of the *biwa-hōshi*, and such native styles of singing as *naga-uta, uta-zawa*, and *ko-uta*, still hold their own in varying degrees.

It has often been observed that the Japanese have not made such progress in music as in other branches of art and this has been put down in part to Japanese religious teaching which has caused the people to regard all expressions of emotion as vulgar.

(J. HAR.)

JAPANESE PAINTING AND PRINTS. Although Japanese painting originated in China, it is undoubtedly a mistake to suppose that the Japanese have been merely imitative in art. It was inevitable that the great empire of the continent, with its ancient civilization, should be to Japan even more than Italy and Greece have been to western Europe. But in their art there is always a difference; and in certain schools and periods the Japanese genius has triumphantly asserted its special gifts and qualities.

General Characteristics.—Japanese painting ignores the cast shadows of nature. It attempts no sculptural effects. It insists very little on the relief of objects portrayed, and prefers the suggestion of modelling to its actual representation. It employs an empirical system of perspective. It does not aim at the complete representation of a scene, but, selecting the significant elements, uses blank space as a factor in the design. Though the Japanese artists study nature with ardent attention, their aim is to train the memory so that when what they wish to paint is completely visualized they shall be able to record the mental image with the utmost vividness and truth. They concentrate on life, movement, character, but always with an eye to decorative effect. Their technique follows that of the Chinese. The medium is Chinese ink, a substance yielding tones that range from deepest lustrous black to silvery grey, water-colours, to which rice-paste or diluted fish-glue is sometimes added according to the pigment used. Paintings are either in ink alone, or light-coloured or full-coloured. The material is silk or absorbent paper. Anything like the elaborate confection of a European oil-painting is therefore unknown. The expressive strokes of the brush are valued as a direct communication of personality, like the handwriting which, also employing the brush, not a pen, is an invaluable training for the painter.

Fresco-painting was practised in early times, but never to the same extent as in China. Pictures are usually in the form of *kakemono*, hanging-paintings, or *makimono*, horizontal-scrolls, which are sometimes of immense length. But some of the finest Japanese paintings are in the form of screens, usually six-fold; these, if in colours, are generally on a gold or silver ground. There are also paintings on sliding-panels, and framed pictures. The *kakemono*, mounted on fine brocade are kept rolled up, and when shown, are hung in a sort of alcove called the *tokonoma*, reserved for this purpose.

The motives of Japanese painting are often similar to those of Chinese art; but except in periods when Chinese influence was paramount, the life of action becomes a far more prominent and fruitful theme. The Japanese, being essentially martial, while the Chinese are pacific, found congenial matter in the painting of heroic episodes of the civil wars which raged so long in mediaeval times. Where the Chinese tradition was followed, the Japanese



AN ACTOR PRINT BY TOYOKUNI, ONE OF THE THREE MASTER ARTISTS OF THE LAST DECADE OF THE 18TH CENTURY

painters tended to use a smaller scale. The national instinct for neatness, for fastidious and cleanly order, is reflected in their art. The high spirit that goes with a martial temper, and a frank gaiety, are also distinctive qualities that find expression in art. Perhaps the chief bane of Japanese painters has been an extreme dexterity, tending to sacrifice inner significance to clever manipulation of the brush. Nevertheless it must be emphasized that the Japanese have for centuries shown an instinctive taste that amounts to genius; and perhaps in no country has fine taste been so widely diffused. The colour-prints of the 18th century were produced by men of the artisan class solely for a public of the same class. Despised by connoisseurs in their own country because of this association, they were appreciated as miracles of refinement and exquisite design by Europeans familiar with the art of the whole world. China has nothing comparable to show of the kind. Nor, so far as we know, have the Chinese ever produced anything like the superb array of screen-paintings by great masters which are among the greatest glories of Japanese painting. If in general Japanese art is less profound than Chinese, nevertheless among the early religious paintings are some sublime masterpieces. In the portrayal of swift and strident action Japanese draughtsmen of mediaeval times are unsurpassed. In the art of the later periods there is a world of humorous vivacity and observation. Japanese painting represents a continuous tradition of 1200 years, perpetually renewing itself and alive to-day. But the fact that nearly all its great masterpieces have remained in Japan has prevented the real range of its achievement from being appreciated by the world at large.

History: Early Buddhist Art.—In the 6th century A.D. Buddhism, in its triumphal progress from India, overflowed, by way of Korea, into Japan. Such rudimentary efforts at mural painting as had existed before hardly need a mention; the real tradition of Japanese painting starts from the introduction of Buddhism. Of its earliest phase the one existing relic is the so-called Tamamushi Shrine, a portable wooden shrine painted with Buddhist figures and legendary scenes in an oil medium and in Chinese Buddhist style. The earliest independent painting is somewhat later in date. It is a portrait of the Crown Prince Shotoku with his two sons. Shotoku was a great and enlightened prince, who as regent under the empress Suik (reigned 593–628) was the chief influence in the propagation of Buddhism and in the fostering of the arts. In this painting, now thought to have been made after Shotoku's death, and in the few other works surviving from the 7th and early 8th centuries, such as the "Beauties under the Trees," a screen-painting, and the exquisite "Kichijoten" in Yakushiji temple, the style of the earlier T'ang period in China is very closely followed. The same full and rounded type of face, the same fashions in coiffure and dress, the same suavity of demeanour, are found in some fragments of Chinese secular painting discovered by Sir Aurel Stein at Turfan (Turkestan) in a tomb of the early 8th century. The grandest works of this time, however, are the frescoes in the Horyuji Temple at Nara: they are no doubt closely modelled on T'ang wall-paintings. Tradition ascribes both these and the portrait of Shotoku to Korean artists. In 756 the consort of the Emperor Shomu dedicated the belongings of her dead husband to Buddha. These have been preserved to this day in the Shosoin at Nara, and bring vividly before us the outward signs of the Chinese civilization of the period, as reflected in the Japanese court. To what extent these objects of noble design and exquisite workmanship were Japanese production, it is difficult to say. But it is certain that the Japanese adopted the arts and graces, the costume and ceremony, the literary and aesthetic pastimes, of Chinese life in no spirit of barbarian mimicry, but with a responsive appreciation. Fine taste and a sensitive docility are qualities in which the Japanese have been surpassed by no other race.

In 794 the capital was moved from Nara to Kyoto, then called Heian; and from this date to 1100 extends the Heian period, the later part of it being often called the Fujiwara period from the ascendancy of the great clan of Fujiwara. We now begin to find recorded the names of individual artists. Among these is the priest, Saint, Kobo, who visited China in 804–806; a few pictures by him still survive, which show that he could compete with Chinese masters on equal terms. The greatest name of the 9th century is that of Kanaoka, who painted secular scenes, animals, birds and flowers, as well as Buddhist subjects. Tradition places him among the greatest of Japanese painters, but no work of his brush now remains. Some splendid pictures have borne his name for centuries, but are now judged to be of considerably later date. We may presume however that with Kanaoka Japanese art began to assume a character of its own. From the end of the 9th century to the 14th intercourse with China was almost suspended; and, shut up within herself, Japan sought to assimilate all the marvellous inheritance she had received from the continent, and at the same time to develop her art according to her own genius. Kanaoka founded the Kose school, Kose being his family name. Other schools which arose were the Takuma and the Kasuga schools, and later the Tosa school, all of them belonging to the Yamato or national tradition. The pictures that have survived of this early period are all of Buddhist inspiration; and though we know from records that the artists by no means confined themselves to religious themes, probably their grandest work was in the Buddhist style. Eshin Sozu (d. 1017), ranks as the greatest of the religious painters of Japan. He is especially associated with beatific visions of Amida Buddha—rising in glory behind the mountains, or descending to welcome the blessed soul to Paradise—though some of the works attributed to him by tradition have been taken from him by modern criticism. During the Fujiwara period the painting of screens, panels and fans was fashionable; even more popular towards the end of it, were the picture-rolls, often illustrating diaries or stories and combined with manuscript.

The Yamato or National Style.—A definitely Japanese style had now been created. Nothing that we know of in Chinese art prepares us for the amazing rolls of Toba Sojo (1053–1140). The priest Kakurju, who became an archbishop, is known in art by this ecclesiastical title. He painted a grand Death of Buddha, but is best known for the witty and animated drawings in which he satirized personages of the day, including the clergy, under the guise of frogs, monkeys, etc. Whether in drawing animals or human figures, his brush tingles with life. Nothing could stale the freshness of these masterly sketches.

The art of caricature is known in Japan after him as Toba-ye; but later artists, while imitating him in a fondness for animal travesties, exaggerate his methods to satiety. Nevertheless, this strain of buoyant fun, which is found thus early, is a notable characteristic of Japanese art. Contrasted with Toba Sojo is Takayoshi, whose work reflects the life of the Court at the close of the Fujiwara days, its refined voluptuousness, its exquisite leisure, its devoted cult of beauty. It was Takayoshi who made the first illustrations to the Genji Monogatari, the marvellous novel written by the Lady Murasaki at the beginning of the 11th century. Here we find at its most splendid and original the fully-formed style of the Tosa school in which the Yamato tradition was to persist so vigorously. All that is truly Japanese, and least Chinese,



"THE STORY OF KASANE," AN ACTOR PRINT BY TOYOKUNI'S EMINENT PUPIL, KUNIYOSHI

in later painting derives from elements here established. It is an art of frank and audacious convention, quite unlike any other art in the world. The conception of life as a continual ceremony is reflected in the formality of the design, in which the play of curving forms against straight line and angle is enriched by the contrast of low-toned but glowing colour. It is an art of interiors chiefly; the profuse beauties of nature are symbolized by tree or flower detached in delicate isolation. There is no hint of Chinese impressionism; cloud and mist intervene in the design as solid bands of gold. About the middle of the 12th century the long



BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

PORTRAIT OF YORITOMO

Copy of a portrait of Yoritomo, the first shōgun (commander-in-chief) of Japan (1192–98), attributed to Takanobu, 12th century, Kamakura period



BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

18TH CENTURY JAPANESE PRINTS

1. The broken shoe-string, by Suzuki Harunobu (1718–70), the first painter to employ full colours in wood block printing
2. Two youths and a girl playing a flute, by Torii Kiyonaga (1752–1815)
3. Beauty in the mirror, by Kitagawa Utamaro (1753–1806) one of Japan's greatest masters of figure design
4. Theatre manager reading an announcement, by Toshiusai Sharaku

rivalry of the great clans of Taira and Minamoto came to a head, and Japan was given up to civil war.

Kamakura Period.—In the end the Minamoto triumphed, and Yoritomo took to himself the title of Shogun. He established his capital at Kamakura, after which the ensuing period is named. The portrait of Yoritomo here reproduced (Plate II.) is an ancient copy of a picture preserved at Kyōto and ascribed to a contemporary painter, Takanobu. We observe the emphatic angles and straight lines on which the design is built; a certain squareness, contrasting with the grandly flowing curves of Chinese painting. Kamakura painting is indeed the most truly national phase of Japanese art, the art of a martial and heroic people. The swift and summary power of stroke, the animated intensity of delineation, which Toba Sojo had shown so signally, were now applied to scenes of action and war, Mitsunaga, Nobugana and Keion are the supreme masters of a vigorous school. "Keion," now thought to be a legendary name, is the traditional author of three picture-rolls of scenes from the civil war, one of which is in the Boston museum. For dramatic design, energy of movement, vehemence of action, the draughtsmanship here shown is not surpassed in the world's art. A detail from the Boston Roll is shown (Plate IV., fig. 1). Mitsunaga is no less a master of expressive gesture and nervous line. Nobugana is famed for a series of portraits of poets, but his masterpiece is the incomparable portrait of Kobo Daishi as a child kneeling upon the lotus, an exquisite work. Takakane, Yoshimitsu, and Korehisa in the 14th century rival the preceding masters in splendour of colour and energy of line. This was a truly national school and it is unfortunate that its masterpieces are so little known, and that the glories of this school can only be fully appreciated in Japan itself. (Many scenes from these rolls have been reproduced in colour in *The Kokka* magazine.) Besides the interiors with their scenes of court life and amorous intrigue, in which no one rivalled Takayoshi, and the battle-scenes, a favourite theme was the life of this or that saint; and here we find episodes and incidents taken from the ordinary life of the people, depicted with an intimacy of truth, a humour and pathos, which are emphasized by the contrast of the formed conventions of the background. Paintings of horse-taming and of demons on a journey are also famous. The school, usually styled the Tosa school, began to show signs of enfeeblement in time and though Mitsunobu and Yukihide did admirable work in the 15th century, a strong reaction from China was already inaugurating a new era in art.

Ashikaga Period. The Chinese Renaissance.—During the 15th century a complete change was to come over the spirit of Japanese painting. During the civil wars of the Kamakura epoch the doctrines of the Zen sect of Buddhism had taken a deep hold of the samurai, or lesser nobility, as well as of the monks. Zen despised ceremony, the worship of images, dogmas; it relied on wordless communication, on contemplation of the absolute in oneself. Zen had been the dominant inspiration of the art of the latter part of the Sung period in China; and it was to the painting of Southern Sung that the Japanese now turned, and took for the supreme exemplars of this new movement or revival the great landscape masters Hsia Kusi and Ma Yuan and a master of the ink-sketch, Mu Chi. The Ashikaga line of Shoguns established their power in 1335 and were to remain in power till 1573. They removed from Kamakura, and Kyōto once again became the capital. During the early part of the period there was renewed intercourse with China; yet the contemporary art of the Ming period had little or no influence at this time in Japan. On the other hand, the ink-paintings inspired by Zen doctrine during the Sung era were eagerly collected. Zen had no longer any power or following in China; it was therefore Japan's opportunity, and in this phase of Chinese painting Japanese collections are particularly rich.

This revival had already a few precursors in the 14th century, notably Cho Densu, known also as Minetio (1351–1427) famous as a painter of Ashat or Buddhist Apostles and one of the greatest religious painters of Japan. And before the 15th century was over the talent of the rising generation was drawn more and more to the Chinese style. From the long rolls depicting in rich colour heroic stories, or ceremonious scenes of court life, or saintly legends, men turned to the swift ink-sketch, charged with concentrated energy—a spray of blossom, a bird poised on a reed, a glimpse of mountains among the mists, a sage absorbed in thought, the theme whatever it was, being not so much the thing represented as what it evoked in the spectator's mind: fact, transmuted to symbol and idea. To find the spiritual reality in oneself was the Zen aim; and an impulse from a vernal word, embodied by the



BY COURTESY OF THE BRITISH MUSEUM

"WOMEN AND CHILDREN," A 17TH CENTURY WOODCUT BY MORONOBU
A translation of the script is: "In choosing a wife (or husband), first, she must be beautiful; then love, and then sympathy comes. And finally there must be conjugal affinity (determined by the signs of the zodiac at birth); if not, the children will be frail, and suffering from poverty will come. Everything will be unsuccessful, causing continual quarrels between husband and wife. Remember these words well."

painter's brush in a hinted scene, could be of more potency than all the teaching of the sages. Soga Shubun, a Chinese artist who settled in Japan, was a pioneer of the revival; he founded a line of painters, among whom his son Soga Jasoku is the most famous. Other pioneers were Josetsu; Bunsei, an artist till recently confused with Josetsu; and Shubun the Priest (to be distinguished from Soga Shubun). These were followed by Oguri Sotan; Nōami and his son and grandson, Gei-ami and Soami; Keishoki, and other masters. All of these belong to what became known as the Chinese School.

A yet greater artist, Sesshu (1420–1506) formed a more personal style and founded the school known by his name. He visited China, but found no peer among the Chinese. The force and intensity of his conceptions are matched by the vehemence of his brush strokes. In Japanese esteem Sesshu probably ranks as the greatest painter of Japan. His follower Sesson at times rose almost to Sesshu's height. A third school was originated by Kano Masanobu, the first of the long line of Kano artists, which has lasted into our own day. Though the art of this whole movement can never mean so much to Western minds as it means to Japanese, because of its subjective character and though its achievements cannot be regarded as equalling those of the Chinese masters it adored, still the revival was of inestimable value to ar art which was becoming impoverished through isolation by re-unit-

ing it to the main stream of Asiatic culture. It is permeated by ideas, and its art begathers a lofty atmosphere. The Kano tradition would not have become so powerful had it not been for the genius of Motonobu, son of Masanobu, who is one of the greatest masters of Japanese painting (1476–1559). In his work the Kano manner assumes the well-marked character which it was to preserve so long. The painters of the Ashikaga revival painted almost exclusively Chinese subjects; but Motonobu painted also scenes from Japanese legend, the special province of the Tosa school. The Kano masters dominated painting for some generations. Motonobu's grandson, Yeitoku (1543–1590) gave a new character to the Kano style. The last Ashikaga Shogun was deposed in 1573.

Toyotomi Period 1573–1602.—There was a revulsion in taste from the reticent severity of Ashikaga towards material splendour. Hidegoshi, the low-born conqueror of Korea, and his nobles, built huge castles, sumptuously decorated. Yeitoku and his pupils painted gorgeous screens to meet their demands. Among the screen-paintings of this period are some of the finest creations of Japanese art. They combine energy and breadth with monumental design, and often with splendid colour. The lines have the imaginative feeling which expresses high artistic sensitiveness and finely developed taste. In its next phase the Kano school returned or tried to return to the simpler taste of Ashikaga times. The civil wars ended at last with the establishment of the Tokugawa dynasty of Shoguns, and Japan settled in peace again shut herself up from the world.

Tokugawa Period.—Tanyu (1602–1674), painter of extraordinary brilliance and power of brush was the model which the Kano school was to follow thereafter. Ink-painting, usually with light tints added, was the favourite medium; but the Zen inspiration which had given aroma and significance to the slight paintings of the Ashikaga masters had lost its fervour and virtuosity could not take its place.

The Tosa school still maintained itself; but by now both traditions of painting, the Chinese and the native or Yamato style, far removed from each other as they were, were living on their past and repeating a consecrated formula. The time was ripe for new movements.

Koyetsu (b. 1558), was not only a distinguished painter and an incomparable calligrapher but also designed in wood, metal, lacquer and brought about a revival of the arts of wood-cutting and printing. Somewhat like William Morris, he presided over a village in which his craftsmen pursued their various crafts under his direction. The screen in the Metropolitan Museum, New York, reproduced (Plate I.), used to be considered the work of Koyetsu; but, as is often the case with screen-paintings, the actual authorship is problematic. Koyetsu sometimes collaborated with his friend and follower Sotatsu, the one supplying the calligraphy, the other the painting. They formed a style which is the most intimately Japanese of all the schools. Yeitoku had already created in his screen-painting a style of mural art which, while taking over some of the Tosa conventions and its traditions of colour, drew from Chinese example a synthetic power, an emotional concentration, and a massive grandeur such as none of the old Tosa artists either aimed at or achieved. Koyetsu and Sotatsu, who founded this art on Tosa principles, completed this fusion of styles and refined on it with the sensitive delicacy of Japanese genius. Starting from an abstract design consisting of related or opposed forms, masses, tones, they fit or melt into the design whatever they choose of natural form and colour. Korin (1661–1716) carried the style to yet further audacities. He uses a freedom and extravagance which in Europe only caricaturists have ventured on to express a superbly decorative idea. The Wave Screen at Boston (Plate I.) is even more an imaginative conception than a glorious decoration. Korin's masterpieces were in lacquer as well as painting. His brother Kenzan was a fine painter, but even more distinguished as a potter. The style was to be revived later by the exquisite but rather cold Hoitsu (1761–1828).

Ukiyo-ye.—Another school which arose in the early 17th century was Ukiyo-ye, the painting of the transient world of daily life. The old Tosa rolls had often portrayed the doings of ordinary folk, but only as accessories to an episode in saintly or heroic lives. Certain Kano painters, chiefly Sanraku, ventured at times on the kind of subject which we call *genre*, though without avowing their authorship of such pictures. Iwasa Matabu (1578–1650) was the first to make this kind of picture his main concern and to take pride in it. His authentic works, one of which is reproduced (Plate VI., fig. 1), are extremely rare; but paintings by his followers are numerous. Although the Chinese in far-off T'ang times had made masterpieces in this kind, especially of the occupations of women, this was a genuinely Japanese movement and fertile in results. Later in the century Moronobu, an admirable painter, exploited the woodcut as an inexpensive means for mirroring the contemporary life of the people; and the woodcut, first hand-coloured then colour-printed, became the medium of a truly popular art which yet was of singular refinement. It is by the colour-prints that Ukiyo-ye, and indeed Japanese pictorial art as a whole, is best known in the West (they are separately treated below). But all the masters of the colour-print were also painters, and a few of the best Ukiyo-ye painters, like Choshun, designed no prints. The chief masters of this school, Okumura Masanobu, Harunobu, Kiyonaga, Utamaro and others in the 18th century, Hokusai and Hiroshige in the 19th, are notable artists who have received fuller appreciation in the West than in their own country, where they have not the prestige of the classic schools. Ukiyo-ye was almost exclusively the art of the populace of Yedo. Meanwhile in Kyōto, during the 18th century, other movements were stirring.

In 1731 a Chinese painter Shen Han-pir came to Nagasaki and stayed two years. He was greatly admired and imitated. A school often known as the neo-Chinese school, since it was different in its aims and inspiration from the Chinese revival of the 15th century, took for models the decorative, coloured style of later Ming or the light, freely-handled landscapes in ink of the Bun-jin-gwa or Literary Man's Painting. Buncho-Kyarikio, Taigado, Buson, Kwazau and others worked with distinction in these Chinese styles. A pupil of Buson's, Goshun, broke away to some extent from this school, craving for a stronger element of the naturalism which was in the atmosphere of the time. Of this naturalism Okyo (1733–95) was the protagonist. Gifted with extraordinary preciseness of vision and wielder of an unerring brush, Okyo studied more directly from nature than earlier Japanese, though he never deserted the main conventions of his country's art. His conceptions are sometimes grandiose but never impassioned. His impeccable fastidious art is rather cold. Ganku (1745–1834), who is sometimes reckoned as the founder of a separate school, expresses a more impulsive temperament. He is famous for his tigers.

The naturalistic movement which Okyo did most to influence is embodied in the Kyoto painters known as the Shijo school, with whose style that of the followers of Buncho and the neo-Chinese movement tended during the 19th century, to coalesce. Mori Sosen (1747–1821), an exquisite painter of monkeys, deer and other animals, which he studied in their native forests, is the most eminent of these masters of a graceful naturalism. Contemporary with Okyo, Soga Shohaku harked back to the great times of Ashikaga, and tried in his ink-pictures of Chinese sages to recover, with some measure of success, the fire and inspiration of the 15th century. Jaku Chu was another contemporary artist who pursued an independent line; he recalls the rich colouring of Ming pictures in his gorgeous paintings of cocks and hens and fishes. The Kano school still produced its academic repetitions of old themes; but its best pupils tended to break away, like the brilliant Itcho (1652–1725) who painted Ukiyo-ye subjects. In the early 19th century there was a revival of the Tosa style by two gifted painters, Totsugen and Tameyasu. Formed in the Kano school, Yosai (1787–1878) made a style of his own; he is famous for his pictures of heroic subjects. Contemporary with him were Zeshin, the distinguished lacquer-designer and painter, and Kyosai, a various and vigorous master.

Meiji Period.—From the 17th century onwards European influence begins intermittently to be felt. Yamada Emosaku in that century learned oil-painting from the Dutch. In the 18th century Shiba Kokan painted in European style and European perspective is attempted in many Ukiyoyo prints. During the first







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JAPANESE PICTURE ROLLS AND SCREENS

1. "Flight of the Court," detail from the "Burning of the Sanjo Palace," a horizontal picture roll or makemono representing the civil war, by "Keion," perhaps a legendary name, Kamakura period. 13th cent.
2. "Two Geese Flying over a Beach," ink-picture on four-fold screen. Kyoto school, 18th century, formerly attributed to Okyo
3. "Cryptomerias and Cedars on a Snowy Hillside," by Yeitoku (1543–90), ink-picture on a six-fold screen, with a lavish use of gold. Kano school, Ashikaga period and Toyotomi period

JAPANESE PAINTING AND PRINTS







BY COURTESY OF THE KOKKWA MAGAZINE, TOKYO

JAPANESE PAINTERS OF THE ASHIKAGA PERIOD—THE CHINESE RENAISSANCE

1. Landscape, by Soga Jasoku, 15th century, Ashikaga period. Soga Jasoku was the son of a Chinese artist who settled in Japan
2. Winter scene, by Motonobu (1476–1559), Kano school, Ashikaga period. Motonobu who followed the Chinese tradition and chose many Chinese subjects, also painted scenes from Japanese legend
3. Jurojin, by Sesshu (1420–1506), Sesshu school, Ashikaga period. Jurojin, symbolising in this painting the genius of immortal old age, is represented as a venerable figure, looking out from blossoming spring trees



BY COURTESY OF (1) THE KOKKWA MAGAZINE, TOKYO, (2) THE MUSEUM OF FINE ARTS BOSTON

PAINTINGS OF THE KANO SCHOOL

1. "Men of Leisure," by Iwasa Matabei (1578–1650), Kano school, founder of Ukiyo-ye school of *genre* painting. Matabei, a Samurai, was the first to make "the painting of the Transient World of daily life" his chief concern and to lead a genuinely Japanese movement in this field. The faces of the women in this painting illustrate the typical feminine face of Matabei, with short nose, long, full cheeks, and round chin
2. "Mist Rising," by Shokei (1628–1717), signed "Hokkyo Shokei, aged 86"; Kano school. Landscape in ink on paper, size 290 mm. x 530 mm. Bigelow Collection, Museum of Fine Arts, Boston

years of the Meiji period (1868–1911) when Western ideas were being eagerly adopted, the European or Dutch style of painting was more cultivated than any other. An English artist, Charles Wirgman, who came to Japan in 1857, had a number of pupils, of whom the best was Takahastu Yuichi. In 1876 the Government invited an Italian artist, A. Fontanesi, to teach painting; she was very successful for a short time. In 1878 E. F. Fenollosa, an



BY COURTESY OF THE BRITISH MUSEUM

SELECTION FROM TOBA SOJO ("SATIRICAL DRAWINGS OF ANIMALS")
The scripts are identical, standing for "Kozanji" or "Takayama Tera," in English, "High Mountain Monastery," and indicate where the drawings were made

American critic, became professor of philosophy in Tokyo. He was the first to open the eyes of the West to the beauty and importance of the older art of Japan and China; but he also had great influence in Japan. He persuaded the Government to forbid the temples to sell works of art, and to schedule as national treasures all the most precious objects. His enthusiasm for the old traditions reacted on Japanese artists. The School of Fine Art set up with Italian professors had been a failure. A new school was established in 1887, and among the teachers were Kawabata Gyokusko, Hashimoto Gaho and Kano Hogai, all eminent painters in traditional styles, though not quite unaffected by Europe. In 1898 a secession from this school, under Okakura Kakuzo, founded the Nihon Bijutsu-in for the teaching of national styles of painting. To this movement belong Yokoyama Taikwan and Shimomura Kwanzan, distinguished living artists. Takeuchi Sciho and Kawai Gyokudo are among the most eminent artists of to-day who maintain the Asiatic traditions of art. Many gifted painters practise oil-painting and follow Western methods; but though the adoption of so much of Western civilization must inevitably modify the mental outlook, it does not seem likely that Japan's ancient inheritance in art will ever be wholly superseded. (A full account of contemporary painting is given in Elisséèv's *Peinture Contemporaine au Japon.*)

ENGRAVING

Copper engraving and etching, learned from the Dutch, was practised by some Japanese in the 18th and 19th centuries, but the medium did not prove congenial. The woodcut is the national mode of engraving and has been carried to a pitch of marvellous perfection. The art of the woodcut was introduced into Japan from China in the wake of Buddhism. It was used for the printing both of texts and pictures. Actually the earliest surviving specimens of printed texts in the world are Japanese, and are in the form of Buddhist charms enclosed in miniature wood pagodas distributed among the temples in the 8th century A.D. For a long period the woodcut was confined to the reproduction of popular images of piety, similar to the Chinese prints discovered at Tunhuang by Sir Aurel Stein. Some remarkable woodcuts were made in 1414 to illustrate block-printed history of the Yudzu Nembutsu but there was no real development of the art till the 17th century. In 1608 an illustrated edition of the Ise Monogatari appeared with woodcuts attributed by some critics to Koyetsu. Other illustrated editions of classic stories followed. But it was Hishikawa Moronobu (1618–1694) who transformed the art and made possible all the brilliant work of the Ukiyo-ye designers of the 18th century. A desire for the pleasures of art had sprung up among the lower classes, now that they at last enjoyed the peace of a settled Government. Paintings were too expensive. Moronobu saw the enormous possibilities of the woodcut, and adapting his style to the limitations and possibilities of the medium devoted himself to supplying the need of the people. He designed chiefly for books, with or without text. A comparison of his early work (*c.* 1660) with his later books shows the immense stride forward that the engravers made under the stimulus of Moronobu's genius. There was soon a demand for colour. Moronobu and his pupils produced broad-sheets as well as books, and these were often coloured by hand, *tan* or red-lead being the dominant colour; hence the name *tan-ye* for these prints.

The theatre was a passion of the Yedo populace; and an actor Toru Kujomoto, who designed posters for the Osaka theatre, came to Yedo in 1687 and though his own work has not survived, he founded a famous dynasty of artists. His son Kujonobu was the first to design portraits of actors, which were to remain one of the staple themes of the print-designers. Kujonobu's son, Kujomasu, rivalled his father. Competing in popularity with the portraits of actors were the portraits of fashionable beauties, especially courtesans. The Kwaigetsudo group of artists during the early years of the 18th century produced some stately prints of women. But in this field Okumura Masanobu was much more inventive and fertile; he designed idyllic groups and enlarged the whole range of the woodcut, while the Toru masters kept almost entirely to the stage. Kujonobu died in 1729, but prints signed with his name continued to be published till the mid-century. This second Kujonobu has not yet been identified with certainty.

In 1740 or 1741 was published the first two-colour print. The colours chosen were *beni* or rose-red and green. Colour-printing had been practised for at least a century before this in China; but the Yedo printers seem to have learned the art afresh. (In a work called Jinko-ki, 1627, one of the woodcuts is printed in colours. "Block-Printing and Book Illustration in Japan," by L. Norton Brown, p. 29.) The cherry-wood used was cut on the plank with a knife, as in Europe till the days of Bewick. A separate block was cut for each colour; so for a two-colour print there would be three printings. An accurate register was secured by the simple means of a guide-mash in the form of a right-angle at the lower right corner of the key-block and a straight line parallel to the lower edge at the left corner. There was no press. Colour-printing soon ousted the hand-coloured print in popularity, though the latter was still composed for some years. The two-colour or *beni* print continued till 1764, and a marvellous range of colour-design was accomplished within this narrow compass. In 1764 the first polychrome prints were made by Harunobu, who till his death in 1770 was to reign undisputed over Ukiyo-ye. Everyone imitated his style. He created the fashion for a smaller sheet, with smaller figures of exquisite grace. He was an enchanting colourist. His chosen subjects were youthful idylls, and he avoided the stage. Harunobu's closest follower was Koryusai, who after his death developed a more personal style, specially excelling in the *Nashira-ye* or pillar-print. Shunsho revived the prestige of the theatrical print, neglected by Harunobu, and produced a long series of extremely fine designs before his death in 1792. But from about 1780 to 1790 Ukiyo-ye was again dominated by a single master, Kiyonaga (1742–1815) in whose designs the almost infantine grace of Harunobu's types was supplanted by tall and stately figures, and his interiors were exchanged for out-door scenes. Kiyonaga designed some masterpieces, especially in the form of diptychs and triptychs and was closely imitated by a whole generation: there is an unrivalled poise and dignity in his groups, and his drawing is masterly; but he had little invention in figure-composition and is apt to be monotonous. Utamaro (1754–1806) is the greatest master of figure-design in the whole school. Among his earlier works are picture-books of insects and shells, exquisite in quality; but his absorbing theme is woman. In

the last few years of his life there is a falling-off, but it was a time of rapid decline in the general taste. In the discovery of beautiful relations between figures, and in a sort of intensity of design, Utamaro is incomparable.

During the 1790's Yeishi and Toyokuni competed with Utamaro for popular favour. Sharaku published in 1794–95 a series of actor-prints surpassing in power all his predecessors in this line, and now immensely sought after. Artists admire them, but the public disliked their pungency. After Utamaro's death in 1806, the decline became a downfall. The school was regenerated by Hokusai (1760–1849), who found a new inspiration in landscape. His Thirty-six Views of Fuji and other sets (*c.* 1820–1830) contain some of the finest landscape designs ever made. A little later Hiroshige (1797–1858) in countless sets of prints depicted every aspect of his own country in every weather, with extraordinary intimacy and freshness. Meanwhile Kuniyoshi and Kunisada were the outstanding masters of figure-design. After Hiroshige's death aniline dyes were introduced. The school which had mirrored the popular life of Yedo for two centuries now virtually came to an end. During the Meiji period (1868–1911) there was a revival, but the art had lost its character. From the days of Moronobu the artists had designed for the woodcut; now, the woodcut was merely the reproduction of a painting. The use of cheap pigments sadly affected the quality of these clever prints. Yoshitoshi, Toshikata and Gekko were perhaps the best of the designers in this period.

All the artists of the colour-print designed illustrations for books, the number of which is almost incredible. Many, however, of the book-illustrations were the work of artists who designed neither single-sheets nor colour-prints, and some of these artists did not belong to the Ukiyo-ye school at all. Ooka Shunboku (1688–1768) was an Osaka artist, who published a number of picture-books; one of these, a copy of a Chinese work of 1702, was printed in colours in 1746. An older contemporary of his, Tachibana Morikuni, was a notable book-illustrator, also at Osaka. Sukenobu was extremely popular as a designer of picture-books of women and children, and strongly influenced some of the earlier Ukiyo-ye artists. Tsukioka Tange made drawings for many of the *meisho* or guide-books. Some of these artists devoted much of their work to reproducing classic pictures or furnishing decorative designs for artisans. The first colour-printed book was produced at Osaka by Sukenobu in 1745. In Yedo, Harunobu produced some beautiful picture-books. Among others too numerous to mention, Shunsho and Shigemasa's *Beauties of the Green Houses* ranks as one of the finest colour printed books, with Utamaro's *Insect Book* in quite a different style, Hokusai's *Hundred Views of Fuji and Mangwa* are famous books in black and white or with a faint tint only. Among more modern works Yosai's *Zenken Kojitsu* and Bairei's books of birds deserve mention.

A new style of colour-printing began in 1889 when the *Kokka* began to reproduce old paintings. For the woodcuts printed in this magazine and in the sumptuous publications of the *Shimbi Shoin* body-colours are used, and sometimes as many as 100 blocks. Not as faithful as photographic reproductions, these prints have an extraordinary beauty of texture and in their way are unrivalled. *See* JAPAN: *Aesthetic Development;* CHINA: *Aesthetic Development;* ART: *Far Eastern Methods;* SCREENS OF CHINA AND JAPAN; CHINESE PAINTING.

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JAPANESE SCULPTURE. It is surprising that so many pieces of sculpture should still be preserved in Japan when we know that they have been housed in wooden buildings which have been reduced to ashes again and again by recurrent conflagrations. Such preservation has been mainly due to the important part sculpture has always played in religion, and in later times to the reverent attitude towards those works of art tolerated by the "tea men" when the *cha-no-yu* (commonly known as the tea ceremonies) came into the life of the people in the 15th century. A commission was created in 1897 for the systematic preservation and care of works of art, and up to the beginning of 1928 no fewer than 1,800 pieces of sculpture, together with about an equal number of objects of aesthetic and historical value, have been scheduled as "national treasures" in addition to the 1,100 old buildings which likewise have been placed under "special State protection."

Few examples in stone remain of the sculpture of the pre-Buddhist period. The stone warriors discovered in the province of Higo date from the second decade of the 6th century A.D. and are rude in workmanship. There survive, however, from this early period a large number of *haniwa,* or baked clay figures of men, women, animals and birds, which decorated the burial mounds of illustrious personages. The expression of peace and amiability on the faces of all these human figures is noteworthy.

Historic Period.—The real history of Japanese sculpture may be said to date from the official introduction of Buddhism from Korea in A.D. 552. Fortunately, there are preserved to this day a comparatively large number of Buddhist images of that time. Most of them are of impassive character, reminiscent of the North Wei dynasty, and showing in bronze and wood the technique of stone. Naturally, there are some that are of Korean type, as Japanese of Korean descent were among the noted sculptors of that time. Among the relics of this period mention may be made of many bronze figures in the Imperial Household collection, including a Kwannon (Avalôkitêsvara) bearing the date 591, and the famous group of 48 figures. Among others, there is a gilded bronze Sakyamuni, dated 623, with two attendants, in the Kondō of Hōryuji, where the group was originally placed by the sculptor Tori, who modelled them. A standing image of Kwannon, of a Korean type, also belongs to the Hōryuji monastery, and in the Dream hall there is another wooden image of Kwannon attributed to Shōtoku Taishi; there is also in the nunnery of Chūgūji, close by, a seated image of Nyo-i-rin Kwannon, and a similar figure is in the temple of Kōryuji at Uzumasa. The peculiarly Japanese grace softening the stiff uncouth style of the last two pieces is remarkable.

A noticeable development occurred in the sculpture of the Hakuhō period (645–707), when magnificent figures in bronze were cast, as may be seen from the Yakushi (Bhâishajyaguru) trinity in Yakushiji of Yamato, all measuring about 10 ft. in height, and with Aryan rather than Chinese features. A masterful achievement in refined workmanship may be seen in the bronze Amitâbha trinity, which belonged to Tachibana Fujin.

Tempyo (708–781) was a great period of sculpture when thousands of Buddhistic images were created in clay, wood, dry lacquer and bronze. The gigantic seated Buddha of Tōdaiji, measuring some 53 ft. in height, was cast at that time, though the head had to be recast twice after being destroyed by fire. The four Deva-kings in the Kaidan-in of the Tōdaiji monastery and the Twelve Generals in Shinyakushiji are excellent examples of the period in clay. Miroku Bosatsu (Mâitrêya) of Hōryuji, and the Eight Genii and the Ten Great Disciples of Buddha in Kofukuji, are among the works in dry lacquer, a technique peculiar to this and the next period. Power and strength may be said to characterize the sculpture of this age, with a tendency to combine realistic with idealistic elements.

The new sects of esoteric Buddhism, Tendai and Shingon, infused a new life into sculpture in the early Heian period (782–888), many learned priests and talented sculptors devoting themselves to the production of deities in wood so faithful to the originals in the *sutras* that they long served as models for forms. Many of the masterpieces of this period are preserved in the temple of Tōji and Jingoji in Kyoto, as well as in Muroo-dera in Yamato. The best of them are executed in bold and deep-cut lines and are characterized by great dignity. The exquisite statue of the 11-faced Kwannon in the Hokkeji nunnery, commonly attributed to the Tempyo, may also be included among the works of this period.

JAPANESE SCULPTURE OF THE TEMPYO AND KAMAKURA PERIODS

BY COURTESY OF JIRO HARADA

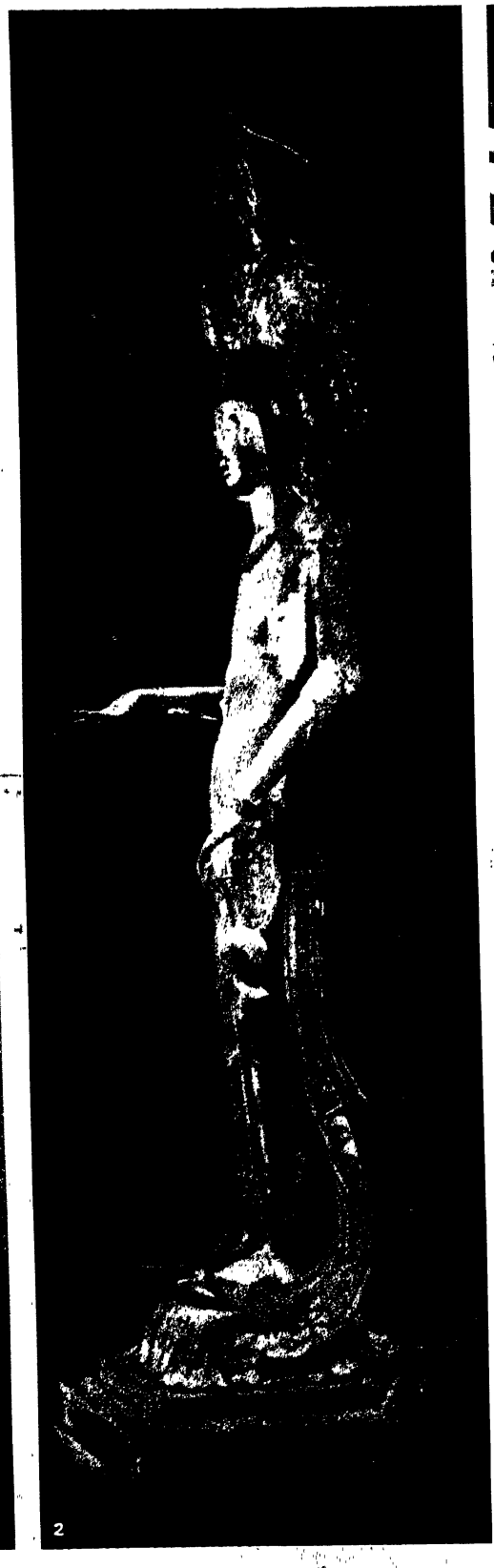
1 and 3. Pair of Deva Kings guarding the Great South Gateway of the Todaiji Monastery, Nara. Wood sculpture, joint work of Unkei and Kaikei. Kamakura period (1186–1335)

2. Head of one of the Four Maharajas of Heaven, in Kaidan-in, Todaiji, Nara. Tempyo period (708–781)

4. Yuima-koji, clay figure; Tempyo period. Kept in the five-storeyed pagoda of the Horyuji

JAPANESE SCULPTURE











BY COURTESY OF JIRO HARADA

BUDDHISTIC IMAGES IN CLAY, WOOD AND DRY-LACQUER

1. A Bodhisattva, clay figure; Tempyo period (708–781). Kept in the five-storied pagoda of the Horyuji
2. Kwannon (Avalokitesvara) wood sculpture; Asuka period (552–644); belonging to the Horyuji
3. Amitabha, wood sculpture, gilded; 11th century, in the Howodo, Uji
4. One of the Ten Great Disciples of Buddha, dry-lacquer; Tempyo period; belonging to the Kofukuji, Nara
5. A Bodhisattva, wood sculpture; Asuka period; belonging to the Horinji

The Fujiwara Periods (889–1183).—At the beginning of the early Fujiwara period (889–1068) sculptors simply followed in the footsteps of their predecessors, until the appearance of the great master, Jōchō. With the assistance of his pupils, Jōchō completed a wooden image of Dainichi (Mahavâirôcana) 32 ft. high for Hōshōji, and hundreds of smaller statues. As in architecture, the nationalist spirit was at work in sculpture, modifying the original type of Buddha. The face became fuller, with narrow benevolent eyes, the lines of the robes took an eloquent flow, the whole figure was realistically represented in beautiful proportions, and the colouring was in accordance with a refined taste, all tending to nobility and dignity. Among the best examples of works of the period now remaining are: the Amitâbha of Hōkaiji in Yamashiro, the 9 statues of Amitâbha of Joruriji and the Amitâbha trinity of Sarzen-in both in Kyoto and the Amitâbha in Hōwōdō at Uji.

In the later Fujiwara period (1069–1183) a tendency became apparent in the direction of excessive detail, elegance and over-emphasis, and by the end of the Fujiwara period the work had become weak and effeminate. In the products of masters only were vigour and life maintained. The use of cut-gold for decoration (leaf-gold cut into strips and applied to form patterns, etc.) which began to be an important factor in early Fujiwara, became profuse towards the close of late Fujiwara.

From Kamakura to Momoyama (1186–1602).—The over-refinement and effeminate delicacy of feeling developed by the end of the preceding era was succeeded in the Kamakura period (1186–1335) by something bold and strong, the romantic giving place to the dramatic. Naturalistic representations were introduced, such as the insertion of rock crystals for the eyes and the use of strong colours and cut-gold for the decoration of robes, etc. There were two elements to be noted: a new school with Sung elements, and the tenacious Fujiwara school of Kyoto which was not eclipsed till the period that came after Kamakura. There was a style in which the figures were of short stature and impressive force, and another in which they were represented in long, flowing robes that partly overhung the pedestal; both these styles reveal the influence of Sung and Yuan. Though wood was the most common material, the masters worked in bronze as well. A great masterpiece is the big bronze Buddha at Kamakura, seated in perfect serenity, with eyes whose gaze penetrates into the very soul of each worshipper standing before him. Two master sculptors, Kaikei and Unkei, made themselves famous, not only during this period, but throughout the history of Japanese sculpture. Their joint work may be seen in two Deva-kings guarding the great south gateway of Tōdaiji.

In the Nambokuchō (1336–93) and Ashikaga (1394–1573) periods the art of sculpture stagnated, though some dignified portraits in wood were produced. Representation reached the extreme of elaboration, and the statues of deities became more human in character. The Kwannon in the Tokyo Imperial Household museum, minutely decorated all over with coloured lacquer and cut-gold, with rock crystals inlaid for the eyes and lips, may be considered one of the best examples of the period. It is to be noted that many sculptors of the time turned their attention to carving masks used in the *Nō* drama, which flourished among the feudal lords.

The aversion from monks shown by Oda Nobunaga and Toyotomi Hideyoshi resulted in the destruction of many temples, and in the Momoyama period (1574–1602) circumstances were not at all conducive to the development of Buddhistic sculpture. The great castles and palaces, however, were profusely decorated externally and internally.

Modern and Recent Sculpture.—During the peaceful Tokugawa régime (1603–1867) the talent of sculptors was mainly turned to the production of articles of luxury for the people. *Nō* masks required a high degree of skill, and a great demand was created for smaller carvings in wood and ivory, such as *netsuke*, or the ornamental piece fastened to the end of the cord attached to the tobacco pouch or the *inro* (small medicine cases hung from the sash). With the restoration of the temples, many images were carved, but these were merely reproductions of the old works of art. Work characteristic of the period is to be found, however, in the carvings adorning temple buildings and shrines. Some localities, such as Kyoto and Nara, produced peculiarly characteristic wooden dolls.

With the restoration of power to the imperial throne in 1868, which was followed by the abolition of the feudal system, a change came over Japanese sculpture. The introduction into Japan of Western clay-modelling, first taught at the Tokyo School of Arts, gave a great impetus to the development of sculpture in Japan. Not only has the new technique found a large number of followers, but the traditional wood-carving has received a great stimulus which has led to improvement. The traditional school, however, still continues to work mainly in wood, while the exponents of foreign ideals choose bronze, marble and clay, as well as wood. In spite of the aggression of the younger school, the older school courageously struggles to hold its own and to preserve that which is characteristically Japanese. (*See* CHINESE SCULPTURE; IVORY CARVING, JAPANESE; WOOD CARVING, FAR EASTERN; MASKS; JAPANESE ARCHITECTURE.) (J. HAR.)

JAPANNING. The art of coating surfaces of metal, wood, etc., with a variety of varnishes, which are dried and hardened on in stoves or hot chambers. These drying processes constitute the main distinguishing features of the art. The trade owes its name to the fact that it is an imitation of the famous lacquering of Japan. Japanning is done in transparent varnishes, in black and in body colours; but black japan is the most characteristic and common style of work. The varnish for black japan consists essentially of pure natural asphaltum with a proportion of gum animé dissolved in linseed oil and thinned with turpentine. In thin layers such a japan has a rich dark brown colour; it only shows a brilliant black in thicker coatings. For fine work, which has to be smoothed and polished, several coats of black are applied in succession, each being separately dried in the stove at a heat which may rise to about 300° F. Body colours consist of a basis of transparent varnish mixed with the special mineral paints of the desired colours or with bronze powders. The transparent varnish used by japanners is a copal varnish which contains less drying oil and more turpentine than is contained in ordinary painters' oil varnish. Japanning produces a brilliant polished surface which is much more durable and less easily affected by heat, moisture or other influences than any ordinary painted and varnished work. It may be regarded as a process intermediate between ordinary painting and vitreous enamelling.

Japans may be applied by either the brushing, spraying or dipping process, and are extensively used in the finishing of the chassis and mud-guards of motor-cars, ordinary ironmongery goods and domestic iron-work, deed boxes, clock dials and papier-mâché articles. The process is also applied to blocks of slate for making imitations of black marble for chimney pieces, and in a modified form is employed for preparing enamelled, japan or patent leather.

JAPHETH was, according to the tradition of the "Priestly" stratum of the Old Testament, the third "son" of Noah; but the older tradition of Gen. ix. 20–27 represents him as the second son. The oracle of blessing, Gen. ix. 27 ("God enlarge Japheth, and let him dwell in the tents of Shem, and let Canaan be his servant") displays hostility against Canaan, and looks favourably upon Japheth, but is not easy to interpret clearly. "Dwell in the tents of" is usually understood to mean "have friendly intercourse with." Bertholet considers the passage late, and suggests that it may have been introduced to express the friendly feeling of the Jews for their Hellenic conquerors, because the table of nations in Gen. x. represents Japheth as the ancestor of the northern peoples, including those of Asia Minor, and the Mediterranean Sea, as well as Armenia. Others understand the phrase to mean "forcibly dispossess," on which basis Wellhausen found a reference to the Phoenicians or Philistines. Ed. Meyer thinks of the northern peoples, including the Philistines, who descended upon Syria in the 12th century. He connects the name with the Greek Titan Iapetos. Gunkel suggests, with some hesitation, the Hittites. *See* the *Cambridge Ancient History*, vol. i. pp. 184 *sqq.* (W. L. W.)

JAPONICA, PIRUS: *see* QUINCE.

JAQUES-DALCROZE, EMILE (1865–), Swiss composer and teacher of musical eurhythmics (*q.v.*) was born at Vienna July 6, 1865, of French-Swiss parents. He went to Geneva in 1875 where he attended the college and the university, and followed the courses at the Conservatoire. He then studied (1887) at the Conservatoires of Vienna and Paris and completed his musical education under Délibes. In 1886 he accepted the post of *chef d'orchestre* at Algiers. Returning to Vienna he studied composition under R. Fuchs and A. Bruckner. After the death of Hugo de Senger, he directed the sol-fa and harmony courses at the Conservatoire of Geneva (1891). His numerous works include many charming songs, including *Chansons populaires, Chansons du coeur qui vole, Chansons de route,* etc. These are written in the simple form of the folk song and have obtained great popularity, not only in Switzerland, but in other countries. His other musical compositions are very numerous, and include three string quartets, two violin concertos and several orchestral suites; also symphonies and choral works on a large scale, such as *La Veillée* (1893) and *Le Festival Vaudois* (1903). Among his other descriptive compositions may be mentioned: *Le violon maudit* (1893), *Janie* (1893), *Sancho Panza* (1897), *Le poême alpestre* (1896), *Le bonhomme jadis* (1905), *Les jumeaux de Bergamo* (1908), *Echo et Narcisse* (1912), *La fête de Juin* (1914), *Les premiers souvenirs* (1918), *La fête de la jeunesse* (1923). His great work, however, has lain in the development of the eurhythmic instinct, particularly in children, and since 1915 he has been the director at Geneva of the *Institut Jaques-Dalcroze,* which he originally founded at Hellerau in Bavaria. His method consists of a development of the instinct for rhythm in close conjunction with the sense of hearing and the instinct for tone, and is based on defined relations between bodily movements and the movements of sound. Special schools based on the Dalcroze method have been founded in London, Paris and elsewhere. The system may be studied in the following works by E. Jaques-Dalcroze: *Rhythmic Movements* (1920); *Rhythm, Music and Education* (1921); and *The Eurhythmics of Jaques-Dalcroze,* by various authors (1912).

JARARACA (*Lachesis jararaca*), a poisonous crotaline snake of tropical South America, related to the bushmaster (*q.v.*). (*See* SNAKE.)

JARGOON or **JARGON** (occasionally in old writings *jargounce* and *jacounce*), a name applied by modern mineralogists to those zircons which are fine enough to be cut as gem-stones, but are not of the red colour which characterizes the hyacinth (*q.v.*). The name is related to Arab *zargun* (zircon). Some of the finest jargoons are green, others brown and yellow, whilst some are colourless. The colourless jargoon may be obtained by heating certain coloured stones. (*See* ZIRCON.)

JARĪR IBN ʿATĪYYA UL-KHATFI (d. 728), Arabian poet, was a member of the tribe Kulaib, a part of the Tamīm, and lived in Irak. He succeeded in winning the favour of Hajjāj, the governor of Irak. (*See* CALIPHATE.) He became widely known by his feud with Farazdaq and Akhtal, and later went to Damascus. He was the only poet received by the pious Omar II.

His verse, which, like that of his contemporaries, is largely satire and eulogy, was published in 2 vols. (Cairo, 1896).

JARKENT, a town of Asiatic Russia in the Kazakstan A.S.S.R. in 44° 12′ N. and 79° 57′ E. on a tributary of the Ili river. It is on a caravan route from Kulja in East Turkistan, and manufactures *makhorka* tobacco and beer. Pop. (1926) 10,956.

JARNAC, a town of western France in the department of Charente, on the right bank of the river Charente, and on the railway 23 m. W. of Angoulême, between that city and Cognac. Pop. (1926) 3,566. The church contains an interesting ogival crypt. Brandy, wine and wine-casks are made in the town. Jarnac was in 1569 the scene of a battle in which the Catholics defeated the Protestants.

JARNACH, PHILIP (1892–), French composer, was born at Noisy of Spanish parents on July 26, 1892. From 1907 he studied in Paris under Risler for piano and Lavignac for harmony. In 1914 he went to Switzerland and from 1918–21 was professor of counterpoint and composition at Zurich conservatoire. He continued his own studies there under Busoni, whose opera *Dr. Faust* he completed after the composer's death. Jarnach's Paris period embraces his work up to op. 9. With op. 10, a string quartet performed at the Donaueschingen festival in 1921, his mature work begins. His string quartet op. 16 was also played at Donaueschingen and at the Salzburg festival in 1924.

JÄRNEFELT, EDVARD ARMAS (1869–), Finnish composer and conductor, was born at Viborg on Aug. 18, 1869. He studied in Helsingfors and afterwards in Berlin and Paris. From 1898 to 1903 he conducted concerts at Viborg. In 1904 he went to Helsingfors as conductor of opera and from 1906 to 1907 was director of the musical institute in that city. Since 1907 he has lived in Stockholm, where he is Hofkapellmeister. Järnefelt is probably the best known of Finnish composers after Sibelius. His *Präludium* and his songs have appealed to a wide public. His works include *Korsholm,* symphonic poem (1894); *Heimatklang,* symphonic fantasy (1895); Serenade; Präludium to drama *The Promised Land;* songs for chorus and orchestra; male choruses, songs, and piano pieces.

JARO, a municipality (with administration centre and 29 *barrios* or districts), of the province of Iloilo, island of Panay, Philippine Islands, on the Jaro river, 2 m. N.W. of Iloilo, the provincial capital, with which it is connected by railway. Pop. (1918) 24,572. It lies on a plain, in the midst of a rich agricultural region, has many fine residences and a cathedral, and is an important market. In 1918, it had 15 manufacturing establishments with output valued at 150,000 pesos; 3 sugar mills with output valued at 205,300 pesos; and 724 household industry establishments with output valued at 204,800 pesos. Of the 18 schools, only seven were public. The language spoken is a dialect of Bisayan.

JAROSITE, a mineral species consisting of hydrous potassium and aluminium sulphate, and often occurring as incrustations of minute indistinct crystals with a yellowish-brown colour and brilliant lustre. The best specimens, consisting of crystalline crusts on limonite, are from the Jaroso ravine in the Sierra Almagrera, province of Almeria, Spain, from which locality the mineral receives its name. It appears to be a common product of decomposition of sulphides in mineral veins, and one variety, from Nevada and New Mexico, plumbojarosite, contains lead.

JARRAH WOOD, the product of a large tree (*Eucalyptus marginata*) found in south-western Australia, where it is said to cover an area of 14,000 sq.m. The trees grow straight in the stem to a great size, and yield squared timber up to 40 ft. length and 24 in. diameter. The wood is hard, heavy and close-grained, with a mahogany-red colour, and sometimes sufficient "figure" to render it suitable for cabinet-makers' use. The timber possesses several useful characteristics; and great expectations were at first formed as to its value for shipbuilding and general constructive purposes; these expectations have not, however, been realized. Its greatest merit for marine purposes is due to the fact that it resists, better than any other timber, the attacks of the *Teredo navalis* and other marine borers, and on land it is equally exempt, in tropical countries, from the ravages of white ants. When felled with the sap at its lowest point and well seasoned, the wood stands exposure to the air, earth or sea remarkably well, on which account it is in request for railway sleepers, telegraph poles and piles in the British colonies and India. The wood, however, frequently shows longitudinal blisters, or lacunae, filled with resin, such as may be observed in spruce fir timber; and it is deficient in fibre, breaking with a short fracture under comparatively moderate pressure.

JARROW, port, municipal borough, Jarrow parliamentary division, Durham, England, on the right bank of the Tyne, 6½ m. below Newcastle, and on the L.N.E. railway. Pop. (1921) 35,576. The parish church of St. Paul was founded in 685, and retains portions of pre-Norman work and good Decorated and Perpendicular details. Close by are the scattered ruins of the monastery begun by Biscop in 681, and consecrated by Ceolfrid in 685. Within the walls of this monastery the Venerable Bede spent his life. The town is wholly industrial, devoted to ship-building, chemical works, paper mills and the neighbouring collieries. It owes its development very largely to Sir Charles Mark Palmer.

Jarrow Slake, a river bay, 1 m. long by ½ m. broad, contains the Tyne docks of the L.N.E. railway company. A great quantity of coal is shipped. Jarrow was incorporated in 1875.

JARRY, NICOLAS, one of the best known 17th century French calligraphers. He was born at Paris about 1620, and was officially employed by Louis XIV. His most famous work is the *Guirlande de Julie* (1641). He died some time before 1674.

JASHAR, BOOK OF, a Hebrew composition mentioned as though well known in Josh. x. 13 and 2 Sam. i. 18. From these two passages it seems to have been a book of songs relating to important events, but no early collection of the kind is now extant, nor is anything known of it. Various speculations have been put forward as to the name: (1) that it means the book of the upright, *i.e.* Israel or distinguished Israelites, the root being the same as in Jeshurun; (2) that Jashar is a transposition of *shir* (song); (3) that it should be pointed Yashir (sing), and was so called after its first word. None of these is very convincing, though support may be found for them all in the versions. The Septuagint favours (1) by its rendering ἐπὶ βιβλίου τοῦ εὐθοῦς in Samuel (it omits the words in Joshua); the Vulgate has *in libro justorum* in both places; the Syriac in Samuel has *Ashir,* which suggests a Hebrew reading *ha-shir* (the song), and in Joshua it translates "book of praises." The Targum on both passages has "book of the law," an explanation which is followed by the chief Jewish commentators, making the incidents the fulfilment of passages in the Pentateuch. Since it contained the lament of David (2 Sam. i. 18) it cannot have been completed till after his time. If Wellhausen's restoration of 1 Kings viii. 12 be accepted (from Septuagint, 1 Kings viii. 53, ἐν βιβλίῳ τῆς ᾠδῆς) where the reference is to the building of the Temple, the book must have been growing in the time of Solomon.

In later times when it became customary to compose midrashic works under well-known names, a book of Jashar naturally made its appearance. This has nothing to do with the older book.

(L. E. B.)

JASHPUR, a feudatory state of India in the Central Provinces, having been transferred from Bengal in 1905. The country is divided almost equally into high and low lands. The Uparghat plateau on the east rises 2,200 ft. above sea level, and the highest hill in these uplands is Ranijula (3,527 ft.). The only river of importance is the Ib, the sands from which from time immemorial have been washed for gold. The high Khuria plateau is much resorted to by graziers from Mirzapur, in the United Provinces. The area of the State is 1,963 sq.m., and the population 154,156, mainly aboriginal; no fewer than 34,000 are Christians, due to mass conversions of the Oraons between 1901 and 1911. Jashpur iron, which is smelted by the Kols, is highly prized. Sal forests abound, and elephants, bison and much other big game are to be found. Jungle products include, besides timber, lac, silk cocoons and beeswax, which are exported.

JASMIN, JACQUES (1798–1864), Provençal poet, was born at Agen, his family name being Boé. In 1825 he published his first volume of *Papillotos* ("Curl Papers"), containing poems in French, and in the familiar Agen *patois*—the popular speech of the working classes. Jasmin was the most famous forerunner in Provençal literature (*q.v.*) of Mistral and the *Félibrige*. His poetic gift, and his flexible voice and action, fitted him admirably for this double rôle of troubadour and jongleur. In 1835 he recited his "Blind Girl of Castel-Cuillé" at Bordeaux, in 1836 at Toulouse; and he met with an enthusiastic reception in both those important cities. Most of his public recitations were given for benevolent purposes, the proceeds being contributed by him to the restoration of the church of Vergt and other good works. Four successive volumes of *Papillotos* were published during his lifetime, mostly pictures of humble life—in many cases real episodes—carefully elaborated by the poet. In 1852 Jasmin's works were crowned by the Académie Française, and a pension was awarded him. His title of "Maistre ès Jeux" is a distinction only conferred by the academy of Toulouse on illustrious writers. Pius IX. sent him the insignia of a knight of St. Gregory the Great, and he was made chevalier of the Legion of Honour. He spent the latter years of his life on a small estate which he had bought near Agen and named "Papillotos," and which he describes in *Ma Bigno* ("My Vine"). He died on Oct. 4, 1864.

See P. Mariéton, *Jacques Jasmin* (1898).

JASMINE or **JESSAMINE,** botanically *Jasminum,* a genus of shrubs or climbers of the family Oleaceae, and comprising about 100 species, of which 40 or more occur in the gardens of Great Britain and North America. The plants of the genus are mostly natives of the warmer regions of the Old World; there is one South American species. The leaves are pinnate or ternate, or sometimes apparently simple, consisting of one leaflet.

The common white jasmine, *Jasminum officinale,* one of the best known and most highly esteemed of hardy cultivated ligneous climbers, is a native of northern India and Persia. In the centre and south of Europe it is thoroughly acclimatized. Although it grows to the height of 12 and sometimes 20 ft., its stem is feeble and requires support. The fragrant white flowers bloom from June to October.

The zambak or Arabian jasmine, *J. Sambac,* is an evergreen white-flowered climber, 6 ft. high. The Spanish, or Catalonian jasmine, *J. grandiflorum,* a native of the north-west Himalaya, and cultivated both in the old and new world, is very like *J. officinale,* but differs in the size of the leaflets; the branches are shorter and stouter, and the flowers very much larger, and reddish underneath. By grafting it on two-year-old plants of *J. officinale,* an erect bush about 3 ft. high is obtained, requiring no supports.

The aroma is extracted by the process known as *enfleurage, i.e.,* absorption by a fatty body, such as purified lard or olive oil. Square glass trays framed with wood about 3 in. deep are spread over with grease about half an inch thick, in which ridges are made to facilitate absorption, and sprinkled with freshly gathered flowers, which are renewed every morning during the whole time the plant remains in blossom. Three pounds of fresh flowers will perfume 1 lb. of grease—this is exhausted by maceration in 1 pt. of rectified spirit to form the extract.

The distinguishing characters of *J. odoratissimum,* a native of the Canary Islands and Madeira, consist principally in the alternate, ternate and pinnate leaves, the 3-flowered terminal peduncles and the 5-cleft yellow corolla with obtuse segments. The flowers have the advantage of retaining when dry their natural perfume, which is suggestive of a mixture of jasmine, jonquil and orange-blossom. In China *J. paniculatum* is cultivated as an erect shrub, known as *sieu-hing-hwa;* it is valued for its flowers, which are used with those of *J. Sambac,* in the proportion of 10 lb. of the former to 30 lb. of the latter, for scenting tea—40 lb. of the mixture being required for 100 lb. of tea. *J. angustifolium* is a beautiful evergreen climber 10 to 12 ft. high, found in the Coromandel forests, and introduced into cultivation.



FLOWERING BRANCH OF JASMINE

Other hardy species commonly cultivated in gardens are the low or Italian yellow-flowered jasmine, *J. humile,* an East Indian species introduced and now found wild in the south of Europe, an erect shrub 3 or 4 ft. high, with angular branches, alternate and mostly ternate leaves, blossoming from June to Sept.; the common yellow jasmine, *J. fruticans,* a native of southern Europe and the Mediterranean region, a hardy evergreen shrub, 10 to 12 ft. high, with weak, slender stems requiring support, and bearing yellow, odourless flowers from spring to autumn; and *J. nudiflorum* (China), which bears its bright yellow flowers in winter or early spring before the leaves appear.

JASON, in Greek legend, son of Aeson, king of Iolcus in Thessaly. After his return from Colchis (*see* ARGONAUTS), he lived at Corinth with his wife Medea (*q.v.*) for many years. At last he put away Medea in order to marry Glauce (or Creüsa), daughter of the Corinthian king, Creon. To avenge herself,

Medea presented the new bride with a robe and head-dress, by whose magic properties the wearer was burnt to death, and slew her children by Jason with her own hand. His death was said to have been due to suicide through grief, caused by Medea's vengeance (Diod. Sic. iv. 55); or he was crushed by the fall of the poop of the ship "Argo," under which he had laid himself down to sleep (Eurip., *Med.* 1386).

See articles by C. Seeliger in Roscher's *Lexikon der Mythologie* and by F. Durrbach in Daremberg and Saglio's *Dictionnaire des antiquités;* H. D. Müller, *Mythologie der griechischen Stämme* ii. 328 (1861), who explains the name Jason as "wanderer"; W. Mannhardt, *Mythologische Forschungen* pp. 75, 130 (1884); O. Crusius, *Beiträge zur griechischen Mythologie und Religionsgeschichte* (Leipzig, 1886).

JASON OF CYRENE, a Hellenistic Jew, who lived about 100 B.C. and wrote a history of the times of the Maccabees down to the victory over Nicanor (175–161 B.C.). This work is said to have been in five books and formed the basis of the present 2 Macc. (*see* ch. ii. 19–32).

JASPAR, HENRI (1870–), Belgian statesman, was born at Schaerbeek, Brussels, on July 28, 1870. He is a member of the Catholic party. While minister of economic affairs in Nov. 1918, he organized the reconstruction of Belgian industries; becoming deputy for Liége in 1919. In 1920, having been appointed minister of the interior and afterwards minister for foreign affairs, he endeavoured, during the Inter-Allied Conference in which he took part, to strengthen the entente between England, France and Belgium, and to secure reparations and security for his own country. In 1922 he negotiated a pact of security and guarantee with England; this, however, owing to the defeat of the French Government, failed to come into operation. Belgium's entry into the League of Nations was due to the efforts of Jaspar, as also was her representation on the Permanent Court of International Justice at The Hague. In July 1921 he concluded an economic agreement between Belgium and Luxembourg and other commercial treaties. He took part in the Dawes Plan negotiations in 1924, but resigned as minister for foreign affairs on March 11, on the rejection by the Chamber of the Franco-Belgian Convention. In May 1926 he took office as prime minister and minister of the interior in a ministry of "national unity." He at once initiated measures to secure economy in the public administration. He had to face a serious financial crisis and a threatened "flight from the franc." There was some difficulty in reconciling the dissident elements in this cabinet, which was eventually reconstituted on Nov. 29, 1927, without the participation of Vandervelde (the outstanding figure in the original cabinet) and his Socialist followers. (*See* BELGIUM.)

JASPER, an impure variety of quartz. It is compact, and being very hard it takes a fine polish. It occurs in many colours—dark green, brown, yellow and sometimes blue or black. Occasionally it is found banded with many different coloured stripes. Unlike chalcedony, it is opaque, and does not possess a splintery fracture. The term jasper is now restricted to opaque stones, but the ancient jaspis or *ἴασπις* was at least partially translucent, and probably included some chalcedony and chrysoprase. Many medicinal values were attributed by the ancients to this stone, and even in 1609 it was still believed that a jasper hung about the neck strengthened the stomach.

Egyptian jasper is brown, occurring as nodules of an agate-like formation in the Lybian desert and the Nile valley. Red jasper is found at Hessen, Löhlbach and Dakota. In riband jasper the colours are arranged in bands, as in the well known Siberian stones, in which there is a definite alternation of red and green stripes. Agate jasper is intermediate between true jasper and chalcedony. An artificially coloured jasper is extensively produced in imitation of lapis lazuli.

See C. W. King, *Precious Stones, Gems and Precious Metals* (1865); M. Bauer, *Precious Stones* (trans. L. J. Spencer, 1904); A. Eppler, *Die Schmuck und Edelsteine* (Stuttgart, 1912). (W. A. W.)

JASSY (Rum. Iaşi), the capital of the department of Jassy, Rumania; situated on the left bank of the river Bahlui, an affluent of the Jijia, about 10 m. W. of the Pruth. Pop. (1928) 185,000 including a great number of Jews. Jassy communicates by rail with Galatz, Kishinev and Czernowitz. The surrounding country is one of uplands and woods, among which rise the monasteries of Cetatuia, Frumoasa, and Galata with its mineral springs, the water-cure establishment of Rapide and the great seminary of Socola. Jassy is the seat of the metropolitan of Moldavia and Suceava, and of a Roman Catholic archbishop. The two oldest churches date from the reign of Stephen the Great (1458–1504); perhaps the finest, however, are the 17th century metropolitan, St. Spiridion and Trei Erarchi, the last a curious example of Byzantine art, erected in 1640 by Vasile Lupu (The Wolf), and adorned with countless gilded carvings on its outer walls and twin towers. The St. Spiridion Foundation (due to the liberality of Prince Gregory Ghika in 1727 and available for the sick of all countries and creeds) maintains hospitals and churches in several towns of Moldavia, besides the baths at Slanic in Walachia. There are six hospitals, the chief Rumanian university, a military academy and schools of art, music and commerce; three museums, a fine hall and a theatre; the state library, where the chief records of Rumanian history are preserved; an appeal court, a chamber of commerce and several banks. The city is the headquarters of the IV. Army Corps. It has an active trade in petroleum, salt, metals, timber, cereals, fruit, wine, spirits, preserved meat, textiles, clothing, leather, cardboard and cigarette paper, and a considerable industry. Jassy is mentioned as early as the 14th century, and probably derives its name from the Cuman "Jazyges" or bowmen. It was often visited by the Moldavian court. In 1565, Prince Alexander Lapusneanu moved the capital of Moldavia from Suceava to Jassy. It was already famous as a centre of culture. Between 1561 and 1563 an excellent school and a Lutheran church were founded by the Greek adventurer, Jacob Basilicus (*see* RUMANIA: *History*). In 1643 the first printed book published in Moldavia was issued from a press established by Vasile Lupu. He also founded a school, the first in which the mother-tongue took the place of Greek. Jassy was burned by the Tatars in 1513, by the Turks in 1538 and by the Russians in 1686. By the Peace of Jassy the second Russo-Turkish War was brought to a close in 1792. A Greek insurrection under Ypsilanti in 1821 led to the storming of the city by the Turks in 1822. In 1844 there was a severe conflagration. In 1861 the government of Rumania was removed to Bucharest; but during the World War was again temporarily transferred to Jassy.

JASTROW, MORRIS (1861–1921), American orientalist, was born in Warsaw, Poland, on Aug. 13, 1861, but at five was taken to Philadelphia, where his father, a rabbi, had been called. He was educated at the University of Pennsylvania and at French and German universities. In 1885 he returned to Pennsylvania as instructor, but soon became professor of Semitic languages and literature and also librarian. He died on June 22, 1921, at Jenkintown, Pa. His early work dealt with archaeological and historical subjects, including *Aspects of Religious Belief and Practice in Babylonia and Assyria* (1911); and *The Civilization of Babylonia and Assyria* (1915). The World War caused him to apply his knowledge of the Orient to contemporary problems as in *Zionism and the Future of Palestine* (1919), and *The Eastern Question and its Solution* (1920).

See J. A. Montgomery, "Morris Jastrow, Jr.," in *The Amer. Jour. of Semitic Lang. and Lit.* (vol. xxxviii., Oct. 1921), and the memorial reprint from the *Jour. of the Amer. Oriental Soc.* (vol. xli., pt. 5, 1921), which contains several estimates and a bibliography.

JĀT, the largest cultivating caste in north-west India, numbering 7,374,817 in 1921, and especially strong in the Punjab, and adjacent districts of the United Provinces, etc. The origin of the name (also Jalt), is unknown. In the Baloch country its equivalent is Jagdal. The early Mohammedans wrote of the Jāts country as lying between Kirmān and Mansūra. Then they are associated with the Meds of Sind, where they appear in force. Both Tīmūr and Babur speak of them as unruly tribes who hampered their invasion. The Rājpūt traditions recognize them as one of the 36 royal races. Speculation has identified in them the Getae of Herodotus, a thesis almost plausible in comparison with those which assign to them Scythian or Indo-Scythic origin. Of Indo-Aryan type the Jāts form a great congeries of tribes which have a persistent tradition that they came from Garh Gajni, possibly

Ghazni, but more probably some place on the Indus. The Jāts, moreover, are all but unanimous on two points, one, that they are fairly recent settlers in their present seats, the other that they were once Rājpūts who by adopting widow re-marriage, or ploughing, lost status. Only three clans are supposed to have been Jāts *ab initio*. Several data point to the south-east Punjab near Delhi as their homeland and not far from it in Bhartpur and Dholpur were founded the only Hindu Jāt States historically known. They sprang up when the Moghul empire decayed. The later Jāt States in the Punjab were of Sikh origin.

In the south-east Punjab and east of the Jumna the Jāts are mainly Hindus; in the south-west Muslim; in the central Punjab, Sikhs. But the fertile belts are seldom Jāt or even Hindu. They are held by Mohammedan Rājpūt tribes intermingled with Jāts converted to Islam as if the earlier Muslim inroads had driven the Hindu tribes into the dry uplands or the infertile country bordering on Rājpūtāna. Intensely democratic by instinct the Jāts have yet evolved hypergamy among themselves. Thus some families will not practise widow re-marriage. But this does not restore them to Rājpūt status. It makes them refuse brides to less punctilious clans and reduce the number of girl babies. Under the Sikh monarchies democracy was modified, but the Jāt was never very submissive to his chiefs or to Brahmans. He has remained essentially the yeoman peasant, industrious, reticent, a little dour, but an excellent soldier, sedate and resolute. He is a good wrestler and horseman.

JĀTAKA, the technical name, in Buddhist literature, for a story of one or other of the previous births of the Buddha. The word is also used for the name of a collection of 547 of such stories included in the Buddhist Pāli canon. The form of most of these tales is a very common Indian one known as *ākhyāna*. It may be a beast fable, a story of common life, or a folk tale told in prose, with the climax or essential part of the dialogue in verse. It is this verse or verses which, as being the utterance of the Bodhisatta or future Buddha, constitutes the canonical portion of the Jātaka. The Jātaka itself (the story of the past) is always preceded by a story of the present, an incident in the life of the historical Buddha, which is the occasion for his telling the story of the past, and followed by the identification, in which the chief characters are declared to be previous births of persons who appear in the story of the present. There is also a verbal commentary explaining the archaic language of the verses.

A few of the tales are almost identical with some of the beast fables of Aesop, and a larger number with the tales of the *Panchatantra*. It is especially among these where evidence of adaptation from non-Buddhist sources appears, the Bodhisatta in some of them being merely a spectator, but necessarily introduced in order to turn the story into a jātaka. The last ten are long romances, and the last of all, the *Vessantara-jātaka,* is a favourite subject of dramatic representation in Burma. The ethical teaching is mostly that of the virtues of secular life, and moral retribution is emphasized by the doctrines of Karma and re-birth (*see* KARMA).

The introduction to the Jātaka-book (*Nidāna-kathā*), which was compiled in Ceylon, but mainly from Indian sources, contains a biography of the Buddha from the period when he first determined to attain Buddhahood down to the beginning of his preaching. There is no evidence for the view formerly held that it was this introduction which reached Persia and formed the direct source of the story of Barlaam and Joasaph. The Buddhistic features in this story more probably came from a Sanskrit source, and recent discoveries show that they passed through a Manichaean channel (*see* BARLAAM AND JOSAPHAT).

Jātaka is mentioned in the canon as being one of the nine divisions of the word of the Buddha, but this is no evidence for the age of the Jātaka-book. The prose of this is a re-translation into Pāli from the Singhalese, probably in the fifth century A.D. A few of the tales, with the same verses but with very archaic prose, are found in the Vinaya, and these appear to be survivals of jātakas as they existed before their translation into Singhalese. The earliest evidence for a collection of such tales is in the carvings illustrating a number of jātakas on the stupa of Bharhut, which are assigned to the third or second century B.C., but additions to the collection probably went on much later. The Pāli canon also contains the *Cariyā-piṭaka,* a collection of 36 jātakas told shortly and baldly in verse.

There is no such great collection of jātakas in Sanskrit works, but many of the Pāli jātakas as well as others are found in the *Mahāvastu* and in Tibetan and Chinese translations from Sanskrit. The *Jātakamālā* is a collection of 34 jātakas in Sanskrit verse by Āryaśūra, a writer of the fourth century A.D. The Avadānas are a similar type of tale, and many of them actually are jātakas (*see* AVADĀNA).

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JATH, native state of India (Bijapur agency), in the Deccan division of Bombay. The small state of Daphlapur was added to Jath on the death of its last ruler in 1917. Area, 981 sq.m. Pop. (1921) 82,654. Tribute £756. Agriculture and cattle-breeding are carried on; there are no important manufactures. The chief, whose title is *deshmukh,* is a Mahratta of the Daphle family. The town of JATH is 92 m. S.E. of Satara. Pop. (1921) 5,193.

JATIVA (formerly written XATIVA) or **SAN FELIPE DE JATIBA,** a town of eastern Spain, in the province of Valencia, on the right bank of the river Albaida, a tributary of the Júcar, and at the junction of the Valencia-Murcia and Valencia-Albacete railways. Pop. (1920), 14,148. Játiva was the Roman Saetabis, afterwards Valeria Augusta, of Carthaginian or Iberian origin. Pliny (23–79) and Martial (*c.* 40–102) mention the excellence of its linen cloth. Under the Visigoths (*c.* 483–711) it became an episcopal see; but early in the 8th century it was captured by the Moors, under whom it attained great prosperity, and received its present name. It was reconquered by James I. of Aragon (1213–76). During the 15th and 16th centuries, Játiva was the home of many members of the house of Borgia or Borja, who migrated hither from Borja in Saragossa. Játiva is built on the margin of a fertile plain, and on the southern slopes of the Monte Bernisa, a hill with two peaks, each surmounted by a castle.

JAUCOURT, ARNAIL FRANÇOIS, MARQUIS DE (1757–1852), French politician, was born on Nov. 14, 1757 at Tournon (Seine-et-Marne). He adopted revolutionary ideas and became colonel of his regiment (Condé's). In the Assembly, in which he represented Seine-et-Marne, his views were too moderate for his colleagues and he resigned in 1792 and was arrested on suspicion of being a reactionary. Mme de Staël procured his release just before the September massacres. He accompanied Talleyrand to England, returning after the execution of Louis XVI. Under the consulate he was for some time president of the tribunate. In 1803 he entered the senate, and in 1804 was attached to the household of Joseph Bonaparte. His imperialist views cooled, and at the Restoration he became minister of state and a peer of France. At the second Restoration he was for a brief period minister of marine. He devoted himself to the Protestant interest in France. A member of the upper house throughout the reign of Louis Philippe, he was driven into private life by the establishment of the Second Republic, but lived to rally to the government of Louis Napoleon, dying in Paris on Feb. 5, 1852.

JAUER, a town in the Prussian province of Silesia, 13 m. south of Liegnitz, on the Wüthende Neisse. Pop. (1925) 12,158. The town was first mentioned in 1242, and was formerly the capital of a principality embracing about 1,200 square miles. From 1392 to 1741 it belonged to the kings of Bohemia, being taken from Maria Theresa by Frederick the Great. Jauer was formerly the prosperous seat of the Silesian linen trade, but three burnings in the Thirty Years' War permanently injured it. St. Martin's church dates from 1267–90, and the Evangelical church from 1655. Jauer manufactures leather, carpets, cigars, carriages and agricultural machinery.

JAUHARI (Abu Nasr Ismail Ibn Ḥammad ul-Jauhari) (d. 1002 or 1010), Arabian lexicographer, was born at Farab on the borders of Turkistan. He studied in Farab and Bagdad, and settled first in Damghan, then at Nishapur, where he died. His great work is the *Kitāb us-Ṣaḥāḥ fil-Lugha,* an Arabic dictionary, in which the words are arranged alphabetically according to the last letter of the root. He only partially finished the last recension, but the work was completed by his pupil, Abū Isḥaq Ibrāhim ibn Ṣāliḥ ul-Warrāq.

Of the edition begun by E. Scheidius with a Latin translation, one part only appeared at Harderwijk (1776). The whole has been published at Tebriz (1854) and at Cairo (1865), and many abridgments and Persian translations have appeared; *cf.* C. Brockelmann, *Geschichte der arabischen Literatur* (Weimar, 1898), i.

JAUNDICE or **ICTERUS,** a term in medicine applied to a yellow coloration of the skin and other parts of the body, often associated with some derangement affecting the liver. This yellow colour is due to the presence in the blood of bile or some of its constituents. Jaundice, however, must be regarded as a symptom of some morbid condition previously existing and not as a disease *per se.*

Cases with jaundice may be divided into two groups:—

1. **Obstructive Jaundice.**—Any obstruction of the passage of bile from the liver into the intestinal canal is sooner or later followed by the appearance of jaundice, which in such circumstances is due to absorption of bile into the blood. The obstruction is due to one of the following causes: (1) Obstruction by foreign bodies within the bile duct, *e.g.*, gallstones or parasites; (2) inflammation of the duodenum or the lining membrane of the duct; (3) stricture or obliteration of the duct; (4) a tumour growing from the duct; (5) pressure on the duct from without, from the liver or other organ, or tumours arising from them. Obstructions from these causes may be partial or complete, and the degree of jaundice will vary accordingly, but it is to be noted that extensive organic disease of the liver may exist without the evidence of obstructive jaundice. By a blood test and the van der Bergh reaction, obstructive jaundice may be distinguished from all other varieties.

The effect upon the liver of impediments to the outflow of bile is an increase in its size, the whole biliary passages and the liver cells being distended with retained bile. The bile thus retained is absorbed into the system, and shows itself by the yellow staining seen to a greater or less extent in all the tissues and many of the fluids of the body. The kidneys, in such circumstances, excrete a portion of the retained bile in the urine.

The symptoms accompanying obstructive jaundice necessarily vary according to the nature of the exciting cause. The first sign of jaundice itself is a yellow coloration of the white of the eye, which is speedily followed by a similar colour on the skin over the body generally. It may be also well seen in the roof of the mouth, but in the lips and gums is not observed till the blood is first pressed from them. The tint varies in depth and in complete obstruction of long duration may be olive-green or dark brown.

The urine exhibits colour changes even before they can be detected on the skin or elsewhere. It is always dark brown like porter, but after standing in the air it becomes greenish. It contains both bile pigments and bile acids. The former are detected by the play of colours yielded on the addition of fuming nitric acid, the latter by the purple colour, produced by placing a piece of lump sugar in the urine tested, and adding thereto a few drops of strong sulphuric acid.

The contents of the bowels, owing to lack of bile, are clay-coloured or white, contain undigested fats, and have an extremely offensive odour. Constitutional symptoms are always present. The patient becomes languid, drowsy and irritable, and has generally a slow pulse. Yellow vision appears to be present in some very rare cases. When not dependent upon serious organic disease, jaundice from obstruction may exist many years, as in those instances where the walls of the bile ducts are thickened from chronic catarrh, but are only partially occluded. In the common cases of acute catarrhal jaundice recovery usually takes place in two or three weeks.

The treatment of this form of jaundice is that of the underlying cause. With its removal the jaundice will disappear, but diaphoretics and diuretics to promote the action of the skin and kidneys are useful. In the more chronic forms the waters of Carlsbad have a high repute.

2. **Haemolytic Jaundice.**—This is a symptom in certain diseases, *e.g.*, yellow fever, acute yellow atrophy, malaria, some forms of spirochaetosis, pyaemia, certain poisons, such as phosphorus, toluylenediamin and snake venom. Jaundice of this kind is relatively slight, compared with that of the obstructive variety. The grave constitutional symptoms often present must be ascribed to the disease with which the jaundice is associated.

Under this group there are the jaundice of new-born infants, which varies enormously in severity; the cases in which a slight form of jaundice obtains in several members of the same family, without other symptoms, and which may persist for years; and lastly perhaps, the group of cases with hypertrophic cirrhosis. (*See* Alimentary System, Diseases of.)

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JAUNPUR, a city and district of British India, in the Benares division of the United Provinces. The city is on the left bank of the river Gumti, 34 m. N.W. from Benares by rail. Pop. (1921), 32,569. Jaunpur is an ancient city, the former capital of a Mohammedan kingdom which once extended from Budaun and Etawah to Behar. It abounds in splendid architectural monuments, most of which belong to the period when the rulers of Jaunpur were independent of Delhi. The fort of Feroze Shah is in great part completely ruined, but there remain a fine gateway of the 16th century, a mosque dating from 1376, and the *hammams* or baths of Ibrahim Shah. Among other buildings may be mentioned the Atala Musjid (1408) and the ruined Jinjiri Musjid, mosques built by Ibrahim, the first of which has a great cloistered court and a magnificent façade; the Dariba mosque constructed by two of Ibrahim's governors; the Lal Darwaza erected by the queen of Mahmud; the Jamma Musjid (1438–1478) or great mosque of Husain, with court and cloisters, standing on a raised terrace, and in part restored in modern times; and finally the splendid bridge over the Gumti, erected by Munim Khan, Mogul governor in 1569–1573. The city has now lost its importance, the only industries surviving being the manufacture of perfumes and papier-mâché articles.

The District of Jaunpur has an area of 1,550 sq.m. It forms part of the wide Gangetic plain, and its surface is accordingly composed of a thick alluvial deposit. The whole country is closely tilled, and is divided into two unequal parts by the sinuous channel of the Gumti, a tributary of the Ganges, which flows past the city of Jaunpur. The Gumti is liable to sudden inundations during the rainy season, owing to the high banks it has piled up at its entrance into the Ganges, which act as dams to prevent the prompt outflow of its flooded waters. The greatest recorded flood took place in Sept. 1871, when 4,000 houses in the city were swept away, besides 9,000 more in villages along its banks. Pop. (1921), 1,155,105. Sugar-refining is the principal industry.

In prehistoric times Jaunpur seems to have formed a portion of the Ajodhya principality, and when it first makes an appearance in authentic history it was subject to the rulers of Benares. With the rest of their dominions it fell under the yoke of the Mohammedan invaders in 1194. In 1388 Mālik Sarwar Khwāja was sent by Mohammed Tughlak to govern the eastern province. He fixed his residence at Jaunpur, made himself independent of the Delhi court, and assumed the title of Sultan-us-Shark, or "eastern emperor." For nearly a century the Sharki dynasty ruled at Jaunpur, and proved formidable rivals to the sovereigns of Delhi, until in 1478 Bahlol Lodi recovered his imperial sway. In 1775 the district became British by the Treaty of Lucknow.

JÁUREGUI, JUAN DE (1583–1641), Spanish poet, whose *Rimas* (1618), a collection of graceful lyrics, is preceded by a controversial preface which attracted much attention on account of its outspoken declaration against *culteranismo*. His poem *Orfeo* (1624), however, is visibly influenced by Góngora, while a translation of the *Pharsalia* (begun before 1614 but not published until 1684) reveals Jáuregui as a complete convert to the new school.

JAURÉGUIBERRY, JEAN BERNARD (1815–1887), French admiral, was born at Bayonne on Aug. 26, 1815. He entered the navy in 1831, served in Crimea and in China, was governor of Senegal, and was promoted to rear-admiral in 1869. He was the the most distinguished of the many naval officers who did good service in the military operations in the Franco-German War of 1870–71. In 1875 he was a member of the council of admiralty: and in February 1879 he became minister of the navy in the Waddington cabinet, and on May 27 following was elected a senator for life. He was again minister of the navy in the Freycinet cabinet in 1880. Jauréguiberry died in Paris on Oct. 21, 1887.

JAURÈS, AUGUSTE MARIÈ JOSEPH JEAN (1859–1914), French socialist leader, was born at Castres (Tarn) on Sept. 3, 1859. His ancestors on his father's side included two admirals, of whom one was ambassador to Spain and to Russia, and Minister of Marine. Jaurès was educated at the collège of Castres, at the Collège Sainte Barbe, the Lycée Louis le Grand and the École Normale Supérieure in Paris. His career at the normal school was the most brilliant possible, and his fellow students, among them being Henri Bergson, predicted for him a great political future.

After having passed the "concours d'agrégation" Jaurès was elected, in 1881, master of philosophy at the Lycée d'Albi. In 1883 he became lecturer in the university of Toulouse. But he had already set his mind upon a parliamentary career, although his mother did her best to dissuade him. At the legislative elections of Oct. 4, 1885, he was elected deputy for Tarn. He was 26 years old. During the first two years of his term, he took little part in debates. His poetic and burning eloquence embarrassed parliamentarians accustomed to the so-called "britannique" eloquence of Clemenceau, Waldeck-Rousseau, Ribot, Pelletan, Freycinet and others. His maiden speech was delivered Oct. 21, 1886, on a question relating to primary education. On every question with which he dealt in the Chamber, he adopted a courageous attitude which showed him incapable of sacrificing his principles to parliamentary compromise or to motives of self-interest. Without allying himself to any party, he devoted himself passionately to the public good and to the general welfare; but at the close of the session the meagre results of his efforts discouraged him so much that he decided to abandon politics, and asked to be reinstated in his post of professor at the University of Toulouse. Persuaded by his friends, however, he stood for Castres, and failed. In November Jaurès resumed the professor's chair. His lectures were now thronged with students, workmen, middle class folk, other professors, men of science, men of learning. During this period he wrote his theses for the doctorate. His French thesis was entitled *De la realité du monde sensible*. In his Latin thesis he traced the origins of German socialism *De primis socialismi germanici lineamentis apud Lutherum, Kant, Fichte et Hegel*.

In the articles which he wrote at this time for the local organ *La Dépêche* his ideas on politics and economics were seen to turn more and more towards Socialism, to which, at the close of 1890, he at last publicly announced his adhesion. After the strike at Carmaux, in the course of which he defended the claims of the miners, Jaurès was elected deputy, in 1893, at a local election, and his term of office was renewed at the general elections of 1894. Defeated again in 1898, he was re-elected in 1902; and his electorate remained faithful to him from that time on. In the Chamber he took a large part in the debates on the Panama and Boulangist crises, in discussions of agrarian and colonial questions, on fiscal policy and protectionist measures, on syndicalism and the separation of Church and State, on military laws and electoral reform. In the Dreyfus affair his energetic intervention captured the Socialist party, which hesitated at first to take part in a conflict which seemed not to concern the proletariat. His campaign in favour of Dreyfus, a "living witness to military lies, to political cowardice, to the crimes of authority" did not cease until Dreyfus was definitely rehabilitated.

Led by the logical development of his metaphysical and religious ideas to social conceptions which obliged him to accept the Socialist teaching, Jaurès adhered closely to the rapidly growing Socialist party. The socialism of Jaurès differed essentially from the Marxian doctrine. "Our socialism," wrote Jaurès, "is French in origin, French in inspiration, and French in character." His ultimate aim was harmony founded on justice. Social harmony implies the disappearance of an injustice which provokes conflicts, hatreds and their horrible consequences, an injustice originating in capitalist ownership. Jaurès was a socialist because "the domination of one class is an outrage against humanity." Into this doctrine he breathed his own glowing and generous ideas and, at the same time, drew from it the strength with which he animated it. "No serious social programme can be realised without a definite social doctrine," he wrote, and for him the whole socialist ideal must inspire organic reformatory action and thus establish a socialism, democratic, republican and lay. Jaurès strove to bring about unification of the various socialist groups. At the Congress of 1901, a section of groups rallied to him under the name of the *parti socialiste français*, while the others formed the *parti socialiste de France!* After the Amsterdam Congress in 1905, the two groups coalesced and Jaurès became, in fact, their moral and intellectual chief. Thereafter his political activity was bound up with that of the unified Socialist party, whose parliamentary activity he directed with great skill. He drafted most of the resolutions at Socialist congresses and defended them in an admirably conciliatory spirit.

His philosophy of history, unlike that of Marx, did not hold that the development of society is explained by historical materialism; he postulated for it an intelligent directing force and an ideal wisdom. To uphold his convictions, Jaurès, after the Amsterdam Congress in 1905, struggled alone against the entire International for a share of power and for the preservation of the democratic-socialist *bloc*. He violently attacked and denounced as impotent the German Social Democracy which dominated the Congress and was supported by the old French Socialist organisations. On April 17, 1904, Jean Jaurès, with Aristide Briand, founded *l'Humanité*, which has become the daily organ of the Socialist party. His daily leading article in it was written for the most part from his seat in the Chamber.

Jaurès early foresaw that the unstable equilibrium of the Triple Alliance and the Triple Entente was bound to end in a catastrophe, and he wished to avert it by the simultaneous international action of the proletariat. A passionate lover of France, he sought to spare his country the horrors of devastation by war. While he maintained that a democracy should not have an aggressive policy, he did not deny the duty of every nation to defend itself. To prevent misunderstanding between socialism and patriotism he wrote: "A nation which could not count, in days of crisis or when its life is in danger, upon the national devotion of the working class, would be a wretched thing indeed." He supported the policy of arbitration and all measures to secure international peace, but at the same time, in the name of the workers of France, he insisted "that the nation organise all its military forces, irrespective of class or caste, for the sole purpose of national defence." Against Germany, militarist and absolutist, stood France, a nation in arms, practising "a policy of supreme national defence which would lead not only to peace but to the assurance of peace." Jaurès expounded and developed his ideas on the organisation of "a nation in arms" in his great book, *L'Armée nouvelle*.

The policy of world-wide solidarity which Jaurès proclaimed was of no avail against the blind forces which precipitated the War, but Jaurès continued to strive for peace. On July 28, 1914, before the outbreak of war, he, and some of his most eminent Socialist colleagues, went to Brussels to confer, in the name of the French Socialist party, with representatives of international labour on the best means of averting the threat of war, which he

still thought could be avoided. But he was none the less full of anguish over the fate of France, compelled to defend herself against aggression. On this subject, he certainly felt no hesitation, for he had always been animated by the purest patriotism.

Il y a un groupement historique qui s'appelle la France, qui a été constitué par des siècles de souffrances communes, d'espérances communes; les lentes formations monarchiques en ont peu à peu juxtaposé et soudé les morceaux, et les ardentes épreuves de la Révolution l'ont fondu en un seul métal. C'est la patrie française . . . Oui, il y a des luttes, des antagonismes profonds de classe. Mais quels que soient ces luttes politiques, ces divisions économiques, ces antagonismes sociaux, ils ne peuvent pas porter atteinte à l'idée même de la patrie. . . . Si notre patrie est menacée . . . nous serions des premiers à la frontière pour défendre la France dont le sang coule dans nos veines, et dont le fier génie est ce qu'il y a de meilleur en nous.

These noble words leave no doubt as to the attitude which Jaurès would have taken, or of the rôle which he would have played in the "holy war for our beloved France if ever she were attacked." But on the very eve of mobilisation, in Paris, on July 31, 1914, at 9.40, Jaurès succumbed to the bullets of an assassin—a wretched half-wit, impelled to this stupid crime by the calumnies of the adversaries of the great tribune. His obsequies were celebrated on Aug. 4 in the midst of an immense popular gathering, and his body was interred at Albi. In 1925 his mortal remains were brought back to Paris, and, borne on the shoulders of his faithful miners of Carmaux, deposited in the Panthéon. (E. He.)

JAVA, one of the larger islands of that portion of the Malay archipelago which is distinguished as the Sunda islands. It lies between 105° 12′ 40″ (St. Nicholas Point) and 114° 35′ 38″ E. (Cape Seloko) and between 5° 52′ 34″ and 8° 46′ 46″ S. It has a total length of 622 m. from Pepper Bay in the west to Banyuwangi in the east, and an extreme breadth of 121 m. from Cape Bugel in Japara to the coast of Jokjakarta, narrowing towards the middle to about 55 miles. Politically and commercially it is important as the seat of the colonial government of the Dutch East Indies, all other parts of the Dutch territory being distinguished as the Outer Possessions (*Buitenbezittungen*). According to the triangulation survey the area of Java proper is 48,504 sq.m.; of Madura, the large adjacent and associated island, 1,732; and of the smaller islands administratively included with Java and Madura 1,416, thus making a total of 50,970 square miles. The more important of these islands are the following: Pulau Panaitan or Princes Island, 47 sq.m., lies in the Sunda Strait, off



COURT DANCING GIRLS IN A MOVEMENT OF THE S'RIMPI DANCE, DECOROUS FIGURE DANCE THAT THEY ALONE ARE PERMITTED TO PERFORM

the south-western peninsula of the main island, from which it is separated by the Behouden Passage. The Thousand Islands are situated almost due N. of Batavia. Of these five were inhabited in 1906 by about 1,280 seafarers from all parts and their descendants. The Karimon Java archipelago, to the north of Semarang, numbers 27 islands with an area of 16 sq.m. Bavian (Bawian), 100 m. north of Surabaya, is a ruined volcano with an area of 73 square miles. About a third of the men are generally absent as traders or coolies. In Singapore and Sumatra they are known as Boyans. They are devout Mohammedans and many of them make the pilgrimage to Mecca. The Sapudi and Kangean archipelagoes are eastward continuations of Madura. The former export cattle, dried fish and trepang; and many of the male population work as day labourers in Java or as lumbermen in Sumbawa, Flores, etc. The main island of the Kangians has an area of 19 sq.m.; the whole group 23 square miles. It is best known for its limestone caves and its buffaloes. Along the south coast the islands are few and small—Klapper or Deli, Trouwers or Tingal, Nusa Kembangan, Sempu and Nusa Barung.

From Sumatra on the W., Java is separated by the Sunda Strait, which at the narrowest is only 14 m. broad, but widens elsewhere to about 50 miles. On the E. the strait of Bali, which parts it from the island of that name, is at the northern end not more than 1½ m. across.

Physical Features.—Built up of alluvium and diluvium, the plains of the north coast-lands in western and middle Java are at their lowest levels, near the mouths of rivers and the sea, in many cases marshy and abounding in lakes and coral remains, but for the rest they are fertile and available for culture. The plains, too, along the south coast of middle Java—of Banyumas and Bagelen—contain many morasses as well as sandy stretches and dunes impeding the outlet of the rivers. They are, nevertheless, available for the cultivation more particularly of rice, and are thickly peopled. In eastern Java, again, the narrow coast plains are to be distinguished from the wider plains lying between the parallel chains of limestone and between the volcanoes. The narrow plains of the north coast are constituted of yellow clay and tuffs containing chalk, washed down by the rivers from the mountain chains and volcanoes. Like the western plains, they, too, are in many cases low and marshy, and fringed with sand and dunes. The plains, on the other hand, at some distance from the sea, or lying in the interior of eastern Java, owe their formation to the volcanoes at whose bases they lie, occupying levels as high as 1,640 ft. down to 328 ft. above the sea, whence they decline to the lower plains of the coast. Lastly, the plains of Lusi, Solo and Brantas, lying between the parallel chains in Japara, Rembang and Surabaya, are in part the product of rivers formerly flowing at a higher level of 30 to 60 or 70 ft., in part the product of the sea.

The considerable rivers of western Java all have their outlets on the north coast, the chief among them being the Chi (Dutch *Tji*) Tarum and the Chi Manuk. They are navigable for native boats and rafts, and are used for the transport of coffee and salt. On the south coast the Chi Tanduwi, on the east of the Preanger, is the only stream available as a waterway, and this only for a few miles above its mouth. In middle Java, also, the rivers discharging at the north coast—the Pamali, Chomal, etc.—are serviceable for the purposes of irrigation and cultivation, but are navigable only near their mouths. The rivers of the south coast—Progo, Serayu, Bogowonto and Upak, enriched by rills from the volcanoes—serve abundantly to irrigate the plains of Bagelen, Banyumas, etc. Their stony beds, shallows and rapids, and the condition of their mouths lessen, however, their value as waterways. More navigable are the larger rivers of eastern Java. The Solo is navigable for large praus, or native boats, as far up as Surakarta, and above that town for lighter boats, as is its affluent the Gentung. The Brantas is also navigable in several parts.

The north coast of Java presents everywhere a low strand covered with nipa or mangrove, morasses and fishponds, sandy stretches and low dunes, shifting river-mouths and coast-lines, ports and roads, demanding continual attention and regulation. The south coast is different. The dunes of Banyumas, Bagelen and Jokjakarta, ranged in three ridges, rising to 50 ft. high, and varying in breadth from 300 to over 1,600 ft., liable, moreover, to transformation from tides and the east monsoon, oppose everywhere, also in Preanger and Besuki, a barrier to the discharge of the rivers and the drainage of the coast-lands. The north coast is of much greater commercial importance than the south coast.

Geology.—With the exception of a few small patches of schist, supposed to be Cretaceous, the whole island, so far as is known, is covered by deposits of Tertiary and Quaternary age. The Cre-

taceous schists have yielded fossils only at Banjarnegara, where a limestone with Orbitolina is interstratified with them. They are succeeded unconformably by Eocene deposits, consisting of sandstones with coal-seams and limestones containing Nummulites, Alveolina and Orthophragmina; and these beds are as limited in extent as the Cretaceous schists themselves. Sedimentary deposits of Upper Tertiary age are widely spread, covering about 38% of the surface. They consist of breccias, marls and limestones containing numerous fossils, and are for the most part Miocene but probably include a part of the Pliocene also. Fluviatile deposits of late Pliocene age have been found in the east of Java, and it was in these that the remarkable anthropoid ape or ape-like man, *Pithecanthropus erectus* of Dubois, was discovered. The Quaternary deposits lie horizontally upon the upturned edges of the Tertiary beds. They are partly marine and partly fluviatile, the marine deposits reaching to a height of some 350 ft. above the sea and thus indicating a considerable elevation of the island in recent times.

The volcanic rocks of Java are of great importance and cover about 28% of the island. The eruptions began in the middle of the Tertiary period, but did not attain their maximum until Quaternary times, and many of the volcanoes are still active. Most of the cones seem to lie along faults parallel to the axis of the island, or on short cross fractures. The lavas and ashes are almost everywhere andesites and basalts, with a little obsidian. Some of the volcanoes, however, have erupted leucite rocks. Similar rocks, together with phonolite, occur in the island of Bavian.

Climate.—Our knowledge of the climate of Batavia, and thus of that of the lowlands of western Java, is almost perfect; but, rainfall excepted, our information as to the climate of Java as a whole is extremely defective. The dominant meteorological facts are simple and obvious: Java lies in the tropics, under an almost vertical sun, and thus has a day of almost uniform length throughout the year. It is also within the perpetual influence of the great atmospheric movements passing between Asia and Australia; and is affected by the neighbourhood of vast expanses of sea and land (Borneo and Sumatra). There are no such maxima of temperature as are recorded from the continents. The mean annual temperature is 79°. The warmest months are May and October, registering 79·5° and 79·46° respectively; the coldest January and February with 77·63° and 77·7° respectively. The daily range is much greater; at one o'clock the thermometer has a mean height of 84°; after two o'clock it declines to about 73° at six o'clock; the greatest daily amplitude is in August and the least in January and February. Eastern Java and the inland plains of middle Java are said to be hotter. The year is divided into two seasons by the prevailing winds: the rainy season, that of the west monsoon, lasting from November to March, and the dry season, that of the east monsoon, during the rest of the year. Thunder-storms are extremely frequent; but the loss of life from lightning is probably diminished by the fact that the palm-trees are excellent conductors. At night the air is almost invariably still. The average rainfall at Batavia is 72·28 in. per annum, of which 51·49 in. are contributed by the west monsoon. There are no long tracts of unbroken rainfall and no long periods of continuous drought. The rainfall is heaviest in January, but it rains only for about one-seventh of the time. Next in order come February, March and December.

Fauna.—Of the 176 mammals of the whole Indo-Malayan region the greater number occur in Java. Of these 41 are found on the continent of Asia, 8 are common to Java and Borneo, and 6 are common to Java and Sumatra (*see* M. Weber, *Das Indo-Malay Archipelago und die Geschichte seiner Thierwelt*, Jena, 1902). No genus and only a few species are confined to the island. Of the land-birds only a small proportion are peculiar. The elephant, the tapir, the bear, and various other genera found in the rest of the region are altogether absent. The Javanese rhinoceros (*Rhinoceros sundaicus*), the largest of the mammals on the island, differs from that of Sumatra in having one horn instead of two. Two species of wild swine, *Sus vittatus* and *Sus verrucosus*, are exceedingly abundant, the former in the hot, the latter in the temperate, region; and their depredations are the cause of much loss to the natives, who, however, being Mohammedans, to whom pork is abhorrent, do not hunt them for the sake of their flesh. Not much less than the rhinoceros is the banteng (*Bibos banteng* or *sundaicus*) found in all the uninhabited districts between 2,000 and 7,000 ft. of elevation. The kidang or muntjak (*Cervulus muntjac*) and the rusa or russa (*Rusa hippelaphus* or *Russa russa*) are the representatives of the deer. The kantjil (*Tragulus javanicus*) is a creature allied to the musk-deer but forming a genus by itself. The royal tiger, the same species as that of India, is still common enough to make a tiger-hunt a characteristic Javanese scene. The leopard (*Felis pardus*) is frequent in the warm regions. In the tree-tops the birds find an enemy in the matjan rembak, or wild cat (*Felis minuta*), about the size of a common cat. The dog tribe is represented by the fox-like adjag (*Cuon* or *Canis sutilans*) and by a wild dog, *Canis tenggeranus*.

Throughout the island the bats, order Cheiroptera, hold a prominent place in the fauna, the principal genera being *Pteropus, Cynonycteris, Cynopterus* and *Macroglossus*. Remarkable especially for size is the kalong, or flying fox, *Pteropus edulis*. Smaller kinds of bats are most abundant, perhaps the commonest being *Scotophilus Temminckii*. In certain places they congregate in myriads, like sea-fowl on the cliffs, and their excrement produces extensive guano deposits utilized by the people of Surakarta and Madiun. The creature known to the Europeans as the flying-cat and to the natives as the kubin is the *Galeopithecus volans* or *variagatus*—a sort of transition from the bats to the lemuroids. The apes are represented by the wou-wou (*Hylobates leuciscus*), the lutung, and kowi (*Semnopithecus maurus* and *pyrrhus*), the surili (*Semnopithecus mitratus*), and the munyuk (*Cercocebus*, or *Macacus, cynamolgos*), the most generally distributed of all. The lutung or black ape also commonly prefers the temperate region. The *Cercocebus* or grey ape keeps for the most part to the warm coast lands. Rats; mice in great variety; porcupines (*Acanthion javanicum*); squirrels (five species) and flying squirrels (four species) represent the rodents.



BY COURTESY OF THE ROYAL PACKET NAVIGATION CO.

A SULTAN IN CEREMONIAL ROBES MADE OF NATIVE BATIK

Nearly 500 species of birds are known. Many of these are, of course, rare and occupy a limited habitat far from the haunts of man. Others exist in myriads and are characteristic features in the landscape. Water-fowl of many kinds, ducks, geese, storks, pelicans, etc., give life to sea-shore and lake, river and marsh. Snipe-shooting is a favourite sport. Common night-birds are the owl (*Strix flammea*) and the goat-sucker (*Caprimulgus affinis*). Three species of hornbill, the year-bird of the older travellers (*Buceros plicatus, lunatus* and *albirostris*) live in the tall trees of the forest zone. The Javanese peacock is a distinct species (*Pavo muticus* or *spiciferus*), and even exceeds the well-known Indian species in the splendour of its plumage. *Gallus Bankiva* is famous as the reputed parent of all barndoor fowls; *Gallus furcatus* is an exquisitely beautiful bird and can be trained for cock-fighting. Of parrots two species only are known: *Palaeornis Alexandri* or *javanicus* and the pretty little grass-green *Curyllis pusilla*, peculiar to Java. As talkers and mimics they are beaten by the *Gracula javanensis*, a favourite cage-bird with the natives. The edible-nest swallow (*Collocalia fuciphaga*) builds in caves in many parts of the island.

Nearly 2,000 species of fish are enumerated. In splendour and

grotesqueness of colouring many kinds, as is well known, look rather like birds than fish. In the neighbourhood of Batavia about three hundred and eighty species are used as food by the natives and the Chinese, who have added to the number by the introduction of the goldfish, which reaches a great size. The sea fish most prized by Europeans is *Lates calcarifer* (a perch). Of more than one hundred species of snakes about 24 species (including the cobra di capella) are poisonous. Geckos are familiar visitants in the houses of the natives. There are two species of crocodiles.

As in other tropical-rain forest lands the variety and abundance of insects are amazing. The *Coleoptera* and the *Lepidoptera* form the glory of all great collections for their size and magnificence. Of butterflies proper five hundred species are known. Of the beetles one of the largest and handsomest is *Chalcosoma atlas*. Among the spiders (a numerously represented order) the most notable is a bird-killing species, *Selene scomia javanensis*. In many parts the island is plagued with ants, termites and mosquitoes.

Flora.—Hardly any similar area in the world has a flora of richer variety than Java. It is estimated that the total number of the species of plants is about 6,000; but this is probably under the mark (De Candolle knew of 2,605 phanerogamous species), and new genera and species of an unexpected character are from time to time discovered. The lower parts of the island are always in the height of summer. The villages and even the smaller towns are in great measure concealed by the abundant and abiding verdure; and their position in the landscape is to be recognized mainly by their groves, orchards and cultivated fields. The amount and distribution of heat and moisture at the various seasons of the year form the dominant factors in determining the character of the vegetation. Thus trees which are evergreen in west Java are deciduous in the east of the island, some dropping their leaves (e.g., *Tetrameles nudiflora*) at the very time they are in bloom or ripening their fruit. This and other contrasts are graphically described from personal observation by A. F. W. Schimper in his *Pflanzen-Geographie auf physiologischer Grundlage* (Jena, 1898). The abundance of epiphytes, orchids, pitcher-plants, mosses and fungi is a striking result of the prevalent humidity; and many trees and plants indeed, which in drier climates root in the soil, derive sufficient moisture from their stronger neighbours. Of orchids J. J. Smith records 562 species (100 genera), but the flowers of all except about a score are inconspicuous. This last fact is the more remarkable because, taken generally, the Javanese vegetation differs from that of many other tropical countries by being abundantly and often gorgeously floriferous. Many of the loftiest trees crown themselves with blossoms and require no assistance from the climbing plants that seek, as it were, to rival them in their display of colour. Shrubs, too, and herbaceous plants often give brilliant effects in the savannahs, the deserted clearings, the edges of the forest and the sides of the highways. The *lantana*, a verbenaceous alien introduced, it is said, from Jamaica by Lady Raffles, has made itself aggressively conspicuous in many parts of the island.

The effect of mere altitude in the distribution of the flora was long ago emphasized by Friedrich Junghuhn, the Humboldt of Java, who divided the island into four vertical botanical zones—a division which has generally been accepted by his successors, though, like all such divisions, it is subject to many modifications and exceptions. The forest, or hot zone, extends to a height of 2,000 ft. above the sea; the second, that of moderate heat, has its upper limit at about 4,500; the third, or cool, zone reaches 7,500; and the fourth, or coldest, comprises all that lies beyond. Many parts of the coast (especially on the north) are fringed with mangrove (*Rhizophora mucronata*), etc., and species of *Bruguiera*; the downs have their characteristic flora—convolvulus and *Spinifex squarrosus* catching the eye for very different reasons. Farther inland along the sea-board appear the nipa dwarf palm (*Nipa fruticans*), the *Alsbonia scholaris* (the wood of which is lighter than cork), Cycadacea, tree-ferns, screw pines (*Pandanus*), etc. In west Java the gebang palm (*Corypha gebanga*) grows in clumps and belts not far from but never quite close to the coast; and in east Java a similar position is occupied by the lontar (*Borassus flabelliformis*), valuable for its timber, its sago and its sugar, and in former times for its leaves, which were used as a writing-material.

The true forest, which occupies a great part of this region, changes its character as we proceed from west to east. In west Java it is a dense rain-forest in which the struggle of existence is maintained at high pressure by a host of lofty trees and parasitic plants in bewildering profusion. The preponderance of certain types is remarkable. Thus of the Moraceae there are in Java (and mostly here) seven genera with 95 species in all, 83 of which are *Ficus* (*see* S. H. Koorders and T. Valeton, "Boomsoorten op Java" in *Bijdr. Mede. Dep. Landbower*, 1906). These include the so-called waringin, several kinds of figs planted as shade-trees in the parks of the nobles and officials. The Magnoliaceae and Anonaceae are both numerously represented. In middle Java the variety of trees is less, a large area being occupied by teak. In eastern Java the character of the forest is mainly determined by the abundance of the Casuarina or Chimoro (*C. montana* and *C. Junghuhniana*). Another species, *C. equisetifolia*, is planted in west Java as an ornamental tree. These trees are not crowded together and encumbered with the heavy parasitic growths of the rain-forest; but their tall stems are often covered with multitudes of small vermilion fungi. Wherever the local climate has sufficient humidity, the rain-forest claims its own.

The second of Junghuhn's zones is the rich region of, more especially, tea, cinchona and coffee plantations, of maize and the sugar palm (areng). In the forest the trees are richly clad with ferns and enormous fungi; there is a profusion of underwood (*Pavetta macrophylla Javanica* and *salicifolia;* several species of *Lasianthus, Boehmarias, Strobilanthus*, etc.), of woody lianas and ratans, of tree ferns (especially *Alsophila*). Between the bushes the ground is covered with ferns, lycopods, tradescantias, Bignoniaceae, species of *Aeschynanthus*. Of the lianas the largest is *Plectocomia elongata;* one specimen of which was found to have a length of nearly 790 feet. One of the fungi, *Telephora princeps*, is more than a yard in diameter. The third zone, which consists mainly of the upper slopes of volcanic mountains, but also comprises several plateaus (the Dieng, parts of the Tengger, the Ijen) is a region of clouds and mists. There are a considerable number of lakes and swamps in several parts of the region, and these have a luxuriant environment of grasses, Cyperaceae, Characeae and similar forms. The taller trees of the region—oaks, chestnuts, various Lauraceae, and four or five species of *Podocarpus*—with some striking exceptions, *Astronia spectabilis*, etc., are less floriferous than those of the lower zones; but the shrubs (*Rhododendron javanicum, Ardisia javanica*, etc.), herbs and parasites more than make up for this defect. Much of this vegetation has European aspect; violets, primulas, thalictrums, ranunculus, vacciniums, equisetums, rhododendrons. The *Primula imperialis*, found only on the Pangerango, is a handsome species, prized by specialists. In the fourth or alpine zone occur such distinctly European forms as *Artemisia vulgaris, Plantago major, Solanum nigrum, Stellaria media;* and altogether the alpine flora contains representatives of no fewer than 33 families. A characteristic shrub is *Anaphalis javanica*, called the Javanese edelweiss.

The tallest and noblest of the numerous trees in the island is the rasamala or liquid-ambar (*Altingia excelsa*), which, rising with a straight clean trunk, sometimes 6 ft. in diameter at the base, to a height of 100 to 130 ft., spreads out into a magnificent crown of branches and foliage. The rasamala, however, occurs only in the Preanger and in the neighbouring parts of Bantam and Buitenzorg. Of the other trees that may be classified as timber—from 300 to 400 species—many attain truly noble proportions. From the economic point of view all these hundreds of trees are of less importance than *Tectona grandis*, the jati or teak, which, almost to the exclusion of all others, occupies about a third of the government forest-lands.

PEOPLE, CULTIVATION, ETC.

Population.—The population of Java (including Madura, etc.) is 36,403,833. The natives consist of the Javanese proper, the Sundanese and the Madurese. All three belong to the Malay stock. The Javanese are the most numerous and civilized of the

three peoples. The bamboo houses in the strictly Javanese districts are always built on the ground; in the Sunda lands they are raised on piles. Some of the well-to-do, however, have stone houses. The principal article of food is rice; a considerable quantity of fish is eaten, but little meat. Family life is usually well ordered. The upper class practice polygamy, but among the common people a man has generally only one wife. The Javanese are nominally Mohammedans, as in former times they were Buddhists and Brahmans; but in reality, not only such exceptional groups as the Kalangs of Surakarta and Jokjakarta and the Baduwis or nomad tribes of Bantam, but the great mass of the people must be considered as believers rather in the primitive animism of their ancestors, for their belief in Islam is overlaid with superstition.

Chief Towns.—The capital of Java and of the Dutch East India possessions is Batavia (*q.v.*), pop. 290,408. At Meester Cornelis (pop. 64,329), between 6 and 7 m. from Batavia on the railway to Buitenzorg, the battle was fought in 1811 which placed Java in the hands of the British. The other chief towns, from west to east through the island, are as follows: Serang (pop. 21,656) bears the same relation to Bantam, about 6 m. distant, which New-Batavia bears to Old Batavia, its slight elevation of 100 ft. above the sea making it fitter for European occupation. Anjer (Angerlor, Anger) lies 96 m. from Batavia by rail on the coast at the narrowest part of the Sunda Strait; formerly European vessels were wont to call there for fresh provisions and water. Pandeglang, 787 ft. above sea-level, is known for its hot and cold sulphur springs. About 17 m. west of Batavia lies Tangerang (pop. 11,061), a busy place with many Chinese. Buitenzorg (*q.v.*) is the country-seat of the governor-general, and its botanic gardens are famous. Krawang, formerly chief town of the residency of that name—the least populous of all—has lost its importance since Purwakerta (pop. 10,892) was made the administrative centre. At Wanyasa in the neighbourhood the first tea plantations were attempted on a large scale.

The Preanger regencies—Bandung, Chanjur, Sukabumi, Sumedang, Garut and Tasikmalaya—constitute the most important of all the residencies, though owing to their lack of harbour on the south and the intractable nature of much of their soil they have not shared in the prosperity enjoyed by many other parts of the island. Bandung, the chief town since 1864, lies 2,300 ft. above sea-level, 109 m. south of Batavia by rail; it is a well-built and flourishing place (pop. 170,498) with a handsome resident's house (1867), a large mosque (1867), a school for the sons of native men of rank, the most important quinine factory in the island, and a race-course where in July a good opportunity is afforded of seeing both the life of fashionable and official Java and the customs and costumes of the common people. The district is famous for its waterfalls, one of the most remarkable of which is where the Chi Tarum rushes through a narrow gully to leap down from the Bandung plateau. In the neighbourhood is the great military camp of Chimahi. Chanjur, formerly the chief town, in spite of its loss of administrative position still has a population of 11,955. From Sukabumi, a pleasant health resort among the hills at an altitude of 1,965 ft., tourists are accustomed to visit Wijnkoopers Bay for the sake of the picturesque shore scenery. Chichalengka became after 1870 one of the centres of the coffee industry. Sumedang has declined since the railway took away the highway traffic.

Agriculture.—About 40% of the soil of Java is under cultivation. Bantam and Besuki have each 16% of land under cultivation; Krawang, 21%; Preanger, 23%; Rembang, 30%; Japara, 62%; Surabaya, 65%; Kedu, 66%; Samarang, 67%. Proceeding along the south coast from its west end, we find that in Bantam all the land cultivated on its south shore amounts to at most but 5% of that regency; in Preanger and Banyumas, as far as Chilachap, the land under cultivation amounts at a maximum to 20%. East of Surakarta the percentages of land on the south coast under cultivation decline from 30 to 20 and 10. East of the residency of Probolinggo the percentage of land cultivated on the south coast falls to as low as 2. On the north coast, in Krawang and Rembang with their morasses and double chains of chalk, there are districts with only 20% and 10% of the soil under cultivation In the residencies, on the other hand, of Batavia, Cheribon, Tegal, Semarang, Surabaya and Pasuruan, there are districts having 80% to 90% of soil, and even more, under cultivation.

The land assigned to the natives for their own culture and use amounts to about 11,000,000 acres. In western Java the prevailing crop is rice, less prominently cultivated in middle Java, while in eastern Java and Madura other articles of food take the first rank. The agricultural produce grown on the lands of the government and private proprietors, comprising an area of nearly 4,000,000 acres, consists of sugar, cinchona, coffee, tobacco, tea, indigo, etc. The Javanese possess buffaloes, ordinary cattle, horses, dogs and cats. The buffalo was probably introduced by the Hindus. The horses, though small, are of excellent character, and their masters, according to their own ideas, are extremely particular in regard to purity of race. Riding comes naturally to the Javanese; horse-races and tournays have been in vogue among them from early times.



BY COURTESY OF THE ROYAL PACKET NAVIGATION CO.
A JAVANESE WOMAN IN A SARONG MADE OF BATIK

Coffee is an alien in Java. Specimens brought in 1696 from Cannanore on the Malabar coast perished in an earthquake and floods in 1699; the effective introduction of the precious shrub was due to Hendrik Zwaardekron (*see* N. P. van den Berg, "Voortbrenging en verbruck van koffie," *Tijdschrift v. Nijverh. en Landb.* 1879; and the article "Koffie" in *Encyc. Ned. Ind.* Wiji kawih is mentioned in a Kavi inscription of A.D. 856, and the bean-broth in David Tappen's list of Javanese beverages, 1667–82, may have been coffee). The first consignment of coffee (894 lb.) to the Netherlands was made in 1711–12, but it was not till after 1721 that the yearly exports reached any considerable amount. The aggregate quantity sold in the home market from 1711 to 1791 was 2,036,437 piculs, or on an average about 143 tons per annum; and this probably represented nearly the whole production of the island. In 1926 the coffee yield was 38,978 tons.

The cultivation of sugar has been long carried on in Java, and there are experimental stations at Pasuruan, Pekalongan and elsewhere, where attempts are made to overcome the many diseases to which the cane is subject. In 1926 1,741,050 tons were exported.

Tea was first introduced to Java by the Japanese scholar von Siebold in 1826. Assam tea was introduced in 1878, and this has rapidly extended. In 1926 the yield was 62,920,000 kilos.

In 1854 the government introduced the culture of cinchona with free labour, and it had considerable success under F. Junghuhn and his successors, though the varieties grown were of inferior quality. Later seed of the best cinchona was obtained, and under skilful management Java has become the chief producer of quinine in the world (1926 cinchona production, 10,643,000 kilos). Cacao is produced in the Preanger regencies, Pekalongan, Semarang, Pasuruan, Besuki, Kediri and Surakarta. *Broussonetia papyrifera* is grown for the sake of its bark, so well known in Japan as a paper material. The ground-nut (the widely spread *Arachis hypogaea* from South America), locally known as kachang china or tanah, is somewhat extensively grown. Tapioca has long been cultivated, especially in the Preanger. The industry is mainly in the hands of the Chinese, and the principal foreign purchasers are English biscuit manufacturers. The kapok is a tree from tropical America which, growing freely in any soil, is extensively used throughout Java along the highways as a support for telegraph and telephone wires, and planted as a prop in pepper and cubeb plantations. The silky fibre contained in its long capsuloid fruits is known as cotton wool; and among other uses it serves almost as well as cork for filling life-belts; and the oil from its seed is employed to adulterate ground-nut oil. Extensive experiments have been made in the cultivation of *Ficus elastica* (the karet of the natives), *Castilloa elastica*, and *Hevea brasiliensis*. The planting of gutta-percha trees was begun about

1886, and a regular system introduced in the Preanger in 1901. The *Palaquium oblongifolium* plantations at Blavan, Kemutuk and Sewang in Banyumas have also been brought under official control. Java tobacco, amounting to about 35,200,000 lb. a year, is cultivated almost exclusively in eastern Java. Among various other products which are of some importance as articles of export may be mentioned nutmegs, mace, pepper, hides, arrack and copra.

Minerals.—Of all the great islands of the archipelago Java is the poorest in metallic ores. Gold and silver are practically non-existent. Manganese is found in Jokjakarta and various other parts. A concession for working the magnetic iron sands in the neighbourhood of Chilachap was granted in 1904. Coal occurs in thin strata and small pockets in many parts (Bantam, Rembang, Jokjakarta, etc.); and in 1905 a concession was granted to a company to work the coal-beds at Bajah close to the harbour of Wijnkoopers Bay, a port of call of the Koninklijk Paketvaart Maatschappij. The discovery by De Groot in 1863 of petroleum added a most important industry to the list of the resources of Java. The great Dort Petroleum Company, now centred at Amsterdam, was founded in 1887. At the same time there is a larger importation of oil from Sumatra as well as from America and Russia. Sulphur is regularly worked in the Gunong Slamet, G. Sindoro, G. Sumbing, and in the crater of the Tangkuban Prahu as well as in other places in the Preanger regencies and in Pasuruan. Brine-wells exist in various parts. The bledegs (salt-mud wells) of Grobogan in the Solo Valley, Semarang, are best known. They rise from Miocene strata and yield iodine and bromine products as well as common salt. The natives of the district are allowed to extract the salt for their own use, but elsewhere (except in Jokjakarta) the manufacture of salt is a government monopoly and confined to the districts of Sumenep, Panekasan and Sampang in Madura, where from 3,000 to 4,000 people are hereditarily engaged in extracting salt from sea water.

Communications.—The principal railways are the Semarang-Jokjakarta and Batavia-Buitenzorg lines of the Netherlands-Indian railway company, and the Surabaya-Pasuruan, Bangil-Mulang, Sidoarjo-Paron, Kertosono-Tulung Agung, Buitenzorg-Chianjur, Surakarta-Madiun, Pasuruan-Probolinggo, Jokjakarta-Chilachap and other lines of the government. The earliest lines, between Batavia and Buitenzorg and between Semarang and the capitals of the sultanates, were built about 1870 by a private company with a state guarantee. In addition, several private companies have built either light railways or tramways, such as that between Semarang and Joana, and the total length of all lines is 2,930. There are some 7,538 miles of telegraph line, and cables connect Java with Madura, Bali and Sumatra, and Port Darwin in Australia. Material welfare was promoted by the establishment of lines of steamships between Java and the other islands, all belonging to a Royal Packet Company, established in 1888 under a special statute, and virtually possessing a monopoly on account of the government mail contracts.

Administration.—Each village (dessa) forms an independent community, a group of dessas forms a district, a group of districts a department and a group of departments a residency, of which there are seventeen. At the head of each residency is a resident, with an assistant resident and a controller, all Dutch officials. The officials of the departments and districts are natives appointed by the government; those of the dessa are also natives, elected by the inhabitants and approved by the resident. In the two sultanates of Surakarta and Jokjokarta the native sultans govern under the supervision of the residents. (For the colonial administration of Netherlands India *see* MALAY ARCHIPELAGO.)

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HISTORY

The first definite reference to Java in European literature is probably that of Marco Polo in the 13th century. Early Arab chroniclers included the greater part, if not the whole, of the archipelago under the general definition of Jawi. The history of the island before the appearance of the Portuguese (*c.* 1511) divides itself into two parts: the long period of Hindu ascendancy and the first part of the succeeding Mohammedan régime. It is said that Hindus visited Java during the first century A.D. Four Hindu kingdoms, existing in the 12th century, became the empire of Majapahit in 1376 or 1378. This lasted for one hundred years, when it was overthrown by the Mohammedans, whose missions had long been at work. A considerable civilization was built up by the Hindus, and de Barros says that the Portuguese found in Java "the most civilized people of these parts"; while all the other peoples of the archipelago were addicted to piracy, there is no account of Javanese piratical expeditions. After the overthrow of Majapahit Java again split up into many kingdoms or provinces. In 1578 the governor of the province of Mataram secured sovereign power and founded the empire of that name. The Dutch arrived in 1595; in 1602 the Dutch East India Company was formed; and in 1610, when the first Dutch governor was appointed, they were given permission to build a fort in the neighbourhood of the present Batavia. In 1677, after several unsuccessful attempts to dislodge the Dutch, the principality of Jakarta was ceded to them. During the next century and a quarter they were repeatedly in conflict with native princes, each challenge ending in an extension of their power. Possession of the Preanger was obtained in 1705 by treaty with Mataram; in 1745 Dutch authority was recognized over the whole of the north-east coast, and ten years later Mataram was divided into the states of Surakarta and Jokjakarta whose princes acknowledged the sovereignty of Holland. The kingdom of Bantam was subjugated in 1808. During the later Napoleonic period France laid claim to Dutch possessions in the East, and the hoisting of the French flag at Batavia brought in the British, who defeated the French at Weltevreden. Stamford Raffles was appointed lieutenant-governor, subject to the control of Lord Minto, governor-general of India. The ablest and most notorious of Dutch governors was Marshal Daendals, who immediately preceded Raffles. His policy of extracting the last ounce of tribute had reduced Java to terror and exhaustion. Raffles promptly revolutionized the whole system of administration, abolished the corvée and reformed the land and legal systems. He was in charge of Java from 1811 to 1816, when it was returned to the Dutch, who had to face a five years' rebellion started in 1825 by Dipa Negara, and suffered heavily in men and money at the very time when they were engaged with the revolt of Belgium at home. In 1830 Holland had no resources with which to relieve the financial difficulties of the colony. Baron van den Bosen offered to provide the necessary funds. He was governor general and colonial minister from 1830 to 1839—black years in Java's history. He resumed the Daendals' policy of extortion and savage tyranny. From a population of some 5,000,000, it is estimated that Holland by forced cultures secured £166,000,000 sterling in 12 years. Belief that Dipa Negara would ultimately return to rescue his unhappy compatriots was responsible for more than one rising from 1848 to 1888. In the meanwhile Dutch opinion at home was roused and in 1854 laws were passed intended to put the whole political and economic administration on a humane and progressive basis, though the reform did not become completely effective till 1872. Dr. Sloet van de Beele as governor general in 1866 abolished passports for natives travelling in Java, reduced the corvée to a minimum and abandoned the monopoly of the fisheries. Primary education

and a liberal penal code were introduced in 1872. Java has since been governed along lines that have frequently commanded the admiration of British students. In 1903 the natives were admitted to a part in local affairs, and a first step in representative government and decentralization was followed by others, till in 1916 a volksraad or people's council was created. The effect of education, the example of Japan, the Chinese Revolution, the Indian Swaraj movement and the national and racial unrest throughout the world, especially since the World War of 1914–18, have had their reactions and repercussions on the Javanese. While the demand for home rule has grown among the moderates, the right to independence is insisted on by extremists. In 1918 it was decreed that the budget, hitherto provided for by the Netherlands East India Council, should be transferred to the governor general acting in consultation with the volksraad, and in 1922 the constitution was further revised with a view to the extension of popular control without prejudice to the authority of the Crown. Restrictions on native representation were consequently imposed. Recent governors general have favoured giving the natives an actual majority in the volksraad. (C. H.; E. S.)

ARCHAEOLOGY

The building of stone temples began at the end of the seventh century, with its centre in middle Java. An earlier West Java period which probably used only light material, has left no traces. The classical, or middle Javanese style, which closely follows Indian traditions, flourished in the eighth and ninth centuries, and while apparently in full flower comes to a sudden and unexplained end about 928. The centre of culture is then transferred to East Java. Of the first centuries of the East Javanese period there are only very sporadic remains; the great mass of monuments dates from the 13th and 14th centuries. Art declined in the 15th century and in the beginning of the 16th century was destroyed by Islam.

Middle Javanese art yields small temples, in groups and singly, square with vestibule in front, projections for niches on the three other sides, a roof in stories with corner towers, while the decoration is very restrained and combines harmoniously with the architecture; the panels of the faces are often smooth, the only ornamentation introduced being in borders around the entrance and niches, consisting of the head of a monster (*kāla*-motive, derived from a lion's head) at the top and a *makara* at each side (*kāla-makara* ornament). The sculpture is simple and severe. On the Dieng plateau, near Wanasaba, a place of pilgrimage was dedicated to Śiva; of the original 200 buildings, eight small temples still survive.

About A.D. 750 this art becomes greatly enriched and refined, with closer political relations with the kingdom of the Śailendra's in Sumatra who ruled over Java as well; we then find larger edifices, better technique, bolder designs, and more extensive, systematically planned groups of temples; the panels of the façades are filled with ornamentation or reliefs. In Sumatra only a few buildings have survived, *e.g.*, the stupa of Muara Takus, on the Upper Kampar. In Java are numerous monuments, almost all dedicated to Mahāyāna Buddhism.

The most important monument is the stupa of Barabudur with its fore-temple Mendut. The latter contains a very large but delicately finished image of the Buddha between two Bodhisattva's. Barabudur itself is a terraced mound, dressed with stone, surrounded by four square galleries, crowned with niches, and covered by three circular terraces, with transparent bell stūpas. In these bells and in the niches are found images of the Dhyāni-Buddhas. Along the galleries Sanskrit texts are illustrated. At the top arises the main stupa, where an unfinished Buddha image has been discovered, thought to be Ādi-Buddha. The foot of the monument was covered from sight even as early as the Middle Javanese period, by a pile of stones.

These edifices were erected in the Śailendra era, A.D. 750–860. Their successors, the princes of Mataram, built even richer monuments especially in Prambanan, where, besides the Buddhistic Chandi Plaosan, consisting of two Vihāras with Bodhisattvas, terraces and side temples, the Chandi Lara Djonggrang (*c.* 900), was constructed as the national temple (dedicated to Śiva), and the royal mausoleum. Within four rows of minor temples, on the middle terrace, lie eight large buildings. The central and most important one is for Śiva and contains the images of the god and his pantheon and a series of Rāmāyana reliefs. On the sides are shrines of Brahma and Vishnu; opposite to Śiva stands a temple for his riding bull Nandin.

As to the relation between Middle and East Javanese art, East Javanese art is regarded by some as the direct descendant of the Middle Javanese style; it being assumed that only the disappearance of the connecting links prevents us from following its footsteps. Others hold that East Javanese art had an individual and indigenous character, and was contemporary with Middle Javanese art. The distinction between the two is clear. The harmonious connection between ornament and architecture is lost; the part is often made conspicuous at the cost of the whole; the systematic groups are replaced by apparently capricious combinations in different styles; the evenly flowing relief conceptions become episodic and the figures represented assume the appearance of the *wayang* puppets (Javanese shadow show). In the frame work ornamentation the *makaras* disappear and the monster heads stand alone; in the roof formation the towers are squeezed inwards, so that pyramidal forms with horizontal layers are formed. The same texts find a place in the shrines of both sects and at last Śiva-Buddha temples are built.

A few very ancient remains are pure Middle Javanese such as Chandi Badut, others, from the transition period, show a combination of Middle and East Javan characteristics, as at Chandi Sanggariti, built round a medicinal spring and at Chandi Gunung-Gangsir near Bangil, an example of ancient brick building. East Java uses brick, combined with stone, while Mid-Java prefers stone. The mausoleum-bathing place (bathing place where burial has also taken place) Djalatunda on the Penanggungan, dating from 977, is distinctly East Javanese; the reliefs which surround the middle terrace form a contrast to Middle Javanese especially in their lively composition. A later bathing place Belahan, yielded a fine image of the king Airlangga (1042) represented as Vishnu on Garuda.

The continuous series of East Javan works of art beginning half way through the 13th century with Chandi Kidal, near Malang, shows that in spite of the great delicacy of execution the feeling of proportion in the ornamentation was weakening. Medallions have become an important motive in decoration, but are replaced later by an inserted plate. At Chandi Djago, somewhat later, are high receding terraces, on top of which the temple stands. The reliefs, rendering ancient Javanese texts, are entirely in *wayang* style. The divine figures of the Bodhisattva Amoghapāśa and his followers are more in accordance with the older style. Both edifices are royal mausolea. The unfinished tower temple of Singasari, with the side chapels built out from it, contained Śivaitic deities. In this neighbourhood was found an image of the Buddhist Prajnāpāramitā, one of the best products of East Javanese art. An image of Harihara, with the features of King Krtarājasa (1294–1309), the founder of Majapahit, from the ruined shrine of Simping is the work of a nearly related school.

At its height, in the 14th century, the Majapahit empire dominated the whole archipelago, and its prosperity is reflected in its monuments. To this period belong Chandi Djabung near Kraksaän, the only example of a circular tower with a circular crown, and probably Chandi Sawentar near Blitar, striking from the severity of its lines. Of Chandi Surawana and Tigawangi only the basements remain, with rich reliefs, in which the available space is filled with reproductions of nature. At Djedong a few gateways remain, as on the ground of the ancient capital Majapahit itself, where also a bathing place and ruins of temples are found.

The chief shrine of East Java was Palah, now Chandi Panataran. This Śiva temple rose on the summit of three terraces, in the reliefs of which the episodes represented were cut up into small pieces, thus sacrificing the clearness of the story to the exigencies of decoration, and the artists gave human forms to the surrounding natural objects (clouds, mountains, trees, etc.). The

group contains further a small temple, around which serpents coil, several terraces, bathing places and many other remains quite unsystematically arranged.

A great Buddhistic group, Chandi Sanggrahan, is almost entirely destroyed; Chandi Ngetos is of much clumsier form and the grottos of Selamangleng are the only examples of relief decorations found within caves hollowed out of the living rock.

In the 15th century art in the plain was declining, as at Chandi Gambar and Tuban; whereas in the mountains there flourished sanctuaries both of a Hindu and a more Indonesian appearance; to the first belong Indrakila, Penanggungan and Penampikan; to the latter Argapura. In the extreme west of East Java, on the Lawu, Chandi Sukuh and Tjeta show how the Hindu Javanese and Indonesian culture, in the course of this century, combine to form a peculiar but not unpleasing mixture. The centre of worship here is not a temple but a pyramidal terrace.

At the beginning of the 15th century Majapahit fell and Islam became dominant, but the Hindu-Javan forms of building had become so national that the new religion used them in the minaret of Kudus and the mosque of Sendang-duwur; this style proved to have no permanent hold on life. Hinduism survived for some time in the eastern corner of the island and there raised the temples of Matjanputih. It finally succumbed and took refuge on the island of Bali, where it exists to the present day.

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(N. J. K.)

JAVELIN, a spear, particularly one light enough to be thrown, a dart. The javelin was often provided with a thong to help in casting. (*See* SPEAR.) Formerly the sheriff of a county or borough had a body of men armed with javelins, and known as javelin-men, who acted as a bodyguard for the judges when they went on assize. Their duties are now performed by the ordinary police. (*See* JAVELIN THROWING.)

JAVELIN THROWING, the art of throwing a spear to the greatest possible distance in a straight line at right angles to a given scratch line.

Javelin throwing is a natural, war-like sport, which was practised at the ancient Olympic Games and has been revived in the modern Olympiads instituted at Athens in 1896 (*see* OLYMPIC GAMES). The modern javelin consists of a wooden shaft attached to a sharp steel point and having about the centre of gravity a grip 16 centimetres broad formed of a binding of whipcord. The total length of the javelin must not exceed 8·5ft. nor the total weight be less than 1·6 lb.

The throw is made from behind a scratch line marked upon the ground and the javelin must be held by the grip. The thrower may take as long a run-up as he wishes, but may neither touch, nor overstep, the scratch line until the point of the javelin has met the ground at the end of the flight. The throw is measured from the point at which the head of the javelin strikes the ground to the scratch line, or the scratch line produced. Each competitor is allowed three trial throws and the best three (at the Olympic Games the best six) are allowed three more throws. Each competitor is credited with the best of all his throws.

As an athletic event this sport has been popular in Scandinavia longer than anywhere else among modern civilized peoples, and the finest throwers still come from Finland and Sweden. It is in Finland, too, that the best javelins are made, the shafts being chosen only from the outer, sunside layer of the finest Finnish birch trees. A javelin so shafted will fly anything up to 30ft. further than one which is shafted with English ash, which is not so stiff.

The first country to hold a javelin throwing championship in modern times was Sweden (1896). In that year Harold Andersson reached 203ft., the aggregate of his right and left hand throws being added together. The improvement that has taken place is clearly indicated by the fact that in 1924 H. Lindstrom, Sweden, with his right hand alone threw 218 ft. 6⅞ in., while S. A. Lay, New Zealand, established 222 ft. 9 in. at the A.A.A. Championship, Stamford Bridge, London. The world's record is held by E. Penttila, Finland, for his 229 ft. 3$\frac{3}{20}$ in. at Viborg, Denmark, in 1927.

The sport is a comparatively simple one to practise, but the whole secret of obtaining distance lies in the athlete's ability to make the throw with the run and without any break in the rhythm of speed or action, and of getting the javelin smoothly away from the hand without setting up tremors in the wooden shaft. The material point is to transmit the power in the longitudinal direction of the javelin so that it may fly through the air in a straight line.

Method of Throwing.—The thrower grasps the javelin by the centre grip with the hand above the shoulder, point of the javelin directed downwards. He takes up his position some 25yd. behind the scratch line and facing the direction in which the throw is to be made. He runs lightly forward at increasing speed, and 16½ft. from the scratch line he draws back the throwing arm to its fullest extent. The upper part of the body is gradually turned in the direction of the drawn-back arm. Eight and a half feet from the throwing line the right leg is bent and the left foot firmly planted as a point of resistance, and the throw is made by the pressing up of the right hip, the straightening out of the rear leg and the action of drawing the right hand, which holds the javelin, strongly forward above the right shoulder on a level with the thrower's ear. During the throw both feet should be upon the ground; after the javelin has left the hand the feet are quickly reversed.

See F. A. M. Webster, *Athletics* (1925); Silfverstrand and Rasmussen, *Illustrated Text Book of Athletics* (1926); T. E. Jones, *Track and Field* (1926).

(F. A. M. W.)

JAW, in anatomy, the term for the upper maxillary bone, and the mandible or lower maxillary bone of the skull; it is sometimes loosely applied to all the lower front parts of the skull (*q.v.*).

JĀWALĪQĪ, ABU MANṢŪR MAUHŪB UL-JĀWALĪQĪ (1073–1145), Arabian grammarian, was born at Baghdad, where he studied philology under Tibrīzī. Later he acted as imam to the caliph Moqtafi. His chief work is the *Kitāb ul-Mu'arrab*, or "Explanation of Foreign Words used in Arabic." The text was edited from an incomplete manuscript by E. Sachau (Leipzig, 1867). Many of the lacunae have been supplied from another manuscript by W. Spitta in the *Journal of the German Oriental Society*, xxxiii. Another work, supplementing the *Durrat ul-Ghawwās* of Harīrī (*q.v.*), has been published as "Le Livre des locutions vicieuses," by H. Derenbourg in *Morgenländische Forschungen* (1875).

JAWHAR, a native state of India (Thana Agency), in the Konkan division of Bombay, situated among the lower ranges of the western Ghats. Area 310 sq.m. Pop. (1921) 49,662; there is no tribute. The chief, who is a Koli by caste, traces back his descent to 1343. The chief crops are rice and millet. The principal village is that of Jawhar (pop. 2,997).

JAWORÓW, a town of Poland, 30 m. W. of Lemberg (Lwow) on the river Skto. Pop (1921) 8,910. It has pottery works and some trade in agricultural produce. The town was once the residence of John Sobieski. It passed to Poland from Austria after the World War.

JAY, JOHN (1745–1829), American statesman and jurist, son of Peter Jay, a wealthy New York merchant of Huguenot descent, was born in New York city on Dec. 12, 1745. He graduated from King's college (now Columbia University) in 1764, was admitted to the bar in 1768 and soon developed a successful practice. In 1774 he married Sarah Livingston, thus connecting himself with one of New York's most prominent families. In the controversy which led to the independence of the United States, Jay was active in resisting British coercive measures and though extremely reluctant to accept the policy of separation from the British Empire, became one of the most ardent supporters of the patriot cause.

A member of the First Continental Congress (1774), he was entrusted with drawing up an address to the people of Great Britain. In the second Congress he prepared addresses to the people of Canada and of Jamaica and Ireland (1775). While still a member of this body he was absent from its sessions in the summer of 1776 attending the provincial congress of New York and thus lost the opportunity of signing the Declaration of Independence. However, he drafted the resolutions which authorized the New York delegation to sign. In 1777 he was chairman of the committee which drafted the New York State Constitution, and shortly after became the first chief justice of the State. The following year he returned to the Continental Congress and on Dec. 10, 1778 became its president.

In the autumn of 1779 Jay was sent to Spain to seek an alliance somewhat similar to the one already existing with France. He was to guarantee the Floridas to Spain in case of Britain's defeat, and in return was to reserve to the United States the free navigation of the Mississippi; he was also to solicit a subsidy and a loan of $5,000,000. Spain had already entered the war as an ally of France, but she feared to imperil her own colonial interests by directly aiding the revolt of Britain's former colonies. Hence her Government withheld recognition of the United States and received Jay only informally. In May 1780, however, the Spanish minister, Count de Florida Blanca, intimated to him that an agreement might be reached if the free navigation of the Mississippi were waived. After months of fruitless discussion he was authorized by Congress (in Feb. 1781) to make concessions on this point. This he did against his own better judgment, but made the offer conditioned upon immediate acceptance. The Spanish Government had not acted when news came of the surrender of Yorktown, and considering the treaty no longer worth a sacrifice Jay withdrew it. He was little more successful in his efforts to obtain a loan. By pledging his personal responsibility he finally induced the Spanish minister to aid him (to the extent of about $150,000) in meeting some of the bills which Congress recklessly drew upon him; others he was forced to protest and the credit of his Government was saved only by a timely subsidy from France.

Jay was commissioned in 1781 to act with Franklin, John Adams, Jefferson and Henry Laurens in negotiating a peace with Great Britain. Their instructions were to act only with the knowledge and concurrence of the French Government; but Jay, for reasons which proved to be well founded, suspected the good faith of that Government and persuaded his fellow negotiators to treat independently with Great Britain. The provisional articles, which were more favourable to the United States than Congress had dared expect and were a great surprise to the courts of France and Spain, were signed on Nov. 30, 1782 and were adopted without important change as the final treaty on Sept. 3, 1783.

On his return to New York in July 1784 Jay was received with much enthusiasm, was presented with the freedom of the city and elected a delegate to the Continental Congress. In the following December he resigned his seat to become Secretary for Foreign Affairs. His experience in diplomacy together with his forceful personality and judicial mind enabled him to raise the uncertain status of this position to one of dignity and prestige. He proposed to Congress a plan under which the outstanding matters of dispute with Great Britain might be adjusted by a mixed commission. Although Congress took no action in the matter, Jay's advocacy of the principle of arbitration is regarded as significant in the light of the later importance of the principle in American history.

Always a strong advocate of centralization, Jay took an active part in the movement for the ratification of the Federal Constitution. He wrote, over the name "Publius," Nos. 2, 3, 4, 5 and 64 of the famous papers known collectively as *The Federalist* (*see* HAMILTON, ALEXANDER). In further defence of the Constitution he published anonymously *An Address to the People of New York*, and ably seconded Hamilton in the convention at Poughkeepsie in obtaining ratification on the part of his State. When Washington became president under the new Government, Jay was appointed chief justice of the supreme court, which position he held from Sept. 1789 to June 1795. The most famous case that came before him was that of *Chisolm* v. *Georgia* in which the question was whether a State can be sued by a citizen of another State. Jay decided against Georgia on the ground that in America sovereignty rested in the people and not in a State. This decision led to the adoption of the 11th amendment to the Constitution, which prohibits any suit being brought in the Federal courts against any State by a citizen of another State or by a foreign citizen or subject.

One of the most famous acts of Jay's career was the negotiation of a treaty between the United States and Great Britain in 1794, known as the Jay Treaty (*q.v.*), which adjusted several of the points of dispute outstanding between the two countries since the close of the Revolutionary War. Returning from England in 1795 Jay found that he had just been elected governor of New York. He served in this capacity until 1801 when he permanently retired from public life.

Aristocratic by temperament, conservative and strongly nationalist in political philosophy, Jay stood with Alexander Hamilton and John Adams as among the foremost leaders of the Federalist Party, in opposition to the more democratic and particularistic Democratic-Republican Party of Thomas Jefferson. Though possessed of a certain vanity which sometimes proved his undoing, he was brilliant, capable and of spotless integrity.

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JAY (*Garrulus glandarius*), a member of the crow family and the type of the subfamily *Garrulinae*. It inhabits the whole of Europe south of 64° N. and is fairly common in the wooded districts of Great Britain, where, however, it is remorselessly persecuted by gamekeepers and is consequently very shy. The body is cinnamon-coloured, the tail-coverts white and the wings contain patches of vivid blue and black striped feathers, used by fishermen for artificial flies. The voice is a harsh scream. The jay, despite its shyness, is a lively bird with an insatiable curiosity. The nest is placed in a tree or bush and in it are laid four to seven eggs of a greenish-white colour closely freckled with light olive. The flight is weak, and on the ground the bird hops. During the breeding season it is almost wholly silent. Its food includes fruits, insects, carrion, and during the spring and summer, eggs and young birds. In east Russia its range overlaps that of the allied *G. brandti*, which is distributed thence across Siberia to Japan. In the south of Europe, Caucasia and Asia Minor occurs *G. krynicki*. Other species occur in Asia and north Africa.



THE ORDINARY EUROPEAN JAY

In America the commonest forms are the extremely tame Canada jay (*Lanius canadensis*), often called the "whisky-jack," which has a very sombre coloration, and the beautiful blue jay (*Cyanurus cristatus*) of eastern North America. Both have habits somewhat similar to the European species. The latter has a considerable talent for mimicry. Allied to the Canada jay is the Siberian jay (*L. infaustus*) of northern Europe and Asia. Like the Canada jay, it inhabits pine forests.

JAY TREATY, the name applied, in U.S. history, to a

treaty signed on Nov. 19, 1794 by John Jay and Lord Grenville on behalf of the United States and Great Britain, respectively. The American grievances which led to the negotiations consisted principally in Great Britain's refusal to withdraw her troops from the forts on the north-western frontier, as required by the peace treaty of 1783; her refusal to make compensation for slaves carried away by the British army at the close of the American Revolution; her restrictions on American commerce; her refusal to enter into any commercial treaty with the United States; and the anti-neutral policy according to which British naval vessels were authorized to search American merchantmen and impress American seamen.

After negotiations which lasted for several months, Jay obtained a treaty which, although departing widely from his instructions, he believed would adjust some of the differences between the two nations. It provided that the north-west posts should be evacuated by June 1, 1796, that commissioners should be appointed to settle the north-east and north-west boundaries, and that the claims of British merchants as well as the American claims for compensation for illegal seizures should be referred to commissioners. The remaining articles of the documents constituted a treaty of commerce. By them the United States was granted privileges of trade in the British East Indies; some provisions were made for reciprocal freedom of trade between the United States and the British dominions in Europe; and some articles were specified under the head of "contraband of war," but only limited concessions were granted in the West Indian trade. The latter clause, which was limited to two years from the close of the existing war (between France and Great Britain and her allies), provided that American vessels not exceeding 70 tons burden might trade with the West Indies, but should carry only American products there and take away to American ports only West Indian products; moreover, the United States was to export in American vessels no molasses, sugar, coffee, cocoa or cotton to any port of the world. Other clauses provided for the free navigation of the Mississippi, that no enemy of England should fit out privateers in American waters, and that Americans should not accept commissions from the French minister. The treaty was silent on such important subjects as compensation for stolen slaves, neutral rights and the impressment of American sailors.

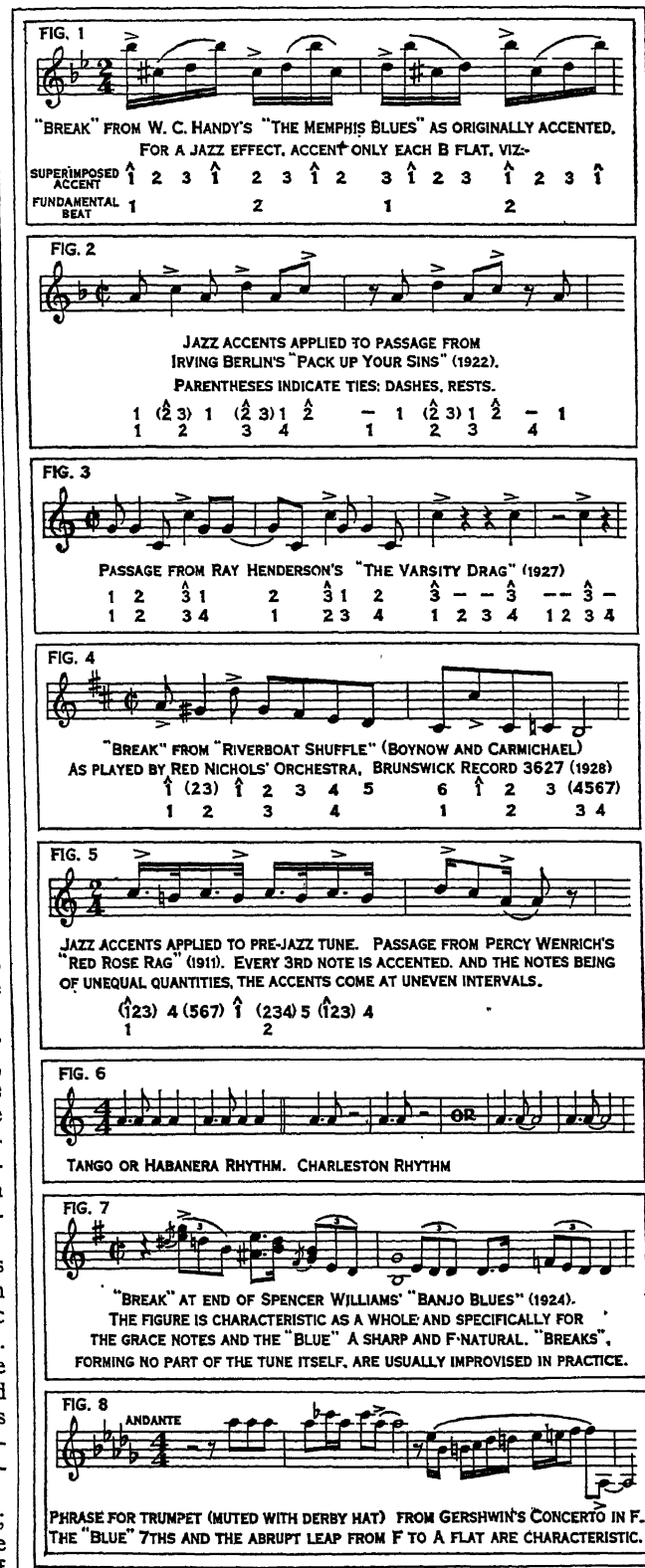
The treaty was laid before a special session of the Senate on June 8, 1795, and, with the exception of the article relating to West Indies trade, was ratified on the 24th by a bare two-thirds majority. Its subsequent publication raised a storm of protest both in America and France. The opposition filled newspapers with articles denouncing it and Jay was burned in effigy. Once in operation the treaty grew in favour.

JAZZ is (1) a technique for the playing of any music, embracing tricks of accent and rhythm, interpolated melodic figures, and instrumental effects; and (2) written music calling for the use of that technique or exhibiting its influence. It may have originated in a revolt of the individual; in the insubordinate attempt of one member of an orchestra to seize attention by startling or amusing the listeners; but the revolt, as such, has been practically suppressed, and its mischievous and humorous tradition, in many quarters, forgotten.

The rhythmical foundation of jazz is *ragtime,* which displays a syncopated air, brought into sharp relief by a regular beat, in common time, in the bass. Ragtime has long been characteristic of the religious and secular folk music of the American negro. In the first decade of the 20th century ragtime became the American popular idiom, and was used with increasing fluency and variety. Jazz represents, in one respect, a continuation of this development of and preoccupation with rhythm. One of its principal novelties, consisting of abnormalities of accent, would probably have come independently of jazz bands.

The commonest of these abnormalities is accenting the off-beat; thus, in 4–4 time, stressing the 2nd and 4th beat in each measure instead of the 1st and 3rd. Almost as common is the device of superimposing a 1, 2, 3 rhythm upon the fundamental 1, 2 or 1, 2, 3, 4 of the dance; *i.e.*, a brief melodic passage is conceived of as divided into consecutive groups of three notes of equal value and is accented accordingly, giving a momentary effect of triple time; obviously, a jazz effect may also be obtained by so accenting beats or equal fractions thereof as to group them in fives, sevens, etc.; or the intervals between accents may be unequal (figs. 1–5).

The effect of jazz accents is complicated by skipping or tying notes (figs. 2, 3, 4), skipping or anticipating beats, etc. "Licks" (unexpected accents interpolated by single instruments) are sprinkled here and there. Patterns are formed by silence through a given part of each of several successive bars ("stop time").



The rhythm instruments have various patterns of their own which may be independent of the jazz accents in the melody. The famous "Charleston" rhythm, common in old spirituals as in jazz, was based on a skipped beat, and arrived at by taking the tango rhythm (a dotted quarter, an eighth and two quarter-notes), and striking only the dotted quarter and the eighth-note (fig. 6). The fashion in jazz rhythms and accents constantly changes; with familiarity, each is successively discarded as "corn-fed".

BEFORE AND DURING THE RAGTIME PERIOD

Jazz in its aspect of instrumental effects and tone colours was incubating before and during the ragtime period. Negro musicians in the 19th century unquestionably played cornets into buckets, boxes and derby hats, filed down the mouthpieces to raise their range, scratched a washboard or a mule's jaw-bone to mark rhythms, played tunes by blowing into the mouths of jugs or lengths of gas-pipe, as to-day. But their experiments were in general sporadic, individual and above all, covert. In jazz they are open, and the visual effect of comic instruments, as of the bodily contortions of the musicians, is, though dispensable, a part of jazz itself. But before the official appearance of jazz, New Orleans, if not other places, had genuine negro jazz bands, obscure and illiterate, but playing a violent form of this music, chiefly marked by a polyphony of strange tone-colours and instrumental effects. Experimentation for novel colours and effects has always been characteristic of jazz orchestras. It has eliminated the strings or retired them to the background in favour of saxophones, clarinets, brasses and banjoes; has extended the upper range of clarinet, trumpet and trombone; perfected a legato technique for trombone and tuba; developed the banjo into a resounding rhythm instrument, the tenor banjo; discovered various effects possible to wind instruments without mechanical aid, such as the guttural flutter-tonguing, the explosive stop-tonguing; and perfected many unfamiliar and effective mutes for the brasses, all with the object at first of surprise and amusement simply, but later, of beauty or volume as well.

If the coming into existence of jazz bands was due to any single stimulus rather than simple evolution, the most plausible stimulus was the rise of the negro *blues* (*q.v.*) and their exploitation by W. C. Handy. The blues are a highly distinctive form of Afro-American secular folk song, which became popular among lower-class Southern negroes before 1910; they are at once melancholy and humorous, and deal exclusively with the singer's own emotions and philosophy. Their chief peculiarities are a three-line stanza, a melody of only 12 measures, in common time, and the fact that between the last syllable of a line, as sung, and the first syllable of the next, there generally occurs a space through which the voice is silent and which is filled in with improvised figures (a "break") on the accompanying instrument. Handy, a negro orchestra-leader in Memphis, Tenn., in 1910 composed a dance in the blues pattern and in 1912, when it had attracted wide attention, published it as "The Memphis Blues." In playing this, the first published blues, one musician after another of the Handy "band" (strings, clarinet, trombone, saxophone, piano and drum) would take the "break" in the third section (fig. 1) solo, and strive to *outdo* the others; on repetitions, moreover, a soloist would improvise a whole chorus while the rest marked the time and the original harmonic changes; a procedure similar to that of the modern "hot chorus." "The Memphis Blues" contained, besides its breaks, another important peculiarity: the frequent flatting of the seventh and third notes in the scale, in a melody whose prevailing mode was major, by which Handy had intended to suggest characteristic slurs of the untrained negro voice. These harsh and mournful sounds are a principal melodic characteristic of jazz, and whether or not they are slurred, or sounded as part of the favourite discord of the minor second, they are known as "blue notes." They abound in the nervous, angular figures of the "breaks" and "hot choruses," in the blues-type of piano jazz (all crashes and chirps) which cannot be analysed here, while jazz tunes are frequently rounded off by a brief *coda* ending on the flat seventh or the chord of the ninth. While the blues pattern itself has not been adopted by white composers, the "breaks," "hot choruses" and "blue notes" are of the essence of jazz, while the spirit of competition aroused by the breaks may well have been the original incentive to determined experimentation in search of surprising and humorous effects. Finally, the humour of the best modern jazz inherits the rueful or bitter flavour of the blues.

POPULARIZATION AND DEVELOPMENT

By 1915 there were white bands in New Orleans, with jazz instruments, and playing what was first known as jazz: polyphony in the sense that while the rhythm and harmonic scheme of some given song were referred to, each man otherwise played, as piercingly as he could (in *competition* with his fellows), whatever he pleased. Late that year one Joseph K. Gorham discovered and brought to Chicago one of these bands (clarinet, cornet, trombone, drum and piano), which there achieved fame as "Brown's Band from Dixieland." Bert Kelly, another manager, in the same winter bestowed the name "jazz bands" upon his numerous Chicago orchestras; and in the spring of 1916 imported a second white New Orleans organization (clarinet, banjo, saxophone, drum and piano). (Kelly was doubtless familiar with one or both of the previous uses of the word "jazz": as a disreputable verb, and, in New Orleans, as a verb applied to music and meaning "to speed up." No more fanciful derivations are worth considering.) In 1916 Brown's Band invaded New York; in 1917 the Dixieland Jazz Band (white, and from New Orleans) spread jazz to the winds with its phonograph record of D. J. La Rocca's "Livery Stable Blues," and Jim Europe (coloured) as an A.E.F. bandmaster introduced it to Europe.

The inevitable movement to modify the hideous noisiness of early jazz was led by Art Hickman, a California orchestra leader, and later taken over by Paul Whiteman, whose celebrated arranger, Ferdie Grofé, introduced the practice of writing elaborate orchestrations of the jazz repertoire which the musicians were required to play as written; sacrificing spontaneity to discipline, but obtaining remarkable beauty and volume of tone. The present-day "sweet" jazz, sprung from the Hickman-Whiteman reaction against cacophony, is opposed to "hot" jazz. The latter, descendant of the Memphis ("take your turn") and New Orleans (polyphonic) schools, has modified the pandemonium of Brown's Band and renewed acquaintance with melody; but to a far greater degree than the "sweet" orchestras, keeps in mind its traditional objectives, surprise and humour. In both modern schools crystallization has set in, and devices which once had, but have long since lost the power to startle or amuse, are now standard; but the apparent social ambition of "sweet" leaders to achieve some sort of *rapprochement* with "respectable" music and symphony orchestras, impairs the prospect that the most interesting future developments of jazz will come from their quarter.

It is true that to Whiteman's suggestion (and the inspired practical collaboration of Grofé) is owed a remarkable experiment in the adaptability of jazz idioms to larger musical forms, George Gershwin's "Rhapsody in Blue" (1924), but the jazz of this composition is in small part "sweet." The "Rhapsody" and its composer's Piano Concerto in F (1926) demonstrated that the two primary objects of jazz can be attained by its own methods independently of the monotonous foxtrot dance-time—a condition to the possibility of long and yet interesting jazz compositions. To how many composers such will be possible is another question. Although writers of unquestioned musicianship and some talent have made the attempt, Gershwin's success remains unique. But one major service which jazz may certainly be said to have rendered to music generally is its revelation of the possibilities of old and new instruments and mutes, and of the volume and beauty of tone and variety of colour obtainable by small orchestras.

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Ballanta, *St. Helena Island Spirituals* (1925); Practical handbooks are: Arthur Lange, *Arranging for the Modern Dance Orchestra* (1926); F. Skinner, *Simplified Method for Modern Arrangement* (1928). Phonograph records are listed in A. Niles, "Jazz, 1928," *Bookman* (N.Y., Jan. 1929). (A. NI.)

JEALOUSY, originally a condition of zealous emulation, hence the modern sense of resentment at being supplanted in the affection of another. The word is another form of "zealous," and is derived from Gr. ζῆλος, ardour, from ζέειν, to boil, ferment. A thick, ribbed and non-transparent glass was formerly called "jealous-glass"; *cf.* the borrowed French word *jalousie,* a blind or shutter, made of slats of wood, which slope in such a way as to admit air and a certain amount of light.

JEAN D'ARRAS, a 15th-century *trouvère,* was the collaborator with Antoine du Val and Fouquart de Cambrai in a collection of stories entitled *Évangiles de quenouille,* told by ladies at their spinning, who relate the current theories on a great variety of subjects. The work throws much light on mediaeval manners.

There were many editions of this book in the 15th and 16th centuries, one of which was printed by Wynkyn de Worde in English, as *The Gospelles of Dystaves.* A modern edition (Collection Jannet) has a preface by Anatole France.

Another *trouvère,* JEAN D'ARRAS who flourished in the second half of the 14th century, wrote, at the request of John, duke of Berry, a long prose romance entitled *Chronique de la princesse.* It relates with many digressions the antecedents and life of the fairy Mélusine (*q.v.*).

JEAN DE MEUN or DE MEUNG (1250?–1305?), whose original name was Jean Clopinel or Chopinel, was born at Meun-sur-Loire. Tradition asserts that he studied at the University of Paris. At any rate he was, like his contemporary, Rutebeuf, a defender of Guillaume de Saint-Amour and a bitter critic of the mendicant orders. Most of his life seems to have been spent in Paris, where he possessed, in the Rue Saint-Jacques, a house described in 1305 as the house of the late Jean de Meung. Jean de Meun says that in his youth he composed songs that were sung in every public place and school in France. In the enumeration of his own works he places first his continuation of the *Roman de la rose* of Guillaume de Lorris (*q.v.*). The date of this second part is generally fixed between 1268 and 1285 by a reference in the poem to the death of Manfred and Conradin, executed (1268) by order of Charles of Anjou (d. 1285), who is described as the present king of Sicily. M. F. Guillon (*Jean Clopinel,* 1903), however, considering the poem primarily as a political satire, places it in the last five years of the 13th century. Jean de Meun doubtless edited the work of his predecessor, Guillaume de Lorris, before using it as the starting-point of his own vast poem, running to 19,000 lines. The continuation of Jean de Meun is a satire on the monastic orders, on celibacy, on the nobility, the papal see, the excessive pretensions of royalty, and especially on women and marriage. Guillaume had been the servant of love, and the exponent of the laws of "courtoisie"; Jean de Meun added an "art of love," exposing with brutality the vices of women, their arts of deception, and the means by which men may outwit them.

Spirit and Style.—Jean de Meun embodied the mocking, sceptical spirit of the *fabliaux.* He did not share in current superstitions, he had no respect for established institutions, and he scorned the conventions of feudalism and romance. His poem shows in the highest degree, in spite of the looseness of its plan, the faculty of keen observation, of lucid reasoning and exposition, and it entitles him to be considered the greatest of French mediaeval poets. He handled the French language with an ease and precision unknown to his predecessors, and the length of his poem was no bar to its popularity in the 13th and 14th centuries. Part of its vogue was no doubt due to the fact that the author, who had mastered practically all the scientific and literary knowledge of his contemporaries in France, had found room in his poem for a great amount of useful information and for numerous citations from classical authors.

Jean de Meun translated in 1284 the treatise, *De re militari,* of Vegetius into French as *Le livre de Vegèce de l'art de chevalerie* (ed. Ulysse Robert, *Soc. des anciens textes fr.,* 1897). He also produced a spirited version, the first in French, of the letters of Abelard and Héloïse. A 14th-century ms. of this translation in the Bibliothèque Nationale has annotations by Petrarch. His translation of the *De consolatione philosophiae* of Boëtius is preceded by a letter to Philip IV. in which he enumerates his earlier works, two of which are lost—*De spirituelle amitié* from the *De spirituali amicitia* of Aelred of Rievaulx (d. 1166), and the *Livre des merveilles d'Hirlande* from the *Topographia Hibernica,* or *De Mirabilibus Hiberniae* of Giraldus Cambrensis (Giraud de Barry). His last poems are doubtless his *Testament* and *Codicille.* The *Testament* is written in quatrains in monorime, and contains advice to the different classes of the community.

See also Paulin Paris in *Hist. lit. de la France,* xxviii. and E. Langlois in *Hist. de la langue et de la lit. française,* ed. L. Petit de Julleville, ii. (1896), and the introd. to Langlois's 1914 ed. of the *Roman de la rose* (*q.v.*).

JEANNETTE, a borough of Westmoreland county, Pa., U.S.A., 23m. S.E. of Pittsburgh; served by the Pennsylvania Railroad. The population was 10,627 in 1920 (20% foreign-born white), and was estimated locally at over 18,000 in 1928. It is supplied with natural gas, and is primarily a manufacturing centre, with an aggregate factory output in 1925 valued at $20,761,744. The principal product is glass, of many kinds and for many purposes: window-glass, marine and submarine equipment, table and cooking-ware, lamps, jars, toys, bottles, sidewalks, prism tile, lenses and many other articles. For the first decade glass was the only manufacture, but since 1899 other industries have been established, notably the manufacture of rubber goods, power-plant equipment, heating systems and iron pipe-fittings. Jeannette was founded in 1888, and was incorporated as a borough in 1889.

JEANNIN, PIERRE (1540–1622), French statesman, was born at Autun. A pupil of the great jurist Jacques Cujas at Bourges, he was an advocate at Dijon in 1569 and became councillor and then president of the *parlement* of Burgundy. He opposed in vain the massacre of St. Bartholomew in his province. As councillor to the duke of Mayenne he sought to reconcile him with Henry IV. After the victory of Fontaine-Française (1595), Henry took Jeannin into his council and in 1602 named him intendant of finances. He took part in the principal events of the reign, negotiated the treaty of Lyons with the duke of Savoy (*see* HENRY IV.), and the defensive alliance between France and the United Netherlands in 1608.

See Berger de Xivrey, *Lettres missives de Henry IV.* (in the *Collection inédite pour l'histoire de France*), t. v. (1850); P(ierre) S(aumaise), *Eloge sur la vie de Pierre Janin* (Dijon, 1623); Sainte-Beuve, *Causeries du lundi,* t. x. (May 1854).

JEANS, SIR JAMES HOPWOOD (1877–), English mathematician, was born in London on Sept. 11, 1877. He was educated at Cambridge, where he was second wrangler in 1898 and Smith's Prizeman in 1900. He has held the posts of Stokes lecturer in applied mathematics at Cambridge and professor of applied mathematics at Princeton university and since 1919 he has been secretary of the Royal Society. Jeans has applied mathematics to many branches of physics and astronomy with marked success. In the kinetic theory of gases he has given proofs for the law of equipartition of energy and for Maxwell's law of distribution of the velocity of molecules. Jeans developed a formula for the distribution of energy emitted by a black body; he used classical methods and arrived at a formula similar to that of Rayleigh which only holds for long wave-lengths. He has also written on other aspects of radiation such as the interaction between radiation and free electrons. In astronomy Jeans has applied mathematics to such good effect that a number of original theories on cosmogony have resulted. As an example, his work on the stability of pear-shaped figures may be taken; he considered such bodies rotating in an incompressible fluid, later he considered the fluid to be compressible. The same mathematical analysis was then applied to problems of splitting due to tides produced by the approach of a second body and this in its turn was applied to the break-up of stars. Jeans also showed that Laplace's theory of the origin of the solar system was incorrect. Another problem of stellar dynamics which has claimed his attention is the effect of the gravitational attraction on the motion of stars. He has also written papers on the formation of binary stars; on the nature of spiral nebulae; on his theory of giant and dwarf stars; on the source of stellar energy; and on the evolution and radiation of gaseous stars.

Jeans is the author of *Dynamical Theory of Gases* (1904), *Mathematical Theory of Electricity and Magnetism* (1908), *Problems of Cosmogony and Stellar Dynamics* (1919), *Radiation and the Quantum Theory* (1914 and 1924), *Atomicity and Quanta* (1926), *Astronomy and Cosmogony* (1928). He was knighted in 1928.

JEBAVÝ, VÁCLAV (1868–), Czech poet, universally known as Ottokar Březina, was born at Počátky, Bohemia, on Sept. 13, 1868. He taught in a secondary school at Jaromeřic, Moravia, where he lived a life of contemplative seclusion, declining the honours and material advantages offered him by the Government. His published works consist of five books of poetry: *Secret Distances* (1895); *Dawn in the West* (1896); *Polar Winds* (1897); *Temple Builders* (1899) and *The Hands* (1901), and a volume of prose essays, *Music of the Springs* (1903); besides a number of poems scattered in various literary papers.

Březina is admittedly the greatest modern Czech poet, and is even judged by some foreign critics to be the greatest contemporary mystic poet of all nations. His development as a mystic philosopher and religious visionary passed from the subjective pessimism of his early poems, through a transcendental revelation of mystic realities, to an evolutionary optimism and a joyful belief in cosmic brotherhood. His diction is so concentrated and pregnant with thought that it presents considerable difficulty at first reading; but this is more than compensated for by the superlative beauty and entrancing music of his verse, the remarkable wealth of his imagery and the extraordinarily human and personal appeal of his philosophy which has its roots in the mystic tradition of the mediaeval Czech religious sects.

See Paul Selver, *Anthology of Modern Slavonic Literature* (1919); *Modern Czech Poetry* (1920), and *A Study in Czech Literature* (1921).

JEBB, SIR RICHARD CLAVERHOUSE (1841–1905), English classical scholar, was born at Dundee on Aug. 27, 1841, and died at Cambridge, where he was professor of Greek, on Dec. 9, 1905. He was educated at Charterhouse and at Trinity college, Cambridge. In 1891 he was M.P. for Cambridge university, in 1900 he was knighted, and in 1905 he received the Order of Merit. Jebb was acknowledged to be one of the most brilliant classical scholars of his time, a humanist in the best sense, and his powers of translation from and into the classical languages were unrivalled. A collected volume, *Translations into Greek and Latin*, appeared in 1873 (ed. 1909). He married in 1874 the widow of General A. J. Slemmer, of the U.S. army, who survived him.

The following are his chief works: The *Characters* of Theophrastus (1870), text, introduction, English translation and commentary (re-edited by J. E. Sandys, 1909); *The Attic Orators from Antiphon to Isaeus* (2nd ed., 1893), with companion volume, *Selections from the Attic Orators* (2nd ed., 1888); *Bentley* (1882); *Sophocles* (3rd ed., 1893), with translation and notes; *Bacchylides* (1905), text, translation and notes; *Homer* (3rd ed., 1888), an introduction to the *Iliad* and *Odyssey; Modern Greece* (1901); *The Growth and Influence of Classical Greek Poetry* (1893); trans. *Rhetoric* of Aristotle (ed. J. E. Sandys, 1909).

A selection from his *Essays and Addresses*, and a subsequent volume, *Life and Letters of Sir Richard Claverhouse Jebb* (with critical introduction by A. W. Verrall) were published by his widow in 1907; *see* also J. E. Sandys, *Hist. of Classical Scholarship*, iii. (1908).

JEBEIL, a village of Syria, about 20 m. N. of Beirut. Pop. about 1,000. There are traces of ancient magnificence in the ruins of its wall, castle, temple and in its numerous granite columns. Written in ink on earthen vessels recently discovered at Luxor were lists of foreign peoples, and heading the Asiatic group came the name of Byblos, i.e., *Kpny*, a name which passed into *Kubn* and then *Gubl*. Thus in the 3rd millennium B.C.—for such is the date of the vessels—Byblos took pride of place before Tyre and Sidon, confirming a tradition of Philo of Byblos as to its antiquity and importance. Byblos owed its position in those days to its flourishing trade in wood and resinous materials of which Egypt took large quantities. In biblical times its sculptors and shipwrights were famous.

A fortunate landslip at the south-east corner of the citadel in 1922 led to the discovery of a hypogeum containing a sarcophagus of great size. Since then a whole royal necropolis containing sarcophagi of the rulers of Byblos has been exposed. Nine such tombs have been examined, but all except three had been previously violated. The funerary furniture shows that Byblos of the 14th century B.C. was Egypt in miniature; although it had at its head indigenous rulers, they were in the pay of the Pharaohs. On a sarcophagus of Ahiram, king of Byblos, found together with cartouches of Ramses II. (13th century B.C.) is an inscription in Phoenician characters. This is 400 years earlier than any Phoenician inscription hitherto known and the forms of the letters are found to differ little (*aleph* is an exception) from the well-known inscriptions of the 9th and 8th centuries B.C. Byblos in the course of time was eclipsed by Sidon and later by Tyre. It was taken by both Alexander the Great and Pompey. The citadel was built with ancient building materials on an old site. The crusaders captured the town in 1103 but lost it to Saladin in 1189.

The temple of Baalat (Aphrodite Byblia), the orgies in which Lucian has described (*Dea. Syr.* vi.), has been partially excavated. It appears to have been erected about 1900 B.C. and existed substantially in its original form until the middle ages when, following on the crusades, Muslim fanaticism destroyed its famous statues and wrecked the building. The modern epoch has exploited it as a quarry for building stones.

See C. Virolleaud, "Découverte à Byblos d'un Hypogée de la douzième Dynastie Egyptienne," *Syria*, iii. (1922), 273 *seq.*; R. Dussaud, "Byblos et la mention des Giblites dans l'Ancien Testament," *Syria*, iv. (1923) 300 *seq.*; "Les Inscriptions phéniciennes du Tombeau de Ahiram, roi de Byblos," *Syria*, v. (1924), 135 *seq.*; "Le Sanctuaire phénicien de Byblos d'après Benjamin de Tudèle," *Syria*, vii. (1926), 247 *seq.*; G. Contenau, *La Civilisation Phénicienne* (1926); M. Pillet, "Le Temple de Byblos," *Syria*, viii. (1927), 105 *seq.*; R. Dussaud, "Nouveaux Renseignements sur la Palestine et la Syrie vers 2000 avant notre Ere," *Syria*, viii. (1927), 216 *seq.* (E. Ro.)

JEBEL, an Arabic word for a mountain chain or a mountain, frequently used in place names, *e.g.*, Gibraltar, *i.e.*, Tarik's mountain. *Jebili* signifies a mountaineer.

JEDBURGH (jĕd'bŭr-ụ), royal burgh, parish and county-town, Roxburghshire, Scotland. Pop. (1921), 2,426; on Jed Water, a tributary of the Teviot, 56¼ m. S.E. of Edinburgh by the L.N.E. railway, via Roxburgh and St. Boswells (49 m. by road). There have been many variants of the name, while locally the word is often pronounced Jethart. The town is situated on the left bank of the Jed, the main streets running at right angles from each side of the central market-place. Of the renowned group of Border abbeys—Jedburgh, Melrose, Dryburgh and Kelso—that of Jedburgh is the stateliest. David, prince of Cumbria, founded a priory here for Augustinian monks from the abbey of St. Quentin at Beauvais in France, and in 1147, after he had become king, erected it into an abbey dedicated to the Virgin. Repeatedly damaged in Border warfare, it was ruined in 1544–45 during the English invasion led by Sir Ralph Evers (or Eure). The establishment was suppressed in 1559, the revenues being temporarily annexed to the Crown. After changing owners more than once, the lands were purchased in 1637 by the 3rd earl of Lothian. Latterly five of the bays at the west end had been utilized as the parish church, but the 9th marquess of Lothian built a church, and presented it to the heritors in exchange for the ruined abbey. In 1913 it was taken over for the nation by the Ancient Monuments Commission.

The abbey was built of Old Red sandstone, and is a beautiful example of the Norman and Transition styles. The west front contains a great Norman porch and a fine wheel window. The tower, at the intersection of the nave and transepts, is of unusually massive proportions. With the exception of the north piers and a small portion of the wall above, which are Norman, the tower dates from the end of the 15th century. The whole of the south transept has perished. The north transept, with early Decorated windows, has been covered in and walled off, and is the burial-ground of the Kerrs of Fernihirst, ancestors of the marquess of Lothian. The earliest tombstone is dated 1524; one of the latest is the recumbent effigy, by G. F. Watts, R.A., of the 8th marquess of Lothian (1832–1870). All that is left of the choir, which contains some very early Norman work, is two bays, corresponding to the design of the nave. It is supposed that the aisle,

with Decorated window and groined roof, south of the chancel, formed the grammar school (removed from the abbey in 1751) in which Samuel Rutherford (1600–1661), principal of St. Mary's College, St. Andrews, and James Thomson, author of *The Seasons,* were educated. The door from the south aisle into a garden, formerly the cloister, is a copy of one which had decayed. It was designed by Sir Rowand Anderson, under whose superintendence restoration in the abbey was carried out.

The castle stood on high ground at the south end of the burgh, or "town-head." Erected by David I., it was one of the strongholds ceded to England in 1174, under the treaty of Falaise, for the ransom of William the Lion. It was, however, so often captured by the English that it became a menace rather than a protection, and the townsfolk demolished it in 1409. It was occasionally used as a royal residence. The site was occupied in 1823 by the county prison, now known as the castle, which gradually fell into disuse and was acquired by the corporation in 1890. A house exists in Backgate in which Mary Queen of Scots resided in 1566, one in Castlegate which Prince Charles Edward occupied in 1745, and one in Canongate where Sir David Brewster was born.

The grammar school (built in 1883 to replace the successor of the school in the abbey) was founded by William Turnbull, bishop of Glasgow (d. 1454). The old market cross still exists. The chief industry is the manufacture of woollens (blankets, tweeds, etc.), but corn-milling and tanning are carried on, and fruit (especially pears) and garden produce are in repute. Jedburgh was made a royal burgh in the reign of David I., and received a charter from Robert I. and another, in 1566, from Mary Queen of Scots. Sacked and burned time after time during the Border strife, the townsmen became keen fighters.

"Jethart" or "Jeddart justice," according to which a man was hanged first and tried afterwards, seems to have been a hasty generalization from a solitary fact—the summary execution in James VI.'s reign of a gang of rogues at the instance of Sir George Home, but has nevertheless passed into a proverb.

JEEJEEBHOY, SIR JAMSETJEE, Bart. (1783–1859), Indian merchant and philanthropist, born in Bombay, of Parsee parents, and was left an orphan in early life. He made his way in life by his own unaided ability. Before he was twenty he undertook a voyage to China; and he subsequently initiated a systematic trade with that country. His second return voyage from China was made in one of the East India Company's fleet, which, under the command of Sir Nathaniel Dance, defeated the French squadron under Admiral Linois (Feb. 15, 1804). On his fourth return voyage from China, the Indiaman in which he sailed was forced to surrender to the French, by whom he was carried as a prisoner to the Cape of Good Hope, then a neutral Dutch possession; eventually he made his way back to Calcutta in a Danish ship. A fifth voyage to China was more successful. He had fairly established his reputation as a merchant, and settled down in Bombay where he extended his commercial operations on a great scale. By 1836 he had amassed what at that period was regarded as fabulous wealth.

Jamsetjee Jeejeebhoy then began that career of private and public philanthropy which is his chief title to fame. Hospitals, schools, homes of charity, pension funds, were founded or endowed by him, while numerous public works in the shape of wells, reservoirs, bridges, causeways and the like, not only in Bombay, but in other parts of India, were the creation of his bounty. The total of his known benefactions amounted at the time of his death, which took place in 1859, to over £230,000. At that time the various communities of India were much more isolated in their habits and their sympathies than they are now. Jamsetjee Jeejeebhoy's unsectarian philanthropy awakened a common understanding and created a bond between them which had a national and political significance. His services were recognized first in 1842 by the bestowal of a knighthood, and in 1858 by that of a baronetcy. These were the first distinctions of their kind conferred by Queen Victoria upon a British subject in India.

JEFFERIES, RICHARD (1848–1887), English naturalist and novelist, was born on Nov. 6, 1848, at Coate near Swindon. He attended school at Sydenham and then at Swindon until the age of fifteen, when he made an unsuccessful attempt to reach Russia and then America. Returning home, he obtained a post on the local paper. His early novels were failures, but in 1872, he published a remarkably original letter in *The Times,* on "The Wiltshire Labourer," which was the turning-point in his career. In 1873 he found his true field of work, the life of the country, and began to write for *Fraser's Magazine* on "Farming and Farmers." The rest of his history is that of continual advance, from close observation to that intimate communion with Nature which is manifested in his later pages. Jefferies died at Goring on Aug. 14, 1887. His best-known books are: *The Gamekeeper at Home* (1878); *Wild Life in a Southern County* (1879); *Wood Magic* (1881); *Life of the Fields* (1884), containing the best paper he ever wrote, "The Pageant of Summer"; *Amaryllis at the Fair* (1884), and the autobiographical works, *Bevis* (1882) and *The Story of My Heart* (1883).

See Sir Walter Besant, *Eulogy of Richard Jefferies* (1888); H. S. Salt, *Richard Jefferies: a Study* (1894); E. Thomas, *Richard Jefferies, his Life and Work* (1909).

JEFFERSON, JOSEPH (1829–1905), American actor, was born in Philadelphia, Pa., Feb. 20, 1829. He was the third actor of this name in a family of actors and managers, and one of the most famous of all American comedians. At the age of three he appeared as the boy in Kotzebue's *Pizarro,* and throughout his youth he underwent all the hardships connected with theatrical touring in those early days. After a miscellaneous experience, partly as actor, partly as manager, he won his first pronounced success in 1858 as Asa Trenchard in Tom Taylor's *Our American Cousin* at Laura Keene's theatre in New York. This play was the turning-point of his career, as it was of Sothern's.

Other early parts were Newman Noggs in *Nicholas Nickleby,* Caleb Plummer in *The Cricket on the Hearth,* Dr. Pangloss in *The Heir at Law,* Salem Scudder in *The Octoroon,* and Bob Acres in *The Rivals,* the last being not so much an interpretation of the character as Sheridan sketched it as a creation of the actor's.

In 1859 Jefferson made a dramatic version of the story of *Rip Van Winkle* on the basis of older plays, and acted it with success at Washington. The play was given its permanent form by Dion Boucicault in London, where (1865) it ran 170 nights, with Jefferson in the leading part. Jefferson was one of the first to establish the travelling combinations which superseded the old system of local stock companies. With the exception of minor parts, such as the First Gravedigger in *Hamlet,* which he played in an "all star combination" headed by Edwin Booth, Jefferson created no new character after 1865; and the success of Rip Van Winkle was so pronounced that he has often been called a one-part actor. If this was a fault, it was the public's, who never wearied of his one masterpiece. Jefferson died on April 23, 1905.

No man in his profession was more honoured for his achievements or his character. He was the friend of many of the leading men in American politics, art and literature. He was an ardent fisherman and lover of nature, and devoted to painting. Jefferson was twice married: to an actress, Margaret Clements Lockyer (1832–61), in 1850, and in 1867 to Sarah Warren, niece of William Warren the actor.

Jefferson's *Autobiography* (1889) is written with admirable spirit and humour, and its judgments with regard to the art of the actor and of the playwright entitle it to a place beside Cibber's *Apology. See* William Winter, *The Jeffersons* (1881), and *Life of Joseph Jefferson* (1894); Mrs. E. Jefferson, *Recollections of Joseph Jefferson* (1909).

JEFFERSON, THOMAS (1743–1826), third president of the United States of America, the most conspicuous of American apostles of democracy, and one of the great liberals of modern times, was born on April 13, 1743, at Shadwell, Albemarle county, Va. His father, Peter Jefferson (1707–57), was a civil engineer who became a justice of the peace, colonel of the county militia and a burgess, served the Crown in inter-colonial boundary surveys, and married into one of the most prominent colonial families, the Randolphs. Albemarle county was then in the frontier wilderness of the Blue Ridge, and was very different, socially, from the lowland counties where a few broad-acred families dominated an open-handed, somewhat luxurious and assertive aristocracy. Unlike his Randolph connections, Peter Jefferson was a

Whig and a thorough democrat; from him, and from the frontier, his son came naturally by democracy.

Education and Personal Traits.—He left the college of William and Mary at Williamsburg, in his 20th year, with a good knowledge of Latin, Greek and French, to which he soon added Spanish, Italian and Anglo-Saxon; and a familiarity with the higher mathematics (throughout life he made practical use of the calculus) and natural sciences only possessed, at his age, by men who have a rare natural taste and ability for those studies. He remained an ardent student throughout life, able to give and take in association with the many scholars, American and foreign, whom he numbered among his friends and correspondents. With a liberal Scotsman, Dr. William Small, then of the faculty of William and Mary and later a friend of Erasmus Darwin, and George Wythe (1726–1806), a very accomplished scholar and leader of the Virginia bar, he was an habitual member, while still in college, of a *partie carrée* at the table of Francis Fauquier (*c.* 1720–68), the accomplished lieutenant-governor of Virginia. Jefferson was an expert violinist, a good singer and dancer, proficient in outdoor sports, and an excellent horseman. Thoroughbred horses always remained to him a necessary luxury. When it is added that Fauquier was a passionate gambler, and that the gentry who gathered every winter at Williamsburg, the seat of provincial Government, were ruinously addicted to the same weakness, and that Jefferson had a taste for racing, it does credit to his early strength of character that of his social environment he took only the good. He never used tobacco, never played cards, never gambled and was never party to a personal quarrel.

A Virginia Lawyer.—Soon after leaving college he entered Wythe's law office, and in 1767, after five years of close study, was admitted to the bar. His average income during seven years of practice, about £300, was large for that time. To his collecting zeal Virginia owes the preservation of a large part of her early statutes, and of such of her colonial reports as still survive. He left practice with a poor opinion of lawyers—"whose trade it is to question everything, yield nothing, and talk by the hour." Moreover, industry and scholarship, not advocacy, for which he had neither the requisite voice nor temperament, were the secret of his success, which was such as to show that the profession had no rewards that were not fairly within his reach. Doubtless he saw and wished to reform the law's abuses. He turned, therefore, the more willingly to politics when his activity in the colonial cause compelled him to abandon practice in 1774.

Marriage and Home Life.—The death of his father had left him an estate of 1,900 ac., the income from which gave him the position of an independent country gentleman; and he added to his farms after the ambitious Virginia fashion until, when he married in his 30th year, there were 5,000 ac., all paid for; and almost as much more (though subject to heavy debts) came to him in 1773 on the death of his father-in-law. On Jan. 1, 1772, he married Martha Wayles Skelton (1749–82), a childless widow of 23, very handsome and accomplished. Their married life was exceedingly happy, and he never remarried after her early death. Of six children born from their union two daughters alone survived infancy. Jefferson's affectionate, generous and devoted relations with his children and grandchildren are among the fine features of his character.

Early Public Services.—He began his public service as a justice of the peace. Later he was chosen a member of the Virginia house of burgesses in 1769, and of every succeeding assembly and convention of the colony until he entered the Continental Congress in 1775. He was prominent in all, and a foremost member of several, great deliberative bodies, yet he can fairly be said never to have made a speech. He hated the "morbid rage of debate," believing men were never convinced by argument, but only by reflection, through reading or unprovocative conversation; and this belief guided him through life. He was, however, as John Adams said of him in the Continental Congress, though a silent member, so "prompt, frank, explicit and decisive upon committees and in conversation (not even Samuel Adams was more so)" that he was soon acknowledged as one of the strongest members. A forceful, facile pen added greatly to his influence. Elected in 1774 to the first Virginia convention, called to consider the state of the colony and advance inter-colonial union, but prevented by illness from attending, he sent to the convention elaborate resolutions, which he proposed as instructions to the Virginia delegates to the Continental Congress that was to meet at Philadelphia in September. In the direct language of reproach and advice, these resolutions attacked the supremacy of Parliament and the errors of the king (with no disingenuous loading of the Crown's policy upon its agents), maintaining that "the relation between Great Britain and these colonies was exactly the same as that of England and Scotland after the accession of James and until the Union; and that our emigration to this country gave England no more rights over us than the emigration of the Danes and Saxons gave to the present authorities of their mother country over England." This was cutting at the common root of allegiance, emigration and colonization; but such radicalism was too thorough-going for the immediate end. The resolutions were published, however, as a pamphlet, entitled *A Summary View of the Rights of America,* which was of immense influence. In England, after receiving such modifications—attributed to Burke—as adapted it to the purposes of the opposition, this pamphlet ran through many editions, and procured for its author, as he said, "the honour of having his name inserted in a long list of proscriptions enrolled in a bill of attainder commenced in one of the two houses of parliament, but suppressed in embryo by the hasty course of events." It placed Jefferson among the foremost leaders of revolution, and procured for him the honour of drafting, later, the Declaration of Independence, whose historical portions were, in large part, only a revised transcript of the *Summary View.* In June 1775 he took his seat in the Continental Congress, taking with him fresh credentials of radicalism in the shape of Virginia's answer, which he had drafted, to Lord North's conciliatory propositions. He soon drafted the reply of Congress to the same propositions. Reappointed to the next Congress, he signalized his service by the authorship of the Declaration of Independence (*q.v.*). Again reappointed, he surrendered his seat, and after refusing a proffered election to serve as a commissioner with Benjamin Franklin and Silas Deane in France, he re-entered in Oct. 1776 the Virginia legislature, where he considered his services most needed.

Revision of the Laws of Virginia.—The local work to which Jefferson attributed such importance was the formulation of Virginia's constitution and a revision of her laws. Various of his proposals for the former (limiting the acquisition of public lands, regulating suffrage and legislative apportionment) were too radical for adoption at that time, and some were never adopted. Of the proposed statutory reforms he says: "I considered four . . . as forming a system by which every trace would be eradicated of ancient or future aristocracy, and a foundation laid for a government truly republican"—the repeal of the laws of entail; the abolition of primogeniture and the unequal division of inheritances (Jefferson was himself an eldest son); the guarantee of freedom of conscience and relief of the people from supporting, by taxation, an established church; and a system of general education. The first object was embodied in law in 1776, the second in 1785, the third—the first law of its kind in Christendom, although not the earliest practice of such liberty in America—in 1786. The last two were parts of a body of codified laws prepared (1776–79) by a commission, but very largely by Jefferson. Not so fortunate were his ambitious schemes of education. District, grammar and classical schools, a free State library and a State college, were all included in his plan. He was the first American statesman to make education by the State a fundamental article of democratic faith. His bill for elementary education he regarded as the most important part of the code, but Virginia had no strong middle class and the planters would not assume the burden of educating the poor. In 1779 he founded at William and Mary the first professorship of law in America.

At this time Jefferson championed the natural right of expatriation and gradual emancipation of all slaves. His earliest legislative effort, in 1769, had been marked by an effort to secure to masters freedom to manumit their slaves without removing

them from the State. It was unsuccessful, and the more radical measure he now favoured was more impossible of attainment; but a bill he introduced to prohibit the importation of slaves was passed in 1778. Finally he endeavoured, though unsuccessfully, to secure the introduction of juries into the courts of chancery, and—a generation and more before the fruition of the labours of Romilly and his co-workers in England—aided in securing a humanitarian revision of the penal code, which, though lost by one vote in 1785, was sustained by public sentiment and adopted in 1796. Capital punishment was confined to treason and murder; the former was not to be attended by corruption of blood, drawing or quartering; all other felonies were made punishable by confinement and hard labour, save a few to which was applied, against Jefferson's desire, the principle of retaliation. Jefferson is of course not entitled to sole credit for all these services: Wythe, George Mason and James Madison, in particular, were his devoted lieutenants, and—after his departure for France—principals in the struggle; moreover, an approving public opinion must receive large credit. But Jefferson was throughout the chief inspirer and most ardent worker.

Governor of Virginia.—In 1779, at almost the gloomiest stage of the war in the Southern States, he succeeded Patrick Henry as the governor of Virginia. In his second term (1780–81) the State was overrun by British expeditions, and Jefferson was blamed for the ineffectual resistance. Though he cannot be said to have been eminently fitted for the task that devolved upon him in such a crisis, most of the criticism of his administration was undoubtedly grossly unjust. He declined the renomination for the governorship, but was unanimously returned to the State legislature; and on the day previously set for legislative inquiry he received, by unanimous vote of the house, a declaration of thanks and confidence. He wished, however, to retire permanently from public life, a wish strengthened by the illness and death of his wife. At this time he composed his *Notes on Virginia*, a semi-statistical work full of humanitarian liberalism.

Services in Congress.—Congress twice offered him an appointment as one of the plenipotentiaries to negotiate peace with England, and he accepted the second offer, but the business was so far advanced before he could sail that his appointment was recalled. The following winter (1783), again in Congress, he headed the committee appointed to consider the treaty of peace. In the succeeding session his service was marked by a report from which resulted the present U.S. monetary system (its decimal basis being due, however, to Gouverneur Morris); and by the honour of reporting the first definitely formulated plan for the government of the Western Territories, that embodied in the ordinance of 1784. For the cession by Virginia to the United States of the vast territory north-west of the Ohio, consummated in that year, Jefferson had long laboured. Its importance to national unity was immense. His ordinance was notable for a provision that slavery should not exist after 1800, defeated in 1784 but adopted in 1787 for the Northwest Territory—a step which is very often said to have saved the Union in the Civil War; the Southwest Territory (out of which were later formed Mississippi, Alabama, etc.) being given over to slavery. To this anti-slavery clause of 1784 (though preceded by unofficial proposals to the same end) belongs rightly some special honour as setting a precedent for Federal control of slavery in the Territories, which later proved of such enormous consequence. His anti-slavery opinions grew in strength with years. Not only justice but patriotism pleaded with him the cause of the negroes, for he realized the dire political dangers of slavery, and foresaw the certainty that the slaves must some day, in some way, be freed; and could any feasible plan of emancipation and re-migration have been suggested he would have regarded its cost as a mere bagatelle. It is true that of his slaves (at one time he owned above 150) he manumitted but a few at his death; and had he fully realized his insolvency doubtless he would have deprived his creditors of none. It is also true that he opposed the Missouri Compromise of 1820—whether rightly or wrongly may be disputed—but at any rate for reasons (reflecting old political struggles) that are unsatisfying.

Minister to France.—From 1784 to 1789 he was in France, first under an appointment to assist Benjamin Franklin and John Adams in negotiating treaties of commerce with European States, and then as Franklin's successor (1785–89) as minister to France. In these years he travelled widely in western Europe. Though the commercial principles of the United States were far too liberal for acceptance, as such, by powers holding colonies in America, Jefferson won some specific concessions to American trade. He was exceedingly popular as a minister.

Religious and Political Theories.—The criticism is even to-day current with the uninformed that Jefferson took his manners (Patrick Henry semi-humorously charged, because he favoured French cooking, that he had "abjured his native victuals"), his morals, "irreligion" and political philosophy from his French residence; and it cannot be wholly ignored. It may therefore be said that there is nothing except scandal to contradict the conclusion, which abundant evidence supports, that Jefferson's morals, mind and tongue were pure. He was not an atheist, but a sincere deist. His attitude toward religion was deeply reverent, but he regarded it as so purely a matter of individual conscience that he was reluctant to discuss it even with his family or friends. "I am a Christian," he wrote in 1823, "in the only sense in which he (Jesus) wished any one to be; sincerely attached to his doctrines in preference to all others; ascribing to himself every human excellence and believing he never claimed any other." Religion was only "evidenced, as concerns the world, by each one's daily life." He compiled from the New Testament a volume of Jesus' teachings which still survives, and has been published as "Jefferson's bible." He was necessarily an enemy of any State church, since he demanded absolute freedom of private judgment, and regarded creeds as "the bane and ruin of the Christian church." To-day he would be a Unitarian, or a member of an ethical culture society.

His political theories had a deep and broad basis in English Whiggism; and though he may well have found at least confirmation of his own ideas in French writers—and notably in Condorcet—he did not read sympathetically the writers commonly named, Rousseau and Montesquieu; besides, although he was deeply interested in all the events leading up to the French Revolution, and all his ideas were coloured by his experience of the five seething years passed in Paris, his democracy was seasoned, and he was rather a teacher than a student of revolutionary politics, when he went there. The *Notes on Virginia*, which were widely read in France, undoubtedly had some influence in forwarding the dissolution of the doctrines of divine right and passive obedience among the cultivated classes. On June 3, 1789, he proposed to the leaders of the third estate a compromise between the king and the nation. In July he received the extraordinary honour of being invited to assist in the deliberations of the committee appointed by the National Assembly to draft a constitution. This honour his official position compelled him, of course, to decline, for he sedulously observed official proprieties.

Secretary of State.—When he returned to America President Washington tendered him the secretaryship of State in the new Federal Government, and he reluctantly accepted. His only essential objection to the Constitution—the absence of a bill of rights—was soon met, at least partially, by amendments. Alexander Hamilton (*q.v.*) was secretary of the Treasury. These two men, antipodal in temperament and political belief, clashed in irreconcilable hostility; and in the conflict of public sentiment, first on the financial measures of Hamilton, and then on questions with regard to France and Great Britain, Jefferson's sympathies being predominantly with the former, Hamilton's with the latter, they formed about themselves the two parties of Democrats and Federalists. The schools of thought for which they stood have since contended for mastery in American politics: Hamilton's gradually strengthened by the necessities of stronger administration, as time gave widening amplitude and increasing weight to the specific powers—and so to Hamilton's great doctrine of the "implied powers"—of the general government of a growing country; Jefferson's rooted in colonial life, and still firmly buttressed by the hopes and convictions of American democracy.

The most perplexing questions treated by Jefferson as secretary of State arose out of the policy of neutrality adopted by the United States toward France, to whom she was bound by treaties and by a heavy debt of gratitude. Separation from European politics—the doctrine of "America for Americans" that was embodied later in the Monroe declaration—was a tenet cherished by Jefferson as by other leaders (not, however, Hamilton) and by none cherished more firmly; for by nature he was peculiarly opposed to war, and peace was a fundamental part of his politics. However deep, therefore, his French sympathies, he drew the same safe line as did Washington between French politics and American politics, and handled the Genêt complications in a manner that should have satisfied even the most partisan Federalists. He expounded, as a very high authority has said, "with remarkable clearness and power the nature and scope of neutral duty," and gave a "classic" statement of the doctrine of recognition (John Bassett Moore).

French Democracy.—But the French question had another side in its reaction on American parties. Jefferson did not read excesses in Paris as warnings against democracy, but as warnings against the abuses of monarchy; nor did he regard Bonaparte's *coup d'état* as revealing the weakness of republics, but rather as revealing the danger of standing armies; he did not look on the war of the coalitions against France as one of mere powers, but as one between forms of government; and though the immediate fruits of the Revolution belied his hopes, as they did those of ardent humanitarians the world over, he had faith that a successful reformation of government in France would insure "a general reformation through Europe, and the resurrection to a new life of their people." Three of these statements could be reversed as regards Hamilton. It is the key to an understanding of the times to remember that the Revolutionary War had disjointed society; and democracy—which Jefferson had proclaimed in the Declaration of Independence and enthroned in Virginia—after strengthening its rights by the sword had run to excesses of speech (and of acts in the Shays rebellion) that produced a conservative reaction. To this reaction Hamilton explicitly appealed in the Constitutional Convention of 1787; and of this reaction various features of the Constitution, and Hamiltonian Federalism generally, were direct fruits. Moreover, independently of special incentives to the alarmist and the man of property, the opinions of many Americans turned again, after the war, into a current of sympathy for England, as naturally as American commerce returned to English ports.

Jefferson, however, far from America in these years and unexposed to reactionary influences, came back with undiminished fervour of democracy, and the talk he heard of praise for England, and fearful recoil before even the beginning of the revolution in France, disheartened him, and filled him with suspicion. It was at this period of his life that he gave expression to some of the opinions for which he has been most severely criticized. For the Shays rebellion he felt little abhorrence, and wrote: "A little rebellion now and then is a good thing . . . an observation of this truth should render honest republican governors so mild in their punishment of rebellions as not to discourage them too much. It is a medicine necessary for the sound health of government." Again, "Can history produce an instance of rebellion so honorably conducted? . . . God forbid that we should ever be twenty years without such a rebellion. . . . What signify a few lives lost in a century or two? The tree of liberty must be refreshed from time to time with the blood of patriots and tyrants: It is its natural manure." And again: "Societies exist under three forms—(1) without government, as among our Indians; (2) under governments wherein the will of everyone has a just influence. . . . (3) under governments of force. . . . It is a problem not clear in my mind that the first condition is not the best" (*Writings*, Ford. ed., iv. 362–63, 467).

Hating as he did feudal class institutions and Tudor-Stuart traditions of arbitrary rule (he turned law students from Blackstone's toryism to Coke's political localism) his attitude can be imagined toward Hamilton's oft-avowed partialities—and Jefferson assumed, his intrigues—for British class-government. In short, Hamilton took from recent years the lesson of the evils of lax government; whereas Jefferson clung to the other lesson, which crumbling colonial governments had illustrated, that governments derived their strength (and the Declaration had proclaimed that they derived their just rights) from the will of the governed. Each built his system accordingly: the one on the basis of order, the other on individualism. The two men and the fate of the parties they led are understandable only by regarding one as the leader of reaction, the other as in line with American tendencies. The educated classes characteristically furnished Federalism with a remarkable body of alarmist leaders; whereas Jefferson, because he had a thorough trust and confidence in the people, became the idol of American democracy.

Retires from Washington's Cabinet.—Hamilton was somewhat officious and very combative, and Jefferson, although uncontentious, was very suspicious. As both men held inflexibly to their opinions, cabinet harmony became impossible when the two had formed about themselves parties whose differences were carried into the newspapers; and Washington abandoned perforce his idea "if parties did exist to reconcile them." Partly from discontent with a position in which he did not feel that he enjoyed the absolute confidence of the president, and partly because of financial embarrassments, Jefferson repeatedly sought to resign, and finally on Dec. 31, 1793, with Washington's reluctant consent, retired to his home at Monticello, near Charlottesville.

There he remained (having refused a foreign mission) until elected vice-president in 1796. He was never truly happy except in the country. He loved gardening, experimented enthusiastically in varieties and rotations of crops, and kept meteorological tables with diligence. For eight years he tabulated with painful accuracy the earliest and latest appearance of 37 vegetables in the Washington market. When abroad he sought out varieties of grasses, trees, rice and olives for American experiment, and after his return from France received yearly for 23 years, from his old friend the superintendent of the *Jardin des plantes*, a box of seeds, which he distributed to public and private gardens throughout the United States. Jefferson seems to have been the first discoverer of an exact formula for the construction of mould-boards of least resistance for ploughs. He was remarkably apt in the practical application of mechanical principles.

Kentucky and Virginia Resolutions.—In 1796 John Adams, the Federalist candidate for the presidency, became president; and Jefferson, the Republican candidate, became vice-president. At first the French reign of terror and the X.Y.Z. disclosures strengthened the Federalists, until these, mistaking popular resentment against France for a reaction against democracy—an equivalence in their own minds—passed the Alien and Sedition laws. In answer to those odious measures Jefferson and Madison prepared and procured the passage of the Kentucky and Virginia resolutions. These resolutions later acquired pernicious prominence in the elaboration of the States' Rights doctrine. It is, however, unquestionably true that as a startling protest against measures "to silence," in Jefferson's words, "by force and not by reason the complaints or criticisms, just or unjust, of our citizens against the conduct of our agents," they served a useful purpose. As a counterblast against Hamiltonian principles of centralization they were probably very salutary; while even as pieces of constitutional interpretation it is to be remembered that they did not contemplate nullification by any single State (*all* "the co-States recurring to their natural rights in cases not made federal"). Moreover, they are not to be judged by constitutional principles established later by courts and war. Jefferson's particularism increased as he grew older; owing mainly, without doubt, to his increasing fear of Chief Justice John Marshall, as that great scion of Federalism developed its doctrines in the decisions of the Supreme Court.

Twice Elected President.—The Federalist party had ruined itself, and it lost the presidential election of 1800. The Republican candidates, Jefferson and Aaron Burr (*q.v.*), receiving equal votes, it devolved upon the House of Representatives, in accordance with the system which then obtained, to make one of the two president, the other vice-president. Party feeling in America

has probably never been more dangerously impassioned than in the three years preceding this election; discount as one will the contrary obsessions of Hamilton and Jefferson, the time was fateful. In the end Hamilton—who very rightly judged Burr wholly undependable, and Jefferson, in addition to being honourable, more radical in theory than in practice—used his influence in favour of the latter, and he became president, entering upon his duties on March 4, 1801. Republicans who had affiliated with the Federalists at the time of the X.Y.Z. disclosures returned; very many of the Federalists Jefferson placated and drew over. "Believing," he wrote, "that (excepting the ardent monarchists) all our citizens agreed in ancient Whig principles I thought it advisable to define and declare them, and let them see the ground on which we can rally." This he did in his inaugural, which, though somewhat rhetorical, is a splendid and famous statement of democracy.[1]

His conciliatory policy produced a mild schism in his own party, but proved eminently wise, and the State elections of 1801 fulfilled his prophecy of 1791 that the policy of the Federalists would leave them "all head and no body." In 1804 he was re-elected by 162 out of 176 votes. Even John Adams voted for him, as a Republican elector in Massachusetts.

Republicanizing the Government.—Jefferson's administrations were distinguished by the simplicity that marked his conduct in private life. He eschewed the pomp and ceremonies, natural inheritances from English origins, that had been an innocent setting to the office of his two predecessors. His dress was of "plain cloth" on the day of his inauguration. Instead of driving to the Capitol in a coach and six, he walked without a guard or servant from his lodgings (or, as a rival tradition has it, he rode, and hitched his horse to a neighbouring fence), attended by a crowd of citizens. Instead of opening Congress with a speech to which a formal reply was expected, he sent in a written message by a private hand. He discontinued the practice of sending ministers abroad in public vessels. Between himself and the governors of States he recognized no difference in rank. He would not have his birthday celebrated by State balls. The weekly levée was practically abandoned. Even such titles as "Excellency," "Honourable," "Mr." were distasteful to him. It was formally agreed in cabinet meeting that "when brought together in society all are perfectly equal, whether foreign or domestic, titled or untitled, in or out of office." Thus diplomatic grades were ignored in social precedence, and foreign relations were seriously compromised by dinner-table complications. One minister who appeared in gold lace and dress sword for his first official call on the president, was received by Jefferson—as he insisted with studied purpose—in negligent undress and slippers down at the heel. In truth, all this was in part premeditated system, indicative of his purpose to republicanize government and public opinion, which was the distinguishing feature of his administration; but it was also the nature of the man. In the company he chose by preference, honesty and knowledge were his only tests. He knew absolutely no social distinctions. "If it be possible," he said, "to be certainly conscious of anything, I am conscious of feeling no difference between writing to the highest and lowest being on earth."

The Louisiana Purchase.—The supreme achievement of his first administration was the Louisiana purchase (*q.v.*), following which Lewis and Clark, sent by him, conducted their famous exploring expedition across the continent to the Pacific. The purchase, judged by his professed principles of constitutional construction (and also by earlier expressions of policy—made, however, long before Napoleon's acquisition of the territory confronted the United States with one of the gravest crises of its history) was the greatest "inconsistency" of his career; although also an illustration, in corresponding degree, of his essential practicality and statesmanship. "This advocate of strict economy had spent on his own executive authority an amount equal to almost three-fourths of the debt which Hamilton had assumed for the States with the sanction of Congress. This champion of the letter of the Constitution had exercised the power of acquiring foreign territory and promising foreigners admission to the citizenship of the United States, for which no clause could be found among the 'enumerated powers.' This opponent of the extension of the 'general Government' had stretched its power far beyond any point the Federalists had reached, and laid the foundation, in the creation of an immense national territory in the West, for that definitive triumph of the nation over the States which his 'countrymen' [Southerners] of the second generation fought so desperately to avert" (Muzzey).

It was consistent, however, with his past attitude toward England and Spain, respectively strong and weak, as western neighbours. It was consistent with his attitude toward American expansion westward, revealed in his writings and acts since 1776 (for 20 years before he sent Lewis and Clark he had been trying to initiate exploration of the trans-Mississippi region). Realizing fully the significance of the purchase he wrote to his envoy, James Monroe (and this when he did not dream of acquiring all of Louisiana): "The future destinies of our country hang on the event of this negotiation." In truth no other act or event in American history has been of vaster consequence. Jefferson's greatness, in statesmanship, is due to the fact that he embodied the frontier experience of colonial times, the tendencies of mind which (as Frederick J. Turner long since convinced students of history) had created American democracy. The words of McLaughlin are profoundly true: "Jefferson was not first of all, through and through, a States' Rights man, a strict constructionist, a sympathizer with France, an ambitious leader of men; he was a frontiersman or half-frontiersman. . . . Jeffersonism treated not as a spirit, but as a mode of constitutional interpretation or as a system of administration, is not Jeffersonism at all" (*Amer. Hist. Rev.*, 20: 266).

Civil Service and Indian Affairs.—It is often said that Jefferson established the "spoils system" by his changes in the civil service. He was the innovator, because for the first time there was opportunity for innovation. But justice requires attention to the fact that incentive to that innovation, and excuse for it, were found in the one-party monopoly maintained by the Federalists. Moreover, Jefferson's ideals were high; his reasons for changes were in general excellent; he at least so far resisted the great pressure for office—producing by his resistance dissatisfaction within his party—as not to lower, apparently, the personnel of the service; and there were no such blots on his administration as President Adams's "midnight judges." Nevertheless, his record here showed regrettable inconsistencies[1].

Another charge frequently made against Jefferson is that he was inconsistent in his treatment of the Indians. It is true. On one hand he voiced, sincerely beyond doubt, the most noble—and alas, in view of the character of American frontiersmen, impracticable—humanism in their behalf. On the other hand his efforts to extinguish Indian titles justify the harsh judgment of Henry Adams that "his greed for land equalled that of any settler on the border"; and in gratifying it he displayed in a few instances an unmoral opportunism that is incapable of condonation. It is, however, to be said in his defence, that in his mind the acquisition of Louisiana was associated with the idea (soon adopted, and followed as a national policy until very recent years) of removing the Indians to reservations of secure hunting grounds—which he (rightly) believed would end frontier wars. To crowd them from their homes east of the Mississippi was therefore, in his system, far removed from the dominant frontier view that Indians were without rights to land or life. Here again—as usually is true—Jefferson's inconsistency of acts turns out to be a lesser inconsistency of principle; and here again, as usually, he made no contemporary explanations, but left the matter to later judgment of the records.

[1]*See* also Jefferson to E. Gerry, Jan. 26, 1799 (*Writings*, vii. 325), and to Du Pont de Nemours (x. 23). *Cf.* Hamilton to J. Dayton, 1799 (*Works*, x. 329).

[1]*See* C. R. Fish, *The Civil Service and the Patronage*, ch. ii. (New York, 1905), and G. Hunt, in *Amer. Hist. Rev.*, 3: 270–291. He would *not*, he said, retain in office extreme Federalists, because he believed them a danger to the country. Theoretically this left a safe zone for moderates; but the importunity of Republican office-seekers made it impossible to maintain the distinction between Jefferson's principle and mere partisanship.

Struggle for Rights of Neutrals.—His second term derives most of its historical interest from the unsuccessful efforts to convict Aaron Burr of treasonable acts in the South-West, and from the efforts made to maintain, without war, the rights of neutrals on the high seas. In his first term he carried out a policy he had urged upon the government when minister to France and when vice-president, by dispatching naval forces to coerce Tripoli into a decent respect for the trade of his country—the first in Christendom to gain honourable immunity from tribute or piracy in the Mediterranean. Against greater powers he showed no such intrepidity. In his diplomacy with Napoleon and Great Britain he betrayed a painful incorrigibility of optimism. One writer has very justly said that what chiefly affects one in the whole matter is the pathos of it—"a philosopher and a friend of peace struggling with a despot of superhuman genius, and a Tory cabinet of superhuman insolence and stolidity" (Trent). All the charges against him of timidity and vacillation, so far as they have any basis, rest upon his foreign policy. In 1807 he was willing to rely chiefly on little gunboats—kept under sheds ashore except when actually needed, and then manned by a sort of naval militia!—and wrote (soon after the British "Leopard" had wrecked and searched the "Chesapeake") of "the ruinous folly of a navy!" It is fair to note, however, that Commodores Barron and Preble approved the gunboat policy. And the embargo, if dispassionately considered, must be pronounced not only amply justified by the contempt for neutral rights displayed equally by France and Great Britain, but quite as logical as the continental blockade.

His Agrarian Outlook.—Jefferson's statesmanship had the limitations of an agrarian outlook. The extreme to which he carried his advocacy of diplomatic isolation, his opposition to the creation of an adequate navy, his estimate of cities as "sores upon the body politic," his prejudice against manufactures, trust in farmers, and political distrust of the artisan class, reflect them. Jefferson favoured the wide distribution of the public land as the basis of personal independence and democracy (Hamilton might well have favoured it, in the interest of taxation and ultimate conservatism, but in fact he opposed it). In 1776 he wished to exclude from purchasing public land any man already holding 50 acres. In 1785 he wrote: "It is too soon yet . . . to say that every man who cannot find employment, but who can find uncultivated land, shall be at liberty to cultivate it, paying a moderate rent. But it is not too soon to provide by every possible means that as few as possible shall be without a little portion of land. The small landowners are the most precious portion of the State." It is probably fair to say that cheap land was the chief basis of his political philosophy (*see* C. Beard, *Economic Origins of Jeffersonian Democracy*, ch. xiv.; also pp. 328, 342, 347, 358).

When, on March 4, 1809, he retired from the presidency he had been almost continuously in the public service for 40 years. He refused to be elected for a third time, though requested by the legislatures of five States to be a candidate; and thus, with Washington's prior example, helped to establish a precedent deemed by him to be of great importance under a democratic government. His influence was little lessened in his retirement. Madison and Monroe, his immediate successors—neighbours and devoted friends, whom he had advised in their early education and led in their maturer years—consulted him on all great questions (though there were few in the latter's peaceful terms); and thus there was no break of principles in the 24 years of the "Jeffersonian system."

Jefferson the Political Leader.—Jefferson was one of the greatest political managers his country has known. He had a quick eye for character, was genuinely amiable, uncontentious, tactful, masterful; and it may be assumed from his success that he was shrewd to a degree. Full explanations do not remove from some important transactions in his political life an impression of indirectness. This is mainly because he would not himself mix in debate, pamphleteering or other controversy, while urging his doctrines upon followers who did so. Nor would he, except in conversations and letters, explain his principles and apply them to his conduct although certainly, unless tested by principles, his acts were often strikingly inconsistent; and, even when so tested, sometimes remain so. But reasonable judgment must find very unjust the stigma of duplicity put upon him by the Federalists. Again, there were philosophic elements in his political faith which have led some to class him as a visionary and fanatic. But although he certainly indulged at times in dreams at which one may still smile, he was not, properly speaking, a visionary—looking backward his political prescience seems remarkable; nor can he with justice be pronounced a fanatic. He did have the full courage of his convictions. Extreme as were some of his principles, his independence in expressing and pertinacity in adhering to them were equally extreme. He felt fervently, was not afraid to risk all on the conclusions to which his heart and his mind led him and declared himself with openness and energy; he spoke and even wrote his conclusions, however bold or abstract, without troubling to detail his reasoning or clip his offhand speculations. Certain it is that there is much in his utterances at which less robust democrats will always cavil—though some of the ideas at which they hesitate are at last receiving consideration: *e.g.*, his doctrine that one generation should not and cannot bind another by paper documents. But be his doctrines and aims ever so radical, in their attainment he proceeded, as Hamilton recognized, conservatively. Indeed, when practicality so counselled he was always content to wait for time and education to do his work. Soar as he might, he was essentially not a doctrinaire but an empiricist; his mind was objective. Though he remained to the end firm in his belief that there had been an active monarchist party, this obsession did not carry him out of touch with the realities of human nature and of his time. He built with surety on the colonial past, and had a better reasoned view of the actual future than had any of his contemporaries.

Faith in the People.—Events soon appraised the Federalist judgment of American democracy, so tersely expressed by Fisher Ames as "like death . . . only the dismal passport to a more dismal hereafter"; and, with it, appraised Jefferson's word in his first inaugural for those who, "in the full tide of successful experiment," were ready to abandon a government that had so far kept them "free and firm, on the visionary fear that it might by possibility lack energy to preserve itself." Time too is still testing his principle that that Government must prove the strongest on earth "where every man . . . would meet invasions of the public order as his own personal concern." He summed up as follows the difference between himself and the Hamiltonian group: "One feared most the ignorance of the people; the other the selfishness of rulers independent of them"; one sect "believing that the executive is the branch of our government which most need (ed) support; the other, that, like the analogous branch in the British government, it (was) already too strong for the republican parts of the Constitution." Jefferson, in short, had unlimited faith in the honesty of the people; a large faith in their common sense; believed that all is to be won by appealing to the reason of voters; that by education their ignorance can be eliminated; that human nature is indefinitely perfectible; that majorities rule, therefore, not only by virtue of force (which was Locke's ultimate justification of them), but of right. His importance as a maker of modern America can scarcely be overstated, for the ideas he advocated have become the very foundations of American republicanism. No other man's ideas have had anything like an equal influence upon the institutions of the country. So competent a scholar as Andrew D. White put him alone in each of the three groups of men who did most to found, to build, and to brace the republic (*Atlantic Monthly*, Jan. 1862). His administrations ended the possibility, probability or certainty—measure it as one will—of a calculated development of Federalism in the direction of class government. Thus by his own labours he vindicated his faith in the experiment of self-government.

Services to the University of Virginia.—His last years were devoted to the establishment of the University of Virginia at Charlottesville, near his home. He planned the buildings and oversaw to the minutest details their construction; and he is to-day—for this work and the construction of Monticello and other buildings—recognized as notable in the history of American architecture. He gathered the faculty—mainly from abroad—

and shaped the organization. "A system," he wrote, "of public instruction . . . as it was the earliest so it will be the latest, of all the public concerns in which I shall permit myself to take an interest." The university was doubtless the most liberal institution of learning in the world at that time: the curriculum was wholly elective; there were no religious tests or practices; the faculty were all equals, under a rotating and elective chairman; students were under the honour system in all tests and discipline; agriculture and political science were first provided for in American education. In short many of the ideas of administration and curriculum that dominate American universities in the 20th century were anticipated by him.

Financial Troubles.—His financial affairs in these last years gave him grave concern. He had left the presidency with debts of $20,000, contracted in an over-generous maintenance of his representative position. After the destruction of the library of Congress by the British in 1814 he sold to the nation for $23,950 some 13,000 volumes of his own collection. But this gave only temporary relief. Relatives, invited guests, and strangers filled Monticello (frequently beds were made for a score and more, sometimes for fifty); they stayed for days, weeks, even months, drank his choice French wines, kept their horses in his stables. For solitude he had to retire to a second home, constructed as a refuge. Threatened with bankruptcy, a national subscription in 1826 (of $16,500) enabled him to die in peace, but a few months later his furniture, silver, pictures and Monticello, which is to-day a national memorial, were sold to pay his debts.

Features and Personality.—Jefferson was 6 ft. 2 in. in height, large-boned, slim, erect and sinewy. He had angular features, a very ruddy complexion, sandy hair, and hazel-flecked grey eyes. Age lessened the unattractiveness of his exterior. His carriage was somewhat loose and undignified. There was grace, nevertheless, in his manners; and his frank and earnest address, his quick sympathy (yet he seemed cold to strangers), his vivacious, varied, informing talk, gave him an engaging charm. Beneath a quiet surface he was aglow with intense convictions and an emotional temperament. Yet he seems to have acted habitually, in great and little things, on system. His mind, no less trenchant and subtle than Hamilton's, was the most impressible, the most receptive, mind of his time in America. The range of his interests —in geography, geology, botany, zoölogy, ethnology, agriculture, plantation, medicine and surgery, mathematics, aeronautics, invention, government, education, languages and literature, religion— is astounding. For many years he was president of the American Philosophical Society. Though it is a tradition that he lacked wit, Molière and *Don Quixote* seem to have been his favourites; and though the utilitarian wholly crowds romanticism out of his writings, he had enough of that quality in youth to prepare to learn Gaelic in order to translate Ossian, and sent to Macpherson for the originals! His interest in art was evidently intellectual. He was singularly sweet-tempered, and shrank from the impassioned political bitterness that raged about him; bore with relative equanimity a flood of coarse and malignant abuse of his motives, morals, religion, personal honesty and decency; cherished very few personal animosities; and better than any of his great antagonists cleared political opposition of ill-blooded personality. In short, his kindness of heart rose above all social, religious or political differences, and nothing destroyed his confidence in men and his sanguine views of life. Complex as was his life in interests and incidents, it can be summed up in a single word: Freedom— freedom in creed, government, thought and speech. "I have sworn," he wrote in 1800, "upon the altar of God eternal hostility against every form of tyranny over the mind of man."

He died on July 4, 1826, the 50th anniversary of the Declaration of Independence, on the same day as John Adams. For his tomb he chose the epitaph: "Here was buried Thomas Jefferson, author of the Declaration of American Independence, of the statute of Virginia for religious freedom, and father of the University of Virginia."

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JEFFERSON CITY (legally and officially the City of Jefferson), the capital of Missouri, U.S.A., and the county seat of Cole county, on the south bank of the Missouri river, near the centre of the State. It is on Federal highways 50, 54 and 63; is served by the Chicago and Alton, the Missouri-Kansas-Texas, and the Missouri Pacific railways, and by motor bus lines as far as Saint Louis, Springfield and Kansas City; it has an airport. The population was 14,490 in 1920 (13.6% negroes) and was estimated locally at 20,000 in 1928. The magnificent State capitol, erected between 1911 and 1918 at a cost of $5,000,000, dominates the scene from a bluff above the river. At the south entrance is a bronze statue of Thomas Jefferson by J. E. Fraser, and in the park stands Karl Bitter's group representing the signing of the Louisiana purchase treaty. There are decorative paintings and sculpture by Frank Brangwyn, Gari Melchers, Charles Hoffbauer, Henry Reuterdahl, A. Stirling Calder, Hermon A. MacNeil and many other artists. In the dome (238ft. high) is the radio broadcasting station of the State bureau of markets. The supreme court building, facing the capitol, houses one of the best law libraries in the country. The State penitentiary and the women's prison farm are located here. Lincoln university for negroes, a State institu

tion since 1879, was founded in 1866 by two regiments of negro infantry on their discharge from the Union army. The city has large railroad shops and various other manufacturing industries with an aggregate output in 1925 valued at $10,896,175.

The original Constitution of Missouri prescribed that the capital should be on the Missouri river, within 40m. of the mouth of the Osage. The site was selected by a commission, and the bill was signed by the first governor of the State on New Year's eve, 1821. In 1822 the town was laid out. The first State-house, built in 1826, was burned in 1837. A larger building was begun the same year, completed in 1842, enlarged in 1887, and in its turn destroyed by fire in 1911. The present structure was erected under the direction of a bi-partisan commission. Jefferson City became the county seat in 1828, and was chartered as a city in 1839. In June, 1861, it was occupied by Union forces, and in Sept.–Oct. 1864, it was threatened by Confederate troops under Gen. Sterling Price.

JEFFERSONVILLE, a city of southern Indiana, U.S.A., on the Ohio river, opposite Louisville, Ky.; the county seat of Clark county. It is served by the Baltimore and Ohio, the Big Four, the Interstate Public Service company (electric), and the Pennsylvania railways, and by river packet lines. The population was 10,098 in 1920 (14% negroes) and was estimated locally at 15,800 in 1928. It is attractively situated on bluffs above the river, which here falls over 26ft., furnishing abundant water-power. There are railroad car works, employing over 1,000 men, a large soap and perfume plant, and sundry other manufacturing industries, with a total output in 1927 valued at over $5,000,000. An army supply depot is located here. In the river opposite Jeffersonville was formerly Corn Island (now completely washed away), from which Gen. George Rogers Clark started (June 24, 1778) on his expedition against Kaskaskia and Vincennes. Ft. Finney (later called Ft. Steuben) was built on the site of the present city in 1786, but was abandoned in 1791. Permanent settlement began in 1802, when a town was laid out, which was incorporated in 1815 and chartered as a city in 1830.

JEFFREY, FRANCIS JEFFREY, Lord (1773–1850), Scottish judge and literary critic, son of a depute-clerk in the Court of Session, was born at Edinburgh on Oct. 23, 1773. He was educated at Edinburgh high school, the university of Glasgow and Queen's College, Oxford. He was admitted to the Scottish bar in Dec. 1794, but found that his Whig politics seriously prejudiced his legal prospects. He went to London in 1798 and worked as a journalist, but without success; his marriage with Catherine Wilson in 1801 made the question of a settled income even more pressing. A project for a new review was brought forward by Sydney Smith in Jeffrey's flat, and resulted (1802) in the *Edinburgh Review*. After the first three numbers the editorial work devolved chiefly on Jeffrey, who was eventually appointed editor.

Most of the collaborators were Whigs; but it numbered Sir Walter Scott among its contributors; and no emphasis was given to its political leanings until the publication in 1808 of an article by Jeffrey himself on the work of Don Pedro Cevallos on the *French Usurpation of Spain*. The tradition established in the early years of the undertaking ensured its success. It had a circulation, great for those days, of 12,000 copies. The period of Jeffrey's editorship extended to about 26 years, ceasing with the 98th number, published in June 1829. Jeffrey's own contributions numbered 200. His criticisms were pungent and effective. But the essential narrowness of his general outlook prevented him from detecting and estimating latent forces, either in politics or in matters intellectual and moral; and this lack of understanding and sympathy accounts for his distrust and dislike of the passion and fancy of Shelley and Keats, and for his praise of the half-hearted and elegant romanticism of Rogers and Campbell. A criticism in the 15th number on the morality of Moore's poems led in 1806 to a duel between the two authors at Chalk Farm. The proceedings were stopped by the police, and Jeffrey's pistol was found to contain no bullet. The affair led to a warm friendship, however, and Moore contributed to the *Review*, while Jeffrey made ample amends in a later article on *Lalla Rookh* (1817).

Jeffrey's wife had died in 1805, and in 1813 he married Charlotte, daughter of Charles Wilkes of New York, and great-niece of John Wilkes. Before returning to England after their marriage in New York, they visited several American cities, and his experience strengthened Jeffrey in the conciliatory policy towards that country. Jeffrey's literary reputation helped his professional advancement. His practice extended rapidly in the civil and criminal courts, and he regularly appeared before the general assembly of the Church of Scotland. His sharpness and insight gave him a formidable advantage over an opponent, and he excelled in eloquent closing appeals. Jeffrey was twice, in 1820 and 1822, elected lord rector of the university of Glasgow. In 1829 he was chosen dean of the faculty of advocates. On the return of the Whigs to power in 1830 he became lord advocate, and entered parliament as member for the Perth burghs. He was unseated, and afterwards returned for Malton, a borough in the interest of Lord Fitzwilliam. After the passing of the Scottish Reform Bill, which he introduced, he was returned for Edinburgh in Dec. 1832. He was raised to the judicial bench as Lord Jeffrey in May 1834. He died at Edinburgh on Jan. 26, 1850.

Some of his contributions to the *Edinburgh Review* appeared in four volumes in 1844 and 1845. This selection includes the essay on "Beauty" contributed to the *Ency. Brit.* The *Life of Lord Jeffrey, with a Selection from his Correspondence*, by Lord Cockburn, appeared in 1852 in 2 vols. *See* also the *Selected Correspondence of Macvey Napier* (1877); the sketch of Jeffrey in Carlyle's *Reminiscences*, vol. ii. (1881); and an essay by Lewis E. Gates in *Three Studies in Literature* (New York, 1899).

JEFFREYS, GEORGE JEFFREYS, 1st Baron (1648–1689), lord chancellor of England, son of John Jeffreys, a Welsh country gentleman, was born at Acton Park, in Denbighshire, in 1648. He was educated at Shrewsbury, St. Paul's and Westminster schools, and at Trinity college, Cambridge, and entered the Inner Temple in 1663. Within three years of his call to the bar in 1668, he was elected common serjeant of the City of London. Jeffreys had remarkable aptitude for the profession of an advocate—quick intelligence, caustic humour, copious eloquence. His powers of cross-examination were masterly; and if he was insufficiently grounded in legal principles to become a profound lawyer, nothing but greater application was needed in the opinion of so hostile a critic as Lord Campbell, to have made him the rival of Nottingham and Hale. While holding the office of common serjeant, he pursued his practice at the bar. With a view to further preferment he now sought to ingratiate himself with the court party, to which he obtained an introduction possibly through William Chiffinch, the notorious keeper of the king's closet. He at once attached himself to the king's mistress, the duchess of Portsmouth; and as early as 1672 he was employed in confidential business by the court. He was knighted in 1677, became solicitor-general to James Duke of York, and recorder of London in 1678.

In the previous month Titus Oates had made his first revelations of the alleged popish plot, and from this time forward Jeffreys was prominently identified, either as advocate or judge, with the memorable state trials by which the political conflict between the crown and the people was waged during the remainder of the 17th century. Jeffreys threw in his lot with the court, displaying his zeal by initiating the movement of the "abhorrers" (*q.v.*) against the "petitioners" who were giving voice to the popular demand for the summoning of parliament. He was rewarded with the office of chief justice of Chester in 1680; but when parliament met in October a hostile resolution induced him to resign his recordership, a piece of pusillanimity that drew from the king the remark that Jeffreys was "not parliament-proof." In 1683 the first of the Rye House conspirators were brought to trial. Jeffreys was briefed for the crown in the prosecution of Lord William Howard; and, having been raised to the bench as lord chief justice of the king's bench, he presided at the trials of Algernon Sidney in 1683 and of Sir Thomas Armstrong in the following year. In 1685 he passed sentence on Titus Oates for perjury in the plot trials; and about the same time James II. rewarded his zeal with a peerage as Baron Jeffreys of Wem, an honour never before conferred on a chief justice during his tenure of office. Jeffreys had been suffering from stone, and the malady probably was in some degree the cause of the unmeasured fury he displayed at the trial of Richard Baxter (*q.v.*) for seditious

libel—if the unofficial *ex parte* report of the trial, which alone exists, is to be accepted as trustworthy.

In 1685 Jeffreys opened at Winchester the "bloody assizes," his conduct of which has branded his name with infamy. The number of persons sentenced to death at these assizes for complicity in the duke of Monmouth's insurrection is uncertain. The official return of those actually executed was 320; many hundreds more were transported and sold into slavery in the West Indies. In all probability the majority of those condemned were in fact concerned in the rising, but the trials were in many cases a mockery of justice. Numbers were cajoled into pleading guilty; the case for the prisoners seldom obtained a hearing. The merciless severity of the chief justice did not however exceed the wishes of James II.; for on his return to London Jeffreys received from the king the great seal with the title of lord chancellor. For the next two years he was a strenuous upholder of prerogative, though he was less abjectly pliant than has sometimes been represented. He even withstood James on occasion, when the latter pushed his Catholic zeal to extremes. But while he watched with misgiving the king's preferment of Roman Catholics, he made himself the masterful instrument of unconstitutional prerogative in coercing the authorities of Cambridge university, who in 1687 refused to confer degrees on a Benedictine monk, and the fellows of Magdalen college, Oxford, who declined to elect as their president a disreputable nominee of the king.

Being thus conspicuously identified with the most tyrannical measures of James II., Jeffreys was in a desperate plight when the king fled from the country on the approach of William of Orange. The lord chancellor also attempted to escape; but in spite of his disguise as a common seaman he was recognized in a tavern at Wapping and was arrested and conveyed to the Tower. The malady from which he had long suffered had recently made fatal progress, and he died in the Tower on April 18, 1689.

It is impossible to determine precisely with what justice tradition has made the name of "Judge Jeffreys" a byword of infamy. The Revolution, which brought about his fall, handed over his reputation to the mercy of his bitterest enemies. They alone have recorded his actions and appraised his motives and character, and their lampoons, while they fanned the undiscriminating hatred of contemporaries who remembered the judge's severities, and perpetuated that hatred in tradition, have not been sufficiently discounted even by historians like Macaulay and Lord Campbell. The name of Jeffreys has therefore been handed down as that of a coarse, ignorant, dissolute bully, who prostituted the seat of justice. That there was ground for the execration is not to be gainsaid. But the portrait has nevertheless been blackened overmuch. An occasional significant admission in his favour may be gleaned even from the writings of his enemies. Roger North and Jekyll have both admitted that in matters where the interests of the court were not concerned, he was as good a judge as they had seen. His conduct to prisoners was a failing so common to the age that not even Hale was exempt from it.

Some of his actions that have incurred the sternest reprobation were otherwise estimated by the best of his contemporaries. His trial of Algernon Sidney, decribed by Macaulay and Lord Campbell as one of the most heinous of his iniquities, was warmly commended by Dr. William Lloyd, one of the seven bishops (*see* letter from the bishop of St. Asaph in H. B. Irving's *Life of Judge Jeffreys*, p. 184). Nor was the habitual illegality of his procedure so unquestionable as frequently assumed. Sir James Stephen inclined to the opinion that no actual abuse of law tainted the trials of the Rye House conspirators, or that of Alice Lisle, the most prominent victim of the "bloody assizes." The conduct of the judges in Russell's trial was, he thinks, "moderate and fair in general"; and the trial of Sidney "much resembled that of Russell." If Jeffreys judged political offenders with cruel severity, he also crushed some glaring abuses; conspicuous examples of which were the frauds of attorneys who infested Westminster hall, and the systematic kidnapping practised by the municipal authorities of Bristol. Even though the popular notion requires to be modified, it remains incontestable that Jeffreys was probably on the whole the worst example of a period when the administration of justice in England had sunk to the lowest degradation, and the judicial bench had become the too willing tool of an unconstitutional and unscrupulous executive.

BIBLIOGRAPHY.—The chief contemporary authorities for the life of Jeffreys are Bishop Burnet's *History of my own Time* (1724) and *see* especially the edition "with notes by the earls of Dartmouth and Hardwick, Speaker Onslow and Dean Swift" (1833); Roger North's *Life of the Right Hon. Francis North, Baron of Guildford* (1808) and *Autobiography* (1887); *Ellis Correspondence, Verney Papers* (Hist. mss. Comm.), *Hatton Correspondence* (Camden Soc. pub.); the earl of Ailesbury's *Memoirs;* Evelyn's *Diary*. The only trustworthy information as to the judicial conduct and capacity of Jeffreys is to be found in the reports of the *State Trials*, vols. vii.–xii.; and *cf.* Sir J. F. Stephen's *History of the Criminal Law of England* (1883). For details of the "bloody assizes," see *Harl. MSS.* 4,689; George Roberts, *The Life, Progresses and Rebellion of James Duke of Monmouth*, vol. ii. (1844); also many pamphlets, lampoons, e c., in the British Museum, as to which *see* the article on "Sources of History for Monmouth's Rebellion and the Bloody Assizes," by A. L. Humphreys, in *Proceedings of the Somersetshire Archaeological and Natural Hist. Soc.* (1892). Later accounts are by H. W. Woolrych, *Memoirs of the Life of Judge Jeffreys* (1827); Lord Campbell, *Tl Lives of the Lord Chancellors* (1845), 1st series, vol. iii.; E. Foss, *The Judges of England* (1864), vol. vii., Henry Roscoe, *Lives of Eminent British Lawyers* (1830); Lord Macauley, *History of England* (1848; and many subsequent editions). Most of these works, and especially those by Macaulay and Campbell, are uncritical in their hostility to Jeffreys, and are based for the most part on untrustworthy authorities. The best modern work on the subject, though unduly favourable to Jeffreys, is H. B. Irving's *Life of Judge Jeffreys* (1898), the appendix to which contains a full bibliography. (C.)

JEHOIACHIN, son of Jehoiakim and king of Judah (2 Kings xxiv. 8 *sqq.;* 2 Chron. xxxvi. 9 *seq.;* Jer. xxii. 20–30). He came to the throne at the age of 18 in the midst of the Chaldean invasion of Judah, and is said to have reigned three months. He was compelled to surrender to Nebuchadrezzar II. and was carried off to Babylon (597 B.C.). Eight thousand people of the better class (including artisans, etc.) were removed, and the Temple was partially despoiled. Nearly 40 years later, Nebuchadrezzar died (562 B.C.) and Evil-Merodach (Amil-Marduk), his successor, released Jehoiachin.

JEHOIAKIM, son of Josiah (*q.v.*) and king of Judah (2 Kings xxiii. 34–xxiv. 6; Jer. xxii. 13–19). On the death of Josiah at Megiddo his younger son Jehoahaz (or Shallum) was chosen by the Judaeans, but the Egyptian conqueror Necho summoned him to his headquarters at Riblah and removed him to Egypt, appointing in his stead Jehoiakim. For a time Jehoiakim remained under the protection of Necho and paid heavy tribute; but with the rise of the new Chaldean empire under Nebuchadrezzar II., and the overthrow of Egypt at the battle of Carchemish (605 B.C.) a vital change occurred. After three years of allegiance the king revolted. Invasions followed by Chaldeans, Syrians, Moabites and Ammonites, perhaps the advance troops despatched by the Babylonian king; the power of Egypt was broken and the whole land came into the hands of Nebuchadrezzar. It was at the close of Jehoiakim's reign, apparently just before his death, that the enemy appeared at the gates of Jerusalem, and although Jehoiakim "slept with his fathers" his young son was destined to see the first captivity of the land of Judah (597 B.C.).

JEHOL or Chēng-Tē-Fu is the capital of a special administrative area, to the north of the Great Wall, formerly attached to the Chinese province of Chih-li. The city is situated about 130 m. N. E. of Peking at the head of navigation of the Lwan-ho on a plain within the belt of scarps which separates the Mongolian plateau from the lowlands of North China. It is famous in Chinese history as the summer residence of the Manchu dynasty, used mainly in autumn when the emperor was journeying to the great hunting-grounds (Wei-Chang) beyond Jehol, which was connected with the capital by a carefully graded road with numerous rest-houses. It was in the palace of Jehol, built in 1703, that the emperor Ch'ien Lung received the historic trade mission from England, headed by Lord Macartney, in 1793. In recent times the country round Jehol, formerly an imperial reserve, has been opened up for agricultural use and is being occupied by an increasing number of Chinese immigrants. The northern portion of the administrative district is drained towards Manchuria and is becoming economically linked up with it.

JEHORAM, the name of two kings in the Bible (also JORAM).

1. The son of Ahab, and king of Israel in succession to his brother Ahaziah. He maintained close relations with Judah, whose king seems to have recognised his suzerainty, and came to his help against Moab, who had revolted (II Kings. i. 1, iii.). The result of the campaign seems to have been a defeat for Israel. Together with Ahaziah, king of Judah, he endeavoured to recover Ramoth-Gilead from Hazael, king of Syria. He was wounded in the fighting round that town, and during his absence a revolution was fomented by the prophetic party (always hostile to the house of Omri), and Jehu seized the throne, putting to death Jehoram, his mother Jezebel, his nephew Ahaziah, king of Judah, all the living members of Ahab's family, and large numbers of the Ba'al party. These events seem to have occurred in or about the year 841 B.C.

2. Son of Jehoshaphat and king of Judah. He married Athaliah, daughter of Ahab, and was thus brother-in-law of 1. above, and contemporary with him. In his days Edom and Libnah revolted (II Kings viii. 20–22), perhaps in concert with one another. The Chronicler (II Chron. xxi. 1–xxii. 1) adds many details: on ascending the throne he massacred his brethren, was condemned to death from disease by Elijah, and was utterly defeated by a great invasion of Philistines and Arabians. He died a year before his namesake of Israel, *i.e.* probably in or about 842 B.C.

JEHOSHAPHAT was the son of Asa and king of Judah in the early part of the ninth century B.C. He seems to have been a subordinate ally of the house of Omri; his son Jehoram married Ahab's daughter Athaliah, and he himself took part in Ahab's fatal expedition to Ramoth-Gilead and in the attack on Mesha, king of Moab by Jehoram, king of Israel. He engaged in distant trading enterprises, but his attempt to establish a fleet at Ezion-Geber (near the modern Akabah) ended in failure. The Chronicler adds an account of an attack on Jehoshaphat by a joint army of Moabites, Ammonites and Edomites, in which the king of Judah was completely victorious (II Chron. xx.; I Kings xxii. 41 *sqq.*).

JEHOVAH, the God of Israel. The pronunciation "Jĕhōvāh" is an error resulting among Christians from combining the consonants *Yhwh* (*Jhvh*) with the vowels of *'ădhōnāy*, "Lord," which the Jews in reading the Scriptures substituted for the sacred name, commonly called the *tetragrammaton* as containing four consonants. It is first found in manuscripts of Martini's *Pugio Fidei* (1278), belonging to the 14th century; and Galatinus (1518) is found arguing against abbreviating it to "Jova," on the analogy of the Latin *Jovis* (as proved by G. F. Moore).

This avoidance of the *tetragrammaton*, due primarily to an over-rigid interpretation of certain passages in the Old Testament (*e.g.*, Lev. xxiv. 15–23; *cf.* Exod. xx. 7), may have arisen from various motives: a feeling that a proper name for God implies the existence of other gods, the fear lest the sacred name should be mispronounced or otherwise profaned, and the desire to prevent its abuse in magical practices. If this hope was the reason, secrecy had the opposite effect; for the *tetragrammaton* became the greatest name in both Jewish and heathen spells and miraculous efficacy was attributed to mere utterance of it. Several centuries before the Christian era the *tetragrammaton* ceased to be commonly used. Some later writers in the Old Testament prevailingly or exclusively employed *'ĕlōhîm*, "God," which editors in some parts uniformly substituted for *Yhwh*; various periphrases also took its place, such as "the Most High," "the God of Heaven" and "the King of Heaven" in Daniel, or simply "Heaven" in I. Maccabees. The oldest Greek versions and the books written in Greek, *e.g.*, Wisdom and II. and III. Maccabees, replaced *Yhwh* by Κύριος, "Lord." The name was still pronounced only in the priestly benediction (Num. vi. 27) after the daily sacrifice in the temple, although a substitute was used in the synagogues, and by the high priest in his prayers and benediction on the Day of Atonement. The Rabbinic tradition that after the death of Simeon the Just (fl. 290 B.C.) it was no longer pronounced even on these occasions, is contradicted by the well-attested statement that in the last generations before the fall of Jerusalem (A.D. 70) it was uttered so low that the sounds were lost in the chant of the priest. After that event the liturgical use of the name ceased, but the tradition was perpetuated in the Rabbinic schools; it continued also to be employed by healers, exorcists and magicians, and is found on many magical *papyri*. It is asserted by Philo that only priests might pronounce it and by Josephus that those who knew it were forbidden to divulge it. Finally the Samaritans shared the scruples of the Jews, except that they used it in judicial oaths.

The early Christian scholars therefore easily learnt the true pronunciation. Clement of Alexandria (d. 212) gives Ἰάουε or Ἰάουαι (or in one manuscript Ἰάου), Origen (d. 253–54) Ἰάη, and Epiphanius (d. 404) Ἰαβε (or Ἰαυε in one manuscript); Theodoret (d. 457) says that the Samaritans pronounced it Ἰαβε. (or Ἰαβα) and the Jews Αἶα (if the text is rightly restored). This direct testimony is supplemented by Ἰαβε or Ἰαβα or even Ἰαωούηε in Greek magical texts and by *Yāwē* in an Ethiopic charm. Clearly a form like *Yahweh* underlies all these transliterations except Αἶα, which represents *'ehyeh* or, in the Babylonian punctuation, *'ahyah*, "I am," a verbal form sometimes used as the Divine name (Exod. iii., 14). Diodorus Siculus (1st century B.C.) and Macrobius (5th century A.D.), in giving Ἰάω, which agrees with *Iao* in Jerome (d. 420), reflect *Yāhû*; and Porphyry (fl. 275) with Ἰεύω goes back to *Yĕhô*—as found in proper names.

MODERN THEORIES

In spite of this testimony, modern scholars have differed widely as to the true pronunciation of the name. Thus Scaliger (1598) inclined to *Yahweh* or *Yehweh* and Genebrardus (1600) proposed *Ihue* (cf. Heb. *yihyeh*, "he becomes") or *Iahue*. Mercerus (d. 1570) suggested *Yehĕweh* (*cf.* Heb. *'ehyeh*, "I am"), Arias Montanus (1527–98) *Jeveh*, and Brinton (1899) *Jahva*. Other scholars were led astray by supposing that Ἰάω or *Iao* represented the *tetragrammaton;* thus Drusius (c. 1604) argued for *Jahvōh*, Bellermann (1818) for *Yāhôh*, and Sayce (1894) for *Yahăvah*. The arguments, however, of a succession of learned scholars from the end of the 15th to the beginning of the 19th century gradually prevailed; the support of Eichorn (1793) and the conversion of Gesenius (1786–1842) and Ewald (1803–75), who at first favoured *Yahwōh* and *Yĕhōvāh* respectively, to *Yahweh* ensured the general acceptance of that form, although *Yahwōh* still finds occasional adherents.

The form *Yahweh*, in which the first *h* is voiced and the accent falls on the second syllable, is of the type of such a place-name as *Yabhneh* (Eng. "Jabneh"), which is properly the imperfect tense of a verb and means "he causeth to build"; the alternative *Yabhnĕ'ēl* (Eng. "Jabneel"), meaning "God causes to build," shows that the implied subject in the abbreviated form is God. While, however, it is universally admitted that *Yahweh* is a verbal form, its precise sense is uncertain.

Firstly, it is disputed whether it is the intransitive or the causative theme; the former would be expected to take *i* in the first syllable, although this *i* was probably *a* originally, while the latter takes *a* invariably. Secondly, the root from which it is derived is open to doubt. The writer of the priestly narrative, who regards it as intransitive, identifies it with *yihyeh*, "he is" or "becomes," "he will be" or "become," when (having changed the third into the first person to suit the context) he explains it by the phrase *'EHYEH 'ăsher 'EHYEH* (Exod. iii., 14); this can be translated "I am that I am" or more exactly "I am wont to be that which I am wont to be" or "I will be that which I will be." The first implies that Yahweh's nature can be defined only by itself or that, while he is, as opposed to non-existent heathen deities, he exists not simply in an abstract sense but actively, ever manifesting himself under fresh aspects (Oehler); the second means that he will be with Israel in future afflictions as in the present oppression (Rashi) or that he will show himself to Israel under the manifold attributes of goodness and so on (Davidson), or that he will be it, viz., the performer of his promises (Ewald). The interpretation ὁ ὤν, "he who is," of the Alexandrian version, in implying metaphysically the assertion of this absolute being, is incorrect; for *hāyāh*, "became" or "was," denotes being phenomenally, not essentially or ontologically.

Although the general idea connected with the *tetragrammaton* by the priestly writer, and after him by the Israelites, was obvi-

usly that of a being who both is and manifests his being, the ossibility cannot be excluded that he intended to attach to it a heological sense totally different from its original meaning. It vas already recognized in the middle ages that formally it might iave a causative meaning (Aaron ben Elijah). Consequently it ias been translated "he causes to be," and this has been variously nterpreted as signifying that he creates or gives life (Gesenius) n the sense that he is the giver either of existence (Schrader) or of life and deliverance (Kuenen), that he calls into existence the events of history (Lagarde), or that he brings to pass, viz., performs his promises (Le Clerc).

The intransitive interpretation agrees with Hebrew tradition but is open to certain objections: that (1) *i* would be expected in place of *a* in the first syllable, and (2) the correct form is *hāyāh*, not *hāwāh*, "was" in biblical Hebrew. Both can be easily explained: (1) the *a* may be an archaism, of which there are traces in the Old Testament; (2) the form *hāwāh* is found sporadically in biblical Hebrew and, being customary in the neighbouring dialects, especially Aramaic, may once have been normal in Hebrew. The causative interpretation, apart from the doubt about *w* for *y*, is liable to far more serious objections: that (1) *hāyāh*, though used of a fulfilment of a definite promise or prediction, can hardly be abstractly so employed with no indication of the promise, and (2) the causative theme of *hāyāh* is found in no Semitic language, except late Syriac, but is replaced by that of some other root. Those, therefore, who still regard it as causative refer it to *hāwāh*, found once in Hebrew in the form *hāwā'*, "fell"; they interpret this as "he causes to fall," *sc.* the rain (Robertson Smith; *cf.* Arab. *haway*, "fell"), or "he overthrows," *sc.* with lightning (Green; *cf.* Arab. *'ahway*, "overthrew" and Heb. *hōwāh* or *hawwāh* "destruction"). But, even though Yahweh was often depicted as a storm-god, the fact that the Heb. *hāwa'*, "fell," is late and rare renders this explanation highly improbable. Even less likely are the attempts to explain it either as "he falls" like a meteoric stone or "he blows" (Wellhausen; *cf.* Arab. *haway*, "fell" and "blew"), on the grounds that his worship originated among the Kenites or Midianites or other tribes to the south of Palestine and that several places sacred to him, *e.g.*, Horeb, Sinai and Kadesh, lay in northern Arabia, or as "he loves" (Gardner; *cf.* Arab, *haway*, "loved"). Such Arabizing interpretations are *a priori* doubtful, and the traditional Hebrew explanation is in itself as reasonable as anything else hitherto proposed.

Outside the Old Testament *Yhwh* occurs only on the Moabite Stone (*c.* 850 B.C.); the usual form is *Yh* or *Yhw*, occurring in unvocalized texts of the 5th and 4th centuries B.C. These forms appear in the Old Testament sporadically as the independent *Yāh* and regularly as *Yāh-* or *Yāhû-* at the beginning and *-Yĕhô* or *-Yô* at the end of proper names. Elsewhere the initial and final forms in composition respectively are *Yw-* and *-Yw* in the 9th, *Yh-* and *-Yhw* in the 7th, *Yhw-* and *-Yhh* in the 6th, *Yh-* and *-Yhw* or *-Y'* in the 5th century B.C.; thereafter most of these forms seem to have been used indiscriminately. In Assyrian and Babylonian texts, which alone give the contemporary vocalization, the *tetragrammaton* appears in transcribed Hebrew names as *Ya-* in the 9th, *Yau-* and *-Yau* or *-Ya* in the 8th, and *Yâḥû-* and *-Yâma* (for *-Yâwa*) in the 5th century B.C. These point to *Yā* as the original pronunciation, in which case the final consonant was merely an orthographic device to avoid a final vowel; similarly, the medial *h* in *Yā(h)w* and *Yā(h)h* must have served merely to mark the *a* long. Afterwards, this *h* came incorrectly to be pronounced, as the hard *h* in *Yâḥû-* and the Biblical *Yĕhô-* and *-Yāhû* show. The forms *Yĕhô-* and *Yô-*, which arise out of *Yĕhau-* and *Yau-* respectively owing to a similar mispronunciation of the orthographic *w* and the change of *aw* or *au* into *ô* according to Hebrew practice, were fully established by the 3rd century B.C., since *ô* has replaced *a* almost always in the Septuagint.

It was formerly held that *Yāh* and similar forms were abbreviations of *Yahweh*. The arguments, however, against this view are overwhelming: (1) the short forms show that *ya* was the essential syllable, although on this theory it would be merely a prefix; (2) the inscriptions and *papyri*, as well as proper names, show that *Yh* or *Yhw*, not *Yahweh*, was the extra-biblical form; (3) it is *a priori* improbable that a name held so sacred as *Yahweh* would be commonly abbreviated; (4) no other Semitic race ever shortened the names of its gods; (5) the endeavour to assign an abstract meaning to a divine name bears the impress of a later period of theological reflection. It has, therefore, been suggested, as Greek speculation shows, that *Yahweh* comes from an original *Yahw*, afterwards vocalized *Yāhû*, either by adding a questionable ending *-ay* become *-eh* (Grimme) or an *-h* like the Arabic vocative *-âh* (Lukyn Williams and Burkitt) or else by assimilation to *yihyeh*, "he is" (van Hoonacker). This last suggestion is probably correct; but, even so, it fails to account for *Yāh* as well as *Yāhû*. It is, however, not impossible that the primitive form was simply *Yā*, which Hebrew orthography required to be written *Yāw* or *Yāh;* later, when *w* was not thought sufficient to indicate the long vowel, *h* was inserted, giving rise to *Yā(h)w*, which came to be mispronounced *Yāhû* (on the false analogy of *saḥw* developed into *sāḥû*, "swimming"). This development explains the presence of *a* and *w*, where *i* and *y* would be expected if *Yahweh* were connected with the substantive verb; for primarily they belonged to the primitive *Ya(hw)*, but secondarily the recollection of the archaic *a* in the imperfect tense and of the North-Palestinian and Aramaic *hāwāh* = *hāyāh*, "became," aided their retention.

This *Yā* was probably ejaculatory in origin (*cf.* Gr. Βάκχος and Ἴακχος); for *yâ* or *yāh* is a common Semitic exclamation. At the Exodus the national unity of the Hebrews was enforced by the worship of one national God, and the adoption of the preeminent God of the patriarchs together with the alteration of his name from the meaningless *Yā* to the significant *Yahweh* reinforced the new idea. The transition, which was effected by a prolongation of the ejaculation natural in moments of emotion or excitement, may have been a gradual process; but its assimilation to and explanation by a simple verb was an act of inspiration. This new name, though at first widely known, as the Moabite Stone shows, was soon considered too sacred for daily use and confined to the Scriptures, while the older form persisted in profane use. On this theory there is no essential discrepancy between the statement that in the days of Enosh men began "to call upon the name of *Yahweh*" (Gen. iv. 26) and God's assertion that in the time of the patriarchs "by my name *Yahweh* I was not known" (Exod. vi. 3); for the writer or compiler of the first passage substituted the later *Yahweh* where strict history required *Yāh*, while in the second he was right to the extent that God was known not as *Yahweh* but as *Yāh* before the Exodus.

It has been argued on several grounds that *Yahweh* was originally a non-Hebrew deity. That he was a Kenite (Tiele) or Canaanite (Land) god is little more than conjecture. Thus it has been claimed that the name *A'ḥiyami*, found on a cuneiform tablet at Taanach (*c.* 1300 B.C.?) is the Hebrew *'Ăḥîyāh*, "Ahijah," meaning "brother of *Yami* (*Yawi*)=*Yah* (*weh*)"; but this final element may just as well be *Yamu*, a deity apparently found in the Hebrew *Yĕmû'ēl*, "Jemuel," which means "*Yĕmû*=*Yamu* is god," or corresponds with *-yā'm* as seen in the Hebrew *'Ăḥiyā'm*, "Ahijam," in which case it is a mere termination. A Babylonian connection for *Yāhû*, afterwards Hebraized as *Yahweh*, has been urged on the ground that a god called *Yaû(m)* occurs in such names as the Bab. *Yaûm-ilum* which is compared with the Heb. *Yô'ēl*, "Yahweh is God"; but the absence of the determinative sign indicating a god before *yaûm* and the discovery of the possessive pronoun *yaûm*, "my," makes the rendering "Mine is God" far more plausible. Similarly, in such names as *Ya'we-ilum* it is probable that *ya'we* is not a divine name but a verbal element, although its meaning is still unknown. Again, names like the Bab. *Bēliya* and *Bēliau* are not identifiable with the Heb. *Ba'alyāh*, "Yah is lord," not only because there is no mark of divinity before the final element but also because *-ya, yau* and so on are well known hypocoristic endings in Assyro-Babylonian, as in the neighbouring languages. The argument for the existence of a Babylonian god called *Yau* rests entirely on proper names; and, since these can be otherwise satisfactorily explained, it must be given up. Further, the occurrence of *Yāh* in proper names outside Hebrew

territory proves nothing; for *Azriyâu* ("Azariah"), lord of Ya'udi, *Yau-bi'di*, king of Hamath, and *Yôrām* ("Jehoram"), prince of Hamath, may have been Hebrews or descendants of Hebrews who had settled abroad and founded their own petty kingdoms; so *Yō'ēl* ("Joel," if the name is rightly interpreted) on a Maltese inscription may be the name of a Jewish settler. Names like "Uriah" the Hittite and "Tobiah" the Ammonite prove even less, since the ending may be not the divine element but a Hebraized form of the hypocoristic *-ya;* the Assyrian *Ṭābiya* and *Uriyâ*, as well as the Cassite *Uriya*, are the foreign counterparts of these names. Yet the common recognition of heathen gods outside their own countries as attested on monuments and in proper names makes it necessary to admit the possibility of a sporadic worship of a god called *Yahweh* outside Hebrew territory. But the evidence hitherto adduced is equivocal and indirect, and no direct evidence exists; for the identification of the Heb. *Yāh* with the Bab. *Ea*, the god of wisdom, is a discovery periodically made by amateurs, which needs no refutation.

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(G. R. D.)

JEHU, a king of Israel. Son of Jehoshaphat and grandson of Nimshi, he was at first general of Ahab and Jehoram of Israel, and was noted for his furious driving of the chariot. During the joint expedition of Jehoram of Israel and Ahaziah of Judah, the former was wounded, and retired to Jezreel, where he was visited by the king of Judah. Instigated by the prophetic party and supported by the Rechabites, Jehu organised a revolution, hastened to Jezreel, where he put to death both Jehoram and Ahaziah, whilst he had the whole of the family of Ahab assassinated. The movement was the result of patriotic hostility to the foreign political theories and the religious innovations introduced by Jezebel from Sidon, which offended both the democratic feeling and the enthusiasm for Yahweh which were characteristic of Israel. Thus not only Jezebel herself but also large numbers of Baal worshippers were put to death.

In the course of an expedition against Damascus, undertaken in 841 B.C., Shalmaneser III. received tribute from Jehu. This was probably paid in order to secure Assyrian protection for the new régime, but it did not prevent the loss of much Israelite territory to the east of Jordan, or continuous war between Jehu and Hazael, king of Damascus, after the withdrawal from the country of the Assyrian armies.

Jehu is also the name of a prophet of the time of Baasha and Jehoshaphat (I Kings xvi.; II Chron. xix. *seq.*).

JELGAVA (German, *Mitau*), a town of Latvia, 29 m. by rail S.W. of Riga, on the river Aa, in a fertile plain only 12 ft. above sea level. Pop. (1925) 28,321. Jelgava is supposed to have been founded in 1266 by Conrad Mandern, grand-master of the order of the Brethren of the Sword. In 1345, when plundered by the Lithuanians, it was already an important town. In 1561 it became the residence of the dukes of Courland. During the 17th century it was thrice taken by the Swedes. Russia annexed it with Courland in 1795. At high water the plain and sometimes also the town are inundated. Jelgava is surrounded by a canal occupying the place of former fortifications. The old castle (1266) of the dukes of Courland was destroyed by Duke Biren, who erected in its place (1738–1772) a palace. Wax-cloth, linen, soap, ink and beer are the chief manufactures.

JELLAČIĆ, JOSEF, COUNT (1801–1859), Croatian soldier and statesman, was born at Péterwárdein, in the Croatian Military Frontier, on Oct. 16, 1801. Entering the Austrian army (1819), he saw service in Bosnia (1845), but it was not his military capacities, but his strong legitimist sympathies that led the emperor Ferdinand, on the advice of Baron Josika, to appoint him ban of Croatia and promote him to lieutenant-general on March 19, 1848, in order to counteract the national movement in Hungary. Jellačić took office on April 14, and immediately began the process of dissociating Croatia from Hungary, to place it directly under Austrian rule. The Hungarian Government, which was still in name loyal and constitutional, ordered Jellačić's measures to be annulled and himself to appear in Buda on a charge of high treason. Jellačić disregarded these orders; whereupon the Hungarian Count Batthyáni visited the Austrian court at Innsbruck and secured (it is said, by a trick) signature of a manifesto condemning the separatist movement in Croatia and depriving Jellačić of all his deputies.

Jellačić, who only a week after (June 19) himself appeared in Innsbruck and was hailed by the court as one of its chief pillars, disregarded the proclamation, and encouraged the separatist movement in the Croatian diet to run its course. On July 9, however, he prorogued it in view of the military situation, and as the movement in Hungary grew rapidly more extreme, the court grew more and more convinced that its salvation lay in the counter-movement led by Jellačić and his Croats. On Sept. 4 he was officially reinstated in his dignities, with a warm testimonial to his loyalty; and on Sept. 11 he crossed the Drave at the head of his troops, to attack Hungary. As a general, Jellačić was anything but talented, and was frequently defeated by the Magyar troops; but his regiments were largely instrumental in crushing the Magyars. Although the reorganization of Croatia carried through by the reaction was far from meeting his own wishes, he personally was loaded with honours. He was left in the post of civil and military governor of Croatia and the military frontier, created count (1855) and given command of the military expedition against Montenegro. He died on May 20, 1859. He published a volume of *Gedichte* in 1851.

JELLICOE, JOHN RUSHWORTH JELLICOE, 1ST EARL (1859–), British admiral, was born Dec. 5, 1859, the son of J. H. Jellicoe, a captain in the mercantile marine. His great-grandfather was Sir James Whalley Smyth Gardiner, the third and last baronet of that name. Educated at Rottingdean, he entered the navy as a naval cadet at the age of thirteen. He obtained his commission as sub-lieutenant in 1880, and his marked ability won him first class certificates in this three examinations for the rank of lieutenant. He soon developed an interest in gunnery and joined the Royal Naval College in 1883 for the theoretical part of the course for gunnery lieutenant, where he won a special £80 prize. The following year he spent in H.M.S. "Excellent," and became a fully qualified gunnery officer. From now onwards gunnery was his speciality, though his interests were by no means confined to this branch.

His first sea-going ship as a gunnery lieutenant was H.M.S. "Monarch," in which he served from 1886 to 1888. During his first year on board he went to the rescue of the crew of a stranded steamer, taking charge of a gig manned by volunteers. The boat upset in a heavy sea and he and the crew saved themselves with difficulty. He received the Board of Trade silver medal for his plucky effort. After two years on the senior staff of the Gunnery School, he was appointed to the admiralty as an assistant to the director of naval ordnance. In 1893 he was promoted to commander, and shortly afterwards was appointed to H.M.S. "Victoria," flagship of Admiral Sir George Tryon, commander-in-chief of the Mediterranean Fleet. When the "Victoria" was rammed and sunk by the "Camperdown," Commander Jellicoe had to take to the water. As he was seriously ill at the time he would have fared badly but for the support he received from a young naval cadet, P. D. Roberts-West, until rescued.

Commander Jellicoe soon recovered and two months later was appointed to the battleship "Ramillies" which flew the flag of the new commander-in-chief, Admiral Sir Michael Culme-Seymour. After a three years commission in that ship he was promoted captain on Jan. 1, 1897, and served on the Ordnance Committee. In 1898 he was appointed to the command of H.M.S. "Centurion," where he became flag captain to Admiral Sir Edward Seymour, commander-in-chief of the China Station. As the latter's chief of staff he took part in the expedition to relieve the legations in Peking during the Boxer rising in 1900. During

these operations Captain Jellicoe was badly wounded. He was subsequently awarded the C.B.

Service at the Admiralty.—He returned to the Admiralty in 1902 to be the naval assistant to the controller (third sea lord). Here he acquired a valuable insight of the work of that department. In August 1903 he went to sea again to take command of the armoured cruiser "Drake." The year 1905 saw him director of naval ordnance at the Admiralty. During his period of office he did much to further the advance of long range firing and to assist the development of naval gunnery on lines which more closely approximated to the real conditions of war. Towards the end of his time he reached the top of the captains' list and was promoted to flag rank in February 1907. In August of that year he hoisted his flag afloat in H.M.S. "Albemarle" as rear-admiral in the Atlantic Fleet. The appointment was for a year's duration only, when once more he returned to the admiralty, this time to become a member of the Board as third sea lord and controller of the navy. In December 1910 he was appointed acting vice-admiral in command of the Atlantic Fleet, being confirmed in that rank in the following November. At the end of the year he transferred his flag to H.M.S. "Hercules," on appointment to the command of the 2nd division of the Home Fleet.

In 1912 important gunnery experiments were carried out by two battleships of this division, the "Thunderer" and "Orion," the former being fitted with this system of director firing which Sir Percy Scott had been perfecting. The trials culminated in competitive firings under Admiral Jellicoe's personal supervision. As a result of these practices and largely owing to Admiral Jellicoe's insistent pressure, this most valuable system was adopted as the primary one for laying and firing the guns of practically all classes of H.M. ships. The event may be regarded as yet another milestone on the path of that gunnery progress for which he was greatly responsible. After a year in this command he returned to the Admiralty to rejoin the Board as second sea lord.

The War Period.—He left Whitehall temporarily in 1913 to become commander-in-chief of the "Red" fleet during manoeuvres, flying his flag in H.M.S. "Thunderer," but had returned to the Admiralty, when, on the eve of war, he was sent to join the Home Fleet at Scapa as second in command. The period of command of Admiral Sir George Callaghan was due to expire in a few months and Vice-Admiral Jellicoe had already been designated as his successor. When war could no longer be averted, it was considered desirable that the change in this most responsible naval command should not be delayed and Sir John Jellicoe was appointed commander-in-chief with acting rank of admiral. He had to perform a peculiarly difficult and trying duty in relieving his former chief, who was trusted and respected in an unusual degree throughout the fleet. That he achieved it so successfully was due to the chivalrous attitude of these two flag officers towards each other and to the very high reputation and strong personal regard which Sir John himself enjoyed.

Admiral Jellicoe was confirmed in his rank in March 1915, and for two years bore the exceptionally heavy burden of organising and training the Grand Fleet and keeping it ready for battle. His command was put to the test at the battle of Jutland (*q.v.*). Now that the full details of that action are better understood, the skilful handling of the British forces against an elusive enemy in conditions of low visibility and approaching darkness, is being increasingly appreciated. The German fleet escaped at night and took refuge in harbour with many ships severely damaged, and such was the impression left by Jutland that Germany never again risked a meeting with the Grand Fleet. The fruits of Admiral Jellicoe's leadership on that day and of his incomparable services throughout his period of command were seen in the historic surrender of German ships at the end of the War.

In the latter part of 1916 Admiral Jellicoe was invited to become first sea lord and regretfully left his last and greatest command afloat to take up that appointment. It was largely due to his tireless labours and wide experience that the danger of the German submarine menace was eventually overcome. He left the Admiralty at the end of 1917. After the Armistice he was sent on a special mission to visit the Dominions and advise on the post-war organisation of their navies. On this tour he flew his flag in H.M.S. "New Zealand." He was promoted to Admiral of the Fleet in 1919 and the following year was made governor of New Zealand. During his four years in this high office he greatly endeared himself to the people of that Dominion.

For his services in the War Admiral Jellicoe received the thanks of parliament and a grant of £50,000, and at the end of 1918 he was raised to the peerage as Viscount Jellicoe of Scapa, subsequently taking the additional title of Viscount Brocas of Southampton. On his return from New Zealand and in recognition of his services as governor he was, in 1925, created an Earl. He received the K.C.V.O. in 1907, G.C.B in 1915 and G.C.V.O in 1916; he also holds a number of foreign orders. He married, in 1902, the daughter of Sir Charles Cayzer, Bart., and has four daughters and a son and heir, Viscount Brocas, who was born in 1918. Earl Jellicoe possesses in remarkable degree the power of inspiring others with his own loyalty and singleness of purpose. Few naval commanders since Nelson's time have enjoyed such devotion and confidence as he did as commander-in-chief of the greatest fleet that ever set forth to do battle. (E. A.; X.)

He published *The Grand Fleet 1914–16, its Creation, Development and Work* (1920); *The Crisis of the Naval War* (1920).

JELLINEK, ADOLF (1821–1893), Jewish preacher and scholar, was born in Moravia. After filling clerical posts in Leipzig, he became *Prediger* (preacher) in Vienna in 1856. He was associated with the promoters of the New Learning within Judaism, and wrote on the history of the Kabbala. His bibliographies (each bearing the Hebrew title *Qontres*) were useful compilations. But his most important work lay in three other directions. (1) *Midrashic.* Jellinek published in the six parts of his *Beth ha-Midrasch* (1853–1878) a large number of smaller *Midrashi,* ancient and mediaeval homilies and folk-lore records, which have been of much service in the recent revival of interest in Jewish apocalyptic literature. A translation of these collections of Jellinek into German was undertaken by A. Wuensche, under the general title *Aus Israels Lehrhalle.* (2) *Psychological.* Before the study of ethnic psychology had become a science, Jellinek devoted attention to the subject. There is much keen analysis and original investigation in his two essays *Der jüdische Stamm* (1869) and *Der jüdische Stamm in nicht-jüdischen Sprüch-wörtern* (1881–1882). It is to Jellinek that we owe the oft-repeated comparison of the Jewish temperament to that of women in its quickness of perception, versatility and sensibility. (3) *Homiletic.* Jellinek was probably the greatest synagogue orator of the 19th century. He published some 200 sermons, in most of which are displayed unobtrusive learning, fresh application of old sayings, and a high conception of Judaism and its claims. Jellinek was a powerful apologist and an accomplished homilist, at once profound and ingenious.

See *Jewish Encyclopedia,* vii. 92–94. For a character sketch of Adolf Jellinek *see* S. Singer, *Lectures and Addresses* (1908), pp. 88–93; Kohut, *Berühmte israelitische Männer und Frauen.* (I. A.)

JELLY: *see* JAMS AND JELLIES.

JELLY FISH: *see* COELENTERATA.

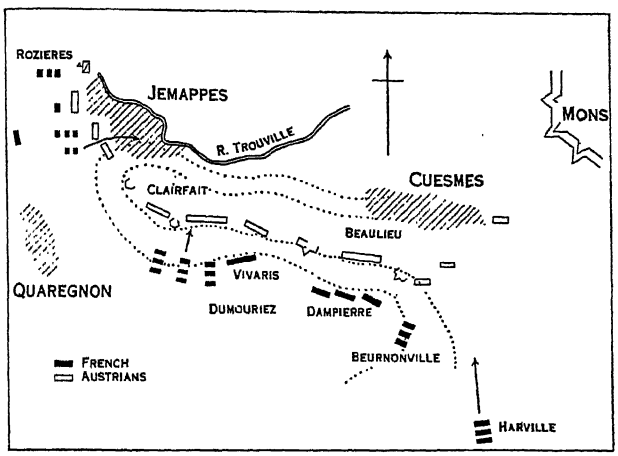
JEMAPPES, town, province of Hainaut, Belgium, near Mons, the scene of the battle at which Dumouriez, with the French Revolutionary army, defeated the Austrian army under the duke of Saxe-Teschen and Clerfayt on Nov. 6, 1792 (*see* FRENCH REVOLUTIONARY WARS).

The Battle of Jemappes (1792).—The wars of Louis XIV. and Louis XV. had shown the advantage of an offensive in Belgium, since Belgium was the weak point in the Hapsburg front. The Austrians had failed in their efforts against Lille, and Dumouriez in command of the Army of the North at Valenciennes at once issued a stirring appeal to the Belgians. Then, in order to mask his intentions, he threatened the Austrians at several points, compelling them to extend their front while with speed he advanced to crush their main forces at Mons.

The Austrians under Duke Albert of Saxe-Teschen had been strongly reinforced by Clerfait, though Dumouriez was not aware of this. Their combined forces numbered about 25,000 men and 50 guns, whilst the French army was probably 55,000 strong and

was accompanied by 100 guns. The Austrian position was a strong one. Clerfait's right was entrenched at Jemappes (province of Hainaut, Belgium), his centre on a ridge south of the village, the eastern slopes of which extended to Cuesmes where his left was posted. As Dumouriez points out the only fault in the position was its difficult line of retreat.

Dumouriez' plan was to engage Clerfait's right and centre, and turn his left; for this turning movement he ordered General Har-



PLAN OF THE BATTLE OF JEMAPPES, NOV. 6, 1792

ville and some 10,000 troops to move up from Maubeuge, outflank the Austrian left and cut Clerfait off from Mons. Harville's forward movement was, however, too slow to effect this, and the plan had to be modified.

Early on Nov. 6 Dumouriez dislodged Clerfait's advanced troops at Quaregnon, and then checked his advance to enable Harville to come up. As he did not appear, and as his young troops were eager to attack, he opened the battle by a bombardment on the Jemappes entrenchments and batteries that crowned the slopes towards Cuesmes. Then, forming his columns of attack, he assaulted the Austrian right and centre. On the right General Beurnonville moved against Cuesmes. This attack failed all along the line except on the south of Jemappes, where a lodgment compelled Clerfait to retreat across the Trouville stream. As the centre recoiled before the enemy's cannon, Dumouriez and his staff rode forward, amongst whom was the young Duke de Chartres (Philippe Égalité), and forming a solid column he called it *le bataillon de Mons*. Leading it forward he drove in the Austrian centre which was already feeling the pressure of the French at Jemappes, as these troops were beginning to threaten their rear. The batteries at Cuesmes were then taken in a hand to hand struggle, and the Austrians seeing Harville's corps advancing in the distance withdrew to Mons, and on the 7th retired to Brussels.

Each side lost some 7,000 men killed and wounded. The moral gain to the French was immense; without manoeuvre they had succeeded in imposing their will, and as one historian writes: "At Valmy they had merely stood their ground; at Jemappes they learnt to conquer."

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JENA, a university town of Germany, in the republic of Thuringia, on the left bank of the Saale, 56 m. S.W. from Leipzig by the Grossberigen-Saalfeld and 12 m. S.E. of Weimar by the Weimar-Gera lines of railway. Pop. (1925) 53,623. Jena appears to have possessed municipal rights in the 13th century. It passed in 1423 from the margraves of Meissen to the elector of Saxony. In 1690 Jena was united with Eisenach, and in 1741 reverted to Weimar.

To the north lies the limestone plateau, descending steeply to the valley, famous as the scene of the battle of Jena (1806) in which Napoleon defeated the Prussians. It contains in addition to the mediaeval market square, many old-fashioned houses and narrow streets. Besides the old university buildings, the most interesting edifices are the 15th-century church of St. Michael, the university library and the bridge across the Saale. Hard by is the Fuchs-Turm (Fox tower) celebrated for student orgies, while in the centre of the town is the house of an astronomer, Weigel, with a deep shaft through which the stars can be seen in the day time. There must also be mentioned the university church, the new university buildings, which occupy the site of the ducal palace (Schloss) where Goethe wrote his *Hermann und Dorothea,* the Schwarzer Bär hotel, where Luther spent the night after his flight from the Wartburg, and four towers and a gateway which now alone mark the position of the ancient walls. In 1547 the elector John Frederick the Magnanimous of Saxony, while a captive of the emperor, conceived the plan, carried out by his three sons of a university at Jena. A charter having been obtained from the emperor Ferdinand I., it was inaugurated in 1558. The most brilliant professoriate was under the duke Charles Augustus, Goethe's patron (1787–1806), when Fichte, Hegel, Schelling, Schlegel and Schiller were on its teaching staff. Founded as a home for the new religious opinions of the 16th century, it has even been in the forefront of German universities in liberal acceptance of new ideas. At the end of the 18th and the beginning of the 19th century, the opening of new universities, co-operating with the suspicions of the various German Governments as to the democratic opinions which obtained at Jena, militated for a while against the university. It had 180 teachers and 1,972 students in 1926. Amongst its numerous auxiliaries may be mentioned the library, the observatory, the meteorological institute and the botanical garden. There are also veterinary and agricultural colleges in connection with the university. The book trade has of late years revived, and there are several printing establishments.

The famous Zeiss firm of optical instrument makers has its seat at Jena and the town has profited in many ways therefrom. Scientific instruments, chemicals, machinery, etc., are also made.

Battle of Jena.—This famous victory on Oct. 14, 1806, by Napoleon over the Prussian army under the prince of Hohenlohe is described under NAPOLEONIC CAMPAIGNS.

JENATSCH, GEORG (1596–1639), Swiss political leader, one of the most striking figures in the troubled history of the Grisons in the 17th century, was born at Samaden, the Upper Engadine. He studied at Zürich and Basel, and in 1617 became the Protestant pastor of Scharans (near Thusis). He took the side of the Venetian and Protestant party of the Salis family, as against the Spanish and Romanist policy supported by the rival family, that of Planta. He headed the "preachers" who in 1618 tortured to death the arch-priest Rusca, of Sondrio, and outlawed the Plantas. As reprisals, a number of Protestants were massacred at Tirano (1620), which then fell into the hands of the Spanish. Jenatsch took part in the murder (1621) of Pompey Planta, the head of the rival party, but later with his friends was compelled to fly the country, giving up his position as a pastor, and henceforth acting solely as a soldier. He helped in the revolt against the Austrians in the Prättigau (1622), and in the invasion of the Valtellina by a French army (1624), but the peace made (1626) between France and Spain left the Valtellina in the hands of the pope, and so destroyed Jenatsch's hopes.

Having killed his colonel, Ruinelli, in a duel, Jenatsch had once more to leave his native land, and took service with the Venetians (1629–1630). In 1631 he went to Paris, and supported Richelieu's schemes for driving the Spaniards out of the Valtellina, which led to the successful campaign of Rohan (1635), one of whose firmest supporters was Jenatsch. But he soon saw that the French were as unwilling as the Spaniards to restore the Valtellina to the Grisons (which had seized it in 1512). So he became a Romanist (1635), and negotiated secretly with the Spaniards and Austrians. He was the leader of the conspiracy which broke out in 1637, and resulted in the expulsion of Rohan and the French from the Grisons. This treachery on Jenatsch's part did not, however, lead to the freeing of the Valtellina from the Spaniards, and once more he tried to get French support. But

on Jan. 24, 1639 he was assassinated at Coire by the Plantas; later in the same year the much coveted valley was restored by Spain to the Grisons, which held it till 1797.

Jenatsch's career is of general historical importance by reason of the long conflict between France and Spain for the possession of the Valtellina, which forms one of the most bloody episodes in the Thirty Years' War. (W. A. B. C.)

See biography by E. Haffter (Davos, 1894).

JENGHIZ KHAN (jĕn'gĭz chahn) (1162–1227), Mongol emperor, born on the banks of the river Onon. His father Yesukai was absent at the time of his birth, in a campaign against a Tatar chieftain named Temuchin. The war brought success to Yesukai, who having slain his enemy returned to his encampment in triumph. He was met by the tidings that his wife Yulun had given birth to a son. On examining the child he observed in its clenched fist a clot of coagulated blood like a red stone. In the eyes of the superstitious Mongol this circumstance referred to his victory over the Tatar chieftain, and he therefore named the infant Temuchin. The death of Yesukai, which placed Temuchin at the age of 13 on the Mongol throne, was the signal also for the dispersal of several tribes whose allegiance the old chieftain had retained by his iron rule. When remonstrated with by Temuchin, the rebels replied: "The deepest wells are sometimes dry, and the hardest stone is sometimes broken; why should we cling to thee?" But Yulun was by no means willing to see her son's power melt away; she led those retainers who remained faithful against the deserters, and succeeded in bringing back fully one-half to their allegiance. With this doubtful material, Temuchin succeeded in holding his ground against the plots and open hostilities of the neighbouring tribes, more especially of the Naimans, Keraits and Merkits. With one or other of these he maintained an almost unceasing warfare until 1206, when he felt strong enough to proclaim himself the ruler of an empire. He therefore summoned the notables of his kingdom to an assembly on the banks of the Onon, and at their unanimous request adopted the name and title of Jenghiz Khan (Chinese, Chêng-sze, or "perfect warrior"; the correct Mongolian spelling is Chingiz, and scholars of oriental studies sometimes spell it in that manner). At this time there remained to him but one open enemy on the Mongolian steppes, Polo the Naiman khan. Against this chief he now led his troops, and in one battle so completely shattered his forces that Kushlek, the successor of Polo, who was left dead upon the field, fled with his ally Toto, the Merkit khan, to the river Irtysh.

CHINESE CONQUESTS

Jenghiz Khan now meditated an invasion of the empire of the Kin Tatars, who had wrested northern China from the Sung dynasty. As a first step he invaded western Hia, and, having captured several strongholds, retired in the summer of 1208 to Lungting to escape the great heat of the plains. While there news reached him that Toto and Kushlek were preparing for war. In a pitched battle on the river Irtysh he overthrew them completely. Toto was amongst the slain, and Kushlek fled for refuge to the Khitan Tatars. Satisfied with his victory, Jenghiz again directed his forces against Hia. After having defeated the Kin army under the leadership of a son of the sovereign, he captured the Wu-liang-hai pass in the Great Wall, and penetrated as far as Ning-sia Fu in Kansuh. With unceasing vigour he pushed on his troops, and even established his sway over the province of Liao-tung. Several of the Kin commanders, seeing how persistently victory attended his banners, deserted to him, and garrisons surrendered at his bidding. Having thus secured a firm footing within the Great Wall, he despatched three armies in the autumn of 1213 to overrun the empire. The right wing, under his three sons, Juji, Jagatai and Ogotai, marched towards the south; the left wing, under his brothers Hochar, Kwang-tsin Noyen and Chow-tse-te-po-shi, advanced eastward towards the sea; while Jenghiz and his son Tulĕ with the centre directed their course in a south-easterly direction. Complete success attended all three expeditions. The right wing advanced as far as Honan, and after having captured upwards of 28 cities rejoined headquarters by the great western road. Hochar made himself master of the country as far as Liao-si; and Jenghiz ceased his triumphal career only when he reached the cliffs of the Shantung promontory. But either because he was weary of the strife, or because it was necessary to revisit his Mongolian empire, he sent an envoy to the Kin emperor in the spring of the following year (1214), saying, "All your possessions in Shantung and the whole country north of the Yellow river are now mine with the solitary exception of Yenking (the modern Peking). By the decree of heaven you are now as weak as I am strong, but I am willing to retire from my conquests; as a condition of my doing so, however, it will be necessary that you distribute largess to my officers and men to appease their fierce hostility." These terms of safety the Kin emperor eagerly accepted, and as a peace offering he presented Jenghiz with a daughter of the late emperor, another princess of the imperial house, 500 youths and maidens and 3,000 horses. No sooner, however, had Jenghiz passed beyond the Great Wall than the Kin emperor, fearing to remain any longer so near the Mongol frontier, moved his court to K'ai-fêng Fu in Honan. This transfer of capital appearing to Jenghiz to indicate a hostile attitude, he once more marched his troops into the doomed empire.

While Jenghiz was thus adding city to city and province to province in China, Kushlek, the fugitive Naiman chief, was not idle. With characteristic treachery he requested permission from his host, the Khitan khan, to collect the fragments of his army which had been scattered by Jenghiz at the battle on the Irtysh, and thus having collected a considerable force he leagued himself with Mohammed, the shah of Khwārizm, against the confiding khan. After a short but decisive campaign the allies remained masters of the position, and the khan was compelled to abdicate the throne in favour of the late guest.

With the power and prestige thus acquired, Kushlek prepared once again to measure swords with the Mongol chief. On receiving the news of his hostile preparations, Jenghiz at once took the field, and in the first battle routed the Naiman troops and made Kushlek a prisoner. His ill-gotten kingdom became an apanage of the Mongol empire. Jenghiz now held sway up to the Khwārizm frontier. Beyond this he had no immediate desire to go, and he therefore sent envoys to Mohammed, the shah, with presents, saying, "I send thee greeting; I know thy power and the vast extent of thine empire; I regard thee as my most cherished son. On my part thou must know that I have conquered China and all the Turkish nations north of it; thou knowest that my country is a magazine of warriors, a mine of silver, and that I have no need of other lands. I take it that we have an equal interest in encouraging trade between our subjects." This peaceful message was well received by the shah, and in all probability the Mongol armies would never have appeared in Europe but for an unfortunate occurrence. Shortly after the despatch of this first mission, Jenghiz sent a party of traders into Transoxiana who were seized and put to death as spies by Inaljuk, the governor of Otrar. As satisfaction for this outrage Jenghiz demanded the extradition of the offending governor. Far from yielding to this summons, however, Mohammed beheaded the chief of the Mongol envoys, and sent the others back without their beards. This insult made war inevitable, and in the spring of 1219 Jenghiz set out from Karakorum on a campaign which was destined to be as startling in its immediate results as its ulterior effects were far-reaching.

SACKING OF BUKHĀRĀ

The invading force was in the first instance divided into two armies: one commanded by Jenghiz's second son Jagatai was directed to march against the Kankalis, the northern defenders of the Khwārizm empire; and the other, led by Juji, his eldest son, advanced by way of Sighnak against Jand (Jend). Against this latter force Mohammed led an army of 400,000 men, who were completely routed, leaving, it is said, 160,000 dead upon the field. With the remnant of his host Mohammed fled to Samarcand. Meanwhile Jagatai marched down upon the Syr Daria (Jaxartes) by the pass of Taras and invested Otrar, the offending city. After a siege of five months the citadel was taken by assault, and Inaljuk and his followers were put to the sword.

The conquerors levelled the walls with the ground, after having given the city over to pillage. At the same time a third army besieged and took Khojent on the Jaxartes; and yet a fourth, led by Jenghiz and his youngest son Tulē, advanced in the direction of Bukhārā. Tashkent and Nur surrendered on their approach, and after a short siege Bukhārā fell into their hands. On entering the town Jenghiz ascended the steps of the principal mosque, and shouted to his followers, "The hay is cut; give your horses fodder." No second invitation to plunder was needed; the city was sacked, and the inhabitants either escaped beyond the walls or were compelled to submit to infamies which were worse than death. As a final act of vengeance the town was fired, and before the last of the Mongols left the district, the great mosque and certain palaces were the only buildings left to mark the spot where the "centre of science" once stood.

From the ruins of Bukhārā Jenghiz advanced along the valley of the Sogd to Samarcand, which, weakened by treachery, surrendered to him, as did also Balkh. But in neither case did submission save either the inhabitants from slaughter or the city from pillage. Beyond this point Jenghiz went no farther westward, but sent Tulē, at the head of 70,000 men, to ravage Khurāsān, and two flying columns under Chēpē and Sabutai Bahadar to pursue after Mohammed who had taken refuge in Nishapur. Defeated and almost alone, Mohammed fled before his pursuers to the village of Astara on the shore of the Caspian sea, where he died of an attack of pleurisy, leaving his empire to his son Jelaleddīn (Jalāl ud-din). Meanwhile Tulē carried his arms into the fertile province of Khurāsān, and after having captured Nessa by assault appeared before Merv. By an act of atrocious treachery the Mongols gained possession of the city, and, after their manner, sacked and burnt the town. From Merv Tulē marched upon Nishapur, where he met with a most determined resistance. For four days the garrison fought desperately on the walls and in the streets, but at length they were overpowered, and, with the exception of 400 artisans who were sent into Mongolia, every man, woman and child was slain. Herat escaped the fate which had overtaken Merv and Nishapur by opening its gates to the Mongols. At this point of his victorious career Tulē received an order to join Jenghiz before Talikhan in Badakshan, where that chieftain was preparing to renew his pursuit of Jelaleddīn, after a check he had sustained in an engagement fought before Ghazni. As soon as sufficient reinforcements arrived Jenghiz advanced against Jelaleddīn, who had taken up a position on the banks of the Indus. Here the Turks, though far outnumbered, defended their ground with undaunted courage, until, beaten at all points, they fled in confusion. Jelaleddīn, seeing that all was lost, mounted a fresh horse and jumped into the river, which flowed 20ft. below. With admiring gaze Jenghiz watched the desperate venture of his enemy, and even saw without regret the dripping horseman mount the opposite bank. From the Indus Jenghiz sent in pursuit of Jelaleddīn, who fled to Delhi, but failing to capture the fugitive the Mongols returned to Ghazni after having ravaged the provinces of Lahore, Peshawar and Melikpur. At this moment news reached Jenghiz that the inhabitants of Herat had deposed the governor whom Tulē had appointed over the city, and had placed one of their own choice in his room. To punish this act of rebellion Jenghiz sent an army of 80,000 men against the offending city, which after a siege of six months was taken by assault. For a whole week the Mongols ceased not to kill, burn and destroy, and 1,600,000 persons are said to have been massacred within the walls. Having consummated this act of vengeance, Jenghiz returned to Mongolia by way of Balkh, Bukhārā and Samarcand.

APPEARANCE IN EUROPE

Meanwhile Chēpē and Sabutai marched through Azerbeijan, and in the spring of 1222 advanced into Georgia. Here they defeated a combined force of Lesghians, Circassians and Kipchaks, and after taking Astrakhan followed the retreating Kipchaks to the Don. The news of the approach of the mysterious enemy of whose name even they were ignorant was received by the Russian princes at Kiev with dismay. At the instigation, however, of Mitislaf, prince of Galicia, they assembled an opposing force on the Dnieper. Here they received envoys from the Mongol camp, whom they barbarously put to death. "You have killed our envoys," was the answer made by the Mongols; "well, as you wish for war you shall have it. We have done you no harm. God is impartial; He will decide our quarrel." In the first battle, on the river Kaleza, the Russians were utterly routed, and fled before the invaders, who, after ravaging Great Bulgaria retired, gorged with booty, through the country of Saksin, along the river Aktuba, on their way to Mongolia.

In China the same success had attended the Mongol arms as in western Asia. The whole of the country north of the Yellow river, with the exception of one or two cities, was added to the Mongol rule, and, on the death of the Kin emperor Süan Tsung in 1223, the Kin empire virtually ceased to be, and Jenghiz's frontiers thus became conterminous with those of the Sung emperors who held sway over the whole of central and southern China. After his return from Central Asia, Jenghiz once more took the field in western China. While on this campaign the five planets appeared in a certain conjunction, which to the superstitiously minded Mongol chief foretold that evil was awaiting him. With this presentiment strongly impressed upon him he turned his face homewards, and had advanced no farther than the Si-Kiang river in Kansuh when he was seized with an illness of which he died a short time afterwards (1227) at his travelling palace at Ha-lao-tu, on the banks of the river Sale in Mongolia. By the terms of his will Ogotai was appointed his successor, but so essential was it considered to be that his death should remain a secret until Ogotai was proclaimed that, as the funeral procession moved northwards to the great ordu on the banks of the Kerulen, the escort killed every one they met. The body of Jenghiz was then carried successively to the ordus of his several wives, and was finally laid to rest in the valley of Kilien.

Thus ended the career of one of the greatest conquerors the world has ever seen. Born and nurtured as the chief of a petty Mongolian tribe, he lived to see his armies victorious from the China sea to the banks of the Dnieper; and, though the empire which he created ultimately dwindled away under the hands of his degenerate descendants, leaving not a wrack behind, we have in the presence of the Turks in Europe a consequence of his rule, since it was the advance of his armies which drove their Osmanli ancestors from their original home in northern Asia, and thus led to their invasion of Bithynia under Othman, and finally their advance into Europe under Amurath I.

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JENKIN, HENRY CHARLES FLEEMING (1833–1885), British engineer, was born near Dungeness on March 25, 1833, his father being a naval commander and his mother a novelist of some repute. He studied at Genoa university, where he took a first-class degree in physical science. In 1851 he was apprenticed to an engineer in Manchester, and subsequently he entered Newall's submarine cable works at Birkenhead. In 1859 he and W. Thomson (afterwards Lord Kelvin) began to work on problems connected with cables, to which he applied his researches on the resistance of gutta-percha. In partnership with Thomson, he was also a consulting telegraph engineer. In 1865 he was elected F.R.S., and was appointed professor of engineering at University college, London, and in 1868 at Edinburgh university. In 1873 he published a textbook of *Magnetism and Electricity*, full of original work. R. L. Stevenson's *Memoir* is a sympathetic tribute to his ability and character. In Stevenson's essay on "Talk and Talkers," Fleeming Jenkin figures as Cockshot. In 1882 Jenkin invented an automatic method of electric transport for goods—"telpherage"—but the details were still incomplete when

he died on June 12, 1885. A telpher line on his system was subsequently erected at Glynde in Sussex.

JENKINS, SIR LAWRENCE (1858–1928), Indian judge and reformer, was born at Cilbronau, Cardigan, on Dec. 22, 1858, and educated at Cheltenham and at University college, Oxford. He was called to the bar in 1883, and became well known as an equity lawyer. He married in 1892 Catherine Kennedy, author of *Sport and Travel in Both Tibets* (1909). In 1896 he was appointed judge in the high court of Calcutta. After three years he was promoted chief justice of Bombay, and was created K.C.I.E. in 1903. Sir Lawrence took a great interest in political and social problems in India, and sometimes aroused adverse criticism in his attempts to minimize the racial gulf between Europeans and Indians.

In 1908 he was made a member of the council of India and played an important part in the Morley-Minto plans for reform. Lord Minto soon urged his appointment as chief justice of Calcutta, and Lord Morley reluctantly agreed to let him go. The political unrest during the following period did not allow Sir Lawrence scope for the abilities which he had exercised in Bombay, and he did not escape criticism on political grounds for his handling of certain cases. After the outbreak of the World War, however, he conducted the Prize Court at Calcutta with a skill admitted both by his colleagues and by the public. He retired from the chief justiceship in 1916, and was made a member of the judicial committee of the Privy Council. Here full use was made of his intimate knowledge of Indian law and practice. In 1924 he received a special appointment on the board to consider the position of the Irish Boundary Commission. He died on Oct. 2, 1928.

JENKINS, SIR LEOLINE (1623–1685), English lawyer and diplomatist, was the son of a Welsh country gentleman. He was born in 1623 and was educated at Jesus college, Oxford. During the civil war and the commonwealth he was an ardent royalist; in 1661 he was made registrar of the consistory court of Westminster; in 1664 deputy judge of the court of arches; about a year later judge of the admiralty court; in 1689 judge of the prerogative court of Canterbury. In these offices Jenkins did enduring work in elucidating and establishing legal principles, especially in relation to international law and admiralty jurisdiction. He was selected to draw up the claim of Charles II. to succeed to the property of his mother, Henrietta Maria, on her death in 1666, and while in Paris for this purpose he succeeded in defeating the rival claim of the duchess of Orleans, being rewarded by a knighthood on his return. He was one of the English representatives at the Congresses of Cologne in 1673, and of Nijmwegen in 1676–79. He was made a privy councillor in 1680 and became secretary of state in April of the same year, in which office he was the official leader of the opposition to the Exclusion Bill. He resigned office in 1684, and died on Sept. 1, 1685. Jenkins left his impress on the law of England in the Statute of Frauds, and the Statute of Distributions, of which he was the principal author, and of which the former profoundly affected the mercantile law of the country, while the latter regulated the inheritance of the personal property of intestates. He was never married.

See William Wynne, *Life of Sir Leoline Jenkins* (2 vols., 1724), which contains a number of his diplomatic despatches, letters, speeches and other papers. *See* also Sir William Temple, *Works*, vol. ii. (4 vols., 1770); Anthony à Wood, *Athenae Oxonienses* (Fasti), ed. by P. Bliss (4 vols., 1813–20), and *History and Antiquities of the University of Oxford*, ed. by J. Gutch (Oxford, 1792–96).

JENKINS, ROBERT (*fl.* 1731–1745), English master mariner, is known as the protagonist of the "Jenkins's ear" incident, which, magnified in England by the press and the opposition, became a contributory cause of the war between England and Spain (1739) which ultimately merged into the War of the Austrian Succession. Bringing home the brig "Rebecca" from the West Indies in 1731, Jenkins was boarded by a Spanish guarda-costa, whose commander rifled the holds and cut off one of his ears. On arriving in England Jenkins stated his grievance to the king. At first the case created no stir, but in 1738 the repetition of his story with dramatic detail before a committee of the House of Commons created much political excitement.

Jenkins was subsequently given command of a ship in the East India Company's service, and later became supervisor of the company's affairs at St. Helena.

See T. H. Brooke, *History of the Island of St. Helena* (2nd ed., 1824), and H. R. Janisch, *Extracts from the St. Helena Records* (1885).

JENKS, JEREMIAH WHIPPLE (1856–), American economist, was born in St. Clair, Mich., on Sept. 2, 1856. He graduated at the University of Michigan in 1878; was admitted to the Michigan bar; taught languages in Mt. Morris college (Ill.); studied in Germany at the University of Halle; taught political science and English literature at Knox college, Galesburg, Ill., (1886–89); was professor of political economy and social science at Indiana State university (1889–91); was professor of political economy and politics at Cornell university (1891–1912); was professor of government and director of the division of public affairs at New York university (1912–17) and thereafter director of the division of oriental commerce and politics. In 1899–1901 he served as an expert agent of the U.S. industrial commission on investigation of trusts and industrial combinations in the United States and Europe. In 1901–02 he was special commissioner of the U.S. war department on colonial administration, and wrote a *Report on Certain Economic Questions in the English and Dutch Colonies in the Orient*, published (1902) by the bureau of insular affairs; and he later served the United States and other Governments as adviser on currency. In 1907–10 he was a member of the U.S. immigration commission; he has also held many administrative positions. Among his principal works are *The Trust Problem* (1900; enlarged ed. with W. E. Clark, 1917); *Citizenship and the Schools* (1906); *Principles of Politics* (1909); *The Immigration Problem* (with W. J. Lauck, 1913; 6th ed. revised by R. D. Smith, 1925); *Business and the Government* (1917).

JENNÉ, a city of West Africa, formerly the capital of the Songhoi empire, now included in the French colony of French Sudan. Jenné is situated on a marigot or natural canal connecting the Niger and its affluent the Bani or Dienné, and is within a few miles of the latter stream. It lies 250 miles south-west of Timbuktu, in a straight line. Thought to have been founded by the Songhoi in the 8th century, Jenné has passed under the dominion of many peoples. It seems to have been at the height of its power from the 12th to the 16th century, when its merchandise was found at every port along the west coast of Africa. It is thought that Jenné (Guinea) gave its name to the whole coast. (*See* GUINEA.) Subsequently, under the control of Moorish, Tuareg and Fula invaders, the importance of the city greatly declined. With the advent of the French, commerce again began to flourish. The city is surrounded by channels connected with the Bani but in the dry season it ceases to be an island. On the north is the Moorish quarter; on the north-west, the oldest part of the city, stood the citadel, now a fort. An old mosque was built on the site of the ancient palace of the Songhoi kings. There is little trace of the influence of Moorish or Arabian art. The buildings are mostly constructed of clay made into flat long bricks. Massive clay walls surround the city.

JENNER, EDWARD (1749–1823), English physician and discoverer of vaccination, was born at Berkeley, Gloucestershire, on May 17, 1749, the son of a clergyman. After his early education at Wotton-under-Edge and Cirencester, he began the study of medicine under Daniel Ludlow, a surgeon of Sodbury, near Bristol; but in 1770, went to London as a pupil of John Hunter. During this period he was employed by Sir Joseph Banks to prepare and arrange the zoological specimens which he had collected on Captain Cook's first voyage in 1771. Jenner was offered the post of naturalist in the second expedition, but he preferred to practise his profession in his native place. In one of his papers contributed at this time to the local medical society, of which he had been the principal founder, he appears to have anticipated the discoveries of others concerning rheumatic inflammations of the heart. He also studied ornithology, the geology of the district, and constructed the first balloon seen in those parts. He was a favourite in society, a fair musician and poet. In 1788 he married Catharine Kingscote and in 1792 obtained the M.D. from St. Andrews.

Meanwhile, the discovery of vaccination matured slowly in his mind. When an apprentice, he had noted a popular belief in Gloucestershire as to the antagonism between cow-pox and small-pox. He first investigated this subject about 1773, and within five years, he had satisfied himself that cow-pox really included two different forms of disease, only one of which protected against small-pox and that many of the failures could thus be explained. He further ascertained that the true cow-pox only protected when communicated at a particular stage of the disease, and at the same time concluded that "the grease" of horses is the same disease as cow-pox and small-pox, each being modified by the organism in which it develops. Cow-pox being scarce in his county at that period, Jenner had no opportunity of testing his theory until May 14, 1769, when he was able to inoculate an eight-year old boy with matter from the cow-pox vesicles on the hands of a milkmaid. In the following July, the boy was inoculated for small-pox, but the disease did not follow. Owing to the continued absence of cow-pox, Jenner was unable to repeat his successful discovery before 1798, in which year he published his *Inquiry into the Cause and Effects of the Variolae Vaccinae*, announcing his discovery to the world.

Henry Cline, surgeon of St. Thomas's hospital, London, made a number of successful inoculations against small-pox, and thereby brought vaccination before the medical profession, which had been prejudiced by the formidable criticism of J. Ingenhousz, a celebrated surgeon. But its adoption was delayed by the rash advocacy of George Pearson, who without seeing a case of cow-pox, lectured on the subject and supplied the virus. The matter which he distributed was derived from infected cows near London, and frequently produced not the mild disease described by Jenner but somewhat severe eruptions resembling small-pox. Hence Jenner had first to show in 1799 that the vaccine supplied by Pearson was accidentally contaminated with variolous matter, and then to secure in 1800 the abandonment of Pearson's project for establishing in London an institution for gratuitous vaccination with this defective vaccine. Jenner was afterwards presented to the members of the Royal family, who materially aided the spread of vaccination in England. (For the general adoption of the discovery, *see* VACCINATION.)

In 1803, the Royal Jennerian Society for the proper spread of vaccination in London was established. In the first 18 months 12,000 persons were inoculated, and the annual average of deaths from small-pox fell from 2,018 to 622. Dissensions within the society, however, led to its extinction in 1808, when the national vaccine establishment was founded. Of this, Jenner was at first the director, but later merely its adviser.

In 1802, a parliamentary grant of £10,000 had been voted for him, but when it was paid in 1804, £1,000 for fees being deducted, it did little more than cover the expenses of his discovery. Meanwhile, Jenner continued to vaccinate gratuitously often as many as 300 poor a day. From abroad, honours were showered upon him, and he was elected a member of the chief scientific societies, the first being that of Göttingen. But perhaps the most flattering proof of his influence was derived from France. On one occasion, when a petition for the release of a number of Englishmen detained in France on the sudden termination of the Peace of Amiens was about to be rejected by Napoleon, Josephine uttered the name of Jenner. The emperor paused and exclaimed: "Ah, we can refuse nothing to that name."

In England his merits were more slowly recognized. In 1806, Lord Henry Petty (afterwards marquess of Lansdowne) became chancellor of the exchequer, and proposed an address to the Crown, praying that the College of Physicians should report on vaccination. The report being strongly favourable, the then chancellor of the exchequer (Spencer Perceval) proposed a further £10,000 for Jenner. Finally the sum was raised to £20,000, and about the same time India raised a subscription of £7,383.

In 1810, the death of his eldest son and incessant labour affected his health. In 1813, Oxford conferred on him an honorary M.D., but he was unsuccessful in being elected into the College of Physicians because of his refusal to undergo an examination in classics. He visited London for the last time in 1814, when he was presented to the allied sovereigns. On his wife's death in the following year, he retired from public life and occupied himself with his work as a physician, naturalist and magistrate. In 1822 he published his last work, *On the Influence of Artificial Eruptions in Certain Diseases*, and in the following year presented to the Royal Society his final paper, *On the Migration of Birds*. He died on Jan. 24, 1823.

See J. Baron, *The Life of E. Jenner* (1827); C. Creighton, *Jenner and Vaccination* (1889). *See* also VACCINATION.

JENNER, SIR WILLIAM, BART. (1815–1898), English physician, was born at Chatham on Jan. 30, 1815, and educated at University college, London. In 1847, at the London Fever hospital, he began investigations into cases of "continued" fever, which enabled him finally to make the distinction between typhus and typhoid on which his reputation as a pathologist principally rests. In 1849 he was appointed professor of pathological anatomy at University college, and held many hospital appointments as a consultant. He was also successively Holme professor of clinical medicine and professor of the principles and practice of medicine at University college. He was president of the college of physicians (1881–88); he was elected F.R.S. in 1864, and received honours and court appointments. In 1868 he was created a baronet. He died at Bishop's Waltham, Hants, on Dec. 11, 1898.

JENNET, a small Spanish horse; the word is sometimes applied in English to a mule, the offspring of a she-ass and a stallion.

JENOLAN CAVES, a series of remarkable caverns in Roxburgh county, New South Wales, Australia; 113 m. W. by N. of Sydney, and 36 m. from Tarana, which is served by railway. They are the most celebrated of several similar groups in the limestone country. The stalactitic formations, sometimes pure white, are of great beauty.

JENSEN, JOHANNES VILHELM (1873–), Danish author, was born at Farsö, North Jutland, on Jan. 20, 1873, of a family of peasant extraction. Jensen belongs to the new school of Danish literature which came into being about 1900. He repudiated the Brandes school with its imitation of French literature, and wrote of nature and outdoor life. Among his novels may be mentioned: *Kongens Fald* (1899–1902), a historical novel of the 16th century; *Madame d'Ora* (1904); and *Den lange Rejse* (1908–21) describing the evolution of the Northern race from the glacial epoch to the time of Columbus. In *Himmerlandshistorier* (1898–1910); *Skovene* (1904); *Eksotiske Noveller* (1907–15) and *Myter og Jagter* (1907–24) he described life and scenery in his native country and abroad with brilliant imaginative talent and mastery of language.

See Otto Gelsted, *Johannes V. Jensen* (1913).

JENSEN, WILHELM (1837–1911), German novelist, was born at Heiligenhafen, Holstein, on Feb. 15, 1837, and died at Munich on Nov. 24, 1911. He wrote some tragedies, but his best work lies in his novels, remarkable for their fine descriptions of scene and place. Among the best examples are: *Eddystone* (1872), *Nirwana* (1877), *Karin* (1878), *Diana Akhnoba* (1890), *Luv und Lee* (1897) and *Vor der Elbmündung* (1905).

JENYNS, SOAME (1704–87), English author, was born in London on Jan. 1, 1704, and was educated at St. John's college, Cambridge. In 1742 he was chosen M.P. for Cambridgeshire, in which his property lay, and he afterwards sat for the borough of Dunwich and the town of Cambridge. From 1755 to 1780 he was one of the commissioners of the board of trade. He died on Dec. 18, 1787. Jenyns wrote poems: *Art of Dancing* (1727) and *Miscellanies* (1770): and, in prose, *Free Inquiry into the Nature and Origin of Evil* (1756), and *View of the Internal Evidence of the Christian Religion* (1776). He is chiefly remembered by the slashing review by Samuel Johnson in the *Literary Magazine* on the *Free Inquiry*, and by references in Boswell's *Life of Johnson*.

JEOPARDY, risk of death, loss or other injury, from O.Fr. *ju* (later *jeu*) and *parti*, even game. It was originally used of a problem in chess or of a stage in any other game at which the chances of success or failure are evenly divided between the players.

JEPHSON, ROBERT (1736–1803), Irish dramatist, was born in Ireland. After serving for some years in the British army,

he retired with the rank of captain, and lived in England, where he was the friend of Garrick, Reynolds, Goldsmith, Johnson, Burke, Burney and Charles Townshend. His appointment as master of the horse to the lord-lieutenant of Ireland took him back to Dublin, and he held his appointment under 12 succeeding viceroys. His plays include a tragedy, *Braganza* (1775), *Conspiracy* (1796), *The Law of Lombardy* (1779), and *The Count of Narbonne* (1781). He died at Blackrock, near Dublin, on May 31, 1803.

Jephson's other works include: *The Bachelor, or Speculations of Jeffrey Wagstaffe*, a defence of the Irish administration; and *The Confessions of Jacques Baptiste Couteau*, a satire on the French revolutionaries.

JEPHTHAH, one of the judges of Israel, in the Bible, was a son of Gilead by a secondary wife, and, being expelled from his father's house by his brethren, took refuge in the Syrian land of Tob, where he gathered around him a powerful band of homeless men like himself. The Ammonites pressing hard on his countrymen, the elders of Gilead called for his help, which he consented to give on condition that in the event of victory he should be made their head (Judges xi. 1–xii. 7). His name is best known in history and literature in connection with his vow, which led to the sacrifice of his daughter on his successful return. The annual lamentation of the women for her death suggests a mythical origin (*see* ADONIS). Attached to the narrative is an account of a quarrel between Jephthah and the Ephraimites. The latter were defeated, and their retreat was cut off by the Gileadites, who had seized the fords of the Jordan. As the fugitives attempted to cross they were bidden to say "shibbōleth," and those who said "sibbōleth" (the Ephraimites apparently being unused to *sh*), were put to death.

JEPSON, WILLIS LINN (1867–), American botanist, was born at Vacaville, Calif., on Aug. 19, 1867. Following his graduation at the University of California in 1889 (Ph.D., 1899), he pursued botanical study at Cornell and Harvard universities and also at Kew and Berlin. After serving as assistant in botany in 1891–94, instructor in 1895–98, assistant professor in 1899–1911 and associate professor in 1911–18, he was made in 1919 professor of botany in the University of California. He made extensive investigations in the taxonomy, geographic distribution and life-history of Western American seed-plants, especially the flora of California.

His works include *Flora of Western Middle California* (1901, 2nd ed., 1911); *The Trees of California* (1909, 2nd ed., 1923); *A Flora of the Economic Plants of California* (1924); *An Illustrated Manual of the Flowering Plants of California* (1925); and numerous contributions to scientific journals.

JERAHMEEL, in the Bible, a clan which with Caleb, the Kenites and others occupied the southern steppes of Palestine (1 Sam. xxx. 29), and was subsequently incorporated into Judah (*q.v.*). The *Chronicles of Jerahmeel* (M. Gaster, *Oriental Translation Fund,* 1899) is a late production containing a number of apocryphal Jewish legends of no historical value.

JERBA, an island off the coast of North Africa in the Gulf of Gabes, forming part of Tunis. It is separated from the mainland by two narrow straits, and save for these channels blocks the entrance to a large bay identified with the Lake Triton of the Romans. The western strait, opening into the Gulf of Gabes, is a mile and a half broad; the eastern strait is wider, but at low water it is possible to cross to the mainland by the Tarik-el-Jemil (road of the camel). The island is irregular in outline, its greatest length and breadth being some 20 m., and its area 425 sq.m. It contains neither rivers nor springs, but is supplied with water by wells and cisterns. It is flat and well wooded with date palms and olive trees. Its population is estimated at about 90,000, mostly Berbers.

Jerba is the Lotophagitis or Lotus-eaters' Island of the Greek and Roman geographers, and is also identified with the Brachion of Scylax. The modern name appears as early as the 4th century in Sextus Aurelius Victor. In the middle ages the possession of Jerba was contested by the Normans of Sicily, the Spaniards and the Turks, the Turks proving victorious. In 1560 after the destruction of the Spanish fleet off the coast of the island by Piali pasha and the corsair Dragut, the Spanish garrison at Haumt-es-Suk was exterminated.

Jerba has a considerable reputation for the manufacture of the woollen tissues interwoven with silk which are known as burnous stuffs; a market for the sale of sponges is held from November till March; and there is a considerable export trade in olives, dates, figs and other fruits. The capital, trading centre and usual landing-place are at Haumt-es-Suk (market quarter) on the north side of the island. Here are a mediaeval fort, built by the Spaniards in 1284, and a modern fort. Gallala, to the south, is noted for the manufacture of a kind of white pottery, much prized.

JERBOA, the name of an Arabian and North African jumping rodent mammal, *Jaculus aegyptius,* typifying the family *Jaculidae,* but in a wider sense applied to most of the representatives of that family, which are distributed over the desert and semi-desert tracts of the Old World, although unknown in Africa south of the Sahara. (For the characteristics of the family *see* RODENTIA.)



BY COURTESY OF THE NEW YORK ZOOLOGICAL SOCIETY

JERBOA (JACULUS AEGYPTIUS), A SMALL RODENT OF AFRICA

In the Egyptian jerboa the length of the body is 8 in., and that of the tail, which is long, cylindrical and covered with short hair terminated by a tuft, 10 in. The five-toed front limbs are extremely short; while the hind pair are six times as long. When about to spring, the jerboa raises its body by means of the hinder extremities, and supports itself at the same time upon its tail, while the fore-feet are so closely pressed to the breast as to be scarcely visible. It then leaps into the air and alights upon its four feet, but instantaneously erecting itself, it makes another spring, and so on in rapid succession. It is a gregarious animal, living in burrows, which it excavates with its nails and teeth in the sandy soil of Egypt and Arabia. In these it remains during the day, emerging at night in search of the herbs on which it feeds. It is exceedingly shy, and this, together with its agility, renders it difficult to capture. The Persian jerboa (*Allactaga indica*) is also a nocturnal burrowing animal, feeding on grain, which it stores up in underground repositories, closing these when full, and only drawing upon them when the supply of food above ground is exhausted. (*See* also JUMPING MOUSE.)

JEREMIAH, the son of Hilkiah, belonging to the priestly family of Anathoth, a few miles to the north-west of Jerusalem, was the last of the great pre-exilic prophets of Israel.

His Life and Times.—The life of Jeremiah falls in one of the most striking and critical periods in the history of the ancient world. His ministry began in 626, the year of the death of Asshur-bani-pal, the last of the great kings of Assyria, at a time when all western Asia was being laid desolate by the inroads of hordes of northern barbarians known to the Greeks as Scythians or Cimmerians and to the Babylonians as Umman-manda. He witnessed the complete overthrow of Assyria culminating in the destruction of Nineveh in 612, followed by the decisive defeat of Egypt's last attempt at world empire in the battle of Carchemish (605). Startling events took place in his own land also. In his youth (639) a king was assassinated; in 621 occurred the great reform of Josiah, who met a tragic end at Megiddo in 608. Judah became a vassal in turn of Egypt and of Babylon, and, rebelling against the latter in 597, suffered invasion, siege, and the deportation of her young king, Jehoiachin, and the best of her people. Jehoiachin's uncle and successor, Zedekiah, after years of vacillation and weakness, yielded to the machinations of his corrupt nobility and to the intrigues of Egypt, and the Jewish kingdom perished in 585 with the capture of Jerusalem and the destruction of the Temple of Solomon.

Jeremiah's call came in 626, when Judah was suffering from Scythian raids and even Jerusalem was threatened. His attitude towards the reforms of Josiah is a matter of dispute, some scholars holding that he regarded the law-book on which it was based as a forgery (*cf.* Jer. viii. 8), and that his uncompromising hos-

tility to sacrifice of any kind (*cf.* Jer. vii. 21) made it impossible for him to approve of a movement which permitted its continuance. On the other hand these views may have been later developments, and Jer. xi. 1–14 suggests naturally that he approved Josiah's action, while it is easy to understand the hostility of his own family (Jer. xi. 18–20, xii. 6) if he was concerned in a movement which would deprive the priests of Anathoth of their ancestral rights. We hear little more of Jeremiah during the rest of the reign of Josiah, for whom the prophet had a deep respect, but the reaction under Jehoiakim called for his condemnation, and his boldness endangered his life (Jer. vii. 1 *sqq.*, xxvi.). He fully realized the significance of the battle of Carchemish, and took a step which, as far as we know, was unprecedented in Israelite prophecy. He secured the services of a professional writer, Baruch by name, to whom he dictated earlier prophecies which were read in public on a festal occasion. Jehoiakim's attempt to suppress this document led only to its being rewritten (Jer. xxxvi.). In Zedekiah's reign he continued his protests against the moral and religious degradation of Israel, and during the final siege of Jerusalem took the unpopular course of recommending surrender to the Chaldeans. Called to Anathoth on family business during an interval of the siege, he was arrested and thrown into prison, where he continued to deliver the same message. An attempt was made to starve him to death in an old well, but he was rescued by an Ethiopian, Ebedmelech by name, and survived the fall of the city. He was allowed by the Chaldeans to make his home at Mizpah with Gedaliah, but, on the assassination of that honourable and chivalrous governor, Jeremiah was taken down to Egypt by the panic-stricken survivors. The last we hear of him is a final denunciation of his fellow-countrymen for adopting the worship of the Queen of Heaven.

The Man and His Message.—Few characters in history have stronger claims on our affection and sympathy than Jeremiah. Nervous, tender, shy, with a deep-rooted love of nature and of man, his temperament demanded a life of quiet domestic obscurity. His calling and his devotion to his God demanded that he should live a life of lonely publicity, always on the unpopular side, always confronted with the disaster which in the end overwhelmed his country, always conscious of sharing in responsibility for evils which he was powerless to avert or postpone. His was a double passion, a love of his people and a love of his God: the longing of his heart was to see them validly wedded to one another; and the tragedy of his life lay in the steady drift of Israel away from Yahweh, till the last blow fell in Egypt, and he had to pronounce their association at an end—they were finally divorced (Jer. xliv. 26–29). At the outset of his career he had received a promise of support in the face of man, and, as far as we know, he never blenched before priest or king or people. But in facing his God he stood alone, often rebelling, sometimes even doubting the good faith of a divine Master, who, as popular theology held, might entrap His very servants to their utter ruin (*cf.* Jer. xii. 1–6, xv. 15–21, xx. 7–11).

Yet though these experiences brought Jeremiah an agony paralleled in Hebrew literature only by that of Job, it was thence that the great significance of his life and work sprang. Accepting the doctrines and attitude of his great predecessors, especially Hosea, he saw that the union between God and man must be spiritual, not material, and he expressed this eternal truth in his prediction of the New Covenant (Jer. xxxi. 31–34). And his relations with Yahweh were a new phenomenon in the history of religion. Living in the midst of a community which nominally worshipped the God who had inspired him, he yet stood apart from it in his spiritual life. To him his religion was essentially personal, not communal, and, as far as we know, he was the first to stand alone with God; he was the Father of all the Saints.

The Book of Jeremiah.—This book exhibits with exceptional clearness the three types of material which were at the disposal of the compilers of our Biblical prophetic literature, for it contains (i.) poetry (mainly actual oracles delivered by the prophet), (ii.) prose written in the first person, giving an account of various utterances of the prophet, sometimes with reference to the occasions on which they were delivered, and (iii.) prose written in the third person, giving an account mainly of events in the life of the prophet. It is usual to attribute passages of the last type to Baruch, the scribe, who acted as secretary to Jeremiah. It is clear that material of type (i.) was already arranged in small collections when it came into the hands of the compiler, who selected suitable sections from material of type (ii.) (or, when necessary, type [iii.]) to form introductions to the poetic collections. Thus i. 1–14 (ii.) forms an introduction, not only to the whole book, but also to the collection ii. 15–iii. 5; iii. 6–18 (ii.) forms an introduction to the collection of oracular poetry contained in iii. 19–vi. 30. It is noticeable that the oracular collections grow shorter as the book proceeds, and that the compiler was forced to use passages of type (iii.) for his "introductions" from ch. 19 onwards. Some modern scholars, notably Duhm and Mowinckel, believe that many of the (ii.) passages are the work of imaginative later scribes, who wished to claim the authority of the prophet for their own theological views, but the originality or otherwise of the sections does not affect their position in the history and structure of the book.

The Greek version (LXX.), representing the text current among Egyptian Jews, frequently differs very widely from the traditional Hebrew text, which is of Palestinian (or Babylonian?) origin. The best illustration of the divergence is to be found in the position of a large collection of oracles against foreign nations. In the common Hebrew text, followed by modern vernacular translations, this collection is placed near the end of the book, occupying chapters xlvi.–li.; in the LXX. it appears between vv. 13 and 15 of ch. xxv. in our familiar arrangement. (T. H. R.)

JEREMY, EPISTLE OF, an apocryphal book of the Old Testament. The letter purports to have been written by Jeremiah to the exiles who were already in Babylon or on the way thither. The author was a Hellenistic Jew, and not improbably a Jew of Alexandria. His work, which shows little literary skill, was written with a serious practical purpose. He veiled his fierce attack on the idol gods of Egypt by holding up to derision the idolatry of Babylon. He warned the exiles that they were to remain in captivity for seven generations; that they would there see the worship paid to idols, from all participation in which they were to hold aloof; for that idols were nothing save the work of men's hands, without the powers of speech, hearing, or self-preservation. They could not bless their worshippers even in the smallest concerns of life; they were indifferent to moral qualities, and were of less value than the commonest household objects, and finally, "with rare irony, the author compared an idol to a scarecrow (*v.* 70), impotent to protect, but deluding to the imagination" (MARSHALL).

The date of the epistle is uncertain; possibly it belongs to the 1st century B.C.

See Ball in Charles's *Apocrypha and Pseudepigrapha*, vol. i.

(R. H. CH.)



END OF TWELFTH VOLUM

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